

# Integrating employees in corporate sustainability innovation

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M.Sc.  
Marc Schmidt-Keilich

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Vorsitzende: Prof. Dr. Petra Lucht, Technische Universität Berlin

Gutachter: Prof. Dr. Ulf Schrader, Technische Universität Berlin

Gutachter: Prof. Dr. Martin Müller, Universität Ulm

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**Integrating employees in corporate sustainability innovation**



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- (i) Muster, V., Schrader, U., Blazejewski, S., Schäfer, M., Buhl, A., Harrach, C., Schmidt-Keilich, M., Süßbauer, E. (2016) ‘Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse – Erprobung eines neuen Forschungsansatzes im Rahmen eines BMBF-Verbundprojekts’, *UmweltWirtschaftsForum*, Vol. 24, 417–421. doi: [10.1007/s00550-016-0435-2](https://doi.org/10.1007/s00550-016-0435-2) (postprint).
- (ii) Schmidt-Keilich, M. and Schrader, U. (2019) ‘Sustainability innovation by integrating employees: the potential of sustainable embedded lead users’, *International Journal of Innovation and Sustainable Development*, Vol. 13 No. 1, 98–115. doi: [10.1504/IJISD.2019.096733](https://doi.org/10.1504/IJISD.2019.096733) (postprint).
- (iii) Buhl, A., Schmidt-Keilich, M., Muster, V., Blazejewski, S., Schrader, U., Harrach, C., Schäfer, M., Süßbauer, E. (2019) ‘Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development’, *Journal of Cleaner Production*, Vol. 231, 1248–1257. doi: [10.1016/j.jclepro.2019.05.259](https://doi.org/10.1016/j.jclepro.2019.05.259) (postprint).
- (iv) Schmidt-Keilich, M., Buhl, A., Süßbauer, E. ‘Innovative green employees: The drivers of corporate eco-innovation?’, *International Journal of Innovation and Sustainable Development* (submitted for publication).

## **Framework text**

### **1. Introduction**

Sustainable development is a pressing issue that requires immediate action and changes from governments, industry, and society as a whole (OECD, 2011). One key driver of this multi-level transition towards (a more) sustainable development are sustainability innovations that support the shift of human activity towards social equity and environmental resilience (Brown, 2011).

While the research field of innovation and sustainability is still nascent and the terminology has not converged, most conceptualizations agree that sustainability innovations imply high levels of complexity. Compared with other types of innovation, sustainability innovations tend to be more difficult, risky and ambiguous as they also incorporate social and environmental issues. Further, this multi-dimensional concept needs to be continuously negotiated between numerous stakeholders that often have contradictory demands (Hall and Vredenburg, 2003).

However, stakeholders may also foster sustainability innovation processes by contributing their expertise, practical knowledge and complementary perspectives that typically are not present within corporate R&D departments. While studies on stakeholder integration in sustainability innovation are rare, most of the literature is outward looking and explores how to resolve differing interests rather than addressing the role of these individuals in core innovation activities (Goodman et al., 2017).

In contrast, an emerging body of scientific work in innovation literature points to the benefits of involving employees in innovation processes. Concepts like employee-driven innovation (EDI) build on e.g. non-R&D employees' tacit knowledge (i.e. company-specific knowledge, expertise and problem-solving skills) which is acquired through learning processes during work routines. Other approaches explicitly address the private domain of employees as a valuable resource for innovation and have shown that e.g. use knowledge gathered outside of work may significantly stimulate corporate innovation activity (Schweisfurth and Herstatt, 2014).

In the field of sustainability, employees who are not officially assigned to innovation-related tasks have widely been unrecognized as an internal source of innovation. Exceptions, such as the 'environmental champion' (Anderson and Bateman, 2000) and the 'green change agent' (Wright et al., 2012), are limited to employees that hold specific corporate functions (e.g. sales representatives) and thus, do not consider that sustainability innovations may arise across departments at any organizational level (Ramus, 2003). Other concepts, like the 'green employee' (Ciocirlan, 2017), are applicable to any employee and suggest that strong environmental values may serve as a valuable asset in sustainability innovation processes.

Despite these first indications that point to non-R&D employees as a promising source for corporate sustainability innovation, an elaborate and systematic analysis so far is missing. In this cumulative

dissertation, the integration of employees in corporate sustainability innovation takes center stage. It explores primarily the following main research questions:

1. What is the potential of employees for corporate sustainability innovation?
2. How can companies integrate employees in sustainability innovation processes to tap into this potential?

Each of the four publications contributes to approach answers to these central research questions from different perspectives and areas of focus.

The following chapter gives an overview of the research project IMKoN in the context of which this dissertation was written. Relevant research areas to which the individual publications contribute are outlined in chapter three. Chapter four explains how the publications relate to each other and discusses their main findings. It also considers limitations of the dissertation as well as further research perspectives. After a short summary in chapter five, the individual publications are presented.

## 2. The research project IMKoN

This dissertation has been written as part of the research project IMKoN ('Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse') which ran from 2015-2018 and was funded by the program for 'Sustainable Economy' of the German Federal Ministry of Education and Research. Led by TU Berlin, Economic Education and Sustainable Consumption, together with affiliated partners TU Berlin Center for Technology and Society and Alanus University of Arts and Social Sciences, and in cooperation with eight industry partners, the aim of the project was to develop implementable instruments by analyzing forms, success factors and effects of the integration of employees as consumers in sustainability innovation processes.

The starting point of IMKoN was the fact that sustainability innovations represent a fundamental requirement for socio-ecologically compatible ways of consumption and production. So far, however, the number and success of effective sustainability innovations is still very limited. Open Innovation – i.e. opening up corporate innovation processes to e.g. consumers – can be an approach to foster the development and diffusion of sustainability innovations. This way, the acceptance of innovative solutions can be improved when need and use knowledge as well as existing solution approaches are considered at an early stage in the innovation process. The integration of *external* consumers in innovation processes has been analyzed by numerous studies. Further, some research has been conducted in the field of consumer integration in sustainability innovation. The results show that the recruitment and selection of trend-setting, external consumers tend to be very laborious for companies. The integration of *internal* consumers – i.e. the consumer role of employees – so far has only been given little consideration. While first studies in this field illuminate the significance of trend-setting internal

users in innovation processes, the complex twin role of employees as consumers has not been investigated in the context of sustainability innovations.

In cooperation with eight industry partners, innovation workshops have been designed, planned, conducted and evaluated. In these workshops, sustainability innovations have been developed that address the market-portfolio of the respective industry partner as well as the immediate workplace and office environment. The results confirm that employees – based on their experience and knowledge as consumers and their varying awareness for sustainability – can provide sustainability-oriented ideas as part of corporate innovation processes. Under which conditions the integration of employees as consumers can really contribute to efficient open innovation approaches that lead to (more) sustainable innovations and are tailored to consumer needs was analyzed within four research foci:

*Research focus 1* was dedicated to the further development and implementation of specific open innovation methods for sustainability innovations, in particular innovation workshops. The characteristics of the industry partners – e.g. company size, orientation towards sustainability – were central for differentiating the open innovation approach. Research focus 1 addressed sustainability innovations as part of the company's market-portfolio and covered the evaluation of their sustainability potential.

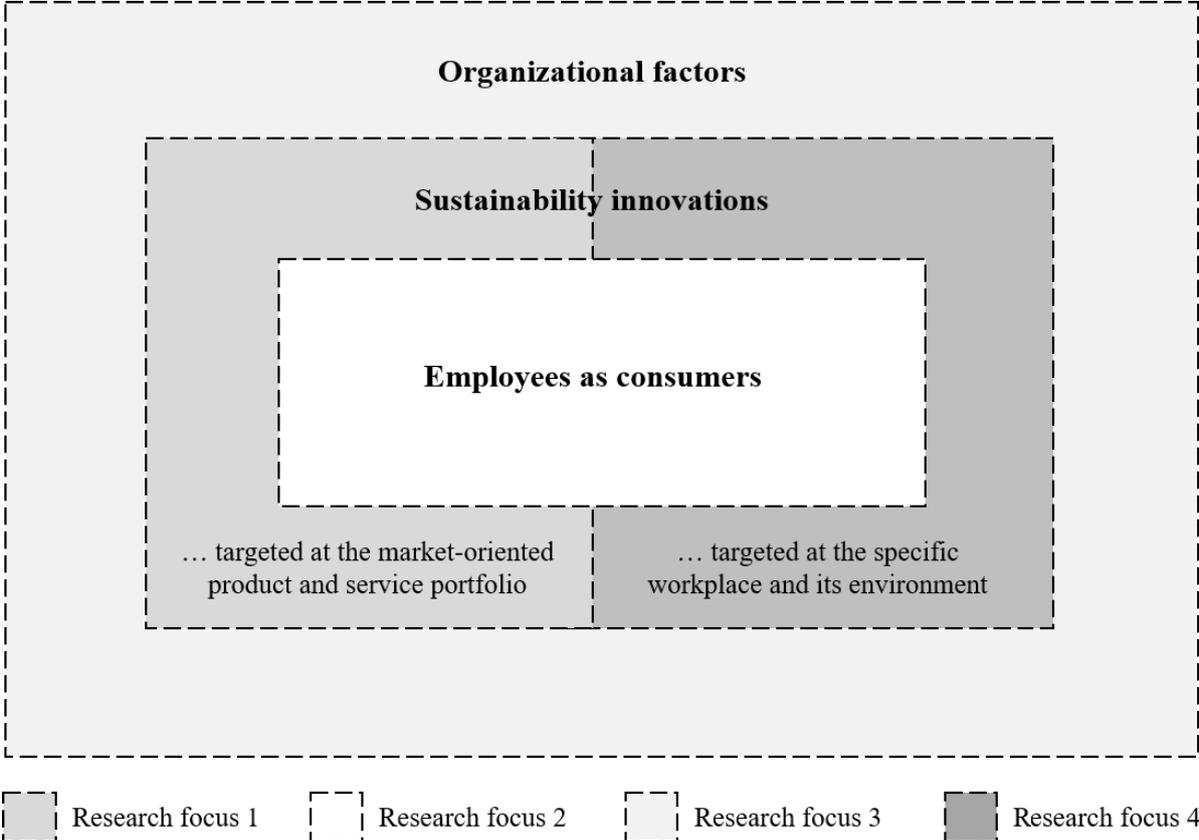
*Research focus 2* dealt with the chances and risks of an integration of consumers in sustainability innovation processes from an employee perspective. On the one hand, it analyzed factors that influence whether employees develop an enhanced satisfaction, commitment, retention and potentially other positive effects because of their involvement. On the other, a critical perspective was assumed and illuminated potential negative effects, such as exclusion, overstraining and reactance of employees. This way, insights on the limitations of an integration of employees as consumers in corporate sustainability innovation were shown. Research focus 2 also investigated the gender perspective and its influence on the chances and risks of the approach.

Organizational factors that affect an integration of employees in corporate sustainability innovation processes were investigated by *research focus 3*. In particular, it was analyzed how the willingness of employees to contribute to sustainability innovation processes is moderated, limited or supported by organizational factors, and how this support can be improved in the future.

Sustainability innovations that provide structures enabling sustainable consumption were analyzed by *research focus 4*. This research focus was especially concerned with taking up suggestions made by employees that address the design of the work environment. Making available (more) sustainable nutritional and mobility offers as well as the management of energy and waste are exemplary activities in this area. Of particular interest here was the question whether such suggestions introduced by employees may also increase the engagement of colleagues.

The dissertation at hand was developed mainly as part of research focus 1. As the different research foci and associated research questions are closely related, the single publications also touch on aspects that were thematically assigned to the research foci 2 and 3.

Figure 1 provides an overview of the four research foci.



3. Research areas, research gaps and short presentation of the individual publications

The dissertation at hand takes an interdisciplinary approach, which is rather common for research in the context of sustainability. Its central points of reference are located in four different fields of research.

Starting and center point of the dissertation is research on *sustainability innovation*. Academic studies on the role of innovation in helping businesses transition to sustainability has established itself as a distinct field of research in the mid-1990s, with contributions from many different disciplines (Hall, 2002), including evolutionary economics, technology studies, environmental studies, innovation management, organizational studies, and sociology (Boons and Lüdeke-Freund, 2013). In particular, over the past 15 to 20 years, a growing importance of sustainable innovation management in practice and academia led to an increase of interest in sustainability-oriented innovation and technology studies (Markard et al., 2012). Since then, however, the literature on sustainable innovation has been hampered by a lack of conceptual consensus and an array of different definitions applied to (aspects of) the phenomenon. The key terms used include “environmental innovation” and “eco-innovation” (Horbach

et al., 2012), “sustainability innovation” (Arnold and Hockerts, 2010), “sustainable innovation” (Nill and Kemp, 2009), “sustainability-oriented innovation” (Klewitz and Hansen, 2014), and “green innovation” (Schiederig et al., 2012).

While a distinction between social and environmental issues in innovation is made to some extent, a clear line is difficult to draw. A rapidly growing body of scholarly work explicitly addresses social aspects under the umbrella of so-called “bottom of the pyramid” initiatives (Prahalad and Hart, 2002). In contrast, most studies focus on the ecological impact of a product or service innovation (Erdmann, 2005). However, improving efficiency with technological product or process innovations is considered insufficient to tackle current global sustainability challenges (Vergragt and Brown, 2007). Therefore, in the last decade, a more holistic approach towards sustainability innovation can be observed in the literature that acknowledges the significance of use systems and cultural aspects (e.g. Jaeger-Erben et al., 2015).

Research on sustainability innovation is the red thread of the dissertation that runs through and interconnects the other three relevant research areas.

*Second*, the literature on *employee innovation* is of particular importance for the present dissertation. Employee innovation typically refers to the generation and implementation of new solutions that originated from employees who are not assigned to this task (Kesting and Ulhøi, 2010). While there is a large body of literature on general employee participation, there is no independent research tradition that specifically focuses on employee innovation.

One research stream that contributes to the understanding of employee innovation is on (individual) creativity as a first innovation step and how it can be enhanced. Related studies analyze innate factors, such as personality and cognition, but also domain-specific factors, such as motivation and knowledge (e.g. Schweisfurth and Herstatt, 2014). Typical measures for innovativeness are entrepreneurship in terms of starting up a business (Ardagna and Lusardi, 2010) and the degree to which certain behaviours are demonstrated in the workplace, e.g. ideation and application of innovation (Hammond et al., 2011). Individual creativity has been identified as the main factor contributing to team innovation, although team functional composition, team process and context moderate this influence (Drach-Zahavy and Somech, 2013).

Another research stream assumes a socio-psychological perspective and explores how organizational factors, e.g. leadership support, affect corporate innovation. A common theme of this stream is that individual employees’ characteristics and organizational factors are both important to achieve high levels of individual innovation. Choi and Price (2005), for example, illustrate that innovation adoption behavior is influenced by organizational factors – such as the existence of an innovative organizational culture, supportive norms for innovation and technical support for innovation – as well as the characteristics of the individual in terms of personal values, positive attitudes toward innovation and

technical abilities for innovation. Both streams, which share the view that resources foster or restrict employees' innovative behavior, are relevant for this work.

A *third* pertinent research field is represented by the studies on *employee green behavior (EGB)*. While scholars have studied environmentally responsible behavior and its antecedents for several decades, interest of organizational researchers in investigating such behavior in the context of the workplace is relatively recent. The literature on EGB builds on the fact that although technology may provide the potential for substantial improvement of the environmental performance of organizations, it depends on employee behavior to realize this potential to its utmost. For example, several studies argue that environmental management system certification only evaluates the presence of an environmental management system, not whether it is used or has any impact on actual environmental performance (Rondinelli and Vastag, 2000). Instead, organizational initiatives and technology need to be supplemented by training and encouraging employees with regard to sustainability-oriented behaviors.

It has been shown that the influence of individual factors, such as attitude and motivation, becomes weaker in the presence of strong contextual factors (Caspi and Moffitt, 1993). Individual behavior at work is, to varying degrees, affected by contextual factors. These factors, such as training of employees, represent the main focus of the burgeoning EGB literature. While contextual variables have been explored mainly at the organizational (e.g. policies, incentives, resources) and supervisory levels (e.g. role-model behavior, communication), institutional (e.g. regulatory and normative pressures) and team-related factors (e.g. perceived colleague support) have also been researched (c.f. Norton et al., 2015).

To date, the literature on EGB has been dominated by the concept of voluntary green behavior. Voluntary EGB aligns closely with the notions of organizational citizenship behavior for the environment (OCBE), which refer to behaviors that support the organizational, social and psychological environment (Organ, 1997). However, recent empirical studies point to the significance of required EGB and distinguish between voluntary green behavior and green behavior performed within the context of employees' job duties (e.g. Ciocirlan, 2017). As companies are seeking to improve their environmental performance by introducing green jobs and duties (Schmit et al., 2012), required green behavior is of particular interest to EGB research.

*Fourth*, the burgeoning literature on *design-driven innovation* offers relevant points of reference for this dissertation. During the last two decades, innovation scholars have increasingly highlighted the potential of design for innovation. This academic interest in the intersection of design and innovation was mainly spurred by the emergence of design thinking (DT), a human-centered approach to innovation based on the ways designers think and work that was popularized most notably by design firm IDEO (Brown, 2008, 2009) and the Rotman School of Management (Martin, 2009).

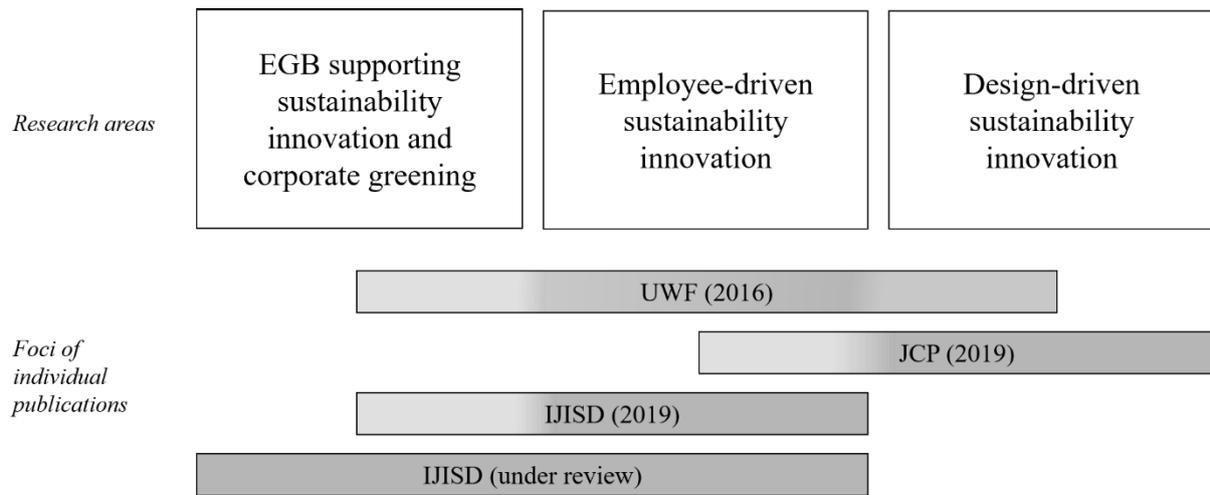
Johansson-Sköldberg et al. (2013) note that research on design thinking can be separated into 1.) 'designerly thinking', which refers to the design research tradition of studying designers and can be

traced back to the 1960s, and 2.) ‘design thinking’, which denotes the concept that has emerged from more recent managerial debates. Although DT seems to be growing in importance, academic research on the phenomenon is still nascent and lacks coherence among scholars. While different DT models almost all describe three stages of a process (data gathering, ideation and testing), a common set of tools and a specific way of thinking, there is inconsistency between the descriptions and emphasis considering the level of detail, normativity and elements of DT (Liedtka, 2015). As a consequence, recent studies on design-driven innovation in general and DT in particular focus on providing a first scientific substantiation of the approach.

In management practice – especially in large organizations from different sectors – DT has been introduced enthusiastically and used in multiple ways during the last few years (Martin, 2011). This was paralleled by a voluminous quantity of contributions by practitioners that have been published mostly as either popular management books (e.g. Brown, 2009; Kelley and Littman, 2005) or articles in major business practitioner publications such as *The Economist*, *Harvard Business Review*, *Business Week*, *The Wall Street Journal*, and *The New York Times* (Liedtka, 2015). The concept has also become a permanent part of the curricula in executive education of renowned schools, such as Stanford University and Harvard Business School.

Despite the high expectations of DT from both practitioners and educators, success of the use of DT in organizational settings is limited to anecdotes (Carlgren et al., 2014). Empirical studies indicate that the use of DT in organizations involves many difficulties (Rauth et al., 2014), an observation that is verified by practitioners in online forums (Nussbaum, 2011). Recent research on DT therefore also focuses on exploring whether DT poses challenges for organizations as it deals with innovation – which typically implies implementation issues in particular for larger companies – or whether the use of DT involves unique barriers due to its inherent characteristics (e.g. Carlgren et al, 2016b). Figure 1 illustrates which research areas are (most) addressed by the individual publications.

Figure 1. Research areas and foci of the individual publications



**IJISD:** International Journal of Innovation and Sustainable Development; **JCP:** Journal of Cleaner Production; **UWF:** UmweltWirtschaftsForum

The first publication in the *UmweltWirtschaftsForum* (UWF, 2016) argues that considering the consumer role of (sustainability-oriented) employees might be beneficial for open sustainability innovation. The approach is central in the research project IMKoN (see chapter 2). Based on interviews and group discussions with representatives from eight companies of different sizes and industries, the article discusses opportunities and risks of the IMKoN approach as a first partial result of the project. The findings suggest that from a practical perspective, an integration of consumption experiences of employees often is not intuitively comprehensible and thus, so far is rather an exception. Further, the results indicate that company size and the specific nature of the core business have a significant effect on the degree to which consumption experiences of employees are integrated. While this seems easier to be realized in smaller companies, larger companies with formalized innovation and technically complex production processes seem to struggle with the approach.

The first draft of the article was written and coordinated by Viola Muster. Together with all other co-authors, Marc Schmidt-Keilich contributed to the development of the project design in general and the IMKoN approach in particular, which represents the basis of this publication. Marc Schmidt-Keilich further significantly supported the planning, implementation and evaluation of the qualitative interviews and group discussions. In particular, he was responsible for the consideration of central aspects of research focus 1, which focused on forms and methods of employee integration in (sustainability) innovation processes.

The second article, which was published in the *Journal of Cleaner Production* (JCP, 2019), conceptually analyzes why and how the innovation approach design thinking (DT) is highly appropriate for the development of sustainability-oriented innovation (SOI). It describes four major challenges that are in particular associated with SOI development, including defining an adequate innovation scope, considering various stakeholders and identifying related user needs and sustainability effects. The article shows that there is a need for appropriate methods and tools that help companies in SOI development. It suggests that design thinking (DT) – a user-centered and iterative problem-solving approach – can foster the development of SOI and presents its five key principles (i.e. problem framing, user focus, diversity, visualization, experimentation and iteration). A research framework with four propositions is developed which demonstrates that the key principles of DT are highly suitable to address the identified SOI challenges.

Dr. Anke Buhl had the main responsibility for this paper and developed large parts of its first draft. Marc Schmidt-Keilich supported in concept development and contributed single chapters. Further, he was responsible for the review process, coordinated internal discussions with co-authors and implemented required adaptations. All other co-authors improved this article with creative suggestions, constructive feedback and critical comments.

The third publication in the *International Journal of Innovation and Sustainable Development* (IJISD, 2019) explores the embedded lead user (ELU) approach in the context of sustainability innovations. Recent studies in innovation management have conceptualized ELU as company employees who exhibit lead user characteristics with regard to a product marketed by their employer (Schweisfurth and Herstatt, 2014). Since ELU are embedded in the producer and user domain, they possess specific resources and capabilities that are beneficial to corporate innovation. The conceptual study argues that the phenomenon may also be highly promising for the development of sustainability innovations. By bringing together existing conceptualizations of a sustainable lead user and the ELU approach, the concept of sustainable embedded lead users (SELU) is introduced. The article illustrates why SELU are suited to support sustainability innovations and how they apply resources from their private and professional domains.

The initial idea for this paper can be credited to Prof. Dr. Ulf Schrader, who supported and improved this publication with his expertise, feedback and comments. Marc Schmidt-Keilich developed the conceptual design, wrote the first draft and implemented subsequent adaptations. He further coordinated the review process in form and content with the editor of the journal.

The fourth article has been accepted for review by the *International Journal of Innovation and Sustainable Development* (IJISD, in review). It builds on the concept of the green employee and empirically explores the potential of innovative green employees, i.e. employees who exhibit an above-average ecological awareness and innovative activity. Using interview data from four green German SMEs, the article finds that innovative green employees contribute to corporate eco-innovation by

generating and discussing pro-environmental ideas that tend to address eco-friendly consumption at the workplace. The results further suggest that they support corporate greening, i.e. the process through which a company becomes more environmentally responsible (Schaefer and Harvey, 1998), by transforming the values and behaviors of colleagues as environmental role-models and opinion leaders. It is also shown that innovative green employees benefit from their environmental knowledge, their professional and private networks, their authenticity and credibility and the dialogue culture present in their company.

Marc Schmidt-Keilich developed the initial concept for the article and questionnaire of the survey, collected and analyzed the data and wrote the first draft of the publication. He further coordinated internal discussions with the co-authors and is responsible for the currently running review process. Dr. Anke Buhl supported in concept development and contributed single passages. Dr. Elisabeth Süßbauer assisted in the data analysis and provided valuable general and critical feedback.

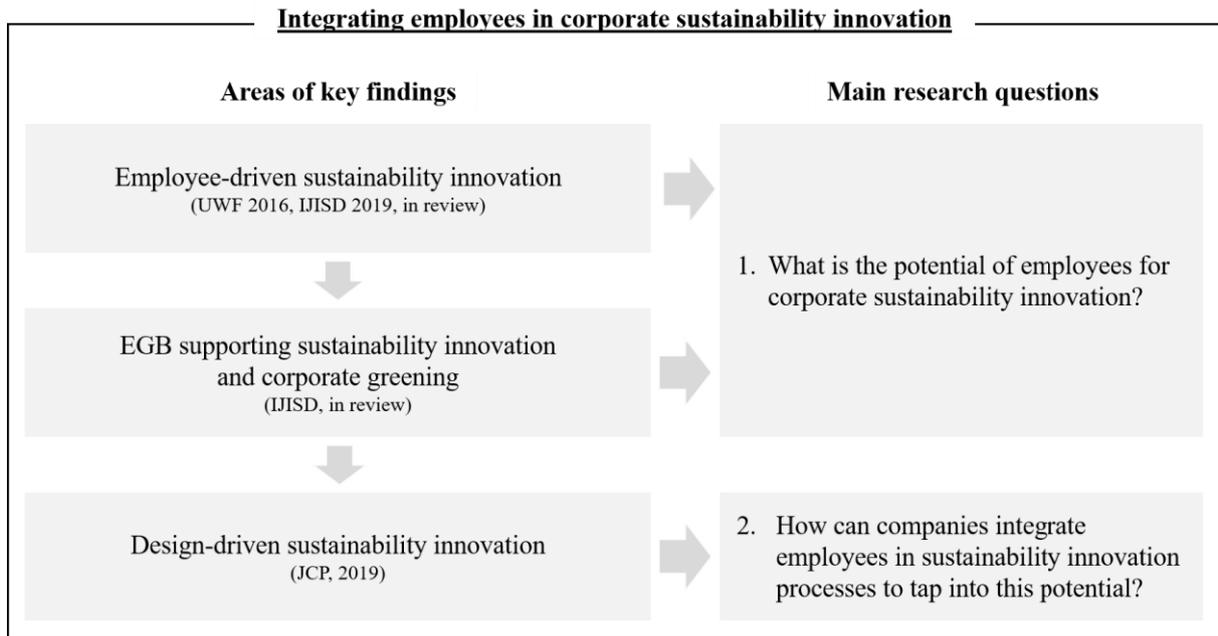
#### 4. Larger context of the individual publications, discussion of the main findings and derivation of research perspectives

Subsequent to the presentation of relevant research areas of this dissertation in chapter two, the larger context of the individual publications is illustrated in the following. Then, the main findings of the dissertation, which are presented in the individual publications, are summarized and discussed. Further, the degree to which the findings contribute to answer the research questions is pointed out as well as avenues for further research.

##### *4.1. Larger context of the individual publications*

The main areas to which the dissertation contributes are illustrated in figure 2. Starting point and overarching bracket is the assumption that non-R&D employees, i.e. employees whose official job description does not include innovation activity, have a high potential to contribute to corporate sustainability innovation. All of the individual publications contribute to illuminate this potential from different perspectives.

Figure 2. Areas of key findings, main research questions and relations between individual publications



UWF (2016) suggests that consumption knowledge and experience of employees may be a valuable resource in particular for corporate sustainability innovation. IJISD (2019) and IJISD (in review) take up this argument and explore the personal characteristics and resources of innovative sustainability-aware employees as well as the ways they engage in corporate sustainability innovation. Whereas IJISD (2019) conceptualizes a new type of employee with a specific set of innovation-related characteristics, IJISD (in review) empirically explores employees with a more general inclination towards innovation. In this respect, the two publications are complementary in their approach to answer the questions:

1. *Which kind of employees are most promising for corporate sustainability?*
2. *How do employees engage in corporate sustainability innovation?*

UWF (2016), IJISD (2019) and IJISD (in review) conclude that companies need to find adequate methods to involve employees in corporate sustainability innovation to fully exploit their innovative potential. JCP (2019) picks up this requirement and explores whether design thinking (DT) may be an appropriate approach to integrate employees in corporate sustainability innovation.

#### 4.2. Discussion of the main findings and derivation of research perspectives

In the following, the findings of the dissertation are summarized and discussed with regard to (4.2.1.) employee-driven sustainability innovation, (4.2.2.) EGB supporting sustainability innovation and corporate greening, and (4.2.3.) design-driven sustainability innovation. Further, limitations are identified as well as resulting perspectives for future research.

#### 4.2.1. Employee-driven sustainability innovation

UWF (2016), IJISD (2019) and IJISD (in review) primarily address the first research question and explore the potential of employees for corporate sustainability innovation.

UWF (2016) proposes that in particular sustainability-aware employees are highly promising to support sustainability innovation processes due to their frequently extensive consumption knowledge and experience. Since the socio-ecological impact of sustainability innovations significantly depends on their specific consumption context, it is crucial to integrate practices, habits and experiences of consumers in the development of these innovations.

IJISD (2019) and IJISD (in review) confirm that an awareness for sustainability is a very valuable characteristic of employees who engage in corporate sustainability innovation. Sustainability-aware employees tend to possess comprehensive sustainability-related knowledge, often have gained years of consumption experience with regard to sustainable products and services and have access to socio-ecological milieus and like-minded social networks. For the development of corporate sustainability innovations, sustainability-oriented employees tap these resources that largely stem from their private life and e.g. bring in inspirations and ideas for sustainable solutions to the company. Most of the ideas the 19 interviewees of IJISD (in review) had introduced directly traced back to their private life. Both articles provide theoretical (IJISD, 2019) and empirical (IJISD, in review) evidence that a consideration of the private domain of employees for corporate sustainability innovation is highly promising. With only one exception (Schrader and Belz, 2012), this valuable resource so far has remained largely unconsidered in sustainability-related literature.

In contrast, recent studies in innovation management have explicitly pointed to private consumption knowledge and experiences of employees as a valuable resource for corporate innovation as part of the embedded lead user (ELU) approach (Schweisfurth and Herstatt, 2014). IJISD (2019) adapts the ELU approach to sustainability innovation and develops the concept of sustainable embedded lead users (SELU): sustainability-oriented employees who exhibit lead user characteristics with regard to a product marketed by their employer. IJISD (2019) illustrates that SELU have a high potential to support all phases of the development process of sustainable solutions: In the ideation phase, SELU may contribute ideas and inspirations that originated from their participation in user groups. In the development phase, companies may engage SELU in e.g. testing and specification setting. In later stages, SELU might act as opinion leaders and support the diffusion of sustainability innovations by influencing the adoption decision of others within their social networks.

The innovative potential of SELU is rooted in their specific need knowledge and use experience with regard to a specific product or service that is marketed by their employing company. IJISD (in review) complements the SELU concept by illustrating that innovative green employees, i.e. employees that exhibit an above average environmental orientation and innovative behavior, frequently promote workplace-related eco-innovations. Since the workplace is an important context for behavioral change

towards sustainable consumption, the significance of workplace-related sustainable innovation increases (Muster, 2011). Innovative green employees primarily contribute to eco-innovation by generating, introducing and discussing pro-environmental ideas. However, their ideas tend to be limited in scope and rarely stand out as particularly creative. Unlike SELU, innovative green employees' use knowledge and consumption experiences relate to all kinds of different ecological solutions, yet do not necessarily refer to the market offerings of their employing company. However, relevant use knowledge of a specific product or service is key to innovation in general (von Hippel, 1994) and eco-innovation in particular (Schrader and Belz, 2012). Accordingly, employees who lack relevant use knowledge might struggle to come up with valuable ideas that address the company's market portfolio.

Further, innovative green employees differ from SELU with regard to their intrapreneurship spirit. While the theoretical considerations of IJISD (2019) suggest that SELU foster new sustainable solutions along the entire innovation process, IJISD (in review) reveals that innovative green employees restrict themselves to the role of idea giver and only seldom engage in idea development and implementation.

Despite the high potential of an integration of consumer knowledge and experiences of employees in corporate sustainability innovation, the approach is applied rarely and rather unsystematically in business practice. UWF (2016) indicates that corporate culture and the organization's perspective on the role of employees have a particular influence on whether organizations associate chances or risks with an integration of the private domain of employees. The findings show that organizations that reduce employees to their professional role regard the approach as more risky than organizations that perceive employees as whole persons.

UWF (2016) further indicates that company size and the specific type of the core business significantly influence whether (privately acquired) consumption experiences of employees are considered or not. While this seems easier to be realized in smaller companies, the typically formalized innovation processes and technically complex production processes of larger organizations appear to hamper the implementation of the approach.

The presented findings on the characteristics, resources and behaviors of SELU and innovative green employees within this dissertation are mere starting points for a more profound and systematic analysis of the role of employees for corporate sustainability innovation. While the considerations of IJISD (2019) on SELU are conceptual, empirical studies need to analyze to what extent these employees hold and exert the qualities and behaviors described. Likewise, the first insights on the potential of innovative green employees presented by IJISD (in review) need to be put into perspective by quantitative research.

To gain a better understanding of the phenomenon of employee-driven sustainability innovation, it further seems necessary to include an analysis of organizational factors that impact their behavior. While IJISD (2019) and IJISD (in review) provide first indications that e.g. a pronounced dialogue culture is beneficial for innovative green employees in introducing and discussing workplace-related ideas,

organizational factors for employee innovation, such as leadership support (Hammond et al., 2011), were out of scope of the two publications.

#### 4.2.2. EGB supporting sustainability innovation and corporate greening

Studies in organizational and environmental literature have frequently referred to the ‘green employee’ to describe the potential of environmentally aware employees for corporate greening (e.g. Renwick et al., 2013), broadly defined by Schaefer and Harvey (1998) as the process by which companies can become more environmentally responsible in their operations. Without providing empirical evidence, scholars have recently suggested that green employees may be valuable in particular for the development of corporate eco-innovation (e.g. Buhl et al., 2016).

IJISD (in review) finds that the subgroup of innovative green employees wants to engage in corporate eco-innovation even if it is not covered by an official job description. However, the findings also reveal that innovative green employees consider any behavior at the workplace that aims at protecting the natural environment as a form of eco-innovation. Most of the interviewees in IJISD (in review) referred to their own eco-friendly consumption at the workplace as innovative, and some of them explained that they do not distinguish between work and private life when it comes to environmental protection.

Further, the findings of IJISD (in review) suggest that innovative green employees regard the responsibility of the individual as key to sustainable development. Hence, innovative green employees engage in activities that aim at transforming the values and behaviors of colleagues. They raise an awareness for environmental issues by their own eco-friendly behavior both within and outside of the company. Based on an authentic lifestyle and their broad environmental knowledge and experience, innovative green employees are perceived as highly credible environmental role-models by fellow colleagues who are stimulated to follow their lead. Some of them more actively spread pro-environmental values within the company as environmental opinion leaders. They approach colleagues and point to the need for more eco-friendly consumption behaviors as well as practical solutions for a more ecologically sustainable lifestyle.

It is noticeable that innovative green employees are very anxious not to make moral accusations in their pursuit to green the values and behaviors of fellow employees. Also, rather than using formal corporate forums – e.g. environmental committees – they take advantage of the characteristic dialogue cultures at their workplace and communicate with colleagues on an informal level. In this respect, innovative green employees have strong similarities with green change agents (Wright et al., 2012), which have been portrayed as role-models and opinion leaders in that they “seek to change employee perceptions and behavior on environmental issues” (p. 461). In contrast, they distinguish from related concepts – such as environmental champions (Sonenshein et al., 2014), environmental issue supporters (Anderson and Bateman, 2000) and sustainable intrapreneurs (Schrader and Harrach, 2013) – that portray employees who are often “on the front lines of addressing pressing social issues like climate change (...)”

(Sonenshein et al., 2014, p. 7) and expose themselves to “convince and enable organization members to turn environmental issues into successful corporate programs” (Anderson and Bateman, 2000, p. 548).

The evaluation of the potential of innovative green employees for corporate sustainability innovation hinges upon how sustainability innovation is defined. While their support for the development of market-oriented sustainable products and services is limited (see 4.2.1), innovative green employees have a great potential to drive corporate greening as a form of organizational innovation. Accordingly, it seems advisable for future research to shed more light on (innovative) green employees’ understanding of sustainability innovation and how they want to engage in it. Further, subsequent studies on (innovative) green employees should consider the type of their organization. The informants in IJISD (in review) were sampled from “green” companies of a rather small to medium size, as this was expected to be a context in which the phenomenon exists. However, while innovative green employees might struggle to convince colleagues of sustainability ideals and the significance of sustainable consumption in rather non-green companies, these might hold the greatest potential for corporate greening. Future research therefore should analyze the behavior and effectiveness of innovative green employees in different organizational settings to evaluate how their potential is affected by the environmental performance of their employer.

#### 4.2.3. Design-driven sustainability innovation

The development of sustainability-oriented innovation (SOI) is considered rather complex. While environmental, social and economic requirements must be met at the same time, SOI are influenced by a multitude of factors, such as technological progress, market forces and government regulations (Horbach et al., 2012). In order to deal with this complexity related to SOI development, adequate approaches for organizations are needed (Adams et al., 2016).

In recent years, design thinking (DT) has increasingly attracted the interest of practitioners and researchers as a user-centered and iterative approach for solving complex and systemic problems (Carlgren et al., 2016a). However, while some scholars have proposed DT as a promising tool for developing innovative solutions to sustainability-related problems, the argumentation so far has largely been anecdotal (e.g. Brown and Wyatt, 2010; Dewberry and Sherwin, 2002).

Before this background, JCP (2019) discusses why and how DT may foster SOI. Derived from the outcome dimensions of SOI (Hansen et al., 2009; Hüsigg, 2014), the central challenges related to SOI development are presented: (i) the definition of an appropriate innovation scope, (ii) the consideration of user needs and behaviors, (iii) the involvement of a wide range of stakeholders, and (iv) the assurance of actual sustainability effects. The article explains how these challenges are addressed by the five key principles of DT (i.e., problem framing, user focus, diversity, visualization as well as experimentation and iteration) by offering four propositions:

*Proposition 1:* Design thinking, in particular its “problem framing” principle, facilitates the definition of an appropriate innovation scope for SOI development.

*Proposition 2:* Design thinking, in particular its “user focus” principle, fosters a thorough understanding and consideration of user needs for SOI development.

*Proposition 3:* Design thinking, in particular its “diversity” principle and indirectly its “visualization” principle, fosters stakeholder involvement in SOI development.

*Proposition 4:* Design thinking, in particular its “experimentation and iteration” principle and indirectly its “visualization” principle, facilitates the assurance of sustainability effects during SOI development.

JCP (2019) also explains why DT is an appropriate approach for organizations to integrate employees and utilize their specific resources and capabilities in SOI development. While DT theoretically ensures an early involvement of diverse stakeholders (Fischer, 2015), identifying and integrating relevant external stakeholders in practice can be challenging (Schrader and Belz, 2012). Therefore, innovation teams might recruit sustainability-aware employees as internal stakeholders. They are intrinsically motivated to support environmental protection at work and possess broad environmental knowledge and skills (Buhl et al., 2016; Ciocirlan, 2017).

When these employees additionally possess relevant use knowledge and consumption experience – such as SELU – they are highly beneficial to bring in the user perspective which is crucial for SOI development. In order to immerse in the relevant user context and determine hitherto undisclosed user needs, DT applies ethnographic methods (e.g. cultural probes) that help to observe users in their natural settings. Sustainability-aware user employees can empathize with these external users and translate their feedback into design criteria. Also, they can directly share their use experiences and related needs with the design team and thus provide a direct access into the user sphere.

However, it can be argued that DT’s focus on current users is also one of its downsides that questions its appropriateness for employee-driven SOI development. While incremental innovation typically draws on existing (use) knowledge to improve and exploit an established solution (Garcia and Calantone, 2002), radical innovation – which is indispensable for a transition towards a green economy (Fichter and Weiß, 2013) – is less dependent on an existing demand, but rather aims at generating new demands not yet recognized by the consumer (Garcia and Calantone, 2002). Indeed, an interview study by Carlgren et al. (2016a) provides a first confirmation that DT is mainly applied for the development of incremental innovation. Hence, it is up to future research to analyze whether DT is inherently confined to the development of incremental innovation, or is also suitable for the generation of truly innovative ideas.

Further, JCP (2019) exclusively focuses on the creation and evaluation of novel ideas for SOI, as an innovation's sustainability effects are largely determined already at this early phase in the development process (Maxwell and van der Vorst, 2003). In line with that, it has been argued that participation of non-R&D employees in corporate innovation is beneficial in particular in the ideation phase (Axtell et al., 2000). However, IJISD (in review) points to the fact that there might not be a shortage of sustainability-related ideas, but a shortage of idea implementation. As DT does not strive to solve a given problem as efficiently as possible to quickly move forward to implementation, but involves a lot of time in the framing of the design challenge and exploring hidden user needs, the approach might not lead to a higher implementation rate of ideas within organizations (Carlgren et al., 2016b). Therefore, subsequent research should look into whether DT is also appropriate to drive SOI development in later stages of the innovation process and explore the role employees might play in these stages.

## 5. Summary

The aim of this framework text was to give an overview of the three single publications of this cumulative dissertation and to delineate the central linkages between them.

After a short introduction of the contributions and the relevant research areas, the central findings that address the research questions have been delineated and contextualized. It was shown that in particular sustainability-aware employees may contribute significantly to corporate sustainability innovation, as they draw from relevant resources that primarily stem from their private life. Combined with a general inclination towards innovation, these employees in particular introduce ideas for workplace-related ideas and foster corporate greening by transforming the values and beliefs of colleagues. In contrast, it has been argued that sustainability-minded employees who additionally exhibit lead usership with regard to the product or service portfolio of their employer have a high potential to support market-oriented solutions through all phases of the innovation process. And finally, it has been explained why DT is an appropriate approach for the development of SOI and how in particular sustainability-aware employees may be integrated in related SOI development processes by organizations.

In addition, various points of reference for further research have been identified.

Finally, it is hoped that this work contributes to a better understanding and consideration of the potential of employees for corporate sustainability innovation. The practical implementation and dissemination of approaches that allow to exploit this potential – such as DT – is the responsibility of organizations. But also, it is up to employees to drive sustainability innovations and engage in activities that foster corporate greening.

All the papers of this cumulative dissertation are presented after the references in chronological order based on the time of publication. Consistent formatting of paragraphs, font, size and numbering is applied to the single publications. The different forms of citation, which had been adapted to the

specifications of the respective publication organs, have been retained. At certain points, formalities have been corrected.

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## **Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse – Erprobung eines neuen Forschungsansatzes im Rahmen eines BMBF-Verbundprojekts**

*Muster, V., Schrader, U., Blazejewski, S., Schäfer, M., Buhl, A., Harrach, C., Schmidt-Keilich, M., Süßbauer, E. (2016), UmweltWirtschaftsForum, Vol. 24, pp.417–421.*

Zusammenfassung:

Die Integration von Konsumenten in Nachhaltigkeitsinnovationsprozesse hat das Potenzial, diese Innovationen erfolgreicher zu machen. Allerdings ist die Einbindung besonders innovativer Konsumenten, sog. Lead User, vielfach sehr aufwendig, wenn diese außerhalb der Unternehmen identifiziert und für die Mitarbeit gewonnen werden müssen. In diesem Beitrag wird mit der Integration von (nachhaltigkeitsorientierten) Mitarbeitern in ihrer Konsumentenrolle ein neuer Ansatz präsentiert. Dieser steht im Mittelpunkt des vom BMBF (Bundesministerium für Bildung und Forschung) finanzierten Verbundprojekts IMKoN (Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse). Als erstes Teilergebnis werden hier Chancen und Risiken des IMKoN-Ansatzes am Beispiel einer Bestandsaufnahme bei acht Unternehmen unterschiedlicher Größe aus verschiedenen Branchen diskutiert.

### 1. Einleitung

Nachhaltige Entwicklung setzt Nachhaltigkeitsinnovationen voraus. Den globalen Herausforderungen wie Klimawandel, Artensterben und Armut lässt sich nur erfolgreich begegnen, wenn bekannte, nicht-nachhaltige Produktions- und Konsumpfade verlassen und neue, sozial-ökologisch verträgliche Lösungen entwickelt und umgesetzt werden. Anzahl und Verbreitung erfolgreicher Nachhaltigkeitsinnovationen sind bislang allerdings begrenzt.

Ein Grund dafür kann sein, dass die Bedürfnisse von Konsumenten und die nachhaltigen Angebote von Unternehmen nicht gut genug aufeinander abgestimmt sind. Offene Innovationsprozesse zielen deshalb darauf ab, durch einen verstärkten Austausch mit der unternehmerischen Umwelt passgenauere Innovationen hervorzubringen. Insbesondere für Nachhaltigkeitsinnovationen, die es oftmals nicht aus der „grünen Nische“ in den Mainstream schaffen, liegt in einem verstärkten Austausch mit Konsumenten eine wichtige Chance (z.B. Belz et al. 2011; Schrader und Belz 2011; Hoffmann 2007).

Während die Integration von Kunden als „externe“ Konsumenten in Forschung und Praxis bereits seit längerem ein bekanntes Thema ist, erhält die Integration von „internen“ Konsumenten, also den Mitarbeitern eines Unternehmens, bislang wenig Aufmerksamkeit. Doch auch „interne Konsumenten“ haben konsumbezogene Bedürfnisse und Erfahrungen, die für Unternehmen von Relevanz sein können (Muster und Schrader 2011; Schrader und Harrach 2013). Dies gilt auch und gerade für Nachhaltigkeitsinnovationen.

Der vorliegende Beitrag beleuchtet deshalb sowohl aus Forschungs- als auch aus Praxissicht die Relevanz der Integration von (nachhaltigkeitsorientierten) Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse.

Zunächst wird kurz erklärt, was unter offenen (Nachhaltigkeits-)Innovationsprozessen verstanden wird. Danach wird argumentiert, dass die Innovativität von Mitarbeitern nicht ausschließlich an ihre formale Funktion im Unternehmen gebunden ist. Anschließend werden die Relevanz des Ansatzes für verschiedene Disziplinen sowie erste empirische Ergebnisse vorgestellt.

## 2. Konsumentenintegration in offene (Nachhaltigkeits-)Innovationsprozesse

Nach Chesbrough (2006) ist unter offenen Innovationen die Nutzung zielgerichteter Ströme von Wissen und Kenntnissen von außerhalb der Unternehmung zur Verbesserung interner Innovationsprozesse zu verstehen. Dahinter steht die grundlegende Annahme, dass es außerhalb der traditionellen Innovationsabteilung Wissensbestände gibt, die ebenfalls wertvoll für unternehmerische Innovationen sind.

Während grundsätzlich alle denkbaren Akteursgruppen Innovationsprozesse durch ihren „Wissenszufluss“ bereichern können, ist die Gruppe der Konsumentinnen und Konsumenten besonders vielversprechend (Lüthje und Herstatt 2004; Reichwald und Piller 2006). (Potentielle) Nutzer verfügen über konkretes Problem- und Anwendungswissen und z.T. auch bereits über Lösungsideen, die in verschiedenen Phasen des Innovationsprozesses fruchtbar sein können. Es lassen sich so Innovationen entwickeln, die besser zu bestehenden Nutzungszusammenhängen passen und die größere Chancen auf Marktakzeptanz und Verbreitung haben (von Hippel 1986).

Innerhalb der Kundengruppe wird das höchste Innovationspotential den sogenannten Lead Usern zugeschrieben. Diese zeichnen sich dadurch aus, dass sie besonders unzufrieden mit bestehenden Marktangeboten sind, zukunftsweisende Ideen haben und ggf. auch schon selbst innovativ tätig waren (von Hippel 1986; Lüthje und Herstatt 2004). Allerdings kann es für Unternehmen sehr aufwendig sein, in ihrem Kundenumfeld Lead User zu identifizieren und für die Beteiligung an Innovationsprozessen zu gewinnen (Schrader und Belz 2011).

Im Kontext von Nachhaltigkeitsinnovationen, also neuartigen Problemlösungen, die zu inter- und intragenerational übertragbaren Produktions- und Konsumstilen beitragen (Fichter 2005a), ist das Anwendungswissen von privaten Nutzern besonders zentral. Um die sozial-ökologische Wirkung eines Produktes oder einer Dienstleistung tatsächlich beurteilen zu können, reicht es nicht, die Innovation losgelöst vom Kontext zu bewerten. Vielmehr kommt es darauf an, dass in der konkreten Handhabung, im Umgang mit dem Produkt, die sozial-ökologische Verträglichkeit gewährleistet bleibt. So können beispielsweise vermeintlich umweltfreundliche Waschkonzentrate einen gegenteiligen Effekt haben, wenn Verbraucher, z.B. auf Grund von Gewohnheit, weiterhin die gleichen Mengen wie bei

herkömmlichen Waschmitteln verwenden. Die Berücksichtigung solcher konkreten Praktiken und Erfahrungen kann deshalb dazu beitragen, dass besonders bedürfnisgerechte und erfolgreiche Nachhaltigkeitsinnovationen entstehen, die Rebound-Effekte und andere unerwünschte Nebenfolgen vermeiden (Fichter 2005b).

Nachhaltigkeitsinnovationsprozesse mit externen Konsumenten, insbesondere Lead Usern, wurden bereits in ersten Forschungsarbeiten analysiert (z.B. Belz et al. 2011; Hoffmann 2007). Auch hier konnte mehrheitlich bestätigt werden, dass es sich lohnt, Lead User in die Entwicklung neuer Produkte einzubeziehen, weil diese zum einen kreativere Lösungen hervorbringen, zum anderen aber auch besonders motiviert und zuverlässig sind (Schrader und Belz 2011). Zugleich gibt es Hinweise darauf, dass auch Non-Lead-User wertvolle Beiträge leisten können, etwa weil sie stärker kontextuale statt spezifisch produktbezogene Anregungen geben (Diehl 2015).

### 3. Innovativität von Mitarbeitern jenseits ihrer formalen Funktion

Mitarbeiter in Unternehmen werden in erster Linie als Funktionsträger innerhalb eines klar definierten Arbeitsbereiches betrachtet. Auf Basis formaler, berufsbezogener Qualifikationen und spezifischer Berufserfahrungen werden sie als wertvoll für einen bestimmten Bereich oder zumindest eine begrenzte Auswahl von Arbeitsaufgaben angesehen.

Neyer et al. (2009) machen jedoch darauf aufmerksam, dass auch Mitarbeiter eines Unternehmens, die aufgrund ihrer formalen Funktionsbeschreibung nicht für Innovationen zuständig sind, den Innovationsprozess bereichern können. Diese „peripheren Innovatoren“ können vor dem Hintergrund ihrer spezifischen Arbeitserfahrungen innovative Ideen produzieren und in den Innovationsprozess einspeisen (Neyer et al. 2009). Auch andere Autoren weisen darauf hin, dass Mitarbeiter jenseits ihrer formalen Aufgabenzuschreibung Innovationen befruchten und voranbringen können (z.B. Høyrup et al. 2012; Leimeister und Zogaj 2013).

Damit wird bereits deutlich, dass die Öffnung des Innovationsprozesses nicht allein auf die (aufzuhebende) Trennung zwischen Unternehmen und deren Umwelt zu beziehen ist, sondern auch eine „interne“ Öffnung über Abteilungsgrenzen hinweg bedeuten kann.

Ebenso kann sich die Öffnung des Innovationsprozesses auf alle Lebensbereiche der Mitarbeiter beziehen. Wie Schrader und Belz (2011: 343) feststellen, wird häufig „übersehen, dass Mitarbeiter nicht nur ein Erwerbsleben, sondern immer auch ein Privatleben haben.“ In ihrem Privatleben sind Mitarbeiter schließlich Konsumenten und Nutzer mit spezifischen Erfahrungen, Bedürfnissen und Ideen. Naheliegender ist deshalb die Vermutung, dass auch diese privaten Konsumerfahrungen zu Innovationen beitragen können.

Erste Arbeiten widmen sich bereits diesen „internen Konsumenten“ (Schweisfurth 2013; Schweisfurth und Herstatt 2014). Dabei wird aufgezeigt, dass ihre doppelte Einbettung in den Nutzungskontext

einerseits und in den Produktionsprozess andererseits, sie zu wertvollen Vermittlern zwischen beiden Bereichen macht. In Schweisfurths (2013) empirischen Untersuchungen von „embedded lead users“ wird deutlich, dass diese Mitarbeiter besonders gut in der Lage sind, Probleme aus Nutzungskontexten mit Lösungswissen aus dem Unternehmen zu kombinieren. Sie können sowohl im Unternehmen als auch im Privatleben auf soziale Netzwerke zurückgreifen und diese Kontakte jeweils nutzen, um Informationen und Erfahrungen auszutauschen. Auch genießen sie auf Grund ihrer „Praxiskenntnisse“ Glaubwürdigkeit im Unternehmen. Diese Ressourcen machen sie in allen Phasen des Innovationsprozesses – von der Ideengenerierung über die Entwicklung bis zur Diffusion – zu wertvollen Innovatoren.

Im Rahmen von Nachhaltigkeitsinnovationsprozessen und unter Berücksichtigung von Konsumentengruppen mit und ohne Lead-User-Eigenschaften wurden „interne Konsumenten“ jedoch bislang noch nicht untersucht.

#### 4. Forschungsrelevanz des Ansatzes: Das BMBF-Verbundprojekt IMKoN

Seit April 2015 wird im Rahmen des vom BMBF (Bundesministerium für Bildung und Forschung) geförderten Verbundprojekts IMKoN („Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse“) die Frage untersucht, ob und unter welchen Bedingungen die Integration von Mitarbeitern als Konsumenten dazu beitragen kann, dass offene Nachhaltigkeitsinnovationsprozesse effizienter und entstehende Innovationen bedürfnisgerechter und nachhaltiger werden. Dabei geht es sowohl um Nachhaltigkeitsinnovationen für Produkte und Dienstleistungen als auch um Nachhaltigkeitsinnovationen zur Gestaltung des Arbeitsplatzes und des Arbeitsumfelds. Im Rahmen des Projekts sollen mögliche Formen, Erfolgsdeterminanten und Effekte einer Integration von Mitarbeitern in Nachhaltigkeitsinnovationsprozesse identifiziert werden.

Das Projekt hat eine Laufzeit von drei Jahren. Die wissenschaftliche Durchführung liegt bei den Autorinnen und Autoren dieses Artikels. Die Projektförderung erfolgt im Rahmen der Sozial-ökologischen Forschung (SÖF) des BMBF. Kennzeichnend für dieses Forschungsprogramm ist der transdisziplinäre Ansatz, also ein Forschungsdesign, das sowohl Interdisziplinarität als auch intensive Zusammenarbeit mit Praxispartnern umfasst. Für das IMKoN-Projekt wurden acht Unternehmen unterschiedlicher Größe und Ausrichtung für die Zusammenarbeit gewonnen. Bei den drei Großunternehmen, die sich im besonderen Maße auf den Weg in Richtung Green Economy gemacht haben („Greening Goliaths“), handelt es sich um Henkel AG & Co. KGaA, Otto GmbH & Co KG und die Tchibo GmbH. Als KMUs, die eine große Reputation als Öko-Pioniere besitzen und sich zunehmend auf den Massenmarkt zubewegen („Growing Green Davids“) wurden die bio verlag GmbH, Elektrizitätswerke Schönau GmbH – EWS, Sonett OHG, Triaz Group GmbH und die WALA Heilmittel GmbH gewonnen. Es ist also gelungen, je mindestens einen „Greening Goliath“ und einen „Growing Green David“ für die Branchen Haushalts-Chemie (Henkel und Sonett) und Einzelhandel (Otto, Tchibo

und Triaz mit Marken wie Waschbär oder Vivanda) zu gewinnen. Zudem ist je ein Praxispartner aus den für den nachhaltigen Konsum ebenfalls zentralen Branchen Energie (EWS) und Medien (bio verlag mit der Zeitschrift „Schrot und Korn“) beteiligt. EWS und bio verlag weisen als von Nutzern gegründete bzw. als von Mitarbeitern geführte Unternehmen zudem Besonderheiten auf, die im Projektkontext von spezifischer Relevanz sind.

Im Zentrum des Projekts steht die Durchführung speziell entwickelter, mehrtägiger Innovationsworkshops, in denen Mitarbeiter als Konsumenten Konzepte für Markt- und Arbeitsplatzinnovationen entwickeln sollen. Die Workshops bedienen sich dabei Elementen aus dem Design Thinking (z.B. Brown und Wyatt 2015; Grots und Pratschke 2009) und werden von der Berliner Innovationsagentur Dark Horse durchgeführt. Eine umfassendere, laufend aktualisierte Projektdarstellung findet sich auf der Website [www.imkon.de](http://www.imkon.de).

Aus dem Verbundprojekt sind relevante Erkenntnisse für verschiedene Forschungsbereiche zu erwarten: Zum Innovations- und Nachhaltigkeitsmanagement soll ein Beitrag geleistet werden, indem die Nachhaltigkeitsorientierung und Innovationsfähigkeit von Mitarbeitern stärker zusammengedacht und weiterentwickelt wird. So soll unter anderem eine Typologie von unterschiedlich nachhaltig und innovativ ausgerichteten Mitarbeitern entwickelt und deren unterschiedlichen Leistungen zur Förderung von Nachhaltigkeitsinnovationen untersucht werden. Auch gilt es, organisationale Faktoren zu identifizieren, die einer erfolgreichen Integration von Mitarbeitern als Konsumenten in Innovationsprozesse entgegenstehen bzw. dieser förderlich sind (Blazejewski et al. 2016). Im Hinblick auf Arbeitsplatzinnovationen ist zu analysieren, wie Mitarbeiter bei der Gestaltung von Ermöglichungsstrukturen für ihren eigenen nachhaltigen Konsum mitwirken können (Jaeger-Erben et al. 2015).

Für die Personalmanagementforschung sind relevante Ergebnisse aus einem erweiterten Verständnis von Mitarbeitern jenseits ihrer formalen Rolle und einer verstärkten Integration von privaten Erfahrungen und Bedürfnissen zu erwarten. So gilt es z.B. herauszufinden, ob insbesondere nachhaltigkeitsorientierte und innovative Mitarbeiter, die verstärkte Möglichkeiten erhalten, diese Erfahrungen am Arbeitsplatz einzubringen, dadurch motivierter und zufriedener sind (Schrader und Harrach 2013). Im Kontext der sogenannten Green Work-Life-Balance (Muster und Schrader 2011) zeigt sich, dass gerade Mitarbeiter, die in ihrem privaten Kontext eine starke ‚grüne‘ Identität entwickelt haben, hoch motiviert sind, ihr Engagement auch in ihrem Arbeitskontext einzubringen (Blazejewski et al. 2016, Harrach et al. 2014). Wenn Unternehmen dieses Anliegen ernst nehmen und Mitarbeiter mit ihren sozial-ökologischen Ideen und Erfahrungen auch am Arbeitsplatz wirksam werden, trägt dies tendenziell zur Erreichung zentraler personalpolitischer Ziele wie Mitarbeiterbindung, Zufriedenheit und Commitment bei (Harrach et al. 2014). Wie und inwieweit die Einbindung in Innovationsprozesse solche positiven Effekte hervorbringen kann, ist jedoch noch genauer zu untersuchen.

Aus soziologischer Sicht ist es sowohl relevant, diesen Ansatz als spezifische Form einer Entgrenzung und Subjektivierung von Arbeit zu untersuchen als auch vor praxistheoretischem Hintergrund zu analysieren, ob und wie Konsumpraktiken aus dem Privatleben an den Arbeitsplatz übertragen werden können und andersherum (Muster 2014). Daraus könnten sich wichtige Hinweise für die Förderung nachhaltigen Konsums ableiten lassen.

#### 5. Praxisrelevanz des Ansatzes: Ergebnisse einer Bestandsaufnahme bei Unternehmen

Im Rahmen einer ersten Bestandsaufnahme bei den acht Unternehmen, die Praxispartner im Verbundprojekt sind, wurden unter anderem die Relevanz sowie die Chancen und Risiken des IMKoN-Ansatzes untersucht. Dazu wurden pro Unternehmen drei bis sechs halbstandardisierte Interviews mit Unternehmensverantwortlichen sowie jeweils eine Gruppendiskussion mit fünf bis zehn Mitarbeitern aus unterschiedlichen Unternehmensbereichen durchgeführt. Im Folgenden werden die zentralen Ergebnisse zusammengefasst.

Zunächst wurde deutlich, dass die Idee einer Integration von Mitarbeitern in ihrer privaten Konsumentenrolle aus Praxissicht vielfach nicht intuitiv verständlich und naheliegend scheint, da selbst die Beteiligung von Mitarbeitern in ihrer reinen Mitarbeiterrolle jenseits der Forschungs- und Entwicklungsabteilung alles andere als selbstverständlich ist.

Die Bestandsaufnahme hat offengelegt, dass die Einbindung von privaten Konsumerfahrungen bei den untersuchten Unternehmen bisher eher eine Ausnahme darstellt und unsystematisch bzw. zufällig passiert. Nur in einem Unternehmen wurde die Bedeutung der privaten Konsumentenrolle für die Weiterentwicklung von Produkten und Dienstleistungen als hoch eingeschätzt.

Zudem fanden sich Hinweise, dass die Unternehmensgröße und die Art des Kerngeschäfts einen besonderen Einfluss darauf haben, ob private Konsumerfahrungen von Mitarbeitern integriert werden oder nicht. In kleineren Unternehmen scheint dies leichter zu gelingen. In größeren Unternehmen mit formalisierten Innovationsprozessen und auch in Unternehmen mit technisch komplexen Produktionsprozessen scheint der Ansatz schwerer realisierbar.

Es zeigte sich, dass die unternehmenskulturell eingebetteten Annahmen über die Rolle des Mitarbeiters ein zentraler Ausgangspunkt dafür sind, ob dem Ansatz verstärkt Chancen oder Risiken beigemessen werden. In Unternehmen, in denen Mitarbeiter fast ausschließlich in ihrer Arbeitsrolle wahrgenommen und angesprochen werden, wird die Idee, private Erfahrungen und Ideen verstärkt einzubinden, als riskanter wahrgenommen als in solchen Unternehmen, die eine Perspektive auf ihre „Mitarbeiter als ganze Menschen“ betonen.

Als Chancen wurden unter anderem genannt, dass entsprechende Maßnahmen zu einer Identifikationssteigerung mit dem Unternehmen beitragen können und sich die Wertschätzung gegenüber den Mitarbeitern sowie Authentizität und Gemeinschaftlichkeit fördern lassen. Risiken

wurden insbesondere in einer möglichen Bevormundung und Überforderung der Mitarbeiter gesehen. Auch wurde befürchtet, dass Mehrarbeit entstehen könne. Zu Frustration könne es kommen, wenn Ideen nicht umgesetzt werden. Aufgrund der mangelnden Erfahrung mit der Integration von Mitarbeitern als Konsumenten in (Nachhaltigkeits-)Innovationsprozesse, basierten die genannten Chancen und Risiken jedoch fast ausschließlich auf Vermutungen und weniger auf konkreten Erfahrungen.

## 6. Fazit und Ausblick

Mitarbeiter sind nicht nur berufliche Funktionsträger, sondern auch private Konsumenten. Ihre Konsumerfahrungen und Ideen könnten fruchtbare Beiträge zu Nachhaltigkeitsinnovationen leisten – sowohl in Bezug auf Produkte und Dienstleistungen als auch am eigenen Arbeitsplatz. Bisher fehlen jedoch empirisch gestützte wissenschaftliche Erkenntnisse über die Integration von Mitarbeitern als Konsumenten in Nachhaltigkeitsinnovationsprozesse. Dies liegt auch am weitgehenden Fehlen praktischer Erfahrungen mit diesem Ansatz, wie die präsentierte Bestandsaufnahme bestätigt hat. Die dort ermittelten Chancen und Risiken aus Sicht von Mitarbeitern und Management werden im Verbundprojekt nun im Rahmen der Evaluation konkreter, nach dem IMKoN-Ansatz gestalteter Innovationsprozesse empirisch überprüft. Diese Projektphase läuft noch, jedoch zeigt die Projekterfahrung bereits, dass es nicht immer leichtfällt, sich auf einen solchen neuen Prozess einzulassen. Dort, wo jedoch die Bereitschaft besteht, diese neuen Pfade zu betreten, sind die Ergebnisse sehr vielversprechend.

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#### Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

## **Sustainability innovation by integrating employees: the potential of sustainable embedded lead users**

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### Abstract:

Recent studies in innovation management have explored the phenomenon of embedded lead users (ELUs): company employees who exhibit lead user characteristics with regard to a product marketed by their employer (Schweisfurth and Herstatt, 2014). Because they are doubly embedded, i.e., in both producer and user domain, these employees possess specific resources and capabilities which may be beneficial to corporate innovation. While the concept of ELU has been analysed in sports, leisure and healthcare industries, this paper suggests that the phenomenon may also be highly relevant in the context of sustainability innovations. By bringing together existing conceptualizations of a sustainable lead user outside of corporate boundaries and the ELU approach, the concept of sustainable embedded lead users (SELU) is presented. We show why SELU are suited to support corporate sustainability innovations and discuss opportunities and limitations of this approach for (sustainable) innovation and human resource management.

### Keywords:

ELU; Embedded lead user; Sustainability innovation; User innovation; Employee participation; Open innovation; Sustainable development

### 1. Introduction

In order to green the economy and decouple economic growth from environmental impacts, the development, implementation and diffusion of more sustainable ways of consumption and production are crucial (Geels, 2010; UNEP, 2011). Businesses in particular – regarded as both part of the problem and the solution – are expected to drive sustainability innovation and effect positive change in the direction of sustainable development (Adams et al., 2015; OECD, 2010; Simanis and Hart, 2009).

Sustainability innovations depend heavily on the way they are accepted and used by consumers in order to realise their socio-ecological potential (Fichter, 2005a; Hansen and Grosse-Dunker, 2012; Schrader and Belz, 2012). Therefore, the integration of contextual use knowledge at an early stage of the development process is decisive. Use knowledge stems from use experience and traditionally is located outside of organisational boundaries. Hence, sustainability innovations often originate in the private domain of users (cf. Belz et al., 2012).

Research on user integration in the field of sustainability so far has mainly focused on the involvement of external lead users (e.g., Fichter, 2005a, 2005b; Paech, 2007). However, the practical implementation of an integration of these lead users can be very cost-intensive and time-consuming, as they tend to be

hard to select and difficult to integrate into corporate innovation processes (Poetz and Prügl, 2010; Schrader and Belz, 2012; von Hippel et al., 2009).

Yet, recent studies have shown that lead users not only exist outside of companies, but are often located inside of corporate borders as well. Schweisfurth and Herstatt (2014) call these users embedded lead users (ELUs) and define them as ‘firm employees, who are also users of the firm’s products’ (p.1). Due to their company affiliation, ELU are not only easier to involve in corporate innovation processes, but also offer great potential for innovation as they combine knowledge from both the private and the professional domain.

Up to now, the ELU concept has not been adopted in the field of sustainability innovations. However, it is conceivable that, e.g., an automotive company systematically integrates employees with private interest and experiences in sustainable mobility into the corporate sustainability innovation processes. In this paper, by applying the ELU concept to sustainability innovations, the concept of sustainable embedded lead users (SELU) is presented. We will clarify the background and characteristics of SELU and discuss their potential value for innovation management.

After a brief overview of the characteristics of open sustainability innovations in Section 2, the phenomenon of ELU is illustrated in Section 3. Section 4 then introduces the SELU concept and discusses opportunities and limitations of an integration of these employees in sustainability innovation processes. Concluding remarks, practical and theoretical implications as well as limitations of the study and avenues for further research are presented in Section 5.

## 2. Open sustainability innovations

### *2.1. Sustainability innovations and sustainable consumption*

In general, sustainability innovations are innovations which are oriented towards the principles of sustainability (Fichter, 2005a; Hansen and Grosse-Dunker, 2012; Schrader and Belz, 2012). Unlike environmental innovations from which they originate, sustainability innovations do not exclusively consider the ecological, but have to reflect adequately the economic and social dimensions of sustainable development as well; a requirement Schaltegger and Wagner (2008) describe as integrativity. Further, whereas environmental innovations typically focus on technology, e.g., product and process innovations (Erdmann, 2005), innovative technical solutions to improve resource efficiency alone will not suffice to tackle current global sustainability challenges (United Nations, 2015; Vergragt and Brown, 2007). Therefore, sustainability innovations have an even greater impact on sustainable development when reaching beyond the product/technology level (Faucheux and Nicolaï, 2011) by also affecting use systems (Hirschl et al., 2003; Mont, 2002) and culture (Beretti et al., 2013; Jaeger-Erben et al., 2015; Rennings, 2000).

For some authors, this positive impact on sustainable development is a constituent characteristic of sustainability innovations that distinguishes them from conventional innovations. Whereas innovations

by definition are accomplished by reaching market penetration (Rogers, 2003), sustainability innovations are additionally defined by their positive impact on sustainable development (Fichter, 2005a; Paech, 2005). Other concepts, like the sustainability-oriented innovation (SOI; Hansen and Grosse-Dunker, 2012; Klewitz and Hansen, 2014), follow a rather relative approach and require these innovations to lead to ‘environmental and (or) social benefits over the prior version’s physical life-cycle’ (Hansen and Grosse-Dunker, 2012, pp.2407–2408), but not necessarily to a positive net benefit for sustainable development.

Next to the unpredictability with regard to market success, sustainability innovations are subject to a high level of uncertainty concerning their impact on the environmental and social dimension (Hansen et al., 2009; Paech, 2007). Especially in the medium- and long-term, ‘directional risks’ are hard to anticipate and evaluate and may lead to rebound effects despite their well-intended normative direction (e.g., Binswanger, 2001; Santarius, 2015). These risks can be traced back mainly to the fact that innovations with a high socio-ecological potential are considerably affected by consumption patterns. In other words, sustainability innovations do not only depend on offering innovative (technological) potential to mass markets, but also on consumers putting into practice this potential for the benefit of sustainable development. The way sustainability innovations are consumed thus constitutes a central factor of sustainability innovations (Fichter, 2005a; Hansen and Grosse-Dunker, 2012; Schrader and Belz, 2012). It may be argued that, in the end, there are no sustainability innovations, but only sustainable lifestyles, which are formed by a combination of sustainability innovations and sustainable consumption patterns (Paech, 2007).

Different studies support the considerable relevance of sustainable consumption for the impact of sustainability innovations on sustainable development (e.g., Liedtke et al., 2015; Sunikka-Blank and Galvin, 2012). Some innovations, which were designed to be sustainable, do not contribute to sustainable development or they may even have negative impacts due to misapplication of products (Liedtke et al., 2013; Santarius, 2012). Further, studies analysing failed innovations show that the sustainability potential of innovations is often barely realised if user practices are not considered sufficiently during the innovation process (Spaargaren, 2011).

Consequently, it is important to consider how users deal with products and to integrate social practices of consumption, routines and lifestyles in sustainability innovation processes (Fichter, 2005a; Hoffmann, 2007). Insights into consumption contexts help to design products and services that can easily be integrated into users’ habits and everyday life and foster more sustainable consumption behaviours (e.g., Heiskanen et al., 2005).

## *2.2 Lead user integration in sustainability innovation processes*

Research on user integration in the field of sustainability so far has mainly focused on the involvement of lead users, and two basic lead user conceptualisations can be distinguished (Hoffmann, 2012). Both adopt von Hippel’s (1986) traditional lead user profile which refers to users who

- are at the leading edge of trends in a marketplace and experience needs months or years ahead of the rest of that marketplace
- expect to gain especially high individual benefits from the satisfaction of these needs.

On top of these characteristics, the first approach to conceptualise a sustainability lead user requires these individuals to anticipate sustainability effects (Paech, 2007). Belz et al. (2012) have empirically concretised this awareness of sustainability in a netnographic study on electric vehicles by showing that – next to their expectation of an individual benefit – lead users in the field of sustainability expect a social benefit of an innovation. A green-minded electrical engineer who has acquired lead user characteristics with regard to solar panels would meet this definition of a sustainability lead user.

In contrast, Fichter (2005a, 2005b) argues that imposing additional sustainability-related requirements on the personal profile would contradict the basic idea of the lead user approach, as it aims at objectively identifying leading-edge users in a selected target market. Instead of expecting these lead users to possess a personal orientation towards sustainability, the author suggests complementing the traditional lead user method (Lüthje and Herstatt, 2004) by sustainability-related criteria, e.g., the selection of sustainability-oriented project goals, target markets and search logics, in order to meet socio-ecological requirements in the course of the innovation process. According to this sustainability framing of the innovation process, the electrical engineer mentioned in the paragraph above would not need to possess a personal awareness of sustainability to qualify as a sustainability lead user according to Fichter's (2005a, 2005b) definition.

In the further course of the paper, we follow the first approach and assume that lead users in a sustainability context are characterised by an additional orientation towards sustainability. Apart from the findings of Belz et al. (2012), this seems plausible also with regard to the results of recent studies in innovation management that have analysed the influence of users' socio-ecological awareness on the development of sustainability innovations. Schweitzer et al. (2014) found that ethically reflective users, who consider environmental, social and economic impacts of products, tend to develop ideas that score high with regard to positive societal impact. The results of a study by Schweitzer et al. (2015) suggest that the tendency of individuals to think about the societal impact of an innovation increases their ability to develop innovative product features, the elaboration of these features, and their positive impact on society. Hence, it seems reasonable to consider an individual sustainability orientation as a beneficial characteristic of lead users with respect to their involvement in sustainability innovation processes.

### 3. The ELU concept

Since companies as institutions cannot be creative (Simon, 1991), employees represent the main source of corporate innovativeness. Hence, a lot of research has been done to analyse the factors determining innovative behaviour of employees in the workplace (Hammond et al., 2011), in particular on individual

factors, such as creativity (Amabile et al., 1996; Oldham and Cummings, 1996) and satisfaction (Scott and Bruce, 1994; Yuan and Woodman, 2010) as well as organisational factors, like leadership support (Janssen, 2001; Janssen, 2005) and organisational atmosphere (Wendelken et al., 2014).

Traditionally, it is the responsibility of members of the R&D department to develop ideas within or beyond corporate boundaries. Neyer et al. (2009) point to the potential of also involving ‘peripheral inside innovators’ (p.410) in corporate innovation. Although their job description does not cover an involvement in innovation processes, Neyer et al. assume that these employees from all over the organisation may support corporate innovation activity based on their daily professional work and functional roles. Recent approaches within innovation management – such as employee-driven innovation (EDI) and internal crowdsourcing (or intra-corporate crowdsourcing (ICC)) – also build on the assumption that employees without responsibilities in the field of innovation may contribute profound contextual knowledge which neither managers nor colleagues from R&D possess (Kesting and Ulhøi, 2010; Simula and Vuori, 2012; Villarroel and Reis, 2010). EDI, internal crowdsourcing and the underlying open innovation paradigm (Chesbrough, 2003) have in common that they reduce employees to their professional role, e.g., marketing managers, controllers or business analysts, while knowledge and experiences from their private lives remain unconsidered.

In contrast, the ELU concept of Schweisfurth and Herstatt (2014) explicitly draws on the potential of employees as private consumers for corporate innovation. ELU are employees who have developed lead user characteristics with respect to a product (category) of their employer (Schweisfurth, 2012, 2017; Schweisfurth and Herstatt, 2014, 2015; Schweisfurth and Raasch, 2015). The concept is based on the insight that innovation occurs when knowledge about needs and solutions is brought together (cf. Alexander, 1964; von Hippel, 1994). Traditionally, need knowledge is located with users outside of the company, whereas solution knowledge rather resides in R&D departments within corporate boundaries (von Hippel, 1998). Principally, for need and solution knowledge to be co-located, either need knowledge has to be transferred into the company, or solution knowledge has to be acquired by the user. Since knowledge can be complex (von Hippel, 1994) and its transfer usually involves a certain effort, the migration of user knowledge across these two domains – the user domain and the producer domain – often presents a major challenge for companies. The ELU concept is presented as an approach to master this challenge. As these employees are embedded in both domains, the transfer of knowledge into the company is a given and the transfer into the R&D department is facilitated.

Schweisfurth and Raasch (2015) show that ELU indeed engage more in innovative work behaviour than regular employees. Expecting to benefit from obtaining satisfiers for their currently unmet needs, ELU are motivated to actively support all the phases of the innovation process (Schweisfurth and Herstatt, 2014). In the ideation phase, ELU contribute ideas which stem from their need knowledge, extensive product use and product-related exchange with other users. A recent study by Schweisfurth (2017)

revealed that compared with ordinary employees, the ideas of ELU score higher in terms of originality, user value and market potential.

Further, Schweisfurth and Herstatt (2014) identified ELU in many companies who participate in specification setting and product testing in the development phase. The authors describe an example of this when members of the R&D department of a manufacturer of bike goggles frequently ask ELU to test products for a weekend and give direct feedback on fit and other characteristics, which in turn directly may be translated into technical specifications. Moreover, ELU support marketing activities during market introduction and diffusion of innovations. Due to their higher customer-orientation, they effectively gather market information and spread it within the company as internal boundary spanners (Schweisfurth and Raasch, 2015). As lead users of employees is positively and significantly related to both domain-specific innovativeness and opinion leadership, they are also more likely to adopt products early and act as catalysts to product diffusion by drawing on their networks within the user domain (Schweisfurth and Herstatt, 2015).

The potential of ELU for corporate innovation is mainly based on their location in both the user and producer domain. This allows ELU to draw on a unique set of *intellectual resources* (use knowledge, solution knowledge, and organisational knowledge) and *social resources* (structural, relational, and cognitive) to drive corporate innovation (Schweisfurth and Herstatt, 2014). As users of the company's products, ELU possess relevant *use knowledge* as a result of direct use experience. Use knowledge is the central prerequisite to identify needs and problems, which are frequently the starting point for ideation. Next to formulating needs and testing products, ELU draw on *solution knowledge* to contribute to problem solving. They develop this knowledge either within the company as part of their functional role, e.g., as members of the R&D department, by trainings etc., or in their private life when they run into use-related problems and directly consider possible solutions. As they are familiar with corporate innovation processes – in contrast to others, e.g., external lead users – *organisational knowledge* helps ELU to evaluate ideas with regard to their strategic fit and feasibility while keeping costs and market potential in mind.

Next to these *intellectual resources*, ELU utilise *social resources* in both the user and the producer domain. As product users, ELU frequently have access to user networks, e.g., online communities, associations, clubs, in which they exchange information and ideas with other users. Within the company, ELU draw on *structural resources* and disseminate this information by accessing internal networks (Schweisfurth and Raasch, 2015). *Relational resources* facilitate these boundary-spanning activities; the authentic user perspective of ELU enhances their credibility within the company, which is reflected by the appreciation of their input by R&D staff.

Based on their dual embeddedness, ELU also deploy what Schweisfurth and Herstatt (2014) describe as *cognitive resources*. In their role as private consumers, they use products without forgetting the company perspective, keeping an eye on performance and technology. This combination of both views enables

ELU to act as a hinge between the corporate world and the user world and to foster the development of user-centric innovations.

However, next to their unique resources and capabilities for innovation management, the dual embeddedness of ELU also has a drawback. While ELU come up with better ideas than regular employees in terms of originality, user value and market potential, Schweisfurth (2017) also shows that their ideas are often less original and of lower value to users than external lead users' ideas. The author offers an explanation for this finding by arguing that the organisation-specific knowledge of ELU, e.g., the consideration of the strategic-fit of an innovation – which is based on their being located in the organisation – might restrict their creativity. Hence, the capability of ELU to produce radical ideas – and thus, their potential to replace external lead users in corporate innovation processes – seems questionable (cf. Dane, 2010; Schweisfurth, 2017).

#### 4. Applying the ELU concept to sustainability innovations: SELU

##### 4.1. Characteristics of SELU

While it is reasonable to assume that ELU are employed not only in the sports, leisure and healthcare industries explored by Schweisfurth and Herstatt (2014), Schweisfurth (2012) assumes that the phenomenon in some industries is more prevalent than in others. In particular, ELU are expected to be more numerous in contexts of

- low-technological complexity
- high-product involvement
- low-industry maturity.

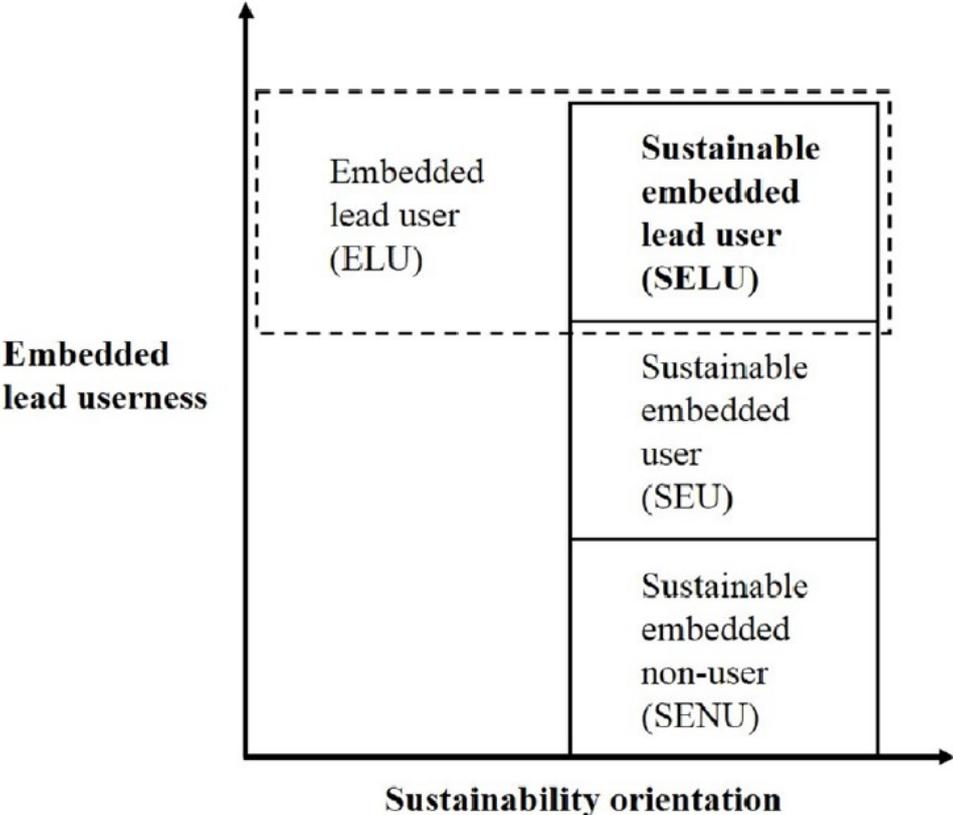
Innovations which bear the potential to benefit sustainable development are created in numerous different industries and sectors, although the need for and relevance of these innovations in some sectors, such as housing, nutrition, and mobility, is considered to be higher than in others. Passive houses and electric vehicles, for instance, entail high product involvement due to the relatively high acquisition costs, and information effort required of customers prior to purchase. Disruptive business model innovations like *Airbnb* and *Uber*, which potentially offer enormous chances (and risks!) for sustainable development (Martin, 2016), often exhibit low technological complexity. A lot of these innovative solutions associated with the term 'sharing economy' are offered by green start-ups and young enterprises in dynamic markets characterised by low industry maturity. The same is true for innovative, more sustainable food offers, which also come with high product involvement for many consumers. Consequently, it may be assumed that ELU may also be found in companies which offer sustainable products and services.

However, it is questionable whether the ELU concept can be applied to sustainability innovations without adapting the personal characteristics of these employees. In line with the findings by Belz et al.

(2012) (see Section 2.2), we argue that ELU in a socio-ecological context also exhibit a relatively strong orientation towards sustainability and suggest calling these employees SELU.

Individual manifestations of these characteristics are dimensional rather than bipolar: While some employees might show a higher lead usersness than others, their socio-ecological orientation might be less pronounced. Against this background, the spectrum of employees may be categorised along the dimensions embedded lead usersness, i.e., lead usersness with regard to the market offers of their employer, and sustainability orientation. Figure 1 offers a typology of employees with regard to these dimensions, which allows identification of SELU.

Figure 1. SELU identification matrix



Next to SELU, other types of employees might also be relevant for the development of sustainability innovations. A study by Schweitzer et al. (2014) found that the ideas of ethically reflective users tend to score high not only in terms of societal impact, but also concerning technical feasibility. Sustainable embedded users (SEU) – who show a relatively high orientation towards sustainability and medium embedded lead usersness – thus might represent a valuable source for ideation of incremental innovations which are technologically feasible and bear a high potential to support sustainable development.

Since sustainability innovations have a greater impact on a system or cultural level (see Section 2), it is particularly important to question current ways of need satisfaction and adopt an ideation approach which is detached from an existing domain reaching beyond the product/technology level. To this end, sustainable embedded non-users (SENU) might contribute valuable input for the development of

sustainability innovations. As they do not possess domain-specific knowledge and use experience which may inhibit them from considering solutions outside of this domain (Wiley, 1998), SENU might have a stronger focus on the actual underlying needs and ideate independently of existing solutions.

In later stages of the innovation process, it might be sensible to test the generated ideas and prototypes on individuals who are not oriented towards sustainability and thus, may represent the majority of potential markets for these innovations. An example of this could be in marketing communications that might be more effectively targeted at customer segments for which a socio-ecological benefit of an innovation is not a relevant purchase criterion. Against this background, non-sustainable employees might be involved in the diffusion of sustainability innovations in order to bring in the perspective of customer segments that lack a pronounced orientation towards sustainability. However, the most promising target group of this typology are SELU, as will be shown in the next section.

#### *4.2. Opportunities for an integration of SELU in sustainability innovation processes*

In general, SELU may be expected to show the benefits and shortcomings which are attributed to ELU (see Section 3), as embedded lead usersness is a constituent characteristic of the SELU profile. Apart from these, however, we argue that SELU are ideally suited to promote the development and diffusion of sustainability innovations.

SELU are embedded in use contexts from which they have acquired direct use knowledge as well as insights on consumption practices, routines and lifestyles. As with conventional innovations, this knowledge is crucial to the identification of problems and needs, which are often the starting point for innovation. And, in addition to an individual benefit, SELU also expect a social benefit for the whole of society.

However, as might be expected due to their sustainability orientation, SELU are likely to harness their solution knowledge to developing ideas which have the potential to positively affect society; in addition, based on their embeddedness in use contexts as well as socio-ecological awareness, SELU might tend to set sustainable consumption as the starting point of ideation. Thus, there is greater probability that there will be an increase in how consumers exploit the potential of these solutions to contribute to sustainable development because a sustainable way of consumption is anchored within the innovation object at an early stage of the innovation process (see Section 2.1).

A central resource for ideation is creativity, which is significantly influenced by motivation (Amabile et al., 1996). As socio-ecologically aware employees often want to bring their private values and knowledge to the workplace (Muster and Schrader, 2011; Schrader and Harrach, 2013), SELU may be expected to be highly motivated to participate in sustainability innovation processes, leading to positive effects on their creative performance. As studies have shown that expected benefits of an innovation are positively correlated with the individual's willingness to devote own resources in order to realise and profit from a new solution (Riggs and von Hippel, 1994; von Hippel, 1988), it may be assumed that SELU motivation is particularly high due to their additional expectation of a social benefit.

Apart from ideation, SELU might also support sustainability innovations in the diffusion phase. As sustainable development is a challenge to be addressed by the whole of society, sustainability innovations have to achieve a certain societal reach in order to develop their full potential. Opinion leaders are considered to be key drivers of the diffusion of innovations (Rogers, 2003). Schweisfurth and Herstatt (2014) have shown that lead usersness of employees is positively and significantly related to opinion leadership (see Section 3). Correspondingly, it may be assumed that SELU have the potential to spur the diffusion of sustainable solutions; an example of this is by participating in user networks and influencing adoption decisions of others within their social network. This way, opinion leadership activity by SELU also seems to be a promising contribution to sustainable development because they can stimulate the diffusion of sustainability innovations.

Next to opportunities of SELU for innovation management, human resource related chances are also conceivable. When employees are put in a position to bring in their private commitment to sustainability in the workplace, positive effects on staff satisfaction, retention and commitment may be expected (Muster and Schrader, 2011; Schrader and Harrach, 2013). As the involvement of SELU in sustainability innovation processes represents an opportunity to articulate private socio-ecological values within corporate boundaries, it may be assumed that for SELU, similar effects can be observed.

Further, the integration of employees and consideration of their private orientation towards sustainability strengthens a participative corporate culture, and this is crucial to anchoring the idea of sustainability within the organisation (Boudreau, 2003). Without integrating employees from all areas in these long-term transformation processes towards sustainable development, efforts in the field of sustainability management run the risk of degenerating to mere rhetoric. Due to their socio-ecological orientation and opinion leader qualities, SELU in particular seem to be ideally suitable and willing to support this process within company borders.

#### *4.3. Limitations of an integration of SELU in sustainability innovation processes*

Next to direct benefits of SELU, potential drawbacks need to be taken into consideration. The involvement of SELU in corporate innovation activity presupposes the existence of employees who exhibit SELU characteristics: lead usersness with regard to a product or service (category) of their employing company and a relatively high orientation towards sustainability. As this profile is rather demanding, it is conceivable that small companies might struggle to find employees who fit this profile. In contrast, ELU are assumed to be attracted by smaller companies, which tend to support their innovative behaviour (see Section 3). In any case, company size seems to have an influence on the existence of SELU and thus, may be a practical obstacle to the approach.

Although ELU usually tend to have a close relationship with R&D personnel who actively seek their advice and trust their judgement (Schweisfurth and Herstatt, 2014), it is conceivable that R&D staff are less open and even suspicious of input from outside their department. This narrowing down of the ‘not-invented-here-syndrome’ (Antons and Piller, 2015; Lichtenthaler and Ernst, 2006) to the departmental

boundaries of R&D might be even more acute concerning SELU, as R&D members might consider their strong socio-ecological motivation to engage in innovative activity as not in line with (conventional) corporate innovation objectives. As a result, R&D personnel might be reluctant to use knowledge provided by SELU and generally reject their involvement in innovation activity.

Further, support of SELU by management might cause negative effects for colleagues who do not have SELU characteristics. The perceived pressure to use individual private resources to foster corporate innovation management could evoke defensive attitudes of employees if they are not able or willing to fulfil these expectations (Muster, 2014). The last point refers to the general finding that ELU ideas are often of limited value compared with those of external lead users (Schweisfurth, 2017; see Section 3). Thus, SELU integration offers a huge potential, but does not substitute initiatives to open sustainability innovation processes beyond corporate borders.

## 5. Conclusion and outlook

By applying the ELU concept on sustainability innovations and considering existing conceptualisations of sustainable lead users, we have derived the concept of SELU. Our conceptual considerations have shown that due to their unique personal profile, the involvement of these employees promises great benefits for companies offering sustainable solutions.

### 5.1. Practical implications

With regard to innovation management, companies are well advised to involve SELU in innovation activity for sustainable solutions. SELU have the potential to come up with ideas that support a sustainable way of consumption and thus, may enhance an innovation's net impact on sustainable development. Further, managers should consider SELU's opinion leadership qualities within and outside of corporate borders and support corresponding activities, e.g., by granting access to the company's latest products in order to create spill-over effects within their social networks (as shown by Schweisfurth and Herstatt, 2015, for ELU in general).

Moreover, the SELU phenomenon also entails potential implications for human resource management. Companies should invite SELU to bring in their private sustainability-oriented values and knowledge, as positive effects on staff satisfaction, retention and commitment may be expected. Also, SELU may be supported in transporting their socio-ecological orientation throughout the organisation and help to embed the principles of sustainability within a corporate culture. However, managers should take care that SELU interests and innovation objectives of the company are broadly compatible. Otherwise, the resulting dissatisfaction of SELU – due to their opinion leadership qualities – may spill over to stakeholders and cause negative effects within and outside of the company.

### 5.2. Theoretical implications

The concept of SELU contributes to the ELU concept by extending its scope to sustainability innovations. We have illustrated that sustainability innovation, in particular, depends on the integration

of contextual use knowledge and argue that ELU might offer a promising way to incorporate this knowledge in sustainability innovation processes. Further, we suggest that SELU differ considerably from conventional ELU due to their socio-ecological orientation, which – in combination with their ELU characteristics – enables them to drive corporate sustainability. Therefore, we have introduced the concept of SELU and illustrated its great potential for sustainable development.

To our knowledge, research on ELU so far has not considered different types of innovation. Our considerations put into perspective the ELU concept by indicating that the thematic focus of innovations, e.g., sustainability, may affect the potential of ELU and require additional recognition. These findings are in line with the recombinant view of creativity which argues that individual creativity depends on the combination of expertise from different domains (Fleming, 2001; Hargadon, 2006; Schilling and Green, 2011). Based on their socio-ecological orientation, SELU have built up expertise in the field of sustainability and thus, may access an additional relevant domain for ideation within sustainability innovation processes.

### *5.3. Limitations and research avenues*

It is the aim of this paper to provide a general outline, the theoretical foundations as well as opportunities and limitations of the SELU concept. While our considerations have been conceptual, empirical studies need to analyse to what extent SELU possess and apply the qualities we have described in order to develop sustainability innovations.

Another limitation of our study is that we do not elaborate on the measurement of sustainability orientation of employees, although this is a central prerequisite for the selection of SELU. Scholars like Diekmann and Preisendörfer (1998), Haws et al. (2014), Lastovicka et al. (1999), Mayer and Frantz (2004), Rushton et al. (1981) and Webb et al. (2008) have developed scales which address only single aspects of an individual's orientation towards sustainability, e.g., environmental awareness. Studies that are more recent combine selected items of these scales to cover different facets of sustainability (Geiger et al., 2018; Weinrich, 2014). To date, however, literature does not offer a generally recognised approach to holistically measure sustainability orientation. Moreover, most of the existing scales only envisage attitudinal aspects and neglect questions on actual behaviour (e.g., Diekmann and Preisendörfer, 1998; Haws et al., 2014; Mayer and Frantz, 2004). Yet, SELU are characterised as authentic sustainable role models and draw on use knowledge and use experience in a sustainability-related domain. This implies that SELU not only share, but act according to socio-ecological values. Consequently, future studies on SELU should include the development of a measurement scale that considers the economic, ecological and social dimension of sustainability and includes items on both attitude and behaviour.

Further investigations should also explore how contextual factors affect the potential of SELU to contribute to corporate sustainability innovation. In particular, a distinction regarding the type of organisation in which SELU are present seems advisable. We have suggested that company size may have an influence on the practical implementation of the SELU concept. Whereas ELU are expected to

be rather numerous in smaller companies, SELU might be hard to find in small- and medium-sized enterprises (SMEs). However, in SMEs in particular, the innovation potential of SELU for sustainable development might play an essential role. Radical sustainability innovations are indispensable for a transition towards a green economy and are developed mostly by green start-ups and new businesses (Fichter and Weiß, 2013). While it seems plausible that SELU may support innovation efforts of SMEs as well, the relevance of SELU and the extent of their resources and capabilities may differ in these organisational contexts. On the one hand, among only a small number of employees, chances are high that SELU are more prominent than in large companies and hence, are involved in innovation processes more extensively. On the other, as start-ups often do not have special R&D departments, SELU might struggle to actively bring in their expertise due to a lack of a systematic corporate innovation management. Therefore, it is up to future research to illuminate the relevance of the SELU concept for SMEs in particular and analyse how their potential is affected by company type and by stage of company development in general.

Subsequent studies should also explore whether the unique potential of SELU might be valuable not only for the development of market-oriented solutions, but also for innovations that aim at greening the workplace. In the last decade, research has substantiated the importance of the workplace as a context for behavioural change towards sustainable consumption (Klode et al., 2013; Michaelis, 2002; Muster, 2011) and companies are increasingly encouraged to enhance pro-environmental behaviour of employees (Blok et al., 2015). SELU might play a key role in fostering sustainable consumption in the workplace not only as opinion leaders and green role models (see Section 4.2.), but also by initiating and implementing sustainable workplace solutions. For instance, SELU might develop a corporate car sharing platform on the corporate intranet, present a business model for a corporate nursery to the management board, advocate organic food at the canteen and organise swap meets for clothes, books, etc. As consumption behaviour is developed both in the private and professional life and spillover effects occur in both directions (Muster and Schrader, 2011), initiatives like these are very promising in order to facilitate sustainable consumption within and outside of the company.

Finally, future scholarly work might analyse how the involvement of SELU in an innovation process should be implemented. As research indicates that ELU usually participate informally outside of institutionalised processes (Schweisfurth, 2012), SELU might have similar preferences and favour perhaps open platforms like internal communities and innovation workshops. Further investigations therefore should propose the design of an integration method and consider that the ideas of (S)ELU seem to be inhibited by organisational knowledge (Schweisfurth, 2017). Involving other types of employees and users, e.g., external lead users, sustainable non-users, might be an approach to counterbalance this shortcoming and lead to ideas of higher quality due to the complementary knowledge of the participants.

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## **Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development**

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### Abstract:

Sustainability-oriented innovations (SOI) are indispensable to enable sustainable consumption and production. However, their multidimensional character makes the development of SOI an often difficult task for companies. This article addresses four major challenges which are in particular associated with SOI development, including defining an adequate innovation scope, considering various stakeholders and identifying related user needs and sustainability effects. This clearly shows that there is a continuous need for adequate methods and tools that enable companies to successfully develop SOI. Design thinking (DT), a user-centered and iterative problem-solving approach, has recently attracted research interest as a possible approach to tackle complex socio-ecological problems. However, a systematic and detailed discussion of the application of DT for SOI development is still missing. This article explores why and how design thinking can foster the development of SOI. For this purpose, the concept of DT with its five key principles (i.e., problem framing, user focus, diversity, visualization, experimentation and iteration) is presented. In a next step, we develop a research framework with four propositions that demonstrate the suitability of DT's key principles for meeting the identified SOI challenges. Finally, boundary conditions, practical implications and opportunities for further research are pointed out.

### Keywords:

Sustainability-oriented innovation; Design thinking; Sustainable development; Creativity; Stakeholder involvement; Human-centered innovation

### 1. Introduction

Sustainability-oriented innovation (SOI) has often been proposed as a key strategic approach for organizations to contribute to sustainable development (Fichter and Clausen, 2016; Hall and Vredenburg, 2003; Hansen and Grosse-Dunker, 2013). However, the development of SOI constitutes a rather complex endeavor, since the corresponding outcomes must meet environmental, social and economic requirements at the same time (Lubberink et al., 2017). Furthermore, SOI, as well as solely economic-oriented innovations, are embedded in a larger innovation system and therefore influenced by a multitude of factors, including technological progress (e.g. infrastructure), market forces (e.g. customer demand) (Horbach et al., 2012), government regulations (e.g. environmental protection acts, subsidies) (Jaenicke, 2008), as well as activities of non-governmental organizations, societal initiatives and the media (Brunner and Marxt, 2013).

In this paper, we focus on the initial phase of SOI processes (i.e., the creation and evaluation of novel ideas) since the majority of an innovation's sustainability effects are determined already at the conception and design stages (Lang-Koetz et al., 2008; Maxwell and van der Vorst, 2003). SOI development in organizations involves major challenges, such as the integration of a wide range of stakeholders, the definition of the relevant innovation scope as well as the need to thoroughly understand related user needs (Hansen and Grosse-Dunker, 2013). While these challenges are also relevant for conventional innovation, they are of particular importance for SOI development. In addition, specific to SOI is that sustainability effects during production, use and disposal must also be taken into account. These challenges entail higher levels of difficulty and uncertainty and an ongoing need for new and appropriate methods and tools (Fischer, 2015).

In recent years, design thinking (DT) has increasingly attracted the interest of practitioners and researchers as a “prescriptive process where multidisciplinary teams take a user-oriented approach to come up with relevant solutions to complex or ‘wicked’ problems” (Carlgren et al., 2016b: 25). Some scholars have even pointed to DT as an approach for developing innovative solutions to sustainability challenges. However, so far the argumentation has mainly been anecdotal or conceptual and less databased. Brown and Wyatt (2010) as well as Dewberry and Sherwin (2002) point out that DT questions problems from a systems perspective. They argue that this approach not only focuses on the product, but also takes into account related consumption choices and lifestyles, which is crucial for creating systemic solutions to sustainability challenges. For a similar reason, Garcia and Dacko (2015) stress the need to involve the user in a systematic consideration of the innovation outcome's sustainability performance over the full product life cycle. The authors reason that the DT approach therefore increases the chances of creating products and services that actually entail positive sustainability effects. Similarly, Fischer (2015) argues that DT has the potential to facilitate the involvement of actors from different backgrounds who are not familiar with organizational innovation development. Shapira et al. (2017) develop and test sustainability-oriented add-ins that are supposed to complement DT processes in order to achieve more sustainable outcomes.

Despite these first approaches, a systematic examination of the inherent suitability of DT as an innovation approach for SOI development is still missing. With the aim of filling this gap, this conceptual paper addresses the following research question: Why and how can DT systematically foster the development of SOI? To answer the research question, we first introduce the concept of SOI and carve out four central challenges. We then present DT and its five key principles identified by Carlgren et al. (2016c). Based on a systematic analysis of how DT's principles may cater to the SOI challenges, we develop a research framework with four propositions. Finally, we draw conclusions about the potential and boundary conditions of DT to facilitate successful SOI development, demonstrate practical implications and suggest future research avenues.

## 2. Sustainability-oriented innovation (SOI)

### 2.1. Definition and dimensions of SOI

Numerous studies have described and investigated the critical role that innovations play with regard to sustainable development in general and corporate sustainability in particular (Fichter and Clausen, 2016). In this paper, we refer to the concept of sustainability-oriented innovation (SOI). By using this term, we emphasize that sustainability is not anticipated as a definite result but rather as a (normative) direction (Dewberry and Sherwin, 2002; Hansen and Grosse-Dunker, 2013). We thus acknowledge that innovation development is always subject to uncertainty regarding the actual outcomes and impacts (Hall et al., 2011; Hüsigg, 2014). SOI is often used synonymously with terms such as sustainability-driven/-related innovation or sustainability/sustainable innovation (Hansen and Grosse-Dunker, 2013) and constitutes an umbrella term which includes eco-innovation (e.g. Horbach et al., 2012) and social innovation (e.g. Phills et al., 2008). Following Hansen and Große-Dunker (2013) as well as Adams et al. (2016), we define SOI as the intentional creation and realization of new (or improved) products, services, processes or practices which aim at environmental and/or social benefits in addition to economic returns throughout the physical life-cycle. This definition makes clear that SOI builds on creative ideas but also comprises their implementation phase. We acknowledge that SOI, just as other kinds of innovation, is “a broader and more complex concept than that of creativity, which generally only refers to the generation of new ideas” (Axtell et al., 2000: 266). However, in this paper we put a clear focus on the initial phase of SOI processes (i.e., the creation and evaluation of novel ideas).

As Hüsigg (2014) notes, innovation represents an outcome and the process that leads to it. For SOI, process outcomes have a constitutive character due to their normative quality. In the following, we therefore first delineate the outcome dimensions of SOI as well as related SOI process challenges. On this basis, we argue why DT is an appropriate approach to ensure the desired SOI outcomes already in the initial phase of a SOI process.

Hansen et al. (2009) propose three interrelated outcome dimensions for SOI: *target*, *life cycle* and *innovation type*. The *target dimension* relates to the triple bottom line of corporate responsibility (Elkington, 1994) and thus proposes three assessment criteria for innovations, namely environmental, social and economic impacts. Rather than being a new form of innovation in a qualitative sense, Wagner and Llerena (2012: 133) describe SOI as “better-managed innovations [...] where more target criteria are integrated and made mutually compatible”. The assessment of the impact of an innovation is also discussed in the general innovation literature. Hüsigg (2014), for instance, refers to the “normative dimension” to determine whether an innovation is successful or not and whether it entails a change for the better or worse. In the case of SOI, however, it is more complex because social and environmental impacts must be taken into account in addition to business-relevant ones (Paech, 2007). The *life cycle dimension* emphasizes that sustainability effects occur over the whole life span of a product, including manufacture (material flows and transformation), use (usage patterns and consumer behaviors) and end-

of-life (e.g., recycling, re-use, and disposal) (Dreyer et al., 2006). Thus, considering the entire value chain is critical for SOI development in order to preemptively detect and remove potential negative (side) effects which may compromise the intended positive impact(s) (Hansen and Grosse-Dunker, 2013). At the same time, these life-cycle considerations illustrate that it does not suffice to simply develop technically improved or entirely new products in order to solve fundamental sustainability issues.

The *innovation type dimension* refers to the content of an innovation and thus corresponds to the “content/object dimension” described in the innovation literature (e.g. Hüsigg, 2014). Possible categories can be product, service, process, organizational and business model innovation (Klewitz and Hansen, 2014). For the case of SOI, the focus is put on an innovation's function rather than on its technical properties. With the aim of creating more sustainable solutions, the central question is how user needs can be best fulfilled while saving resources. Product-service systems, for instance, entail an increasing service content of products and thus disengage the value proposition from the consumption of resources (Mont, 2002).

An additional central dimension for SOI, which is also well-established in innovation literature, is the *novelty dimension*, often also referred to as “innovativeness” (e.g. Garcia and Calantone, 2002; Hüsigg, 2014). Since we consider it very important also for SOI, we complement Hansen et al.’s (2013) outcome dimensions by including it as a fourth dimension. The novelty dimension assesses the degree of novelty of an innovation and ranges from low in e.g. “incremental” innovation to high in e.g. “radical” innovation (Hüsigg, 2014). With regard to SOI, Bos-Brouwers (2010) demonstrated that many sustainable innovations are incremental and focus on improving efficiency, e.g. cars with lower petrol consumption (Schaltegger and Wagner, 2011). Since such technological improvements typically address a single issue at a time and focus on reducing harm while maintaining business as usual (Adams et al., 2016), incremental SOI are widely considered insufficient to bring about substantial changes in sustainable consumption and production (Larson, 2000). Instead, SOI will often require radical solutions that move beyond incremental adjustments on a product/technology level (e.g. Schaltegger and Wagner, 2011) and also affect use systems (e.g. Mont, 2002) and culture (e.g. Jaeger-Erben et al., 2015). In the field of mobility, for instance, Firnkorn and Müller (2011) have shown that the more radical mobility solution of free-floating car-sharing seems to have the potential to reduce private vehicle ownership in cities and also CO<sub>2</sub>-reduction per average user.

## 2.2. Central challenges of SOI

The four outcome dimensions (i.e., target, life cycle, innovation type, and degree of novelty) add to the complexity of SOI development (Adams et al., 2016; Schaltegger and Wagner, 2011). Based on these dimensions, we identify four key challenges arising for the SOI process: innovation scope, user needs and behaviors, stakeholder involvement and assurance of positive sustainability effects. These four challenges are presented in more detail in the following. While the innovation scope, user needs and

behaviors, and stakeholder involvement are general challenges for innovation, the assurance of positive sustainability effects is of particular importance for the development of SOI.

### 2.2.1. Challenge 1: Innovation scope

The consideration of multidimensional targets (i.e., environmental, social, and economic impacts) distinguishes the development of SOI from solely economic-oriented innovations (Adams et al., 2016). The resulting complexity makes SOI difficult to grasp (Paech, 2007) and increases the challenge of determining an appropriate innovation scope (Hansen and Grosse-Dunker, 2013).

The innovation scope defines the space in which innovation teams can search for possible solutions. Adams et al. (2016) distinguish three forms of SOI that differ with regard to their innovation scope. First, SOI that aim at ‘doing less harm’ focus on technically improving companies' products and practices (i.e., efficiency gains and risk reduction). Their innovation scope is determined by an internal focus and rather isolated innovation processes. Second, SOI that aim at creating shared value focus on providing benefits for companies and for society. They are characterized by an expanded innovation scope which additionally takes into account immediate stakeholders. Third, the innovation scope of SOI that aim at large-scale transformations (i.e., redesign of institutions, infrastructures, and cultures) is characterized by a system perspective that goes beyond the single firm. It is based on the assumption that sustainability value cannot be achieved through efforts of a single firm, but only in collaboration with external actors from wider systems.

Breuer et al. (2018) define “systemic thinking” as a guiding principle for sustainability-oriented business model development, since it involves a focus on life cycle thinking (e.g., from ‘cradle to cradle’ Braungart et al. (2007)), product-service systems and tools like value mapping (Bocken et al., 2013) to reflect sustainability-related outcomes. In addition, Boons et al. (2013) introduce “systemness” as a frequent characteristic of SOI to emphasize that they have to engage with a multidimensional and global system of consumption and production to be successful. While we acknowledge the significance of a system perspective for SOI development, we also include non-systemic and rather insular solutions in our considerations as they often represent first steps towards more systemic SOI for many firms (Adams et al., 2016). Therefore, we regard the system perspective not as a distinct challenge of SOI, but rather as an approach for defining an appropriate innovation scope.

In general, a scope defined too narrowly limits the space of possible solutions and might therefore lead to solutions that are too confined to have a meaningful impact. Hence, narrowing down the innovation scope too early (e.g., exclusive focus on products and technologies) might inhibit the development of SOI with much larger sustainability effects (e.g., product-service systems) (Hansen and Grosse-Dunker, 2013). In contrast, a broader innovation scope (e.g., including new business areas) opens up a multitude of hitherto unanticipated solutions (Hansen et al., 2009). However, broadening the innovation scope from a specific problem (e.g., fine dust pollution in city centers) to a more abstract problem (e.g., climate

change) always carries the risk of producing imprecise, all-embracing solutions which are too abstract to solve the actual core problem.

### 2.2.2. Challenge 2: User needs and behaviors

User needs and behaviors (i.e., lifestyles, preferences, and consumption patterns) entail significant environmental impacts and determine SOI-related sustainability effects (Hansen and Grosse-Dunker, 2013; Schrader and Belz, 2012). Hence, it is indispensable to thoroughly analyze and consider user needs and behaviors (i.e., product choice and usage) before deciding on SOI-related product specification (Hoffmann, 2007; Schrader and Belz, 2012). The integration of sustainability-related product attributes (e.g., recyclability, toxic content reduction, resource efficiency) with more traditional ones (e.g., price, safety, reliability) increases the degree of complexity and, accordingly, entails various possible tradeoffs (Berchicci and Bodewes, 2005). Ottman et al. (2006) point out that a predominant focus on products' socio-ecological effects might be at the expense of user satisfaction. One classic example are electric cars since they produce less pollution emission but are limited with regard to distance reach.

However, product/technology-based SOI alone cannot promote the systemic changes that are necessary for sustainable development. Their effectiveness depends to a large extent on the integration into real-life usage contexts and correct use (Heiskanen and Lovio, 2010; Hoffmann, 2007). For instance, user behavior is decisive in the case of eco-detergents which are effective even in small doses while still allowing for washing at low temperatures. However, related environmental benefits remain insignificant as long as users stick to previous behaviors (i.e., large doses, high temperatures) (Mylan, 2016). Therefore, relevant user behaviors must be detected and considered when striving to come up with more sustainable alternatives for satisfying user needs. This is particularly true for the development of SOI that aim at replacing physical products by services (e.g., sharing and leasing offerings) or target life-cycle improvements (e.g., product take-back systems for recycling) (Hansen and Grosse-Dunker, 2013). These cases require a thorough analysis and questioning of current consumption patterns and, to this end, depend on a close interaction between the innovation team and potential users (Clark et al., 2009; Lindahl et al., 2014; Mont, 2002).

### 2.2.3. Challenge 3: Stakeholder involvement

SOI requires the involvement and active participation of various internal and external stakeholders (Adams et al., 2016; Ayuso et al., 2006; Goodman et al., 2017; Lee and Kim, 2011; Neutzling et al., 2018; Tyl et al., 2015). This is due to the fact that SOI development necessitates specific expertise and practical knowledge in order to identify all relevant sustainability issues that may occur throughout a SOI's entire life-cycle (Fischer, 2015). Since that knowledge is usually not sufficiently represented within R&D departments, stakeholders may contribute complementary resources and perspectives which allow companies to innovate for social good (Ayuso et al., 2006; Goodman et al., 2017) and may even trigger more radical innovations (Hall and Martin, 2005). This concerns primary stakeholders, who

are directly related to the company (e.g., customers, shareholders, employees and suppliers), as well as secondary stakeholders, who do not have business relations but still can influence or are potentially influenced by the respective company (e.g., civil society organizations, public authorities and academic institutions) (Goodman et al., 2017).

However, the multifaceted, often contradictory stakeholder interests (Driessen et al., 2013; Hall and Vredenburg, 2003) can make it challenging to identify the ideal SOI solution that offers positive sustainability effects for the largest number of stakeholders (Ayuso et al., 2006). Hence, in order to navigate the complex endeavor of creating value for a variety of stakeholders, organizations need new innovation methods and tools that systematically facilitate stakeholder collaboration for SOI development (Goodman et al., 2017).

#### 2.2.4. Challenge 4: Assurance of positive sustainability effects

Sustainability-oriented innovations, as indicated by the name, are intended to provide solutions to sustainability issues. However, the simultaneous pursuit of economic, environmental and social objectives implies diverse “directional risks” (Paech, 2007). The economic success is related to high levels of uncertainty since core consumer needs and behaviors as well as future market conditions are hard to anticipate (Cooper, 2001). The additional consideration of socio-ecological impacts occurring throughout life cycles make it particularly complicated to predict and assess SOI effects and, above all, to ensure that these effects will be positive in the long term (Hansen et al., 2009).

Hansen and Große-Dunker (2013) illustrate this difficulty with the example of bio fuels. Bio fuels had been considered an environmental improvement until their negative side effects (e.g., monocultures and loss of biodiversity, impact on food prices) were identified which ultimately undermined their intended positive impact. Another example of such contrary effects are rebound effects, which refer to an increase in resource demand that results from an efficiency improvement (Santarius, 2016). They occur when firms or consumers use savings that result from an efficiency increase to buy more of the same or other goods and services.

It becomes evident from the example above that SOI as such do not necessarily contribute to more sustainability. As a consequence, related effects must be thoroughly monitored in order to ensure that SOI actually lead to sustainability-related improvements. Accordingly, there is a need to embed regular ‘sustainability checkpoints’ into the screening stages of SOI development processes (Blomquist and Sandström, 2004; Hansen and Grosse-Dunker, 2013).

### 3. Design thinking (DT)

#### 3.1. *The DT concept*

DT is a human-centered, iterative problem-solving approach that involves stakeholders from various backgrounds. In contrast to linear innovation approaches, DT is no rigid process but rather a framework

that integrates creative and analytic modes of reasoning, certain mindsets, as well as various hands-on tools and techniques (Liedtka, 2015). DT-based projects typically start with an exploratory phase that serves to understand the given problem and context, to observe users in real-life situations and, based on these insights, to define an adequate problem frame. During the phase of ideation, participants generate a variety of ideas which could solve the user's problem. In the phase of experimentation, the most promising ideas are selected, prototyped, and tested with potential users according to predefined criteria. After each iteration, the ideas are adapted according to the user feedback and reiterated until an optimal, yet feasible and sustainable solution is found (Beckman and Barry, 2007; Brown, 2008, 2009; Liedtka, 2015; Zheng, 2018). DT's primary focus lies on the comprehensive apprehension of a given problem for which various possible solutions are created and then tested with potential users and other relevant stakeholders (Beverland et al., 2015). Instead of merely solving a given problem, DT thus facilitates the creation and sharing of new knowledge and previously inconceivable possibilities (Kolko, 2015; Michlewski, 2008).

So far, most existing publications on DT address practitioners rather than academics, which is why some researchers have deplored a lack of theoretical foundation (Johansson-Sköldberg et al., 2013). Accordingly, there is no commonly accepted definition of the term 'design thinking', and interpretations and forms of application vary (Carlgren et al., 2016c; Glen et al., 2015). Johansson-Sköldberg et al. (2013) differentiate between "designerly thinking" and "design thinking". Whereas the former refers to the professional designer's skills and competences and is rooted in the academic field of design, the latter transfers the way designers think and work to other areas of application (e.g., innovation development) (Carlgren et al., 2016b). Although having been popularized by Tim Brown (2008, 2009; Brown and Wyatt, 2010) of the Californian design firm IDEO, Herbert Simon (1969: 4) was one of the first to propose design as an approach for "the transformation of existing conditions into preferred ones". This constitutes a different approach compared to prevalent decision-making practices that primarily rely on analytical (i.e., deductive and inductive) thinking and aim for consistent and predictable outcomes (Martin, 2009). In contrast, designers frame innovation challenges differently and question previous ways of creating value by asking "what if?" questions rather than relying on cause-effect relationships (Liedtka, 2004; Verganti, 2008). This so-called abductive reasoning departs from desired results ("what might be") rather than from the status quo ("what is") and is a central hallmark of DT (Beverland et al., 2015; Fischer, 2015).

### *3.2. DT key principles*

Based on empirical findings from semi-structured interviews with employees from different functions such as R&D and innovation managers and DT practitioners in six large organizations, Carlgren et al. (2016c) distinguish five DT key principles which succinctly characterize the approach as it is currently applied: Problem framing, user focus, diversity, visualization, as well as experimentation and iteration. In so doing, the authors provide a systematic structure and a language for discussing DT in detail.

Despite an inconsistent use of terminology, these key principles are mentioned by various authors (Carlgren et al., 2016b; Glen et al., 2015; Shapira et al., 2017). The five principles are highly intertwined and may be applied in varying order throughout DT processes (Brown, 2008, 2009).

### 3.2.1. Problem framing

The first principle refers to the task of defining a problem statement which will delimit the scope for the ideation phase. DT builds on the assumption that “identifying a larger problem space helps create a larger solution space” (Carlgren et al., 2016c: 47). Accordingly, its problem framing approach is characterized by a broad system perspective and involves “zooming out for context” (Suri and Howard, 2006). The consideration of additional contextual factors enables new perspectives, a broader understanding of the problem and additional solution options. In the course of a DT process, the initial problem frame is continuously questioned and reframed until it is adequately set (Carlgren et al., 2016c).

### 3.2.2. User focus

The second principle of DT refers to a thorough understanding of users, their needs, behaviors and contexts. While product/ technology-centered innovation approaches primarily depart from predefined specifications, DT constitutes a human-centered approach which understands users as humans with multiple personal needs and experiences (Beverland et al., 2015; Brown, 2009; Kimbell, 2015; Liedtka, 2015). To build empathy with users and to gain deep insights, DT includes extensive research based on ethnographic methods (e.g., observations, interviews, diaries) (Beckman and Barry, 2007; Suri and Howard, 2006). In addition, user feedback is gathered consistently during the development process and incorporated in further iteration loops (Carlgren et al., 2016a, 2016b).

### 3.2.3. Diversity

The third principle refers to collaboration in multidisciplinary innovation teams which are characterized by a combination of different skills, personalities and hierarchical positions (Shapira et al., 2017). Team members can be, for instance, employees from different departments of the company or external stakeholders like consumers, scientists or experts from civil society organizations. Carlgren et al. (2016c) provide empirical evidence that diverse teams enable the tapping and incorporation of diverse perspectives and expertise from various fields throughout the development process.

### 3.2.4. Visualization

The fourth principle proposes to make abstract ideas visible and tangible. The quick development of prototypes (i.e., simple and rough representation of the idea) is what Carlgren et al. (2016a) refer to as “thinking by doing”. Possible prototyping approaches include mock-ups that are made out of simple materials (e.g., cardboard, wool or wood) as well as role-plays, user scenarios and storyboarding (Carlgren et al., 2016c; Holloway, 2009). Prototypes enable real world experimentation by visually or narratively transporting the basic idea and its main features to potential users and other stakeholders. As a consequence, prototypes enable the gathering of extensive and accurate feedback from experts and potential users (Liedtka, 2015).

### 3.2.5. Experimentation and iteration

The fifth principle addresses the experimental and iterative approach of DT. DT observes the motto “fail often, fail early” and values trying out things and learning from mistakes (Carlgren et al., 2016c). To continuously improve created solutions, ideas are generated, prototyped and tried out early in the development process. Based on the feedback that was obtained during iterative, criteria-led testing phases with potential users, the prototypes are then abandoned or refined and adjusted to actual user needs. The constant change between convergent and divergent ways of thinking facilitates the creation of many alternative solutions and prevents to narrow down the choice too quickly to a single one (Beckman and Barry, 2007; Fischer, 2015; Zheng, 2018).

## 4. DT for SOI: Development of a conceptual framework

SOI, as outlined in detail above, poses a number of diverse challenges for innovation management. Against this background, we recognize that SOI development requires adequate approaches for organizations to tackle the above mentioned challenges (Adams et al., 2016; Hansen et al., 2009). In this chapter, we systematically explore and discuss how DT inherently addresses the central challenges of SOI development. For each of the four identified SOI challenges, we refer to one or more DT principle(s) and derive four research propositions.

### *4.1. Tackling challenge 1: Identifying an appropriate innovation scope by means of “problem framing”*

The DT principle problem framing constitutes a promising approach to identify the appropriate innovation scope for SOI development. Hansen and Große-Dunker (2013: 2413) stress its central role by pointing out that “one often neglected but with regard to SOI quite remarkable phase is the one of problem definition.” Due to the four outcome dimensions, SOI development is usually characterized by a wide variety of user needs, ill-specified problem statements, and unknown results (Buchanan, 1992; Goodman et al., 2017).

DT appears particularly beneficial for comprehensively solving sustainability-related problems since it explores the problem context before mapping out the scope for innovation (Kolko, 2015: 70). DT understands “problem definition as contingent on the system in which it emerges” (Beverland et al., 2015: 593). Therefore, it takes a systemic perspective that not just focuses on the obvious problem, but also looks at how it is embedded within the surrounding system (e.g., market context, user needs, social factors, emerging trends) (Fischer, 2015; Owen, 2007). Thus, it enables a holistic understanding of complex sustainability-related problems and the discovery of non-obvious root causes (Shapira et al., 2017; Zheng, 2018). Furthermore, by expanding the problem frame DT opens up a larger innovation scope which might facilitate innovative alternatives of fulfilling user needs that go beyond efficiency-enhancing product improvements (e.g., services instead of products, digital instead of physical products) (Adams et al., 2016).

One specific DT tool for finding an appropriate problem frame is a “design challenge” (DC). Glen et al. (2014: 660) state that it “provides a general portrayal of the problem situation. The breadth and nature of this challenge will reflect the course in which the project takes place.” An expedient DC opens up a large solution space while simultaneously narrowing down the problem to be solved. Fischer (2015) describes the search for a situation's central paradox as an essential hallmark of DT. With regard to SOI development, such paradoxes might emerge at the juxtaposition of user demands and sustainability constraints. For example, a DC could be formulated as follows: “How can we offer sophisticated product packaging and at the same time reduce resource consumption?”. Hence, a DC which explicitly points out the sustainability target constitutes a starting point for exploring the formulated problem in more detail. Based on these considerations, we derive our first proposition:

*Proposition 1. Design thinking, in particular its “problem framing” principle, facilitates the definition of an appropriate innovation scope for SOI development.*

#### *4.2. Tackling challenge 2: Identifying core user needs and behaviors by means of “user focus”*

The DT principle user focus appears conducive to identifying and incorporating relevant user needs and behaviors for the development of SOI. In the context of social innovation, Brown and Wyatt (2010: 29) maintain that “design thinking addresses the needs of the people who will consume a product or service and the infrastructure that enables it”. Hence, DT strives for a deep understanding of user needs and behaviors (i.e., personal lifestyles, consumption choices, social contexts) and allows for detecting their relevance regarding social and ecologic issues (Beverland et al., 2015; Dewberry and Sherwin, 2002). Identified needs and behaviors are then translated into design criteria and constitute the starting point for generating ideas in the subsequent ideation stage (Liedtka, 2015; Sametinger et al., 2015).

However, when developing SOI, it is not enough to simply ask users what they need or how they behave. First of all, they often are not aware of related sustainability effects and are therefore unable to describe their own corresponding behavior or latent needs (Liedtka, 2015). Apart from that, social desirability concerns might prevent users to admit disinterest or even anti-environmental behavior (Milfont, 2009). For such situations of indeterminate user needs, DT appears beneficial since it encourages innovation teams to immerse in the relevant user context, which Glen (2015: 183) describes as to “walk a mile in their moccasins”. By means of ethnographic methods, DT involves observations and direct interactions with users in their natural settings (Beckman and Barry, 2007; Suri and Howard, 2006). One such conversational method is a “cultural probe” (CP) which constitutes a means to disclose hidden user-related information. Sametinger et al. (2015) describe that CPs “include open-ended, question-based elements that animate participants to narrate rather than deliver precise data”. For the specific context of SOI development, a CP may involve diary-like parts where users are asked about their daily routines and consumption habits. The instructions are quite specific and guide users to reveal details of their everyday lives that they usually might have not reported (e.g., frequency of car use, average time of mobile phone use, number of wash loads per week) (Gaver et al., 2004). In contrast to other user research

methods, CPs provide more detailed insights into users' personal spheres. Thus, they enable innovation teams to develop a deep understanding of unarticulated user needs and behaviors that underlie a certain sustainability-related problem. Therefore, the second proposition is:

*Proposition 2. Design thinking, in particular its “user focus” principle, fosters a thorough understanding and consideration of user needs for SOI development.*

#### *4.3. Tackling challenge 3: Involving stakeholders by means of “diversity” and “visualization”*

DT, in particular due to its inherent diversity focus, constitutes a promising approach to ensure an early and (inter)active involvement of diverse stakeholders in core creative activities (Fischer, 2015). With regard to SOI development, DT's collaborative approach of “engaging stakeholders as designers in the design process” (Björgvinsson et al., 2012: 102) is beneficial mainly for two reasons. First, because its underlying idea of participation makes it clear that everyone affected by a specific sustainability problem and thus by the resulting SOI should have a say in the development process (Brown and Martin, 2015). Second, DT understands heterogeneous perspectives and skills as valuable resources and assumes that collaboration in multidisciplinary and cross-functional teams will lead to better innovation outcomes (Sato, 2009; Shapira et al., 2017; Zheng, 2018). Therefore, stakeholders are explicitly encouraged to bring in their tacit knowledge (i.e., their formal competencies as well as their practical skills) in the early stages of the innovation process. Geissdoerfer et al. (2016) show with their study that DT can support the inclusion of the perspectives and needs of multiple stakeholders as well as the identification and resolution of conflicts between them. However, identifying and integrating relevant external stakeholders can be challenging (Schrader and Belz, 2012). When putting together heterogeneous innovation teams, managers may therefore want to consider recruiting relevant internal stakeholders. For example, ‘sustainability-oriented employees’ may constitute promising participants when tackling SOI challenges. They are intrinsically motivated to protect the environment through their work and possess extensive environmental knowledge and skills (Buhl et al., 2016; Ciocirlan, 2017). ‘Sustainable embedded lead users’ (SELU) are a specific subcategory of sustainability-oriented employees. In addition to a strong orientation towards sustainability, they also show lead user characteristics regarding their employer's market offers (Schmidt-Keilich and Schrader, 2019).

In light of the diversity of all participating stakeholders, difficulties of interpersonal communication may impede an equal and effective collaboration for SOI development. Especially when sustainability-oriented employees and SELU are involved, differences in interpretations (e.g., regarding an understanding of what is meant by sustainability-oriented innovation) among the members of the innovation team may act as barriers (Berchicci and Bodewes, 2005). Therefore, Fischer (2015) refers to DT's use of a common design language that may help to bridge disciplinary-specific terminologies. This is where another DT principle comes in handy: Visualization implies the use of imagery (i.e., visual or narrative) and promotes the transformation of abstract ideas into visible and tangible prototypes (Carlgrén et al., 2016c; Liedtka, 2015). As Kimbell (2015: 287) states, “visual artifacts and prototypes

help multidisciplinary teams work together.” The results of a qualitative study by Carlgren et al. (2016c) confirm this by showing that DT workshop participants find visualization (i.e., drawing and creating rough prototypes) very useful. Prototypes make it possible to capture and share individual ideas within the innovation team by offering a common set of metaphors (Klemmer et al., 2006). In addition, prototypes facilitate discussion and collective sensemaking (Stigliani and Ravasi, 2012) which is useful to achieve a joint vision and thus a basis for collective innovation development (Liedtka, 2015). Furthermore, prototypes enable the innovation team to externalize their ideas by communicating them to outsiders (Brown and Wyatt, 2010; Carlgren et al., 2016c). Prototypes provide vivid “pre-experiences” and thus allow outside stakeholders to explore the ideas in a hands-on way (Liedtka, 2015). Thus, prototypes enable stakeholders to quickly understand the innovation idea regardless of language, cultural or discipline-related barriers which is a necessary prerequisite for participating in complex SOI development processes (Bjögvinsson et al., 2012). Against this background, we suggest the following proposition:

*Proposition 3. Design thinking, in particular its “diversity” principle and indirectly its “visualization” principle, fosters stakeholder involvement in SOI development.*

#### *4.4. Tackling challenge 4: Assuring positive sustainability effects by means of “experimentation and iteration” and “visualization”*

DT's reliance on experimentation and iteration makes it “best suited to decision contexts in which uncertainty and ambiguity are high” (Liedtka, 2015: 927) and therefore particularly adequate for SOI development. The principle of experimentation encourages innovation teams to explore and rapidly test multiple SOI options with end-users in order to “experiment its way to solutions” (Kolko, 2015: 70). For this purpose, DT typically envisages low-cost and rough prototypes (Carlgren et al., 2016a, 2016c) that are quickly produced using simple office and craft materials (Geissdoerfer et al., 2016). By means of its divergent-convergent way of thinking, DT mediates tensions between various possible solutions and given sustainability-related constraints (e.g., waste avoidance, conservation of resources or fair working conditions) (Carlgren et al., 2016c; Liedtka, 2015). Thus, DT's experimentation approach is particularly beneficial for conciliating multiple stakeholder interests and corresponding SOI options. This is emphasized by Zheng (2018: 746) who points out that “the synthesis of diversity depends on experimentation”.

Finally, DT facilitates the selection of those SOI ideas which best meet the respective imperative. In the case of SOI, the imperative refers to generating positive while avoiding negative sustainability effects. However, as indicated by the term of sustainability-oriented innovation, positive sustainability effects (i.e., social, ecologic and economic benefits) are an intended, but not a certain outcome. To ensure that SOI actually provide value in social and ecological terms and, in addition, address market demand, Berchicci and Bodewes (2005) stress the need to verify the innovation team's assumptions during the development process. To this end, Hansen and Große-Dunker (2013) suggest to integrate regular

'sustainability checkpoints' into SOI development in order to assess a SOI's positive as well as negative sustainability effects. DT user tests can constitute such sustainability checkpoints if predefined test criteria are integrated which cover sustainability targets on different assessment levels (e.g., social, environmental and economic risks and benefits, life cycle stages) (Beckman and Barry, 2007). One possible tool for a more structured assessment of a SOI's sustainability effects is the "Sustainability Innovation Cube" (SIC) (Hansen et al., 2009). The SIC classifies SOI according to three outcome dimensions (i.e., target, life cycle, innovation type) and indicates where positive and/or negative sustainability effects may potentially arise. Based on the results, a SOI's potential negative sustainability effects can then be revised and improved in a subsequent iteration loop (Beckman and Barry, 2007; Liedtka, 2015; Shapira et al., 2017).

The DT principle of visualization facilitates experimentation and therefore indirectly fosters the assurance of positive sustainability effects. Prototypes constitute essential instruments to quickly test possible solutions with potential users and help to enhance the accuracy and usefulness of their feedback (Carlgren et al., 2016c). By providing vivid manifestations of the respective idea, prototypes serve as "playgrounds" (Schrage, 2008), allowing potential users to experience the idea instead of only having to grasp it on an intellectual level. However, Beckman and Barry (2007: 43) point out that "before creating a prototype, the team must determine what it wants to learn from the prototyping process so that it can focus its prototype on acquiring the associated feedback". In the case of SOI, the learning objectives refer to a thorough understanding of positive and negative sustainability effects that may occur along the entire life cycle of the innovation. In order to visualize the intended sustainability objectives, prototypes should be built using ecofriendly materials (e.g., recycled or waste materials). This takes us to our following proposition:

*Proposition 4. Design thinking, in particular its "experimentation and iteration" principle and indirectly its "visualization" principle, facilitates the assurance of sustainability effects during SOI development.*

Fig. 1 presents an overview of the four central SOI challenges and the five DT key principles. Furthermore, it indicates the above discussed linkages and depicts the research propositions derived from our discussion above. We see four direct connections between (P1) innovation scope & problem framing, (P2) user needs & user focus, (P3) stakeholder involvement & diversity, and (P4) assurance of positive sustainability effects & experimentation and iteration. As indicated by the dotted arrows, we suppose indirect connections between (P3) stakeholder involvement & visualization and (P4) assurance of positive sustainability effects & visualization. This is due to the fact that we expect the principle of visualization to facilitate diversity and experimentation. To sum up, these connections suggest that DT constitutes an inherently favorable approach for SOI development.

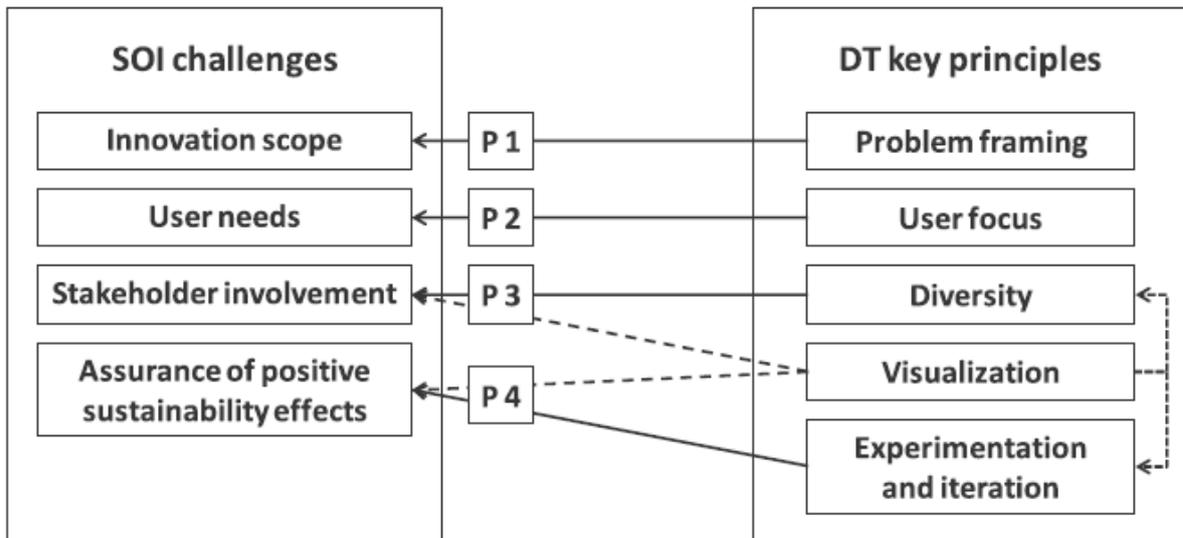


Fig. 1. Overview of DT and SOI relations and indication of research propositions.

## 5. Conclusion

Sustainable development at the macro level requires innovative contributions by organizations and organizational members. This calls for appropriate methods that promote organizational capabilities to tackle the challenging task of SOI development (i.e., the generation and evaluation of new SOI ideas). This conceptual article examines the question of why and how DT might foster SOI development and presents a framework (Fig.1) that systematically illustrates the links between DT (i.e., innovation approach) and SOI (i.e., innovation outcome). To develop this framework, we delineated the outcome dimensions of SOI and derived four central challenges of SOI development: (i) the definition of an appropriate innovation scope, (ii) the consideration of user needs and behavior, (iii) the involvement of a wide range of stakeholders, and (iv) the assurance of actual sustainability effects. In a next step, we presented the concept of DT with its five key principles (i.e., problem framing, user focus, diversity, visualization as well as experimentation and iteration) and developed four research propositions, which show that these principles could be suitable to meet the challenges associated with the development of SOI. It should be noted that these propositions are not designed as verifiable hypotheses. Rather, they constitute starting points and are intended as orientation for further research. Based on our framework, we suggest DT as a suitable approach to ensure that sustainability aspects are already taken into account in the initial phase of organizational innovation processes, i.e. when generating and evaluating SOI ideas.

In this way, we show managers who are confronted with SOI development a method to overcome the challenges and complexity of SOI development. Furthermore, the framework equips them with arguments to advocate the use of DT for SOI in their organization. In sum, DT's approach to problem

framing appears helpful to set the appropriate innovation scope for SOI. Its strong focus on users (e.g., product choice and usage) and stakeholders fosters the development of SOI that meet actual user needs. With its focus on iterative experimentation, DT makes it possible to assure positive sustainability effects while reducing the risk of innovation failure. This is of particular relevance for companies, since innovations which users eventually do not adopt imply a waste of energy, material and financial resources that are used for their production, storage, marketing, distribution, and disposal. In this case, envisaged positive sustainability effects are neutralized or even reversed into negative effects (Buhl, 2018). Furthermore, our conceptual framework provides a differentiated basis underpinning the assumptions of several researchers (e.g. Fischer, 2015; Shapira et al., 2017) that a DT-based approach is an essential, yet often overlooked asset when addressing sustainability challenges.

### *5.1. Boundary conditions, implications for practice, and future research*

The propositions presented in this article constitute starting points and provide orientation for future research. In a next step, further research should investigate under which conditions the use of DT is advantageous for the development of SOI. We therefore invite future studies to look more closely at the following boundary conditions, which are likely to influence the proposed relationships between SOI outcomes and the DT approach:

The first boundary condition refers to the degree of novelty of SOI. Scholars have shown that the management of radical innovation involves different requirements for organizations than incremental innovation (e.g. Hüsigg, 2014). While radical innovation introduces new knowledge, is potentially disruptive to a current solution and may lead to discontinuities at both micro (i.e., customer) and macro (i.e., industry) levels, incremental innovation draws on existing knowledge to improve and exploit an established solution (Garcia and Calantone, 2002). Accordingly, it can be assumed that, for example, user focus, a key principle of DT, is less relevant for radical innovation than for incremental innovation, since radical innovation often does not aim at a perceived demand, but instead generates a demand not yet recognized by the consumer (Garcia and Calantone, 2002). Based on an interview study of five large firms, Carlgren et al. (2016a) show that DT is primarily applied for the development of incremental innovation. Against this background, more research is needed to find out whether DT is fundamentally suitable for developing truly innovative ideas.

The second boundary condition refers to the role of the designer, i.e. the person(s) who lead(s) the innovation process. Iskander (2018) describes designers as ‘gatekeepers’ in DT processes who interpret the ideas and feedback obtained from users and stakeholders and decide to what extent it will be included in the further development process. The author points out that the associated subjectivity not only limits participation of stakeholders in the design process, but also narrows the scope for radical ideas and rather leads to a preservation of the status quo. She therefore questions whether DT is suitable for challenges that are characterized by a high degree of uncertainty, such as most sustainability-related challenges. With regard to SOI, Iskander's (2018) critique raises the question to what extent environmental and

social values of the designer influence or even dominate the sustainability of the innovation outcome of a DT process (cf. Schaltegger and Wagner, 2011 for sustainable entrepreneur). Accordingly, future studies should investigate to what extent the integration of socio-ecologically oriented employees (e.g., green employees and/or SELU) into DT processes has an impact on the degree of novelty and the sustainability effects of innovation outcomes.

Third, the success of an application of DT also depends on the existence of a conducive organizational and leadership culture. In view of the involvement of various stakeholders with diverse, often diverging perspectives and interests, several authors emphasize the premise of a democratic spirit and an openness for unorthodox opinions (Carlgren et al., 2016c; Liedtka, 2015). Furthermore, DT requires leadership which is characterized by a willingness to take risks and to accept unforeseeable failures (i.e., iterative trial-and error innovation culture) (Beverland et al., 2015; Kolko, 2015; Shapira et al., 2017; Zheng, 2018). Managers considering the application of DT for SOI development might perceive the approach as counterintuitive and resource-demanding. Instead of striving for solving the given problem as quickly and efficiently as possible, DT first requires investing a lot of time in framing the problem adequately and exploring user needs (Carlgren et al., 2016a, 2016c). Since real participative processes require managers to give up a certain amount of control, further research could look into whether and to what extent the use of DT will lead to changes in organizational culture in the long term.

In view of these boundary conditions, future research should examine whether and how DT needs to be adapted to ensure that innovation outcomes actually have positive sustainability effects. Building on the insights of this article and Shapira et al.'s (2017) sustainability-oriented add-ins, further specific tools and practices are required which systematically anchor sustainability aspects in DT processes. Furthermore, this article focuses on the question of why and to what extent DT is inherently suitable for the development of SOI, but not whether it is better or worse suited than other approaches. Comparative case studies should therefore consider other potential innovation approaches, such as Sustainable Product and Service Development (SPSD) (Maxwell et al., 2006) or sustainable living labs (Liedtke et al., 2015), in order to make statements about the relative benefits of DT.

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#### Declaration of interest

None.

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## **Innovative green employees: The drivers of corporate eco-innovation?**

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### **Abstract:**

Previous studies have increasingly referred to the green employee as a promising resource for eco-innovation. However, while the concept was only vaguely defined until recently, empirical research is missing. Building on the concept of green employees, this paper explores ‘innovative green employees’ and their potential for eco-innovation. We use interview data from four green German companies of a small to medium size. We find that innovative green employees contribute to corporate eco-innovation by generating and discussing pro-environmental ideas. In our sample, these ideas mainly focus on fostering eco-friendly consumption at the workplace. Further, our results show that innovative green employees contribute to corporate greening by transforming the values and behaviors of colleagues as environmental role-models and opinion leaders. To this end, they draw on their environmental knowledge, their professional and private networks, their authenticity and credibility and on the dialogue culture present in their company.

### **Keywords:**

Eco-innovation; Employee innovation; Green employee; Environmental green behavior; Corporate greening

### **1. Introduction**

Not too long ago, most companies reduced addressing environmental issues to regulatory compliance and a trade-off with corporate goals (Triguero et al., 2013; Yarahmadi and Higgins, 2012). Today, however, a growing number of firms are aware of the potential benefits of environmental performance and are increasingly integrating the concept of environmental sustainability into their business strategy (Ambec and Lanoie, 2008; Sharma, 2000). A key factor to enhance environmental performance is seen in corporate eco-innovation (Bansal and Roth, 2000; Nidumolu et al., 2009). The Eco-Innovation Observatory (2012, p. 8) defines eco-innovation as the “introduction of any new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle”. Academic studies on eco-innovation have seen an upsurge in recent years (Hojnik and Ruzzier, 2016). Yet, their practical development tends to be highly complex, ambiguous and risky as they involve a wide range of stakeholders with often contradictory demands (Hall and Vredenburg, 2003; Van Zyl, 2013).

While employees have been identified as a very important stakeholder group for corporate greening (Wolf, 2013), in particular those employees with strong environmental values are considered promising to initiate and drive eco-innovations (Buhl et al., 2016; Ciocirlan, 2017; DuBois et al., 2013; Ramus and Steger, 2000; Schmidt-Keilich and Schrader, 2019). They want to bring in their private values to the workplace (Muster and Schrader, 2011; Schrader and Harrach, 2013) and thus might be highly motivated to engage in eco-innovation activities. As task motivation positively influences creativity (Amabile et al., 1996; DuBois et al., 2013), the ideas of eco-oriented employees to enhance corporate environmental performance are expected to be highly creative. Further, based on their pro-environmental consumption behavior, eco-oriented employees tend to possess domain-specific use knowledge, which is a key resource for the development of corporate product innovation (Schweisfurth and Herstatt, 2014). Apart from official idea and innovation management channels, empirical studies suggest that these employees are inclined to activate their internal network and mobilize colleagues for pro-environmental projects that might be the starting point for eco-innovation development (Anderson and Bateman, 2000; Ciocirlan and Pettersson, 2012).

Despite these theoretical benefits of a green employee for eco-innovation, empirical evidence so far is missing (Ciocirlan, 2017). This paper aims at shedding more light on the innovative potentials of green employees by exploring how innovative green employees contribute to corporate eco-innovation. To answer this question, we draw on interviews with 19 informants of four German SMEs from the energy, media, mail order as well as medical and cosmetics industries.

The paper is structured as follows: After explaining the theoretical background (section 2), we describe our methodological approach (section 3). Then, we present our findings (section 4), discuss our results (section 5), and point out implications, limitations and future research avenues (section 6).

## 2. Theoretical background

### 2.1. *The concept of the green employee*

Previous studies in organizational and environmental literature have often referred to the “green employee” to imply the potential of employees who possess environmental values and are intrinsically motivated to protect the environment (e.g. Mandip, 2012; Renwick et al., 2013). Only recently, Ciocirlan (2017, p. 52) delineated the concept and proposed that “a green employee has an environmental identity, an intrinsic motivation to protect the environment through work, and aims for consistency between home and work environmental behaviors”. In contrast to research that focused on green leadership (Ones et al., 2010), Ciocirlan (2017) points out that green employees can be found throughout the organization on all hierarchical levels. Further, green employees form their environmental values and beliefs both at work and in their private life (e.g. Andersson et al., 2012), building a cycle of reciprocal spillovers described by Muster and Schrader (2011) as ‘green work-life balance’. However, Ciocirlan (2017, p. 53) argues that green employees “might differ in the extent of their commitment to their environmental

identity (...)"'. Some green employees might have a more salient and prominent environmental identity than their green colleagues. Following segmentation analyses of employees that distinguish between laggards, late majority, early majority, early adopters, and innovators, depending on their degree of motivation to adopt environmental innovations (e.g. DuBois et al., 2013), Ciocirlan (2017) accordingly expects that green employees also differ with respect to the type of behaviors they typically perform. The majority of green employees might regularly engage in rather low-intensity environmental behaviors driven by habitual and environmental concern as an extension of domestic behavior (Smith and O'Sullivan, 2012). Only a subset of green employees is expected to conduct high-intensity environmental behaviors, as these are associated with more visibility, risk and potential costs.

The potential of employees who show a more or less pronounced environmental orientation to promote corporate greening – i.e. the process by which a company becomes more environmentally responsible (Schaefer and Harvey, 1998) – has also been addressed by other concepts, e.g. the 'environmental champion' (Anderson and Bateman, 2000), the 'environmental issue supporter' (Sonenshein et al., 2014) and the 'green change agent' (Wright et al., 2012). However, while these concepts address employees that hold specific corporate functions (e.g. sales representatives), theoretically any staff member of the organization may exhibit green employee characteristics as conceptualized by Ciocirlan (2017). Therefore, in the remainder of this paper, we adapt the author's definition and consider an environmental identity, an intrinsic motivation to protect the environment through work, and a consistency between home and work environmental behaviors as key characteristics of a green employee.

## 2.2. *(Green) employee potentials for eco-innovation*

The potentials of green employees for the development of eco-innovation in organizations have been discussed by different studies (Buhl et al., 2016; DuBois et al., 2013; Schrader and Belz, 2012). DuBois et al. (2013) expect green employees to be intrinsically motivated to engage in eco-innovation development. Buhl et al. (2016) emphasize the role of a strong green identity for green employee motivation to participate in eco-innovation activity. The authors refer to empirical studies that identify a green identity as a crucial determinant of high-intensity pro-environmental behavior at work (Ciocirlan, 2017; Matsuba et al., 2012; McDonald, 2014; Stets and Biga, 2003). We follow this line of argumentation and expect innovative green employees to exhibit a high intrinsic motivation to support corporate eco-innovation.

Motivation highly influences creativity, which is a central resource of innovation (Amabile et al., 1996). In the context of eco-innovation, Chen and Chang (2013) have coined the term 'green creativity' to describe the development of innovative pro-environmental solutions. As green employees want to bring in their pro-environmental values and beliefs to the workplace, we expect them to be highly motivated to engage in eco-innovation, leading to positive effects on their 'green creativity'.

Further, we expect green employees to possess comprehensive environmental knowledge and skills as a result of their environmental engagement in private settings (Anderson and Bateman, 2000; Buhl et al., 2016). Participation in eco-preserving initiatives, environmental volunteer work or in a renewable energy cooperative may enhance domain-specific knowledge and provide inspirations for pro-environmental ideas. Next to motivation, domain-specific knowledge is a key element of individual creativity (Schilling and Green, 2011). We argue that green employees build up environmental expertise and thus, may access a relevant domain for the ideation of eco-innovations. Buhl et al. (2016) in particular emphasize the significance of green employees' private consumer experience for eco-innovation development. The environmental impact of an innovation is significantly determined by the way it is purchased, used and disposed of rather than by related manufacturing processes (Kammerer, 2009). Therefore, the integration of consumption knowledge in eco-innovation development is considered vital (Liedtke et al., 2015; Schrader and Belz, 2012). In line with the concept of sustainable embedded lead users by Schmidt-Keilich and Schrader (2019), we argue that green employees' private consumption knowledge and experiences constitute a valuable resource for eco-innovation activities.

Next to an engagement in official innovation processes (e.g. appointments on work councils), green employees might also support the development of eco-innovation in rather informal ways (Anderson and Bateman, 2000; Ciocirlan and Pettersson, 2012). Like environmental champions, green employees might use coalition building and inspirational appeal to mobilize fellow colleagues and supervisors to spread their eco-related vision and push environmental issues on the top management agenda (Ciocirlan, 2017).

Due to these potentials, Buhl et al. (2016) have called for empirical research on the contribution of green employees for eco-innovation. We follow this call and investigate the resources green employees deploy and the behavior they engage in to foster corporate eco-innovation development.

### 3. Methods

A phenomenon-based research perspective is assumed to investigate innovative green employees based on interview data (Krogh et al., 2012). This approach is appropriate in light of the lack of empirical knowledge about innovative green employees and their potential for corporate eco-innovation and has been followed similarly by other scholars (Beverland, 2005; Schweisfurth and Herstatt, 2014).

#### 3.1. *Sampling and data collection*

In order to observe the phenomenon under study, our sampling approach focused on a context in which we expected innovative green employees to engage in corporate eco-innovation. Therefore, we selected four "green" companies, as these tend to attract employees who are characterized by an above-average environmental orientation. The companies are all located in Germany; the data collection was undertaken in 2016/2017.

The sampling of the interviewees was carried out using a comprehensive online survey that was conducted in all four companies and in which the employees assessed their engagement in corporate eco-innovation as well as their environmental orientation. To capture their engagement in eco-innovation, we built on the three-dimensional Innovative Workplace Behavior (IWB) scale (Janssen, 2000; Scott and Bruce, 1994) and developed a nine-item scale of three dimensions (i.e., idea generation, promotion and implementation) represented by three items each. By adding phrases such as “eco-innovation”, “more sustainable way,” or “company’s sustainability performance”, we adapted the original IWB items to the context of eco-innovation. The environmental orientation of the interviewees was measured by applying the six items of the GREEN scale provided by Haws et al. (2014). All items were translated into German. In total, we received 454 completed questionnaires. From those employees who showed above-average results with respect to eco-innovation engagement and environmental orientation, we selected a random sample of 19 employees. We conducted individual interviews with them that lasted between 20 to 50 minutes using a semi-structured interview guideline. All interviews were recorded and subsequently transcribed. Table I provides an overview of the characteristics of the interviewees.

<b>ID</b>	<b>Industry</b>	<b>Function</b>	<b>Tenure (yrs.)</b>	<b>Age</b>
1	Energy	Head of Strategic Business Development	2	37
2	Energy	Technical Support Locat Heat	0,75	33
3	Energy	Public Relations	8	44
4	Energy	Public Relations	13	54
5	Mail order	Project Lead Organizational Development	5	49
6	Mail order	Sustainability Department, Environmental and Energy Officer	5	50
7	Mail order	Sustainability Department (Textile Production)	6,5	31
8	Mail order	Dispatcher	5	53
9	Mail order	Graphics Assistant	1,5	32
10	Media	Sustainability Officer (Monitoring)	5	52
11	Media	Online Editor	3,5	30
12	Media	Editor	2	29
13	Media	Editor	4	54
14	Media	Editor	5	50
15	Media	Marketing	4	33
16	Medical & cosmetics	Analytical R&D, Quality Officer	18	46
17	Medical & cosmetics	Warehouse worker	30	58
18	Medical & cosmetics	Sales	6	45
19	Medical & cosmetics	Analytical R&D	6	32

Table I. Characteristics of interviewees (innovative green employees)

The interview guide contained around 30 questions. All interviews were conducted in German by the first author via telephone. We interviewed innovative green employees from different hierarchical levels and functional areas to prevent informant bias, retrospective sense making, and social answering and to ensure reliability. Further, we relied on neutral, non-directive questioning techniques to avoid influencing the interviewees. In addition, all of the informants voluntarily took part in the study and

were motivated to talk to us as the topic addressed their personal values and concern for the natural environment. It has been demonstrated that these factors increase the cooperation with researchers and the validity of the interviewee's report (Miller et al., 1997). At the beginning of each interview, we assured the informants that their accounts would be kept confidential to foster frankness.

### 3.2. *Coding, data reduction, and analysis*

To reduce and analyse the data from the transcribed interviews, we applied qualitative content analysis, a method that is considered suitable for systematic, theory-driven analysis of large quantities of data (Kuckartz, 2012). The first step of our analysis involved a detailed reading of the complete text material and the composition of memos and case summaries. While we did not exclude any aspects from our analysis in advance, we focused on the personal characteristics of innovative green employees, their individual innovative behaviour, as well as the resources they draw on to engage in eco-innovation. As these themes are directly derived from our research question, they had been leading questions in our interview guideline and served as higher-order categories in our analysis. We further divided these categories into relevant subcodes inspired by relevant literature (e.g. Ciocirlan, 2017; Schweisfurth and Herstatt, 2014; Smith and O'Sullivan, 2012; Hammond et al., 2011; Shalley et al., 2004). With this first draft of a code system, we carried out a test run by coding 20% of the material using the qualitative data analysis software MaxQDA. As some subcodes turned out to be irrelevant, we reduced our initial category set to eight subcodes. We then assigned codings to the complete interview material. Following a consensual coding approach, the first and third author of this paper coded the material independently. Afterwards, individual codings were compared. In case of different codings, each particular case was discussed to finally reach a consensus. This approach often lead to a more precise definition of the respective code. Consensual coding is considered an appropriate way to improve the reliability of the coding process (Kuckartz, 2012).

Subsequently, each subcode was analysed separately including every coded passage belonging to this code. This lead to a further differentiation of the first-order categories by inductively determining subcodes directly from the interviews. Using this revised system of codes, we coded the complete text material in a consensual coding approach once more. A comparison and discussion of our codings brought up 11 subcodes. These subcodes are shown in Figure I. (authenticity & credibility, environmental knowledge, etc.). The findings are also structured according to our final system of codes.

## 4. Findings

We find that our interviewees correspond to the definition of a green employee proposed by Ciocirlan (2017). Apart from that, our findings have been developed exploratively and are not derived from or test an established theory in the literature. Figure I illustrates the structure of these findings.

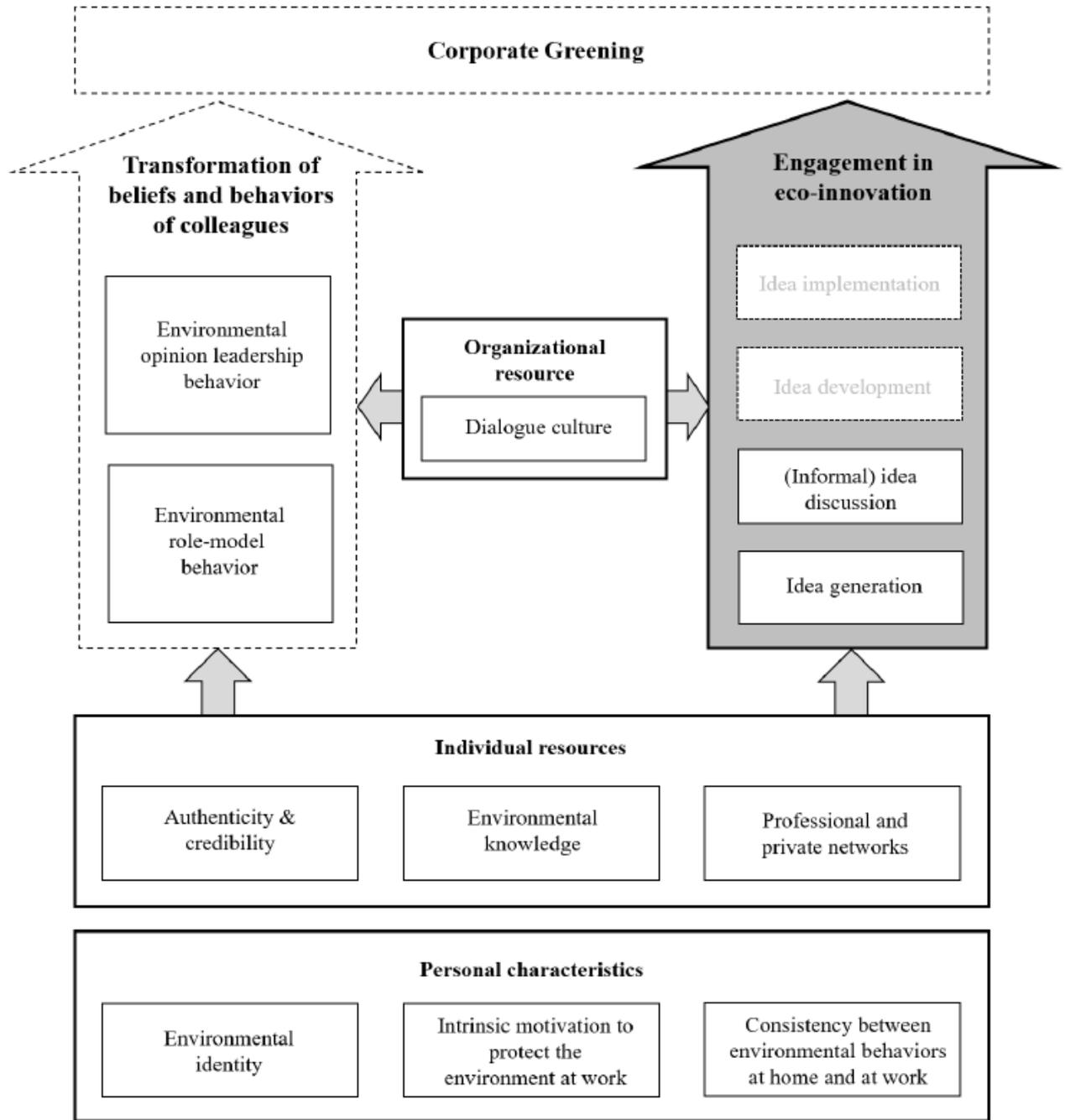


Figure I. Innovative green employees: Characteristics, resources, and behaviors

#### 4.1. Personal characteristics

##### *Environmental identity*

All of our respondents hold a rather strong and prominent environmental identity. In 14 of the 19 cases, they trace back this environmental identity to their upbringing and growing up close to nature. A vast majority of them reported that they come from families who have strong environmental values that often

originated in farming and agriculture. Therefore, our interviewees perceived environmental issues as immediate and personal, as one public relations manager vividly described:

“In general, I live in close touch with nature, and it is not only that I would demand that from others, but it is something we put into practice at home on a daily basis. We always leave a grass strip in the garden. We have a meadow orchard, which is pesticide-free, with apple trees, plum trees, nut trees. Nothing is treated with pesticides or fertilizer (...). Yes, we just live “sustainability”, it is a part of who we are.”

#### *Intrinsic motivation to protect the environment at work*

The presence of a strong and prominent environmental identity has significantly influenced our respondents' choice of employer. With only one exception, all of our interview partners have selected their current employer due to the company's pronounced commitment to pro-environmental values. Asked why, they explained that they want to protect the environment not only in their private domain, but also at work. Indeed, several employees revealed that they have accepted financial and/ or career-related drawbacks in favor of their current job. Others illustrated that due to their quite high expectations with regard to the environmental performance of their employer, the number of possible organizations is quite small. A sustainability officer described her situation as follows:

“I always say that I can only work for companies like the WWF (...). I want my job to have meaning, where I do not have to risk my neck with careless talk to explain why I work there. Unfortunately, not many employers come into question then, I have to say.”

We further find that their intrinsic motivation to protect the environment expands to engagement in eco-innovation. All but two of our interview partners perceived this engagement as part of their regular job, even if it was not covered by their official job description.

#### *Consistency of environmental behaviors between home and work settings*

For our respondents, it is self-evident that they engage in pro-environmental behavior both in their private and in their professional life. In their efforts to protect the natural environment, a distinction between the two life domains is irrelevant. A project manager put it as follows:

“Well, I don't heat up 1.5 liters of water to use half a liter, and then let the rest cool down, only to heat it up once again. And this is how I do it here as well.”

To summarize, we find that 16 out of 19 of our respondents possess a strong and prominent environmental identity, are intrinsically motivated to protect the environment at work and strive for a consistency between their environmental behavior at home and at work. We therefore conclude that they meet the definition of a green employee as offered by Ciocirlan (2017). However, we regard our interview partners as a sub-group of green employees, as they additionally show a high level of

innovativeness (see section 3. Methods). Therefore, in the remainder of this paper, we refer to our respondents as innovative green employees.

#### *4.2. Engagement in eco-innovation*

In this section, we focus on the actual activities innovative green employees undertake with respect to eco-innovation development.

##### *Idea generation*

Innovative green employees introduce many eco-oriented ideas to their company. In the course of our interviews, all interviewees could name several ideas that they had recently put forward. Of these ideas, only two aimed at improving the environmental performance of a current market offering; all other ideas addressed environmental improvements of the workplace. Without exception, these ideas were rather small in scope in that they focused on punctual environmental improvements within a specific department or location of the company. Rather than extensive personnel and financial resources or adjustments of internal processes, their implementation often required little effort. An online editor suggested the following:

“(...) being a publishing house, we have lots of books; one reason is that we get a lot of review copies from other publishers, a lot of recipe books on nutrition. Therefore, I have suggested installing an open bookcase somewhere outdoors in the garden area, where it can be accessed by the public, where people from the surrounding area can come, take books, and bring them back again (...).”

Characteristic for all reported ideas is a rather low degree of novelty, also referred to as ‘newness’ (Johannessen et al., 2001). Novelty usually describes unique or very rare ideas (Runco and Charles, 1993) that only few people come up with (Diedrich et al., 2015). In contrast, many suggestions made by innovative green employees simply transfer their own private environmental-friendly behavior into a work setting. A marketing manager brought up this idea:

“For several years, we had a pallet of printing paper for dot matrix printers in our storage, though such printers had been replaced a long time ago. Then they said we should dispose of the paper, but I suggested giving it to a nursery, as the paper could still be used there. At home, when I print something out and I notice it was bodge, I don’t throw it away either when I can still use it as scratch paper.”

##### *(Informal) idea discussion*

When innovative green employees come up with a pro-environmental idea, they often do not directly submit it to official corporate idea management channels. Instead, they tend to discuss their new approach with colleagues first, most of the time in passing. As nearly all of the ideas of innovative green employees are workplace-related, this direct feedback of their potential target group is highly valuable. A project manager described this process as:

“There is an official idea management where you can describe and submit your ideas, but eventually, these ideas will hit the desks of the sustainability department, I suppose. I prefer to discuss such ideas upfront with colleagues to get an idea whether the ideas are good. In particular, when I’m not sure... is it appropriate?”

Next to getting feedback, these informal discussions serve as incubators for utterly new ideas that have pro-environmental potential. Existing ideas might be discarded, but inspire to take another perspective, leading to new innovative approaches. A graphics assistant put it concisely:

“Well, we talk a lot to each other in our breaks, also about things like that. And sometimes, things are developed further and new ideas develop.”

Engagement of innovative green employees in phases of eco-innovation development that follow idea generation and idea discussion – i.e. idea development, idea implementation – is very rare. Only one of our interviewees reported that she pushed her idea to further development and supported its implementation.

#### *4.3. Transformation of beliefs and behaviors of colleagues*

Apart from their engagement in corporate eco-innovation, we find that innovative green employees foster corporate greening by transforming the values and behaviors of fellow employees.

##### *Environmental role-model behavior*

Our findings show that innovative green employees intentionally assume the role of an environmental role-model and are well aware and make use of their potential to transform the beliefs and behavior of colleagues. In particular, the behavior on the way to work was repeatedly mentioned as an example. A project manager reported:

“I have been cycling to work with my bike for two years in any weather. And I always pointed out: It’s not that bad, once you sit on the bike, everything is great. And then my colleague started cycling to work. By now, she’s the one cycling to work in any weather. And I am sometimes the shirker who takes the car (...). After she had started cycling to work, my colleague then sold her car. It’s her only option now.”

##### *Environmental opinion leadership behavior*

Some innovative green employees go beyond mere role-modeling by exhibiting environmental opinion leadership qualities. Especially in every-day situations at the office, e.g. in discussions in the copying room on the need to conserve resources, they insistently (and sometimes passionately) voice their opinion on ecological issues. However, opinion leadership activities of innovative green employees do not only aim at preventing behavior of colleagues that is potentially harmful to the environment. Rather, they strive to transform the values and beliefs of colleagues towards a more pronounced ecological consciousness. A public relations manager described this motivation accordingly:

“Well, I do try and actively approach colleagues to get certain information in their heads and hearts so that a willingness for sustainability or a willingness for transformation develops.”

#### *4.4. Individual and organizational resources*

In the preceding section, we have presented our findings with regard to individual contributions of innovative green employees to corporate greening. The following section focuses on the individual and organizational resources they draw on to undertake these contributions.

##### *Authenticity & credibility*

The environmental role model and opinion leader activities of innovative green employees rest upon the fact that their colleagues perceive them as authentic and credible. Innovative green employees “live” environmental sustainability; this can be observed within the company and is well known among colleagues. As a result, their pro-environmental acts and arguments are seen as highly credible by co-workers.

“Well, I always think that when you exemplify it through your own behavior, when you live it neck and crop, you come across as more authentic and credible, that is always important to me.”

##### *Environmental knowledge*

Like authenticity and credibility, innovative green employees’ environmental knowledge plays a vital part in their efforts to spread pro-environmental behavior and values among colleagues. A vast majority of our respondents categorized their environmental knowledge as rather broad and general. Some pointed out that, in addition, there were specific areas in which they had accumulated expert knowledge. This knowledge was either acquired in a recent private project, e.g. the renovation of one’s home in accordance with ecological standards, or stemmed from work-related professional expertise, e.g. managing the nutrition segment in a journal for natural food. An online editor pictured this as:

“Well, I would say that I have a broad basis and that I know pretty well where I can get what information of which field or whom I have to ask. And yes, in areas in which I am more interested in – take vegan diet, for example, as I am a vegan myself – I know a bit more.”

##### *Professional and private networks*

Innovative green employees further profit from their solid professional network within the company to foster corporate greening. Apart from discussing ideas with like-minded fellow employees, they use their contacts to individuals in key positions to e.g. put forward eco-oriented ideas. A public relations manager remembered this episode:

“About a year ago (...), I drove past the building and thought: Wow, this is such a green golf lawn! In fact, it is not treated with pesticides or something, but for me, it simply was not a living lawn. On that same day, I approached a member of the board of the company and pointed out to him: “Gosh!

Isn't it possible to reshape the garden and transform it into a field of flowers for bees, bumble bees and others species?"

Next to their professional network within the company, innovative green employees are embedded in a comprehensive pro-environmental network in their private life. This network – which often stretches from like-minded family members, friends and colleagues to eco-oriented organizations and initiatives – serves as their primary pool for pro-environmental inspirations and ideas. Indeed, for several of the ideas that our interviewees have brought into the company, a direct link to a source in their private life could be established. A head of strategic business development reports:

“In my close circle of friends there are people who also work in this field and when we're out, we cannot but talk 50% about this topic and discuss new ideas for which we maybe don't have the time at work, and afterwards, we bring that into the company. I would guess that there are a lot of ideas which are driven rather by the private sphere.”

#### *Dialogue culture*

On an organizational level, the activities of our interview partners to foster eco-innovation and corporate greening were supported by a distinct culture of dialogue present in their respective companies. Informal exchange between colleagues on environmental topics is widespread and happens on a daily basis. Not only in the cafeteria during lunch breaks, environment-related gossip, news, ideas and opinions are shared and discussed. Often, innovative green employees approach fellow employees to spread and obtain information relating to environmental protection. One interviewee reported:

“I observe that more with regard to things we talk about. For example, that there recently opened a shop offering organic clothing, where you ask something or somebody recommends something. Every now and then, a colleague drops by and asks for organic cosmetic products. This is obviously something I am well informed of (...). I have also talked to a colleague and exchanged tips how to save plastics by making it yourself. These are rather everyday items, for which (*company name*) is a place where this happens.”

## 5. Discussion

By definition, green employees are intrinsically motivated to protect the environment at work (Ciocirlan, 2017). Therefore, in principle, innovative green employees are also motivated to engage in corporate eco-innovation. Our findings show that even if this engagement is not covered by their official task description, they perceive it as part of their regular job.

Innovative green employees contribute to corporate eco-innovation by introducing and discussing pro-environmental ideas. All of our interviewees have brought several ideas into the company in the course of one year. In nearly all of the cases, the origin of the idea traced back to the private domain of the

employee. Resulting from their strong green identity, innovative green employees have a high interest in technological, political and social developments in the field of environmental protection. They possess a rather broad environmental knowledge as well as professional and private networks that serve as valuable sources for eco-related information, inspiration, and exchange of experiences. In addition, innovative green employees try to live according to their environmental values and strive to consume in an ecologically sustainable way. The majority of our informants were vegetarians, mainly consumed organic products and tried to avoid motorized private transport. As we had expected, innovative green employees capitalize on their knowledge and experience that stems from consuming eco-friendly products and services to generate eco-related ideas.

To introduce an idea into the company, innovative green employees often bypass official idea management channels. They deplore bureaucratic idea management systems that involve a lot of effort to submit an idea. In addition, innovative green employees prefer to make use of their network within the firm to discuss their idea with selected colleagues. A vast majority of these ideas focuses on fostering more eco-friendly behavior of employees at the workplace. Innovative green employees consider it as a responsibility of their employer to provide the necessary framework that enables eco-friendly consumption at work (c.f. Klade et al., 2013). However, in order to lead to environmental benefits, there must also be a willingness on the part of the employees to make use of these offers. Consequently, it makes sense for innovative green employees to present their idea to their target audience first and get direct feedback before they submit it to official idea management channels.

Many suggestions made by innovative green employees transfer their own private eco-friendly behavior and routines into a work setting, qualifying as low-intensity behavior as defined by Ciocirlan (2017) and Smith and O'Sullivan (2012). Typical examples like using recycled paper, carpooling to work or organizing a clothes exchange bazaar illustrate that these suggestions are exclusively workplace-related, tend to be limited in scope and seldom stand out as particularly creative. At this point, the question arises what type of pro-environmental idea we can reasonably expect from innovative green employees.

Unlike sustainable embedded lead users, innovative green employees' use knowledge and consumption experiences relate to all kinds of different ecological solutions, yet do not necessarily refer to the market offerings of their employing company. However, relevant use knowledge of a specific product or service is key to innovation in general (Hippel, 1995) and eco-innovation in particular (Schrader and Belz, 2012). Sustainable embedded lead users are expected to have great potential to generate ideas for specific product and service solutions by tapping this specific knowledge. As this resource is typically not available to innovative green employees, they may find it difficult to come up with ideas that address the offerings portfolio of their company. Instead, innovative green employees and employees who exhibit lead user characteristics with regard to workplace-related eco-innovation may complement the innovative potential of sustainable embedded lead users by introducing new ideas to green the workplace.

Further, as innovative green employees theoretically may be found in every corporate function, their professional background and specialist knowledge varies. As a consequence, they do not necessarily possess profound technical, intraorganizational or processual know-how. However, complex technological innovations, such as the implementation of eco-efficient manufacturing technologies, require this kind of subject-specific knowledge (Kanter, 1988). Innovative green employees may contribute to such technology-driven eco-innovations e.g. by raising awareness for promising green tech startups or new technology trends in the field of eco-efficiency. Detailed implementation proposals of technological solutions should rather be expected from specialists with appropriate expertise.

In contrast, innovative green employees have specialist knowledge in the field of eco-friendly consumption and bring related ideas into the company. However, it seems they do not claim ownership of and push these ideas forward. Unlike the green activist or the sustainable intrapreneur who “develops and promotes practical solutions for environmental or social challenges” and “pushes and pulls colleagues and supervisors towards these solutions” (Schrader and Harrach, 2013; p.185), innovative green employees rather confine themselves to the role of inspiration and idea giver. This finding is in contrast to Blazejewski et al. (2018) who observed that green activists pursue their idea even in non-supportive corporate settings.

As idea implementation regularly requires relevant experts with specific functional and strategic knowledge, it has been argued that participation of ‘ordinary’ employees in corporate innovation is beneficial in particular in the ideation phase (Axtell et al., 2000). Our findings are in line with this assumption and suggest that innovative green employees refrain from driving their own idea as they do not expect to get the necessary resources for implementation from their organization. In addition, the low intrapreneurship spirit of innovative green employees could be owed to the way they want to put their idea into practice. While innovative green employees want to foster pro-environmental consumption at work, they generally oppose dictating this behavior. Instead, they are convinced that personal values and behavior change lastingly only out of inner conviction. Hence, instead of putting forward ideas that make pro-environmental behavior obligatory (e.g. a veggie day in the canteen), innovative green employees promote critical thinking and an awareness for ecological issues by setting a good example with their own eco-friendly behavior. As environmental role models, they possess environmental expert knowledge and comprehensive first-hand experience from authentically living according to environmental values, both within and outside the company. Therefore, their colleagues perceive them as highly credible, which stimulates imitation.

Interestingly, innovative green employees consider their own eco-friendly consumption practices at work as a form of eco-innovation. While this does not correspond to the definition of eco-innovation we have adapted for this study, it reveals how innovative green employees understand eco-innovation and their approach to fostering it.

Some innovative green employees go beyond a mere role-modeling approach and take a more active stance to spreading pro-environmental values and behavior. On their own initiative, they address and uphold environmental values and try to convince fellow employees to follow their lead. In doing so, they pay a lot of attention not to make moral accusations, but to point out practical solutions for a more ecologically sustainable life.

## 6. Conclusion

### 6.1. *Theoretical implications*

We contribute to existing research in three ways. First, we add to the literature by providing empirical support of Ciocirlan's (2017) definition of a green employee: All but three of our 19 interview partners held a strong and prominent environmental identity, were intrinsically motivated to protect the environment at work and strove for a consistency between environmental behaviors in both life domains. Our findings further provide insights into how these rather abstract criteria materialize in the lives of green employees. To better understand and guide further research of this concept, these insights into the lives of green employees are highly valuable.

Second, we explore the phenomenon of innovative green employees, a sub-group of green employees that so far has not been explicitly addressed by theoretical or empirical studies. We build on the concept of green employees and explore its potential for corporate eco-innovation. We find that innovative green employees contribute to corporate eco-innovation by generating, introducing and discussing pro-environmental ideas. Further, innovative green employees act as environmental role-models and opinion leaders by transforming the values and behavior of colleagues. In contrast to e.g. environmental champions (Anderson and Bateman, 2000) and green change agents (Wright et al., 2012), innovative green employees may be scattered throughout the organization, as they are not tied to a specific corporate function. Hence, their potential to green the company from within is particularly high.

Our third contribution is to the literature on innovative behavior inside the firm, since we explore the resources that employees make use of to support corporate innovation (Scott and Bruce, 1994; Janssen, 2005). We find that innovative green employees access their broad environmental and consumption-related knowledge in particular to promote pro-environmental consumption practices at the workplace. Contrary to other resources that originate from employees' work environment, their environment-related knowledge is rooted mainly in their private domain.

### 6.2. *Practical implications*

From the insights of this qualitative study, central indications for practitioners can be derived. First, the findings indicate that innovative green employees play a special role in the development of eco-innovations and thus significantly contribute to corporate greening. In order to make targeted use of their potential, it is advisable to identify existing innovative green employees in the organization and explicitly involve them in processes for eco-innovation development. Another way of enhancing the

benefits resulting from their specific knowledge and consumption experiences is to increase the number of innovative green employees in the company, for example, by taking individual green values and lifestyles into account as selection criteria when selecting new employees (Bissing-Olson et al., 2013; Boiral, 2009).

Furthermore, the results demonstrate that innovative green employees typically refrain from making use of official corporate idea management channels and rather engage in exchange processes with colleagues. Against this background, it seems advisable to create more opportunities for informal exchanges between colleagues (Axtell et al., 2000), for example during lunch breaks, team outings or through a more open architectural design of the office spaces. This gives them more opportunities to check the relevance of their ideas in discussions with colleagues. In addition, the ideas often develop further and are better adapted to the conditions in the company and to actual customer needs. On the other hand, it may make sense to make the use of such official channels more straightforward, thereby reducing the time and effort required to submit ideas to official idea management platforms.

### *6.3. Limitations and future research*

This study is a first step to investigate innovative green employees and their potential for corporate eco-innovation. However, the study has limitations that may serve as cues for further research.

First, due to a lack of empirical knowledge in the literature, we have selected an explorative approach to gain a first understanding of the phenomenon under study. While our findings provide an indication of how innovative green employees contribute to corporate eco-innovation, we cannot make inferences about the scope of the phenomenon and the generalization of our findings. It is therefore up to qualitative research to validate our findings and to put these into perspective.

The second limitation of our study is that our participants self-reported their environmental orientation and activities supporting corporate eco-innovation. The use of self-reports for the identification of environmentally-aware employees has been shown to be a reliable and valid technique by similar research (Paillé and Boiral, 2013; Norton et al., 2015). In contrast, however, the limitations of this methodology have been described in detail by Podsakoff et al. (2012). A recent meta-analysis by Kormos and Gifford (2014) suggests that the correlation between self-report and objective measures of environmental behavior is functionally small. With regard to environmental behavior at work in particular, self-reports might be biased by social desirability, which might prevent people from accurately evaluating their green behavior. As an alternative, future research could use additional sources, e.g. supervisor ratings (Hoffman et al., 2010) and peer nominations (Anderson and Bateman, 2000) to get a more objective evaluation of the participants' innovative green behavior at the workplace.

As a third limitation, we concentrated on green SMEs to identify and recruit participants as these tend to attract employees who are characterized by an above-average environmental orientation. Further, it is widely acknowledged that SMEs cannot afford to underutilize their workforce and must rely on their

staff for learning, innovation and creativity (Klewitz et al., 2012). Hence, we assumed that innovative green employee engagement for corporate eco-innovation must be in particular relevant for and observable in green SMEs. However, it is likely that their contributions to corporate greening are considerably affected by organizational factors, such as company size and environmental commitment. On the one hand, among a small number of employees, chances are high that innovative green employees are more prominent than in large companies and hence, are involved in eco-innovation development more extensively. On the other hand, SME practices of employee involvement and participation typically do not rise to the level of functionality and professionalism found in large firms (Rohlfers, 2018) that offer e.g. sophisticated software tools to facilitate the submission and evaluation of employee suggestions (Gerlach and Brem, 2017). In addition, suggestions that promote eco-friendly consumption behavior of employees might struggle to get a positive response in non-green companies, as such approaches typically are not aligned with organizational goals. On the contrary, the biggest lever to contribute to environmental protection might lie precisely in such large companies that lag behind in terms of corporate greening and thus, have the greatest potential for improvement. Therefore, we invite future research to illuminate the behavior of innovative green employees in different organizational contexts and how their potential is affected by e.g. the size and ecological commitment of their employing company.

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