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# End-users as co-developers for novel green products and services – an exploratory case study analysis of the innovation process in incumbent firms

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## ABSTRACT

Studies focusing on green innovation have shown that companies can gain a competitive advantage by collaborating with multiple stakeholders in the innovation process. Since novel green innovations are often systemic in nature and require changes in consumption behavior, end-user integration along the innovation process may be particularly relevant for the success of such products and services. The main aim of this paper is therefore to add to our understanding of the role of users in the green innovation processes of incumbent firms. The comparative case study in the context of e-mobility and smart housing outlines the methods used by three European incumbent firms to integrate users at different stages of the innovation process as well as their motivation and benefit.

The findings show that users were basically co-developing the novel green product or service from the beginning. In the cases under review, early and constant end-user integration served as a risk-management tool, since it uncovered behavioral changes induced by the innovations among potential future users. This helped companies to overcome risk aversion towards the development of genuinely new green products and services and to bring these to the market. Field trials similar to living labs proved to be of particular importance for gaining insight into the everyday lifestyle of users. Thereby, the paper stresses an approach to green innovation in incumbent firms, which has not been given much attention in literature before. In addition, our cases show that the benefits of user integration can not only be high for rather incremental green innovations but also for genuinely new innovation in highly technological industries. User integration helped the case companies to uncover behavioral changes in the consumption phase and strengthening market acceptance. We conclude that firms may profit from an extensive user input throughout all phases of the innovation process to develop novel green products and services, and call for further research on how firms can overcome entry barriers to user integration in green product development in the future.

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## 1. Introduction

During the last decade, innovation has increasingly been put forward as a means to address the challenges of the 21st century and foster sustainable development (e.g., Carrillo-Hermosilla et al., 2010; De Medeiros et al., 2014). There is widespread agreement that so-called green or environmental innovation requires the integration of external and internal knowledge, due to its systemic

character and related technological uncertainties (e.g., De Marchi, 2012; Driessen and Hillebrand, 2013). Most research in this area focuses on the collaboration with R&D institutes and universities (Castaldi et al., 2013; Trencher et al., 2013) or suppliers (Lee and Kim, 2011; Mlecnik, 2013). The role of end-users in green innovation processes is less understood (Carrillo-Hermosilla et al., 2010; Slotegraaf, 2012). This is surprising, considering the fact that authors focusing on the transition to sustainable consumption and production propose that the collaboration with users in the innovation process is key for the success of final products or services, since they often lack market attractiveness and require changes in consumption behavior (Heiskanen et al., 2005; Hoffmann, 2007; Ornetzeder and Rohrer, 2006).

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Existing literature on the role of users in green innovation processes mainly focuses on independent user innovation (e.g., Hyysalo et al., 2013; Ornetzeder and Rohracher, 2006; Seyfang, 2007) and cases where non-governmental organizations, research institutes or government agencies implemented and tested a particular method of developing environmentally friendly products and services (e.g., Fuller et al., 2012; Jerneck and Olson, 2013). Empirical studies on the role of users in company-driven green innovation processes are rather scarce and the few existing studies show mixed results, in particular with regard to very novel and rather radical innovation. Whereas Laperche and Picard (2013) find that user integration is a precondition for the success of green product service system innovations in manufacturing firms, De Marchi (2012) discovers no increased importance of user integration to environmental innovations at all, due to a lack of sophisticated technical knowledge on the part of the users.

Against this background, the objective of this article is to empirically investigate the role of users in the development of novel green products and services in incumbent firms, focusing on the overall innovation process and not only an individual method that is applied on a selective basis. The research question therefore is: How does company-driven user integration affect green innovation in incumbent firms?

To investigate this research question, we analyzed the innovation process of three European firms in the automotive and electricity sector, considering that the ecological impact of these industries' products and services throughout the overall lifecycle is among the highest across all industries (Tukker et al., 2006). Investigating the possible influence of user integration in this context is particularly suitable, since the innovations under investigation hold the potential to reduce the environmental footprint of the industries, mainly by inducing behavior changes in the consumption phase. We give special attention to the methods used to integrate users, the underlying company's motivations as well as the benefits associated with the approach. The results of the qualitative comparative analysis show that the companies collaborated intensively with users at different stages of the innovation process. This extensive user integration helped incumbent firms to gain distance from more incremental innovation and overcome risk aversion towards genuinely new environmentally friendly innovations. These results contribute to the understanding of users in the context of green innovation in incumbent firms and the identified practices and conditions might serve as a roadmap for companies and policy makers alike.

## 2. Theoretical background

This chapter gives an overview of the theoretical background of green innovation on one hand, and user integration into the innovation process on the other. We will further elaborate previous findings of user integration into green innovation processes only. The aim of the chapter is to not only to outline the status quo of the relevant literature, but also to specify and define the relevant terms used in the subsequent chapters, in order to set the stage for the case study analysis.

### 2.1. Green innovation

New environmentally friendly products and services are often put forward as a central means to achieve a sustainable economy (Del Rio Gonzalez, 2005; Sangle, 2011). Ever more companies therefore focus their innovation efforts on developing or adopting new technologies and related products and services which are less harmful to the environment than relevant alternatives (e.g., Irwin and Hooper, 1992; Sangle, 2011). Authors increasingly refer to

“sustainability innovation” (Schaltegger and Wagner, 2011), “green innovation” (Olson, 2013) or “eco-innovation” (Carrillo-Hermosilla et al., 2010) in order to allow for the fact that a newly developed technology adds value across the economic, ecological and/or social dimensions of products and services. This paper focuses on environmental and ecological value only and therefore mainly uses the term “green innovation”.

Several scholars have noted that the transition to green technologies such as electric vehicles (EVs) and smart homes is systemic in nature, since the technology cannot be anchored onto existing systems (e.g., Abdelkafi et al., 2013; Johnson and Suskewicz, 2009). Against this background, the collaboration with external actors and the opening up of the innovation process is found to be key to the successful development of sustainable technologies (e.g., Dangelico et al., 2013; Driessen and Hillebrand, 2013; Laperche and Picard, 2013). Research has shown that green innovations require a higher degree of cooperation with external actors such as suppliers, knowledge-intensive business services and research institutes than conventional innovations (De Marchi, 2012).

Green products and services do not only break down the barriers between existing industries and require cross-industry collaboration (Dangelico et al., 2013), but in many cases also imply changes in consumer behavior (Vergragt et al., 2014). Companies face the challenge of translating environmental benefits of novel green products and services in consumer benefits, which makes customers' acceptance a particularly challenging and crucial topic to green products and services (Heiskanen et al., 2005). Several scholars have therefore called for a deeper integration of end-users into the green innovation process (Hyysalo et al., 2013; Slotegraaf, 2012; Vergragt et al., 2014), since it enables companies to spot customers' needs more accurately and customers to experience new technology and raise ideas for product/service development and improvement.

### 2.2. The role of users in the innovation process

Authors have shown that companies can gain from collaborating with users (e.g., Bogers et al., 2010; Bosch-Sijtsema and Bosch, 2015; Von Hippel, 1986). Users can be divided into end-users and intermediate or professional users (Von Hippel et al., 2013). The study focuses on end-users only, who use a product and/or service in their everyday life. Often, end-users are also customers (Priem et al., 2011).

Traditionally, users play a rather passive role in innovation, giving feedback based on past experiences with a product or service (Bosch-Sijtsema and Bosch, 2015). Two important trends, however, have emerged recently. On the one hand, users have started to innovate by themselves, developing new products independently from corporate actors. This phenomenon is generally called user innovation (Von Hippel, 2007). On the other hand, firms have increasingly recognized the potential of integrating users in a more active way, which is often referred to as user integration (Bogers et al., 2010; Bosch-Sijtsema and Bosch, 2015). By making them co-innovators, co-creators and co-producers, firms not only value knowledge about users' needs, but also tap into users' solution knowledge (Priem et al., 2011; Von Hippel, 1986). Among the most prominent methods used in this context are lead-user workshops (Von Hippel, 1986), user toolkits (Franke and Piller, 2004), idea contests (Piller and Walcher, 2006), innovation labs and communities (Fuller et al., 2014). As one author stresses, end-users have begun to “participate in the design phase (...) and not just during its refinement phase” (Weber, 2003, p.153). Thus, a rich body of literature has shown that users not only can give important feedback for improving existing products, but can also be an important source for ideas and an agent for the diffusion and commercialization of new products and services in many different sectors and industries.

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