Sustainable entrepreneurship: creating environmental solutions in light of planetary boundaries

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Abstract: This article discusses sustainable entrepreneurship in light of planetary boundaries and related aims to contribute to managing for and in a safe operating space for humanity. The rapidly developing research area of environmental, social and sustainable entrepreneurship has flourished for the last two decades and improved our understanding of the phenomenon. However, while a contribution to sustainable development is often stated in general terms or implied, most of the sustainable entrepreneurship literature focuses on classifications, motivations, processes and specific outcomes without explicit links to how planetary boundaries are addressed. This paper discusses links between sustainable entrepreneurship and the planetary boundaries concept by addressing both perspectives: how can the concept of planetary boundaries provide perspectives for designing and assessing sustainable entrepreneurship? And how can sustainable entrepreneurship contribute effectively to an economy and society operating in a safe operating space for humanity?

Keywords: sustainable entrepreneurship; environmental solutions; planetary boundaries; ecopreneurship; environmental entrepreneurship; safe operating space; transition; sustainability transformation; corporate sustainability.

1 Introduction

Broad scientific evidence exists on huge environmental problems such as climate change, biodiversity loss and depletion of the ozone layer. A large number of publications and media activities are highlighting these problems and the planetary boundary concept (Rockström et al., 2009) has received particular attention as an approach that structures key ecological themes and provides reference for project development and sustainability management. While the UN sustainable development goals (SDGs) provide a broad set of social, environmental and economic goals, the planetary boundary concept focuses on key ecological themes which are also reflected in the SDGs. Accepting that societies, economies and companies are embedded in and dependent on the natural environment puts the planetary boundary concept into a fundamental position for discussions on saving the Earth’s ecosystem and the survival of humankind, societies and economies.

Increasing environmental problems and the observation that at least three of nine planetary boundaries are already exceeded [Rockström et al., (2009), p.472] has motivated a large number of actors to engage in the search for solutions. One
group of actors that has received growing attention in research and media are entrepreneurs addressing sustainability issues and developing offers to create change towards sustainable development. Sustainable entrepreneurship, including social and environmental entrepreneurship, has developed as an innovative research field for the last decade (e.g., Fellnhofer et al., 2014; Gast et al., 2017).

Although addressing planetary boundaries may at a first glance be seen as a topic for environmental entrepreneurship (or ecopreneurship) with a clear focus on ‘green issues’ only, a broader view becomes apparent for two reasons. Firstly, the planetary boundaries concept – although addressing ecological issues explicitly – is an approach deducted from the societal and economic goal aim to define a ‘safe operating space for humanity’ [Rockström et al., (2009), p.472]. Since the industrial revolution, human actions have been the main driver for environmental change, thus changing the Holocene into the Anthropocene (e.g., Crutzen, 2002; Steffen et al., 2006, 2007, 2015). The planetary boundary approach draws on knowledge of the essential role of the life-support properties of the environment for human wellbeing and the biophysical constraints for the growth of the economy [Rockström et al., (2009), pp.474–475]. Creating solutions with regard to meeting planetary boundaries is therefore closely linked to finding ways of creating human wellbeing and economic prosperity which enable humankind to stay in the safe operating space of planetary boundaries.

Secondly, the interconnectedness between striving for solutions to ecological problems and social and economic challenges cannot be avoided if effective solutions in the real world are the aim. Reducing environmental impacts and creating contributions to keeping economic and societal activities in the planetary boundaries require social and economic changes which need to consider social and economic goals of stakeholders to receive their support. Without stakeholder support, it is not likely that environmental solutions will be accepted, supported and implemented effectively. To receive such support, in turn, requires that also the social and economic interests of stakeholders are considered. ‘Unsocial’ and ‘uneconomic’ environmental solutions may thus be weak or remain an illusion.

Addressing planetary boundaries with entrepreneurship thus requires sustainable entrepreneurship, including social entrepreneurship creating solutions to social problems while respecting planetary boundaries, environmental entrepreneurship considering the necessity to also provide solutions to social and economic goals, as well as economic entrepreneurship that enables the economy and society to stay in the planetary boundaries.

The necessity to find solutions to huge global environmental and societal problems has been interpreted as an opportunity to sustainability-oriented entrepreneurs (e.g., Bygrave, 2004; Dean and McMullen, 2007; Schaltegger and Wagner, 2010; Schaltegger et al., 2012; Hockerts, 2015; York and Venkataraman, 2010; Zollo et al., 2009). Although not addressed explicitly in the existing entrepreneurship literature, the planetary boundary concept can be seen as a call to think about value propositions contributing to solve global ecological problems relating to planetary boundaries. While a contribution to sustainable development is often stated in general terms or implied, most of the sustainable entrepreneurship literature focuses on classifications, motivations, processes and specific outcomes without explicit links to how planetary boundaries are addressed.

This paper discusses links between sustainable entrepreneurship and the planetary boundaries concept by addressing both perspectives: how can the concept of
planetary boundaries provide perspectives for designing and assessing sustainable entrepreneurship? And how can sustainable entrepreneurship contribute effectively to an economy and society operating in a safe operating space for humanity?

Our argument is organised as follows. First, we briefly review sustainable entrepreneurship as a process of generating innovations that benefits from having a sense of purpose and direction. Second, we introduce the planetary boundaries as a concept that not only provides such sense of purpose and direction but also creates new challenges that require a number of complementary innovations. Third, we develop how various forms of sustainable entrepreneurship can contribute to meeting those innovation challenges. The paper concludes by discussing our argument and deriving implications for future research.

2 Sustainable entrepreneurship: innovating with purpose to overcome unsustainability

At the heart of entrepreneurship lies the idea of innovation as originally advanced by Schumpeter (1962/1934) and more recently developed by Drucker (1986). Entrepreneurship describes the processes and entrepreneurs are the actors who discover, realise and create opportunities for developing novel and superior solutions out of the former status quo (Stevenson and Gumpert, 1985). Entrepreneurship is thus concerned with the discovery, profitable exploitation and active creation of business opportunities by generating new market disequilibria (Shane and Venkataraman, 2000). These disequilibria allow what Schumpeter (1962/1934) refers to as the temporary generation of entrepreneurial rents. Ultimately, these will be eroded as competitors imitate the entrepreneur thus moving the market towards a new (temporary) equilibrium.

Entrepreneurs create these disequilibria by recombining already existing elements into new combinations. In recent years, the concept of entrepreneurship has not only been applied to entrepreneurs who successfully implement and scale new products, new ways of organising or new business models (Chesbrough, 2010), but also to so called ‘institutional entrepreneurs’ (Tracey et al., 2011), who create new institutions that govern important aspects of organisational or societal life. By this logic, entrepreneurship is a critical driver for change or a process of ‘creative destruction’ (Schumpeter, 1962/1934): it destroys the status quo by innovating superior alternatives that make the existing offers obsolete.

Extending the concept to sustainability, one can thus advance that sustainable entrepreneurs find ways to creatively destroy market failures (Dean and McMullen, 2007) as well as government and bureaucracy failures that result in negative social and environmental externalities. Such market and government (incl. bureaucracy) failures mean that society is in a suboptimal state. Innovating ways to overcome negative externalities holds the potential for socially and environmentally preferable outcomes, and thus potential economic outcomes (York and Venkataraman, 2010). To this end – i.e., to direct their entrepreneurial activities towards overcoming unsustainability – entrepreneurs, however, need to develop a clear understanding of these externalities, their magnitudes and what activities may be effective in supporting sustainable development.

Opportunities hidden in (unsustainable) market and government failures may entail economic potentials for sustainability-oriented innovations. Yet, what primarily motivates sustainable entrepreneurship is not necessarily its economic feasibility but its
Sustainable entrepreneurship contributes to overcoming pressing social and ecological problems. For many, if not most sustainability-oriented entrepreneurs, this purposive contribution to sustainable development is their primary motivation rather than conventional profit maximisation (Choi and Gray, 2008a, 2008b; Kirkwood and Walton, 2010; Hansen and Schaltegger, 2013; Shepherd et al., 2013; Koe and Majid, 2014; Koe et al., 2014). In fact, sustainable entrepreneurship is often linked to individual values of the entrepreneurs and the passion for sustainable business (Koe and Majid 2014a, 2014b; Gast et al., 2017). Ultimately, the success of sustainable entrepreneurship lies not just in the success of the individual entrepreneurial business but the transformation of a sector towards more sustainable practices, as competitors begin to imitate the entrepreneurial practices (Hockerts and Wüstenhagen, 2010). Apart from imitation by competitors, market transformation can furthermore be achieved through further co-evolutionary processes such as mergers and acquisitions, replication or growth of the sustainable entrepreneur (Schaltegger et al., 2016).

Although not all entrepreneurs dealing with sustainability equally strive to change the world (Allen and Malin, 2008; Choi and Gray, 2008b), empirical research still shows that primary motivations for many actors to engage in sustainable entrepreneurship are to spread their green values, to educate society and to follow their passion for a green business idea (Kirkwood and Walton, 2010; Parrish, 2010; Shepherd et al., 2013; Jolink and Niesten, 2015). Koe and Majid (2014; Koe et al., 2014) further argue that attitudes and values linked to sustainability (i.e., a sustainability orientation) motivate individual entrepreneurs to engage in environmentally friendly practices and positively affect their intention to engage in sustainable entrepreneurship. Consequently, sustainable entrepreneurship benefits from a clear sense of purpose of how to make the world more sustainable.

Finally, this sense of purpose is not only relevant for the entrepreneurs themselves but also for their relationship with important stakeholders. As Schaltegger and Hörisch (2017) analysed, the entrepreneurs’ environmental orientation can serve to secure legitimacy for their entrepreneurial ventures. Securing legitimacy and social capital among stakeholders, however, is important when entrepreneurs try to create innovations that bring together and recombine diverse resources held by different stakeholders.

In sum, sustainable entrepreneurship is about the entrepreneurial process of finding and implementing innovative solutions to address social, economic and ecological shortcomings. As our short review has shown, however, sustainable entrepreneurship benefits from certain critical inputs in order to reap its full potential: first, with regard to their goal of creatively destroying unsustainable market and government failures, sustainable entrepreneurs benefit from understanding what the most pressing and unattended sustainability challenges actually are. Given the complexity and often lack of transparency that characterise market and government failures, sustainable entrepreneurs thus can capitalise on outside expertise. Second, in order to be able to make an effective contribution to sustainable development and to develop a clear sense of purpose, sustainable entrepreneurs benefit from understanding the magnitude of the different challenges, where innovation is most urgently needed and how different sustainability challenges are linked to each other. Third, to be able to create a common cause, to secure legitimacy and attract the resources from other stakeholders, sustainable entrepreneurs benefit from shared awareness about sustainability challenges and the desirability of
overcoming them. In short, sustainable entrepreneurship benefits from a clear sense of purpose and direction.

The following section discusses how the concept of planetary boundaries can fulfil such a heuristic function as a fruitful reference point for sustainable entrepreneurship (research).

**Figure 1** Planetary boundaries (see online version for colours)

Source: Rockström et al. (2009, p.472)

### 3 Planetary boundaries as reference points for sustainable entrepreneurship

Sustainable entrepreneurship benefits from an empirically informed and collectively shared understanding of the ‘bigger picture’ regarding relevant sustainability challenges. The concept of planetary boundaries provides a highly fruitful reference point in this regard. Drawing on and aggregating relevant knowledge in the natural sciences, the ‘planetary boundaries’ create a big picture perspective by looking at critical ecosystem constraints that define the limits of a ‘safe operating space’ for all of humanity and for economic activities therein [Rockström et al., (2009), p.472]. Although not named a such in the original literature, the planetary boundary concept relates to acknowledging the carrying capacity of the earth (e.g., Wetzel and Wetzel, 1995; Costanza et al., 2014) by distinguishing nine different areas (Figure 1): climate change, ocean acidification, stratospheric ozone depletion, biochemical flow boundary including the nitrogen and the
phosphorous circle, global freshwater use, changing land use, biodiversity loss, atmospheric aerosol loading and chemical pollution. It thus identifies and brings attention to critical fields in which unsustainable practices threaten the planet’s future and where innovations are needed to creatively destroy current unsustainable patterns.

Moreover, as illustrated in Figure 1, the planetary boundary concept seeks to quantify both the critical thresholds of and the actual eco-pressures on each category. It thus provides a sense of magnitude and direction for where action is most urgently needed. The inner circle in Figure 1 represents the planetary boundaries for each field. The boundaries of biodiversity loss, climate change and the nitrogen cycle are assessed to already be overstepped (shaded dark) while the two boundaries of chemical pollution and atmospheric aerosol loading have not been quantified, yet.

One reason that exceeding planetary boundaries is particularly problematic lies in the characteristics of non-substitutability, irreversibility and nonlinearity of many planetary processes (Dyllick and Hockerts, 2002). Firstly, the planetary boundary argument is based on the assumption of non-substitutability of natural capital as advanced by early ecological economists such as Daly (1991). The complex nature and multi-functionality of many planetary resources is one of the primary reasons why fully substituting them through technological solutions is either extremely challenging or not economically feasible. A further issue with exceeding planetary boundaries lies in the likely irreversibility of such outcomes. Loss in biodiversity or soil fertility tends to be irrevocable with current human technological capabilities. A final problem is the nonlinearity of many planetary processes. Predicting, for example, the acceleration rate of climate change is one good example.

After its publication, the planetary boundary concept has quickly gained traction in the global sustainability discourse. While it is still a largely academic concept (with already some 5,000 citations of the 2009 Nature article that popularised the concept) and although various parts of the concept still lack a good quantitative data support, it holds the potential to provide a common language and shared awareness among policy makers, companies, civil society and academics. In management research, scholars have recently started to call for an improved, explicit consideration of planetary boundaries in corporate management (Whiteman et al., 2013; Winn and Pogutz, 2013) and accounting and reporting for sustainability (Gray, 2010; Antonini and Larrinaga, 2017; Qian and Schaltegger, 2017; Schaltegger et al., 2017). While the existing literature has suggested the consideration of planetary boundaries as benchmarks to evaluate, measure, assess and transform existing companies (e.g., Nishitani et al., 2012; Whiteman et al., 2013; Winn and Pogutz, 2013) no research has so far been conducted calling for an explicit planetary boundary-orientation of entrepreneurship.

From this perspective, the entrepreneurial opportunity is to “create value in the ecological sphere” [Schlange, (2006), p.17; Gast et al., 2017]. A key competence to develop such an opportunity is the entrepreneur’s knowledge of ecosystems, carrying capacity and planetary boundaries (similar to Gast et al., 2017; Shepherd and Patzelt, 2011). The question of how sustainable a given entrepreneurship phenomenon is (whether called social, environmental or sustainable) may from a deep green and ecological perspective be answered by whether and how well it contributes to an economy and society that respects and leads to staying in the safe operating space of planetary boundaries.
The planetary boundaries concept thus provides a fruitful reference point for sustainable entrepreneurship. It is an important basic academic and conceptual innovation. At the same time, however, it also spells out the need for further practical innovations that the concept itself cannot generate:

First, while the planetary boundaries concept highlights what the most pressing ecological issue are, it does not provide an answer as to how solutions might look like that can also be reconciled with the social and economic needs of the stakeholders who need to implement them. Here, technological and business model innovation is needed to integrate ecological, social and economic considerations (e.g., Stubbs and Cocklin, 2008; Boons and Lüdeke-Freund, 2013; Schaltegger et al., 2016; Upward and Jones, 2016).

Second, as Whiteman et al. (2013, p.328–329) emphasise, “planetary boundaries thresholds need to be disaggregated in meaningful ways”. In other words, the big picture needs to be broken down onto the level of individual actors, organisations and communities. Here, organisational and accounting innovations are needed to make the systematic planetary boundaries concept relevant and tangible for individual actors.

Third, action on the individual level needs to be coordinated and reintegrated to add up on the macro-level. This calls for thinking about and designing transformation effects of sustainable entrepreneurship contributing to sustainability transitions of markets and society (e.g., Schaltegger et al., 2016). In addition, governance and institutional innovations, possibly spurred by policy and institutional entrepreneurship (Mintrom, 1997; Tracey et al., 2011), are needed to link the individual level of implementing sustainability solutions with the bigger macro-picture of the planetary boundaries.

In short, while the planetary boundaries are a conceptual academic innovation with a significant heuristic potential, they call themselves for various forms of practical sustainability-oriented innovations. The next section discusses how sustainable entrepreneurship can be an important avenue for advancing such innovations.

4 Breaking down planetary boundaries for sustainable entrepreneurship

The planetary boundaries concept thus highlights the need for various, complementary innovations. On the one hand, technological and business model innovations are needed to create ecological solutions that can be implemented on the micro-level of the different stakeholders and their actions. On the other hand, organisational, governance and policy innovations are needed to link this micro-level with the macro-level of the planetary system. Understood more broadly as a process of fostering sustainability-oriented innovations, sustainable entrepreneurship can contribute innovations on both levels. In the following, we will briefly discuss them in more detail.

First, on the level of concrete technological and business model innovations, sustainable entrepreneurs can use the planetary boundaries concepts to engage with the relevant knowledge about drivers and impacts leading to insufficient consideration. Table 1 provides an overview of possible environmental contributions and sustainable entrepreneurship projects and ventures as well as social and economic aspects relating to the nine planetary boundaries. The boundaries are ordered by degree of overuse as identified by Rockström et al. (2009) [with the last two being ‘not yet quantified’ (n.y.q.)].
<table>
<thead>
<tr>
<th>Planetary boundary and key drivers (ordered according to degree of overuse; Rockström et al., 2009)</th>
<th>Possible sustainable entrepreneurship projects and ventures (examples)</th>
<th>Environmental aspect and contribution (examples)</th>
<th>Social and economic aspects and contributions (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity loss</td>
<td>Eco-tourism that saves ecosystems; cause related marketing that finances protection areas.</td>
<td>Securing ecosystem functioning; restoring biodiversity hotspots (ecosystems, rare species, genetic pool).</td>
<td>Medical potential of certain species; reduction of crop/harvest risk losses through diversification of species and genetic variety.</td>
</tr>
<tr>
<td>Nitrogen cycle (part of biochemical flow boundary)</td>
<td>Emission free mobility (attractive public transport, car sharing, efficient electric cars, etc.); fertiliser system impeding over-fertilisation.</td>
<td>Less/no nitrogen air emissions; less/no over-fertilising of land (and related higher biodiversity on land).</td>
<td>Less breathing illnesses and less related working days lost; less quality problems for drinking water production; protection of marine eco-systems and their services.</td>
</tr>
<tr>
<td>Climate change</td>
<td>Saving and restoring forests; climate compensation services; renewable energy.</td>
<td>Less climate change related ecosystem change; reduced increase of average global temperature.</td>
<td>Reduction of flood and drought risks, reduction of ecologically driven migration and conflicts.</td>
</tr>
<tr>
<td>Phosphorus cycle (part of biochemical flow boundary)</td>
<td>Phosphorus-efficient or -free fertilisers.</td>
<td>Less phosphorus over-fertilisation of water systems.</td>
<td>Availability of phosphorus for key life supporting function of humanity.</td>
</tr>
<tr>
<td>Ocean acidification</td>
<td>Less water pollution into the seas; reduction of climate change and CO₂ emissions.</td>
<td>Conservation of coral reefs and sea biodiversity; higher carbon capture of sea plankton.</td>
<td>Conservation of coral reef-related tourism; higher fish population and catch potential.</td>
</tr>
<tr>
<td>Land use change</td>
<td>Space-efficient production, transportation and living; restoration of biodiversity-rich land.</td>
<td>Less land use; restored biodiversity-rich land; mixed land use.</td>
<td>Higher ecosystem resilience; higher land diversity more attractive for tourism; higher recreation value of land.</td>
</tr>
<tr>
<td>Global freshwater use</td>
<td>Freshwater saving equipment; freshwater basin; restoration projects.</td>
<td>Reduction of freshwater use; restored freshwater basin.</td>
<td>Availability/renewability of freshwater/drinking water; securing agricultural production potential.</td>
</tr>
<tr>
<td>Stratospheric ozone layer depletion</td>
<td>Replacements for CFCs and other ozone layer destroying chemicals.</td>
<td>No depletion of ozone layer.</td>
<td>Business development for new, less harmful chemicals.</td>
</tr>
<tr>
<td>Atmospheric aerosol loading (n.y.q.)</td>
<td>Aerosol replacements through new cleaning and new non-aerosol propellants; clean mobility and renewable energies.</td>
<td>No aerosol emissions; prevention of changes to rain cycles.</td>
<td>New products without aerosols; reduction of skin cancer and production loss through high UV ray concentration; health benefits through cleaner air.</td>
</tr>
<tr>
<td>Chemical pollution (n.y.q.)</td>
<td>Replacement of toxic chemicals by non-toxic, non-persistent chemicals; reduction of chemical use.</td>
<td>Reduction of/no use of artificial chemicals; no concentration of ‘natural’ chemicals.</td>
<td>‘Green’ chemistry; ‘natural’ chemical based products and production.</td>
</tr>
</tbody>
</table>
A comparison of examples of possible sustainable entrepreneurship activities and ventures for the different planetary boundaries shows that some activities and activity areas may relate to different planetary boundaries. This has also been acknowledged by Rockström et al. (2009, p.472) who mention two key reasons why planetary boundaries are overstepped:

- first, the reliance on fossil fuels, and
- second, the industrialised forms of agriculture.

Sustainable entrepreneurship addressing the overstepping of planetary boundaries can thus in many cases be targeted to the replacement or reduction of fossil fuel use and/or the change of agricultural industry practices to sustainable agricultural practices.

Second, with regard to aligning the level of individual sustainability efforts with the larger planetary picture, organisational and governance innovations are needed. One example that goes into this direction is the discussion about ‘science based targets’ for combating climate change (Bakker and Rockström, 2012). The idea of this organisational innovation is to break the planetary boundaries regarding global warming (or more precisely, the aim to reach the 2° goal) down to the level of organisational commitments and reduction targets (CDP et al., 2015). The non-for-profit Carbon Disclosure Project (CDP) can be understood as a sustainability-oriented new venture with the aim of translating the relevance of the climate planetary boundary to the business world. Its concept of ‘science-based targets’ helps to disaggregate the macro-level concept of planetary boundaries in a way that makes it meaningful for individual actors. Guidelines and standards how to measure and how to account for greenhouse gases, like the greenhouse gas protocol (WBCSD and WRI, 2004) are further institutional innovations supporting the identification of problematic activities, processes and products as well as the development of solutions. At the same time, sustainable intrapreneurs within the business world are needed to take up such concepts and to use them for their organisational innovations. With the CDP’s successful initiative for carbon transparency, new forms of soft governance have emerged that make these individual contributions comparable. Yet, many more governance innovations are needed to move forward to a carbon-neutral economy.

The ‘science-based targets’ for climate action and new transparency norms illustrate how organisational and institutional innovations can begin to link the planetary boundaries with the individual actor level. More recently, the CDP has also started to call for business transparency with regard to its water foot-print, thus addressing the planetary boundary of global freshwater (e.g., CDP, 2016). Yet, for most planetary boundaries, such innovations are still far away. This could be a field in which sustainable entrepreneurship can generate much needed innovations.

5 Discussion

Ecologically-oriented sustainable entrepreneurs can either recognise a market gap as an opportunity to start a business or they create opportunities resulting from their determination to create solutions to existing ecological problems. Planetary boundary-orientation may rather emphasise the second approach as the complexity of the nine abstract boundary phenomena is very high and requires ways of breaking down
areas of action. Many opportunities are not just here but have to be created with the help of various stakeholders that support awareness raising, knowledge about potential solutions, new approaches to serving customer needs in a more sustainable manner and changing market conditions towards a more environmentally supportive market framework.

On the other hand, to be effective requires that the entrepreneurs are successful in existing markets or that they change and create new markets (e.g., Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2010; Schaltegger et al., 2016). The pragmatic nature of entrepreneurship may thus in many cases not obviously be in line with the abstract global vision of working and living in a safe operating space of humanity. In this space between the planetary boundary vision and market reality entrepreneurs may have to start with less radical offers in a first step which are mainly oriented to customer needs, existing knowledge and regulations rather than more radical changes desirable from a planetary boundary concept view.

In observations of successful compared to unsuccessful entrepreneurs and companies, various authors, including Treacy and Wiersma (1995) and Morrish et al. (2010), recommend a clear focus on clearly defined products and services targeted to clearly defined customer groups and market segments. In spite of its high ambitions – or maybe exactly because of its high ambitions – sustainable entrepreneurship thus must in practice go beyond ‘cloudy’ discussions about abstract visions. Driven by the desire to contribute tangibly and in line with the ‘nature’ of start-ups, spin-offs and new ventures, this may mean that sustainable entrepreneurship practice as an activity-oriented phenomenon may in a first step of realisation be less radical than necessary to change production, consumption and life-style patterns.

Given the complexities of broad ecological problems such as climate change or loss of biodiversity, it is not astonishing and may be a good advice to focus on more narrow sustainability topics. Replacement or substantial reduction of fossil fuel consumption in certain areas such as mobility may be examples of narrowing down the focus to increase the potential effectiveness of entrepreneurial activity. As comprehensive sustainability innovations in tendency encompass more or more far reaching changes affecting more stakeholders, it can be expected and maybe also has to be recommended that entrepreneurs start with ‘smaller’ solutions involving less stakeholders, less capital and less time.

One possible fruitful lens through which research may better illuminate the challenges and opportunities of sustainable entrepreneurship is social interdependence theory. Social interdependence refers to states in which success of one individual’s efforts is affected by the actions of others (Johnson and Johnson 2009). Interdependence can be positive or negative.

The magnitude of planetary boundaries suggests that sustainable entrepreneurs will have to look for positive interdependence opportunities in order to motivate other individuals (customers, competitors and regulators) to perceive that they can reach their objectives only if they co-operate with the sustainable entrepreneur.

Much of contemporary political discourse tends to focus on negative interdependence in which individuals perceive that they can obtain their goals only if other individuals fail to obtain their goals. Thus workers in the coal industry interpret the attempts of climate change activists as obstructing their own efforts to achieve the (subjectively legitimate) goal of maintaining employment and income for their families.
Thus, one important way through which sustainable entrepreneurs can achieve their goals are the psychological processes that allow them to demonstrate to their stakeholders how their self-interests can be expanded to become a joint interest in the process of creating new mutually beneficial objectives. Johnson et al.’s (2007) work on social learning suggests that a successive escalation of positive interaction and feedback might be a more fruitful path for sustainable entrepreneurs than the hostile approach of sustainability activists.

“The more effort (individuals) expend in working together, the more they tend to like each other. The more they like each other, the harder they tend to work. The more individuals work together, the greater tends to be their social competencies, self-esteem, and general psychological health. The healthier individuals are psychologically, the more effectively they tend to work together. The more caring and committed relationships individuals are involved in, the healthier they will tend to be psychologically; the healthier individuals are psychologically, the more able they are to form caring and committed relationships. These multiple outcomes form a gestalt that is central to creating a learning community.” (Johnson et al., 2007)

6 Conclusions and outlook for the future of this evolving field

The current economic and societal activities are largely unsustainable and require a transition to a more sustainable economy. While this need may be accepted by most in general terms, the challenge remains who should change what and how. The large impact and change potential of companies raises the question of what they could contribute apart from reducing negative environmental and social impacts of their existing businesses. As entrepreneurship is the approach of destroying existing structures through more convincing offers (Schumpeter, 1962/1934) sustainable entrepreneurship is seen as a key driver for a sustainability transition of markets, the economy and society (Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2010).

However, the existing literature has so far either addressed very specific sustainability issues (such as organic food) or it remained on a highly abstract level. This paper argues that the planetary boundary concept may be a reference point to develop sustainable entrepreneurship in a way that it visibly and more explicitly contributes to sustainable development. While the planetary boundaries are still rather abstract and complex, main drivers contributing to the overstepping are the use of fossil fuels and industrial production systems in the agricultural sector. Considering these key drivers provides a link between the existing sustainable entrepreneurship literature that has emphasised and analysed specific cases and environmental topics and the need to contribute to a safe operating economy in the space of planetary boundaries.

Future research could address links between the planetary boundary concept and the UN SDGs. Griggs et al. (2013), for example, call for explicit integration of the planetary boundaries perspective and the SDGs.

Acknowledgements

Stefan Schaltegger would like to thank for research project funding by the Bundesministerium für Bildung und Forschung (Project Number 01UT1425D).
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