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The role of an SME’s green strategy in public-private eco-innovation initiatives: the case of Ecoprofit

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Abstract
Increasingly, eco-innovation is a major challenge for small and medium sized enterprises (SMEs). To diffuse eco-innovation, public support programs have been established as inter-organizational networks between local authorities and smaller companies. Based on seven public private partnership cases from the eco-efficiency Ecoprofit initiative, we identified three behavioral patterns (hold-up, step-up, and frontrunner) developed by the companies within the partnership. These were the result of an interaction between the companies’ green strategy and their related level of absorptive capacity which influenced their ability to respond to the handholding processes offered in the partnership. Reactive companies mostly benefit from agent-based instruments (for example individual consulting). More proactive companies can also capitalize on peer-based handholding (for example ‘clubs’). The longitudinal research design shows that public private partnerships can stimulate adaptations in a company’s green strategy over time. Propositions and an integrated framework are developed with implications for policy makers.

Keywords: eco-innovation, sustainability, green strategy, absorptive capacity, public private partnerships, public support programs, case study, SMEs

Introduction
Eco-innovation has been the topic of research for some time, but usually with a focus on large enterprises (Rennings 2000). Undertaking more research with small and medium sized enterprises (SMEs)—here defined as companies with fewer than 250 employees (TCEC 2003)—is important as they make up the majority of companies in the European Union (ECEI 2010). Additionally, eco-innovation in SMEs functions differently than in large companies. First, they are not just smaller versions of large companies (Welsh and White 1981). Second, they are equipped with characteristics that are both advantageous for eco-innovation (flexibility to market demands) and disadvantageous (lack of financial capital) (Bos-Brouwers 2010; Del Brío and Junquera 2003). Overall, eco-innovation in SMEs occurs to varying degrees as a result of different green strategies, ranging from reactive to more proactive strategies (Noci and Verganti 1999).

To nurse an SME’s innovation capacity for environmental sustainability, the construct of absorptive capacity is important as it describes a company’s ability to identify, assimilate
and exploit external knowledge (Cohen and Levinthal 1989; 1990; 1994) which is crucial in reinforcing or complementing an existing knowledge base (Lane, Koka and Pathak 2006). Hence, a company’s strategy and related absorptive capacity determines how they can obtain and transform valuable external eco-innovation knowledge. However, companies are limited in their ability to gather and process all the relevant information and knowledge (Cooke 2005) and even though innovative SMEs use both internal and external linkages for the innovation process, the establishment of external links results in high opportunity costs (Rothwell and Dodgson 1991). The ways in which way SMEs with different eco-innovation strategies can efficiently and effectively seek out external knowledge sources remain unclear.

Research suggests the formation of collaborative relationships (Clarke and Roome 1999; Roome 2001), that is, to diffuse eco-innovations, inter-organizational relationships in the form of public-private partnerships (PPPs) can be established which support SMEs through various handholding instruments (Friedman and Miles 2002). Examples are the National Cleaner Production Centres (Luken and Navratil 2004), the Small Business Support Program (van Berkel 2007), and the Ecoprofit initiative (Martinuzzi, Huchler and Obermayr 2000; Sage 2000). Studies in this field mostly focus on aggregated program success (see, for example, Luken and Navratil 2004), but to the best of our knowledge, the literature is incomplete in terms of a focus on the inter-organizational dynamics at the micro level. Accordingly, this paper relates to a multiple case study conducted in order to answer the following questions:

(I) What is the role of an SME’s green strategy pattern in public-private eco-innovation partnerships and how is it transformed?

(II) How do an SME’s green strategy, absorptive capacity and the type of PPP handholding processes interact?
Seven local PPPs based on Ecoprofit® (a registered trademark: ECOlogical PROject for Integrated Environmental Technology; we simply refer to Ecoprofit), a program established across Continental Europe to support companies in eco-innovation processes, will be analyzed. The main contribution of this paper lies in demonstrating the relationship between three independent but related constructs, namely, green strategies (Noci and Verganti 1999), absorptive capacity (Cohen and Levinthal 1990; 1994), and handholding processes provided within PPPs (Friedman and Miles 2002). We provide an integrated framework with implications for policy makers.

The remainder of the paper is structured as follows: after the introduction, we present the literature on eco-innovation in the context of SMEs, with a particular focus on green strategy patterns, absorptive capacity, and PPPs. The multiple case study research design is then shown. Subsequently the findings are presented, discussed, and integrated into a visual framework. Finally, concluding remarks indicate directions for future research, policy implications, and the limitations of the present study.

**Literature Review**

*Eco-innovation in SMEs from a strategy perspective*

Eco-innovation includes new or enhanced processes, products, technologies, services, and business models that are beneficial to the environment in that they reduce or avoid negative environmental impacts (Beise and Rennings 2005; Hansen et al. 2009; Rennings 2000; van Hemel and Cramer 2002). For eco-innovation and broader sustainability issues in SMEs, extant research shows a range of advantageous and disadvantageous characteristics (Bos-Brouwers 2010; Del Brio and Junquera 2003; Jenkins 2009; Perrini 2006; Russo and Tencati 2009; Spence 1999). For instance, resource constraints (lack of time, personnel, financial capital, or knowledge) may result in a reluctance to invest in and implement eco-innovations (Noci and Verganti 1999). On the other hand, lean and flexible organizational
structures may allow for fast responses to customer and market demands for eco-innovations (Bos-Brouwers 2010; Jenkins 2009). Identifying an SME’s specific eco-innovation strategy helps to understand why it chooses to engage in eco-innovation, for example, increasing the eco-efficiency of their production processes, and in which ways this influences organizational, product, and/or process innovations. As is pointed out by Hansen, Sondergard and Meredith (2002):

> “Environmental innovations are decided upon within the context of the strategic horizon and overall business strategy of the enterprise. Specific decisions on environmental innovations are, therefore, subject to strategic interpretation and assessment of the effects on future business opportunities.”

(p.39)

The literature suggests that an SME’s eco-innovation strategies can range from reactive, to anticipatory, to innovation-based strategies (Aragón-Correa et al. 2008; Noci and Verganti 1999; Tilley 1999). Why an SME may choose to follow a certain strategy type depends on internal (competencies and strategic attitude) and external factors (competitive environment) (Noci and Verganti 1999). **Reactive** SMEs respond to external stimuli, that is, regulation, green movements, and benchmarking (Noci and Verganti 1999), and/or external pressure (Tilley 1999). Incremental changes in processes and end-of-pipe solutions are to be expected. An **anticipatory** strategy (Noci and Verganti 1999) describes an ‘early mover SME’ which makes strategic choices based on possible competitive advantages offered through the adoption of green technologies. Such SMEs may develop eco-efficiency processes, technologies, and products. **Innovation-based** SMEs are able to translate environmental issues into innovation-based solutions, for example new green technologies, and to successfully create a consistent green image (Noci and Verganti 1999). They make use of the SME characteristics in such a way as to fully leverage the advantages. In order to advance sustainability, they may shape or create new markets and introduce radical process and
product innovations (Noci and Verganti 1999). Accordingly, ecopreneurs and sustainable entrepreneurs would also belong to this category (Schaltegger and Wagner 2011).

To nurse an SME’s innovation capacity for environmental sustainability, the construct of absorptive capacity holds explanatory power.

**Absorptive capacity for eco-innovation**

With Cohen and Levinthal’s seminal work (1989; 1990; 1994) on the construct of absorptive capacity, it was understood as a company’s ‘ability’ to *identify, assimilate, and exploit external knowledge*, primarily operationalized in terms of R&D activity and/or patents. Since then a broad literature base dealing with absorptive capacity has been developed (Lane and Lubatkin 1998; Van den Bosch, Volberda and de Boer 1999; Zahra and George 2002), as well as means for its measurement (for example dominant logic, and potential and realized absorptive capacity). In an extensive review of 289 absorptive capacity papers, Lane, Koka and Pathak (2006) rejuvenate the concept and develop a more comprehensive perspective on absorptive capacity and define it as firm’s ability to:

> “utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning.” (p.856)

With this definition, absorptive capacity becomes learning process-oriented and moves beyond mere expenditure on R&D (which reduces absorptive capacity to a static resource). In order to analyze the absorptive capacity for eco-innovation in SMEs, three dimensions are necessary. First, *knowledge identification* is the company’s ability to recognize and understand new external knowledge, which is also described as exploratory learning (Lane, Koka and Pathak 2006). Secondly, *knowledge assimilation* describes the process of transforming the new (valuable) knowledge by connecting it to the prior existing knowledge on eco-innovation, also known as transformative learning (Lane, Koka and Pathak
Thirdly, *knowledge application* is the actual implementation of the knowledge, also described as exploitative learning, whereby ideally the application of knowledge then leads to *knowledge outputs* (Lane, Koka and Pathak 2006), for instance in the form of eco-innovation.

In this paper we adopt this learning process view of absorptive capacity as it relates much more to the SME context than a more limited definition. SMEs usually lack formalized structures (for example separate R&D departments), are seldom in the position to handle any significant number of patents and, from the viewpoint of ability to innovate, the skills and capabilities of the workforce in an SME may be more important than pure R&D (Varis and Littunen 2010). Furthermore, it encompasses the established view of innovation as an increasingly non-linear but iterative, and multi-agent process (Kline 1985; Perkman and Walsh 2007; von Hippel 1987).

As companies are limited in their ability to gather and process all the relevant (external) information and knowledge (Cooke 2005), research suggests collaborative relationships be formed (see, for example Clarke and Roome 1999; Roome 2001) as thereby platforms for knowledge development and learning are created which lead to innovation and adaptation (Roome 2001). An SME’s absorptive capacity for eco-innovation may thus be nurtured through engaging in inter-organizational relationships, for example in collaboration with public partners, to receive active support in terms of education (Parker, Redmond and Simpson 2009).

**Public Private Partnerships for Diffusion of Eco-innovations in SMEs**

SMEs are increasingly recognizing governments, trade associations, and professional and business networks as catalysts for future change in terms of active support for absorbing eco-related knowledge (Biondi, Iraldo and Meredith 2002; de Bruijn and Hofman 2000; Hoevenagel and Wolters, 2000; Revell, Stokes and Chen 2010). Here, local authorities are attributed a special role in implementing technology transfer and other diffusion programs
that encourage and educate SMEs (Bradford, Fraser and Evan 2008). More specifically, in
public knowledge transfer programs local authorities can establish a public-private partnership (PPP) with SMEs. Because PPPs are loosely defined, comprising various partnership constellations (for example management contracts, or licensing), this paper understands PPPs as a “constitutional arrangement” (Hodge and Greve 2008, p.545) between a local authority and an SME with the aim of sharing risks, costs, and resources and leading to a long term partnership (Hodge and Greve 2007; Malmborg 2003; Martinuzzi, Huchler and Obermayr 2000).

The effective diffusion of knowledge within participating SMEs requires some level of absorptive capacity, but it also depends on the specific handholding provided by the PPP (Friedman and Miles 2002). It is through the PPP’s handholding processes that SMEs are guided through the processes for adopting (or absorbing) external knowledge. Both ‘agent-assisted’ handholding processes (direct support of SMEs in terms of lectures, site visits, award schemes) and ‘peer-assisted’ processes (interactive workshops and loose assistance in terms of networks or clubs) can spur learning in SMEs (Bessant, Tsekouras and Rush 2009). In peer-assisted learning networks, SMEs can exchange expert knowledge throughout the duration of the program and, more importantly, after it has ended (Bessant, Kaplinsky and Morris 2003; Clarke and Roome 1999; Friedman and Miles 2002).

As will be presented in the next section, we chose to study the case of Ecoprofit as a PPP that aims to diffuse eco-innovations amongst SMEs through offering various levels of handholding.

An Introduction to the Ecoprofit Initiative

The Ecoprofit initiative was developed in Austria in the early 1990s by the Environment Department of the City of Graz and is a diffusion-oriented public program based on a PPP concept to diffuse eco-innovation. Through education and customized
problem solving it aims to improve the eco-efficiency of processes, products, practices, and services in organizations (Krenn and Fresner 2009), including SMEs.

Ecoprofit is recognized as a Best-Practice example by the European Union (ECE 2011; EUCOM 2004), has received international rewards (Ecoprofit 2008), and has spread to countries such as Germany, the Netherlands, Hungary, Slovenia, Russia, Italy, and China (Balcázar 2010). In Germany, Ecoprofit has been implemented in around 80 locations with at present over 2000 participating organizations. With the foundation of the ‘Ecoprofit network Germany’ in 2000, the program itself is continuously being developed. At present, Ecoprofit has three modules: the beginner program (module 1), the Ecoprofit club (module 2), and ‘from Ecoprofit to EMAS/ISO’ (module 3).

The beginner program (of one year’s duration) covers about 15 organizations, which can range in size, sector, and prior involvement in eco-innovation. It consists of eight to ten workshops, five individual on-site consulting sessions, and the Ecoprofit award process. To facilitate SMEs acquiring new knowledge, despite different levels of prior knowledge of and experience with eco-innovation, various handholding instruments are employed. The workshops, for instance, can range from cleaner production strategies to eco-control and monitoring of indicators (Krenn and Fresner 2009; Sage 2000). More individualized support in applying the knowledge assimilated in the workshops is given through on-site consultations which may include a material flow analysis, the setting up of eco-control systems, or the implementation of a new waste management system (Sage 2000). After a one-year period, the Ecoprofit award is given if certain measures have been accomplished, such as a legal compliance audit, the institution of an environmental policy, and the development of an environmental program for the following year (Krenn and Fresner 2009; Sage 2000).

To continuously enable SMEs to identify and apply new knowledge on eco-innovation, the Ecoprofit club is based on network relations, with a regular program structure
of common workshops, on-site consultation, and opportunities for informal exchange (Krenn and Fresner 2009; Sage 2000). As the Ecoprofit certificate can only be used for a limited time, club membership also includes the opportunity for recertification.

**Methodology**

Though the use of PPPs to diffuse eco-innovations has been the topic of research for several years (confer Introduction) and is thus moving towards the development of intermediate theory (Edmondson and McManus 2007), we chose a multiple case study design for a “freshness in perspective to an already researched topic” (Eisenhardt 1989; confer Yin 2003).

**Case Sample**

The case selection is based on theoretical sampling (Eisenhardt and Grabner 2007) with three embedded units of analysis (Yin 2003) in that each case represents a unique PPP setting of a regional Ecoprofit initiative. Accordingly, each case consists of a local authority administering Ecoprofit, a participating company, and the consultants involved in the implementation of eco-innovations in the company. With this approach we are able to increase the validity of the study by using “numerous and highly knowledgeable informants who view the focal phenomena from diverse perspectives” and thereby including perspectives outside the individual organization (Eisenhardt and Graebner 2007, p.28).

As SMEs are heterogeneous in terms of sector diversity (Hillary 2006), we chose a sector-specific focus to ensure better comparability between cases and define limits for generalizing the findings (Eisenhardt 1989) as we can better control for industry-specific contingencies as well as external influences. The metal and mechanical engineering industry was chosen as it is one of the five major industries in Germany (Kritikos and Schiersch 2010;
VDMA 2010) and is a key supplier to industries such as the automobile industry, electronics, and construction (Steier 2009) and, thus, faces pressures to implement sustainability.

With SMEs at the heart of our analysis, the companies for this study were selected from a privately owned but publically accessible database (www.arqum.de/datenbank/) listing Ecoprofit certified companies between 1998 and 2010. Our aim was to choose companies with different longitudinal patterns concerning their green strategy. Through an iterative process moving between (preliminary) data collection and theory building, we selected seven different PPP cases (see Table 1). All of the SMEs included are family businesses, operate in the metal and mechanical engineering sector in a business-to-business environment, were among the first companies to participate in the respective regional programs (first-movers), and completed the Ecoprofit beginner program successfully (module 1).

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**Data Collection**

We used multiple methods. First, we used data from the Ecoprofit database, as mentioned in the previous section, to analyze the type of eco-innovation in the individual companies achieved through participation in the beginner program.

Second, we conducted semi-structured interviews in two phases. In the first phase (August 2010), we interviewed managers from the seven companies. We were able to conduct interviews with the person responsible for Ecoprofit and in three companies interviews were conducted with the owner-managers. In all cases the respondents were responsible for multiple tasks to increase the breadth of the individual respondents (see Pagell and Wu 2009). The subject of the interviews was the distinct sustainability and eco-innovation approach of the SMEs as well as their role in and perceptions of the Ecoprofit program. In the second phase of the interviews (July 2011), we broadened the scope of
interviews to establish embedded cases in that we interviewed the companies again, but also
the local authorities and the consultancies involved in the Ecoprofit initiative (see Table 2).
One exception is EN4 which decided not to participate again for time reasons. The semi-
structured interviews conducted were digitally recorded and transcribed.

Third, we used archival data, such as publications on Ecoprofit, company websites,
and internal protocols from the Ecoprofit network Germany (from 2006 to 2010) provided by
some of the interviewees.

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Data Analysis

It should be mentioned that a long period elapsed between initial Ecoprofit
participation and the time we collected data. Even though this allows us to analyze only in
retrospect (and with full awareness of the related limitations, confer van de Ven and Poole
1990), the time lag is helpful to understand the development of the SME’s eco-innovation
behavior before, during and after Ecoprofit participation. This is important to consider
because significant changes in an SME’s environmental behavior should be expected with a
delay of between three and five years after program participation (Altham 2007; Hennicke
2000; Rosenfeld 1996).

The data were analyzed using first within case analysis and then cross-case analysis
(Yin 2003). Based on the within case analysis (data structuring, defining, reduction, and
contextualization), we were able to conduct a cross-case analysis to identify differences and
patterns (Eisenhardt and Graebner 2007). The research process was characterized by
iterations between preliminary theory, inductive reasoning from data, and new data
collection. Our contribution to theory development lies in putting forward explicit theoretical
propositions and developing a visual summary in the sense of a framework (Eisenhardt and
Graebner 2007).
Findings

This section presents and discusses the findings of the cross-case analysis undertaken to analyze the relationship between the three constructs of green strategy, absorptive capacity, and handholding processes in a PPP for eco-innovation. On the basis of this, we develop an integrated framework for eco-innovation in the context of PPPs. We first provide an overview of the three patterns observed in the PPPs.

An overview of the three patterns of green strategy development in PPPs

Amongst our sample we found three longitudinal patterns of SME behavior with regard to eco-innovation in PPPs, as summarized in Table 3 (detailed findings are provided in Table 4).

Pattern 1: hold-up: SMEs in this pattern (EN1, EN2, EN3, and EN4) remain fixed on their cost perspective with regard to environmental issues. Before and after Ecoprofit participation they have limited internal resources and competencies available for eco-innovation, lack owner-management commitment, and wait for external stimuli to arise before engaging in eco-innovation. They are within a PPP context where the public partner (local authority) exhibits a low (and at best medium) degree of proactivity.

Pattern 2: step-up: these SMEs (EN5 and EN6) started their participation with a similar reactive strategy to the prior pattern. However, we will show that the specificities of their participation, such as owner-manager involvement and a medium degree of PPP proactivity, enabled them to develop from a reactive towards an anticipatory green strategy. Ecoprofit pushed these SMEs out of their initial comfort zone by enabling them to recognize and develop a more explicit strategic interpretation of future opportunities for eco-innovation (see Hansen, Sondergard and Meredith 2002). Moreover, the SMEs made competencies
available, engaged in some networking activities, and continued to engage in eco-innovations years after Ecoprofit participation.

*Pattern 3: frontrunner:* this pattern is represented by one SME (EN7) in our sample. Prior to Ecoprofit, this SME already pursued an innovation-based strategy, that is, both process and product eco-innovations were already part of conventional business. In this pattern, Ecoprofit is used as an instrument to further deploy innovation-based strategies.

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In order to understand these three patterns in more detail, this section is structured as follows: first we present the analysis of green strategy as found prior to Ecoprofit. We then proceed to explain the eco-innovation processes in the PPPs as an interaction between an SME’s prior strategy, related level of absorptive capacity, and the handholding processes provided by the public partners. Finally, we turn to the actual impacts of Ecoprofit on the SMEs’ green strategy.

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*Strategies prior to participation in Ecoprofit*

We determined the SMEs’ implemented green strategy with reference to (a subset of) dimensions suggested by Noci and Verganti (1999): competitive arena, key technologies, networking infrastructure, and green image. Furthermore, we used the SMEs’ stated motivation to participate in Ecoprofit (for example cost reduction, etc.) as an indicator for their strategic stance.

Concerning prior strategies, the SMEs in *pattern 1: hold-up* and *pattern 2: step-up* both followed a reactive strategy and demonstrated broadly the same characteristics prior to Ecoprofit. They operate in competitive international (*pattern 1: hold-up*) and national
(pattern 2: step-up) niche markets. In these patterns, the SMEs’ most pressing concern regarding the environment prior to Ecoprofit was to comply with regulations and, sometimes, to reduce costs through eco-efficiency. These SMEs also did not see any specific pressure or demand for eco-innovations from the external environment. Hence, environmental sustainability was perceived as irrelevant to their industry and not as something demanded by their customers (in a business-to-business context); accordingly no green image was pursued by the SMEs:

“And to them [business customers] it doesn’t matter at all if a machine has any environmental features. They are only interested in whether the machine can produce cog-wheels efficiently. When you have machines on offer that save energy it becomes more interesting, but this is a question no one usually asks.” (EN1, executive manager)

Before participation in Ecoprofit, SMEs in these patterns only invested to a limited degree, at best, in key technologies in the sense of eco-innovations. For instance some of the SMEs (EN2, EN3, and EN4) implemented incremental process innovations (for example in the area of energy efficiency). No significant prior external networking infrastructure for eco-related knowledge existed in the SMEs, with Ecoprofit being the first type of structured approach to eco-innovation. The need to receive an external stimulus to engage in eco-innovation in the form of the proactive approach by the local authority further demonstrates their reactive strategy.

In pattern 3: frontrunner, the SME followed an innovation-based strategy long before participation. What is similar to the prior patterns is that the SME did not perceive pressure for managing ecological issues from the external environment. However, in all other aspects the SME’s behavior differed. The company mainly operates in a regional market (though to some minor extent in the national market) and, as the owner-manager explained, the SME had gained significant prior technological experience in the area of process and product innovations with improved eco-efficiency:
“We started with the area of green innovation about 20 years ago, I mean before participation in Ecoprofit. For example, in the 1990s we started developing alternative waste water treatment systems.” (EN7, owner-manager)

The company also maintained one business area with environmental technology and gained prior experience with environmental aspects in their core business. They also considered factors other than costs and profits in relation to eco-innovation: that is, the owner-managers, based on normative reasons (personal and family values), had consciously decided to make ecological issues an integral part of their business:

“Really, we [the two owner-managers] have been environmentally oriented for a long time, primarily due to personal reasons. We are two leaders, my brother and I.” (EN7, owner-manager)

The SME seems to be able to create a win-win situation, which is demonstrated, for instance, by their perceived impact of their green image on employee performance:

“[We] think that we want to work and live in a community, that it is worth it, for ourselves and for our employees [...] that really is a win-win situation, you have satisfied employees and improved performance.” (EN7, owner-manager)

Their focus on regional markets may also have led to more tangible opportunities to actively pursue a green image. Finally, also in line with their proactive strategy, instead of simply reacting to a one-off external stimulus by the local authority, the owner-manager pointed out that the company deliberately decided to be one of the first companies to participate in the program.

**Discussion: the relationship between green strategy and absorptive capacity**

Green strategies have been identified as an important antecedent for eco-innovations (Noci and Verganti 1999). We have shown that participating SMEs had implemented different green strategies prior to their participation in the PPP (reactive and innovation-based; in our sample no SME with an anticipatory strategy was identified). Given that a firm’s strategies are one of the key antecedents of absorptive capacity (Lane, Koka and Pathak 2006, p.856), we would also expect that these strategic investments in eco-related
competencies, technologies, and networking infrastructure prior to the PPP initiative would influence eco-related absorptive capacity—either directly or as a ‘by-product’ (Cohen and Levinthal 1990; 1994). Depending on which green strategy SMEs have pursued before Ecoprofit, they can be expected to have different starting levels of absorptive capacity (low, medium, high) at the beginning of the PPP. Next to the chosen strategy itself, it is probably also in relation to absorptive capacity that knowledge transfer into companies intended by a PPP is generally easier for the more proactive companies (anticipatory and innovation-based) (Macpherson and Holt 2007, p.182).

**Proposition 1:** depending on the green strategy (reactive, anticipatory, or innovation-based) followed prior to involvement with the PPP, SMEs enter the PPP with a related level of absorptive capacity (low, medium, or high, respectively).

Next, we turn to the PPP set up and the ways in which the green strategies and the related level of absorptive capacity interact with the handholding mechanisms.

**Green strategies, absorptive capacity, and the SMEs’ response to PPP handholding**

Through the analysis of the data of the overall PPP, we identified that the prior existing green strategy and the related level of absorptive capacity are together an important antecedent for the SMEs’ behavior in the PPP, but not the only one. Another is the specific PPP set up, particularly with regard to the public partner’s level of proactivity which can make SME behavior differ. The remainder of this section further analyzes the role of green strategy, prior absorptive capacity, and local authorities’ level of proactivity by looking at individual handholding processes in relation to the three key dimensions for knowledge absorption (*identification*, *assimilation* and *application*) (Lane, Koka and Pathak 2006; Zahra and George 2002).
**Handholding processes and the identification of knowledge**

With its focus on eco-efficiency, Ecoprofit ‘preselects’ specific external knowledge in order to increase the overlap with the SMEs’ existing knowledge base which generally eases knowledge identification. The PPP provides two different types of handholding to facilitate knowledge identification with its beginner and the club program. This provides the necessary incentives for company representatives to participate and thereby contributes to their individual competency development. This is important as the actual identification of knowledge occurs at the individual level (Cohen and Levinthal 1990). For each pattern, SME behavior differs.

In **pattern 1: hold-up**, due to their prior reactive green strategy, the SMEs started participation in the PPP with a low level of absorptive capacity. With their limited prior knowledge base related to environmental issues, there was limited overlap with the new knowledge offered by the PPP. Accordingly, they strongly requested sector-focused knowledge which had the potential for direct application in their specific organization. This was shown in the concern often raised by the SMEs in this pattern (and **pattern 2: step-up**) that the handholding offered was not always (sector) specific enough:

"Well you would really need an offer [referring to the club], if it ever came again, with a group of companies that share the same interests; something that is tailor-made. We don’t need to talk about waste with someone who has to get rid of hollow needles or, I don’t know, that is dealing with plastics. We have different topics. [...] For us the problem is that, as an industrial company, we had basically nothing in common with the people at the table there [referring back to beginner and club program].” (EN1, executive manager)

"In the meetings of the trade associations [in contrast to Ecoprofit] it is really of advantage that you have companies from the same sector with similar problems.” (EN2, executive manager)

In many of the PPPs in this pattern the club program was not offered, discontinued, or offered at a later stage by the local authority, and therefore could not serve as an immediate means to continuously identify new knowledge (EN1, EN3, and EN4). If the club was offered, the owner-managers of the companies (EN2) denied the environmental team further engagement in the club.
Initially following the same reactive strategy, pattern 2: step-up shows similar behaviors in many respects, particularly, the demand for sector specificity. However, it also differs: the owner-managers were the main contact person for the Ecoprofit program. We found that there are various reasons for this: first, the SMEs in this pattern were still small enough (all had fewer than 65 employees) that the owner-manager(s) could deal with it directly. Additionally, we find that in contrast to pattern 1, pattern 2: step-up is characterized by PPPs with an overall medium level of activity by the local authority, which might also have influenced the decision of owner-managers to participate directly in the initiative. As one owner-manager states:

“I was motivated really through an external hint from the city where we were contacted personally to get involved” (EN6, owner-manager)

That, next to prior strategy, both SME size and the local authorities’ level of activity is important for owner-management involvement is perhaps best shown from the example of one SME from pattern 1: hold-up (EN3) which is also small (50 employees), but participated in a PPP with a rather unenthusiastic local authority which cancelled the program shortly after initiation, much to the dismay of the company as the manager explains:

“It was basically enough [the beginner program]. You could have continued [...] maybe with two meetings a year to keep at it [eco-innovation] better.” (EN3, manager)

Proposition 2: green strategy, SME size, and level of activity by the local authority influence whether an SME’s owner-management decides to become personally involved in the PPP’s handholding processes.

Even though the local authorities with a medium level of activity managed—with limited success—to offer the club program, the SMEs in this pattern also demonstrated a strong need for focused, sector-specific knowledge (as in pattern 1: hold-up). Hence, the SMEs’ absorptive capacity stemming from its priory reactive green strategy is simply not enough to engage in such a peer-to-peer handholding process which is more or less
unstructured, of cross-industry nature, and has a high diversity of actors and knowledge. Besides lack of absorptive capacity, the SMEs also did not participate because they simply ‘had no time’. Again, this is directly related to the rather small size of the SMEs in this pattern (24 and 65 employees)—a fact also recognized by the local authorities: “for such small companies it is just too much to participate in the club” (LA6).1

The SME from pattern 3: frontrunner, in clear contrast to the request for focus and sector specificity in earlier patterns, easily absorbed the information given in the beginner program, sought out networks to further deploy its strategy, and saw a benefit from exchanging knowledge with a high diversity of actors:

“Generally networks are really important, not just a buyers’ network but really any kind, like round tables or with the local chamber of handicraft. This also goes for the trade association, really important. Really a network is important because during daily work you don’t think of these things [eco-innovation] and in a network you stay on top of things and get new ideas continuously.” (EN7, owner-manager)

The SME was located in a PPP context which was proactively driven by the local authority. The local authority had successfully designed and maintained a peer-to-peer-based club program, in which the sample SME has been participating for over 10 years. This handholding process is rooted much more strongly in knowledge exchange between participating firms. The high diversity of partners offered in the club is important as the potential for problem solving is constrained if actors are too similar (Boons and Berends 2001), as is also reflected by the owner-manager’s comment:

There is no competition because you are from different sectors, which is an advantage [for open exchange] [...]. In this area [eco-innovation] an exchange is really wanted and aimed for. [...] Being more sector-specific may have some advantages but I think overall the disadvantages outweigh them. I mean then you think more or less the same stuff and you have the same development-jams. [If it is not sector-specific] you look more openly what is he doing and maybe it’s not such a bad idea. For example, a cleaning-company thought about converting its fleet into a fleet with only electro mobiles, as they have many short-distances to cover. Well, we also do this [...] surprisingly you find we have the same challenges.” (EN7, owner-manager)

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1 Consider that, though these two companies belonging to our sample did not participate in the two regions’ club offers, there are further SMEs in each of the regions which have participated.
The Ecoprofit club was also rather unstructured and the participants needed to steer the agenda themselves rather than being told what to do. According to both the local authority and the consultant involved, the club facilitated implementation of measures from the beginner program, continuous improvement, generation of new ideas, and ways simply to stay ahead:

“The club functions after plan-do-check-act with the goal to secure and implement the basic knowledge acquired in the beginner program. The clubs helps to do so with its structure and regular meetings to initiate continuous improvement towards environmental management. The networks are important for the exchange of new ideas and new solutions. They also motivate you to look for new potential measures […].”

(CO7, Consultant)

The difference between the patterns with regard to the SMEs’ participation in the club program leads us to the following proposition:

**Proposition 3a:** even though SMEs can benefit from basic handholding processes which deliver (semi-) structured and more focused knowledge, their absorptive capacity for eco-innovation determines to what extent they can cope with unstructured and less industry-specific knowledge offered in the PPP setting.

**Proposition 3b:** an SME’s ability to participate in peer-to-peer handholding processes (‘clubs’) characterized by unstructured, unfocused knowledge and idea generation through mechanisms of self-organization requires a high level of absorptive capacity (and a more proactive green strategy in prior periods).

**Handholding processes and the assimilation of knowledge**

The second dimension of absorptive capacity, assimilation, is also supported by the PPPs. First of all, the participation in workshops, as explained earlier, makes company participants switch between a company’s internal and external spaces. Coming back from workshops and related handholding processes, they transfer the knowledge back into the organization, which may lead to an assimilation of knowledge through informal exchange.
These appointed individuals are champions of communication or boundary spanning individuals, roles which have been recognized as a very important element for innovation (Tushman 1977). As different people are involved in the three patterns, this facilitates assimilation accordingly.

A more formal approach to knowledge assimilation also required by Ecoprofit is the establishment of an environmental team. The patterns demonstrated different set ups (confer identification dimension) due to a mix of prior green strategy and SME size. In pattern 1: hold-up, the SMEs appointed only one or two persons to the environmental team, without owner-management involvement. These were managers from the areas of maintenance, purchasing or sales. For SMEs in pattern 2: step-up, the major difference was that owner-managers were part of the environmental team. Size-wise the diversity increased: one SME installed a team with four members, the other—the smallest SME—initially had a ‘team’ consisting only of the owner-manager (enlarged at later stage). In pattern 3: frontrunner, the environmental team consisted of one owner-manager and two other managers. The formation of the environmental team is important as it collaboratively evaluates the new knowledge in the context of the specific organization and searches for potential applications, a process in which further organizational members are ideally involved. Through this process, the individual knowledge expansion is slowly translated into organizational knowledge and new absorptive capacity becomes available in subsequent periods.

In pattern 2: step-up and pattern 3: frontrunner, with their larger size and with various functions being represented, the environmental team usually represented a cross-functional team or, in the case of owner-management involvement, a team crossing hierarchical levels. Both characteristics are important for knowledge assimilation across organizations (Lane, Koka and Pathak 2006), dissolving knowledge islands, and ultimately successfully pursuing eco-innovations (Hart 1995). In contrast to previous research (for
example, Del Brío and Junquera 2003), our findings regarding the environmental team suggest that, even in SMEs, a certain degree of formal structure for environmental management can be established.

*Proposition 4: the formation of the environmental team with regard to functions represented and hierarchical levels is an important antecedent for effective knowledge assimilation.*

**Handholding processes and the application of knowledge**

The application dimension is operationalized here in three aspects: general fit with the dominant logic, handholding in the form of consultancy services, and—as result of the former aspects—the eco-innovations actually implemented.

First, the overall orientation of Ecoprofit, with its focus on eco-efficiency and process innovation (‘preselected knowledge’), means that this new knowledge remains close to even the most reactive SME’s ‘dominant logic’ (Lane and Lubatkin 1998). This generally increases the likelihood that the knowledge will be applied (actual eco-innovation).

Second, the PPPs’ beginner program provides agent-based handholding in the form of customized consultancy services in order to support the implementation of the knowledge gained directly (‘application for commercial ends’) in each of the SMEs. Thus, our findings support the notion that agent-assisted handholding helps in terms of guiding SMEs individually through the innovation process (Friedman and Miles 2002). Sending consultants into the target organization has also previously been recognized as an effective practice for knowledge transfer (Dyer and Singh 1998). As a by-product of these implementation projects, new absorptive capacity is developed.

Third, concerning actual eco-innovation, all the SMEs were able to reap the benefits of participation in the Ecoprofit program: that is, they realized economic gains coupled with
environmental improvements. The majority of eco-innovations implemented by all the SMEs related to eco-efficiency improvements of their processes.

Whilst the latter demonstrates some of the more general characteristics which we found to be rather similar across the sample, we also found several differences regarding the SMEs’ patterns. The SMEs from pattern 1: hold-up remained fixed on the idea that environmental issues were only relevant if they lead to a reduction of costs in processes:

“It’s not about continually getting new ideas; instead we want to optimize existing processes, that is the manufacturing costs, so that we can guarantee the survival of the company.” (EN1, executive manager)

In this pattern, the SMEs particularly stressed the high importance of the consultant to support the eco-innovation implementation process. Still, despite this support, only a limited number of process improvements (energy-efficiency, waste management, and replacement of hazardous materials) were implemented. For one SME we could explicitly recognize how the green strategy pattern hindered eco-innovation: plans for more energy-efficiency through a thermal heat plant were not implemented for several years due to a lack of owner-management support (EN2). This shows that, despite proper knowledge processing in the identification and assimilation dimensions, the ultimate absorption of knowledge can be hindered when there is a reactive strategic posture and a lack of owner-manager involvement. This sometimes renders the PPP’s most basic handholding to be ineffective. In other words, without direct or at least indirect owner-manager support, it is difficult to unfreeze the dominant logic. Instead, the SMEs enforce their deliberately chosen reactive green strategy and, consequently, hinder further development of absorptive capacity.

The SMEs in pattern 2: step-up were similar to those in the reactive hold-up pattern in that during the initiative only a couple of process innovations were implemented. However, their dominant logic unfroze to some extent in the later stages of the program as they developed awareness of a business case for corporate greening:
“We realized it was only the first step to deal with the topic [eco-innovation] and then to deduce measures which can also be turned into a competitive advantage.” (EN5, owner-manager)

We theorize that it is the direct involvement (or at least support) of owner-managers in the application phase which allows for timely changes in the top manager’s perception of environmental issues.

The SME in pattern 3: frontrunner already exhibited a strong dedication to environmental sustainability before Ecoprofit. It entered the PPP with an eco-benign dominant logic and demonstrated openness towards all types of eco-innovation. In this pattern the SME implemented the highest number of process innovations. Further, in contrast to the other patterns, it had already implemented an organizational innovation (a monitoring system) showing its orientation towards continuous improvement.

**Discussion: handholding processes and absorptive capacity**

Through the direct linkage of the PPP’s handholding processes to each of the three dimensions of absorptive capacity (identification, assimilation, and application), knowledge transfer into SMEs is improved. Hence, although from the standpoint of an independent company it would be expected that SMEs would be constrained by their actual absorptive capacity (as an outcome of deliberate strategy choice in earlier periods), the handholding processes offered during the PPP’s runtime enable them to absorb more knowledge. Basically, an SME’s absorptive capacity is ‘temporarily enhanced’ through the concerted handholding efforts of the PPP.

**Proposition 5: the effectiveness of knowledge transfer into SMEs and the degree to which new absorptive capacity is developed as a by-product depends on the concerted offering of handholding processes directed at each of the three dimensions of knowledge absorption: identification, assimilation, and application.**
In all of the three dimensions of absorptive capacity, owner-manager involvement is crucial. It is represented by the aggregation of involvement in participation in workshops (identification), the making of appointments to the environmental team (assimilation), and decision-making regarding actual implementation of eco-innovations (application). Thus, our findings further specify those of Macpherson and Holt (2007: 181) that the entrepreneur (or owner-manager) mediates the creation of absorptive capacity. We propose the following:

*Proposition 6a:* owner-manager involvement in handholding processes in knowledge identification, assimilation, application drives the development of absorptive capacity.

*Proposition 6b:* if owner-manager(s) are involved in knowledge identification and assimilation, they are sensitized to ecological issues, facilitating application and the transformation of the firm’s dominant logic.

The PPP is an inter-organizational structure providing strong ties between the local authority and the participating SMEs and it can therefore be understood to be part of the “firm’s [inter-organizational] structures and processes” and thereby as antecedent of absorptive capacity (Lane, Koka and Pathak 2006, p.856; see also: Hansen, Sondergard and Meredith 2002). More specifically, as absorptive capacity is cumulative, by this process of PPP-facilitated knowledge transfer through handholding processes, new absorptive capacity is developed as a by-product (Cohen and Levinthal 1994) and is then available in subsequent periods for improved knowledge absorption. This then contributes to the formation of expectations (Cohen and Levinthal 1990; Hansen, Sondergard and Meredith 2002) and subsequently enables an SME better to evaluate the role of (ecological) factors for the future development of technology and markets (Cohen and Levinthal 1994). New knowledge can alter the way in which companies define their industry and competitive strategy, lead to strategic flexibility, and thereby enable strategic change (Lane, Koka and Pathak 2006; Zahra and George 2002, p.190), particularly when owner-managers are involved directly in the
handholding processes. Eventually, this temporary elevation could lead to the transformation of routines and behavioral patterns, even beyond the runtime of the PPP.

These mechanisms related to green strategy are what was observed after Ecoprofit’s beginner program and is presented in detail in the next section.

**The impact of participation in Ecoprofit on SMEs’ green strategies**

As is evident from Table 3, we identified a significant change in green strategies only in pattern 2: *step-up* (that is from a reactive to an anticipatory strategy), whereas for pattern 1: *hold-up* and pattern 3: *frontrunner*, their green strategies were further reinforced (reactive and innovation-based, respectively). Each pattern is described in greater detail by making reference to knowledge identification, assimilation, and application.

**Pattern 1: hold-up**

In pattern 1: *hold-up*, SMEs implemented few eco-innovations and after the beginner program maintained their reactive stance. They still perceived ecological issues to be related to cost and efficiency in nature, without recognizing the potential for business opportunities:

“For us the ultimate goal is to make the processes as cost-efficient as possible [...]. If environmental things cause costs, we undertake measures to avoid that [...]. But the environment itself is not a driver [for us]. [...] We don’t wish to reorganize everything ecologically.” (EN1, executive manager)

With regard to identification of new knowledge after Ecoprofit, pattern 1: *hold-up* SMEs did not actively seek further eco-related knowledge sources. They rather lamented that they missed further support from Ecoprofit after the beginner program. This is partly reasonable as in two cases the local authority terminated the complete program (EN1 and EN3). Concerning the knowledge assimilation dimension, pattern 1: *hold-up* SMEs to a certain degree reduced the time the environmental team could invest in further eco-innovations after the initiative’s termination (EN1, EN2, and EN3). Concerning application, the SMEs did not implement any significant further eco-innovations, except for one SME
(EN2) which, as mentioned earlier, did finally implement one of the eco-innovations originally planned within the beginner program.

A major barrier to further innovation and strategy development lies in the continued lack of owner-management support, as one manager explained:

“There is a lot of potential here. [...] This is the decision of the owner-manager; it’s a question of doing either just the basics or the optimal thing. I mean you could really get in a person on a part-time contract who would pick out [and implement] projects that are in the area of environmental management, but [in our case] often just the minimum is done and not necessarily what would be optimal.” (EN2, executive manager)

**Pattern 2: step-up**

In contrast to the prior pattern, the SMEs in *pattern 2: step-up* were able to develop further absorptive capacity based on which they adjusted their dominant logic and realized that addressing environmental issues could lead to competitive advantages:

“We have realized that you can use it [eco-innovation] for an image advantage for the main customers.” (EN5, owner-manager)

That there is indeed a strategic change, not only at the level of owner-management perception, but also at the level of company action is demonstrated when looking at how SMEs dealt with knowledge some time after participation in the beginner program.

With regard to knowledge *identification*, the SMEs in this pattern further collaborated with other (network) initiatives and partners. For instance, one SME (EN6) tapped into another environmental initiative in its federal state which facilitates SMEs in monitoring their environmental improvements and provides support through guidelines, workshops, and cooperation with capacity building institutions. This opportunity for further networking was also actively supported by their local authorities with their overall medium level of activity. Most importantly, in *pattern 2: step-up* the local authorities provided long-term stability in what they offered, compared to *pattern 1: hold-up*, as the local authorities realized that coordinating or even cooperating with other environmental networks (in this case with the
environmental network of a trade association) is important in terms of sharing resources and maintaining offers in the long-term.

**Proposition 7:** the long-term continuation of (some part of) the public partner’s handholding processes is an important factor in the development and transformation of participating SMEs.

Concerning knowledge assimilation, the SMEs partly increased their environmental teams. One owner-manager brought his son, who will take over the company in the long term, into the team (EN6). His responsibility was then to focus on the integration of eco-indicators into the ISO 9001 quality management system. Bringing additional family members into the team demonstrates the increasing strategic relevance given to eco-innovation and, more broadly, demonstrates the role unique family dynamics (and values) play in the choice of the eco-innovation strategy (Sharma and Sharma 2011).

Also regarding the application dimension, the SMEs in this pattern changed. They all implemented further process innovations in the areas of energy, water, waste, or hazardous materials. Moreover, as the former example (EN6) demonstrates, at least some of the SMEs engaged in organizational innovations (in this case, the ISO 9001 management system). Based on the positive experience of receiving individualized handholding, some SMEs subsequently sought other third party support. For example, EN5 now has a consultant coming in twice a month funded by their own budget, also to deal with environmental issues.

Overall, the changed behaviors on all dimensions of absorptive capacity demonstrate how the SMEs further developed their individual competencies, networking capacity, and key technologies to ‘step up’ from a reactive to an anticipatory green strategy (Noci and Verganti 1999).

**Proposition 8:** an SME’s owner-manager involvement in handholding processes and a proactive public partner best enables more reactive SMEs to develop new absorptive
capacity, change the formation of expectations regarding ecological issues, and step-up their green strategy.

**Pattern 3: frontrunner**

The SME (EN7) in pattern 3: frontrunner benefited from the handholding process from both the beginner and club programs, established a sturdy environmental team, and engaged most strongly in eco-innovation. Thereby, it was able to use Ecoprofit to deploy its innovation-based strategy to a greater extent. Basically, this pattern shows that SMEs can go even further than relating eco-innovation to competitive advantage and actually aim to make the business ‘as green as possible’:

“We [my brother and I] have made it our goal to make the company as green as possible.” (EN7, owner-manager)

Ultimately, through Ecoprofit participation the two owner-managers became more strongly committed to their values and able to develop a broader vision of sustainability for their company:

“For the future, we think we have a social responsibility as entrepreneurs of a smaller company and that we must stand up for and make use of the possibilities to shape the [societal/institutional] framework.” (EN7, owner-manager)

Concerning the identification dimensions of absorptive capacity, they saw the Ecoprofit club in particular as an opportunity to ensure continuous learning, monitor future opportunities for eco-innovation (product, process, and organizational), and to expand their business network:

“Yes, we are very interested in this [continuing to expand the area of green technologies] and through Ecoprofit [the club] we are able to expand our contacts.” (EN7, owner-manager)

Beyond the club program, and similar to pattern 2: step-up, the SME in this pattern also started to engage in other external networks for knowledge sourcing. Comparable to pattern 2: step-up, the local authority proactively contributed to this by offering information about or even partnering with other sustainability network initiatives. For example, a
collaboration with a neighboring Ecoprofit initiative led to a joint club offer where participants from both initiatives came together in order to discuss issues beyond eco-efficiency and gain a deeper understanding of more comprehensive sustainability issues.

Concerning assimilation, in this pattern it became clear that Ecoprofit had an impact on employees beyond the environmental team:

“If we had left the club five years ago we would not be anywhere near as active as we are now.” (EN7, owner-manager)

Concerning application, EN7 not only further pursued basic efficiency-related process innovations, but was also active in the area of renewable energies. For example, it planned to upgrade their car fleet with electric mobiles. Moreover, the SME became involved in citizenship projects within its community for which it received an award in 2009 from the federal state for its exceptional societal commitment. This further stresses how the SME, as part of its strategy, systematically integrated sustainability into its green (sustainability) image.

Based on the above presentation of our findings and the subsequent discussion, we are able to develop an integrated framework for eco-innovation in the context of PPPs which we will briefly present in the next section.

**An integrated framework for eco-innovation in the context of PPPs**

This paper contributes to the literature on eco-innovation in SMEs by demonstrating the relationship between three independent but related constructs, namely green strategies (Noci and Verganti 1999), absorptive capacity (Cohen and Levinthal 1990; 1994), and handholding processes provided within PPPs (Friedman and Miles 2002). As such, our research goes beyond looking at the effects of mere membership in an inter-organizational network on absorptive capacity, but rather focuses on “the nature of the links in terms of structures and processes” (Lane, Koka and Pathak 2006, p. 849) and is an attempt to shed
more light on knowledge transfer and learning in inter-organizational collaborations. By covering the above-mentioned constructs in a single approach, we also contribute to Lane, Koka and Pathak’s (2006, p.857) call for integrating firm strategies into empirical research on absorptive capacity.

Based on our findings, we first showed that green strategies play an important role in an SME’s participation in a PPP. The SMEs’ chosen green strategy before participation in the partnership determines their level of absorptive capacity and accordingly which types of handholding processes they are able to respond to. By addressing the various dimensions of absorptive capacity (identification, assimilation, application) we were able to demonstrate the function of handholding processes and how they need to be combined to deliver appropriate support for knowledge absorption. We also found that prior green strategy, SME size, and the proactivity of the public partner all influence whether owner-managers directly participate in handholding processes and how this influences strategy transformation. Finally, we also showed that, more generally, the local authorities’ level of activity is an important moderator in terms of the SMEs’ response to handholding processes (see Figure 1).

----------------- PLEASE INSERT FIGURE 1 HERE -------------------------------

**Conclusion**

From our study we conclude that PPPs can result in an SME engaging in a structured manner in eco-innovation, or intensifying existing efforts. In some cases a transformation of the SME’s green strategy is even possible. We therefore disagree with the recent findings of Varis and Littunen (2010) who suggest that the role of regional support organizations is only marginally important. Still, as our case analysis shows, more often than not, an SME’s strategic pattern remained constant over the time of the PPP, which reflects Cohen and
Levinthal’s (1990) observation that “reactive and proactive modes of firm behaviour should remain rather stable over time” (p.138). In the few cases where a change of strategic pattern could be observed, we identified several combined factors, including the SME’s owner-management involvement and the local authority’s level of activity as key determinants. The owner-manager involvement is necessary to ‘unfreeze’ the dominant logic of companies, which confirms research highlighting distinct SME characteristics, such as being managed by owners (see, for example, Bougrain and Haudeville 2002; Spence 1999) and, as Varis and Littunen (2010) deduce from the literature (not confirmed in their empirical results), that “innovativeness may translate into the innovativeness of the entrepreneur” (p. 132). Future research could shed more light on the role of the individual entrepreneur in handholding processes, their interaction with other organizational members, and how this changes the formation of expectations and strategy choice. Given the family factor of our sample, it would also be worthwhile to discuss further how ‘family involvement’ as an intangible factor of company behavior (see, for example, Habbershon, Williams and MacMillan, 2003; Moores 2009) actually influences the deployment of more holistic sustainability strategies.

From our analysis we can further suggest that strategy changes benefit from a high degree of proactivity on the part of the local authority. This relates to recent research by Mu et al. (2010) on disseminative capacity, which stresses the need to focus not only on the receiver but also on the sender of knowledge in inter-organizational partnerships. Whilst we realize that disseminative capacity is somewhat under researched, this study further contributes to research on absorptive capacity in inter-organizational collaborations.

**Implications for policy makers**

With this we are able to derive several implications for policy. First, despite the need to limit the runtime of PPPs, it is important that some are established with a long-term vision,
that is, provide companies with the opportunity to continuously access basic handholding processes (for example information services, club offers).

Second, policy makers should consider that support programs need to be customized to the (green) strategies employed by SMEs because poorly-matched communication will be disregarded by SMEs (Hansen, Søndergard and Meredith 2002). Therefore, either various types of handholding processes need to be offered within the same program (for example beginner vs. club programs) or programs need to be directed exclusively at groups of SMEs with the same strategy pattern. Last but not least, policy makers should emphasize that support programs are designed in a way which encourage (or even mandate) the involvement of the entrepreneur (for example the owner-manager) as this significantly increases the potential for strategy transformation.

Limitations

This study is limited in various ways. First, as we explained earlier (see data analysis), our longitudinal research design represents “retrospective case histories” (van de Ven and Poole 1990). Future longitudinal case designs should also be considered that scrutinize how the innovation process itself unfolds (van de Ven and Poole 1990), for example, by using participatory or action research. Second, we interviewed only one participating SME in each of the PPP initiatives. Third, in this study we analyzed the SMEs across all strategic patterns with an emphasis on eco-efficiency. More research is needed into how SMEs can achieve radical process, product and business model innovations with research on entrepreneurship and sustainable development being a promising path (see, for example, Hall, Daneke and Lenox 2010; Schaltegger and Wagner 2011). Fourth, we have assumed a rather positive link between inter-organizational structure and the SMEs’ absorptive capacity. However, other studies (Lane, Koka and Pathak 2006) also show that inter-organizational structure could lead to the deterioration of absorptive capacity, in that reliance on PPP handholding processes
weakens the individual SME’s competencies in identifying external knowledge as a
dependence structure is established. Nonetheless, a customized PPP set up which recognizes
the different green strategies found in the heterogeneous group that SMEs make up may
trigger change for eco-innovation.

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## Appendix

### Table 1

**Characteristics of the case study SMEs from the metal and mechanical engineering industry**

<table>
<thead>
<tr>
<th>Case</th>
<th>Enterprise code</th>
<th>Staff #</th>
<th>Age</th>
<th>Family Business</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EN1^a</td>
<td>170</td>
<td>more than 100 years</td>
<td>+</td>
<td>High precision machine tools and gear profile grinding machines</td>
</tr>
<tr>
<td>2</td>
<td>EN2</td>
<td>93</td>
<td>more than 50 years</td>
<td>3rd family generation</td>
<td>+ Heavy anchoring technology</td>
</tr>
<tr>
<td>3</td>
<td>EN3</td>
<td>45-50</td>
<td>more than 50 years</td>
<td>+</td>
<td>Staircase constructions, bending technology, and steel construction</td>
</tr>
<tr>
<td>4</td>
<td>EN4</td>
<td>230</td>
<td>more than 100 years</td>
<td>+</td>
<td>Microfinishing and superfinishing machines</td>
</tr>
<tr>
<td>5</td>
<td>EN5</td>
<td>65</td>
<td>up to 50 years</td>
<td>+</td>
<td>Purpose-built machinery manufacturing</td>
</tr>
<tr>
<td>6</td>
<td>EN6</td>
<td>24</td>
<td>up to 50 years</td>
<td>3rd family generation</td>
<td>+ Cutting tools with CNC-, grinding-, and measuring technology</td>
</tr>
<tr>
<td>7</td>
<td>EN7</td>
<td>100</td>
<td>more than 100 years</td>
<td>4th family generation</td>
<td>+ Steel and metal constructions</td>
</tr>
</tbody>
</table>

^a 1997 integration into larger company group
### Table 2

**Total interviews conducted**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Group</th>
<th>#Organizations</th>
<th>#Interviews</th>
<th>Av. duration [min]</th>
</tr>
</thead>
<tbody>
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<td>Phase 1</td>
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<td>7</td>
<td>7</td>
<td>16</td>
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<tr>
<td>Phase 2</td>
<td>SMEs&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Local authorities&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Consultancies&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3</td>
<td>4</td>
<td>57</td>
</tr>
</tbody>
</table>

<sup>a</sup> Three owner-managers; three executive managers (maintenance, purchasing); one manager (sales).

<sup>b</sup> Company EN4 decided not to participate in the second phase of interviews given time restraints.

<sup>c</sup> Given program termination (EN3) several years in the past, the persons responsible for the program could not be contacted; instead a short call covering general information took place with the person we contacted for our interview request; overall case EN4 was not pursued in detail as the SME decided not to participate again.

<sup>d</sup> Interviews were conducted with the two major consultancies that work with Ecoprofit, and one smaller but experienced consultancy in Ecoprofit; two senior consultants (EN1, EN2); one program manager (responsible for both EN5 and EN7); one director of consultancy (EN6).

### Table 3

**Overview of SME patterns identified**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>SME Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hold-up</td>
</tr>
<tr>
<td><strong>Companies (cases)</strong></td>
<td>EN1, EN2, EN3, EN4</td>
</tr>
<tr>
<td><strong>Prior green strategy</strong></td>
<td>Reactive</td>
</tr>
<tr>
<td>- View of environmental issues</td>
<td>Costs</td>
</tr>
<tr>
<td>- Market context</td>
<td>International</td>
</tr>
<tr>
<td><strong>Participation in beginner program (overall)</strong></td>
<td>Low</td>
</tr>
<tr>
<td>- Level of absorptive capacity</td>
<td>Low</td>
</tr>
<tr>
<td>- Local authority activity level</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>- Environmental team</td>
<td>Small</td>
</tr>
<tr>
<td>- Top management involvement</td>
<td>-</td>
</tr>
<tr>
<td>- Participation in club program</td>
<td>-</td>
</tr>
<tr>
<td>- Process innovations</td>
<td>Low (partly delayed)</td>
</tr>
<tr>
<td>- Organizational innovations</td>
<td>-</td>
</tr>
<tr>
<td><strong>Eco-innovation activities after Ecoprofit beginner program:</strong></td>
<td>Low</td>
</tr>
<tr>
<td>- New level of absorptive capacity</td>
<td>Low</td>
</tr>
<tr>
<td>- Process innovations</td>
<td>-/negligible</td>
</tr>
<tr>
<td>- Organizational innovations</td>
<td>-</td>
</tr>
<tr>
<td>- Product innovations</td>
<td>Low&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>- Alternative knowledge sources (for example other networks)</td>
<td>Low&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> High (search for new business opportunities)

<sup>b</sup> High
Change of strategic pattern through Ecoprofit - Move from reactive to anticipatory Deployment of innovation-based strategy
- View of environmental issues Costs Competitive advantage and normative goal

In only one case did we identify relevant eco-product-innovations. Interestingly, the interviewee from EN1 did not mention its role as supplier of technology for wind power. This was identified through data triangulation from corporate websites and press releases.

In only one case (EN1) did the company seek out alternative knowledge sources (as of 2009) in the form of an industry specific initiative which particularly aims to increase the energy-efficiency of production processes in the manufacturing sector. EN1 is part of the initiative as the small company is integrated into a larger business group.

Figure 1

A process framework of PPP-facilitated eco-innovation in SMEs
### Table 4

**Cross-case overview: eco-innovation behavior before, during and after Ecoprofit participation**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>SME (code)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN1</td>
</tr>
<tr>
<td><strong>Eco-innovation strategy prior to Ecoprofit participation:</strong></td>
<td></td>
</tr>
<tr>
<td>- Eco-innovations before Ecoprofit</td>
<td></td>
</tr>
<tr>
<td>No documented measures before Ecoprofit</td>
<td></td>
</tr>
<tr>
<td>Documented measures 1975, 1985, 1995 (for example energy efficiency)</td>
<td></td>
</tr>
<tr>
<td>Documented measures since 1994 (e.g. introduction of biodegradable oils for machines; optimization of lighting system; optimized thermal insulation)</td>
<td></td>
</tr>
<tr>
<td>Documented measures since 1994 (e.g. renewal of heating system, optimization of lighting system)</td>
<td></td>
</tr>
<tr>
<td>Documented measures since 1998 (e.g. improvement of products to reduce environmental impact; integration of environmental sustainability into firm philosophy in 1995)</td>
<td></td>
</tr>
<tr>
<td><strong>Eco-innovations during Ecoprofit participation:</strong></td>
<td></td>
</tr>
<tr>
<td>- Process innovations</td>
<td></td>
</tr>
<tr>
<td>Waste; energy; hazardous materials; water</td>
<td></td>
</tr>
<tr>
<td>Hazardous materials; energy; regulations</td>
<td></td>
</tr>
<tr>
<td>- Organizational innovations</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>- Environmental team</td>
<td></td>
</tr>
<tr>
<td>2 staff; no OM commitment</td>
<td>No</td>
</tr>
<tr>
<td><strong>Ecoprofit club</strong></td>
<td></td>
</tr>
<tr>
<td>- Participation of SME in club</td>
<td>No</td>
</tr>
<tr>
<td><strong>Eco-innovations after Ecoprofit:</strong></td>
<td></td>
</tr>
<tr>
<td>- Participation of SME in club</td>
<td>No</td>
</tr>
</tbody>
</table>

*Ecoprofit participation for SME.*
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Few (supplier of technology for wind power stations)</td>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>No</td>
<td>Yes (strengthening of business area for green technologies)</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>No</td>
<td>Yes (internal eco-indicator database ISO 9000 certification)</td>
<td>Yes (continued monitoring of environmental performance)</td>
</tr>
<tr>
<td>- Product innovations</td>
<td>Few</td>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>Yes (strengthening of business area for green technologies)</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>No</td>
<td>Yes (internal eco-indicator database ISO 9000 certification)</td>
<td>Yes (continued monitoring of environmental performance)</td>
</tr>
<tr>
<td>- Organizational innovations</td>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>No</td>
<td>Yes (strengthening of business area for green technologies)</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>./</td>
<td>No</td>
<td>No</td>
<td>Yes (internal eco-indicator database ISO 9000 certification)</td>
<td>Yes (continued monitoring of environmental performance)</td>
</tr>
</tbody>
</table>

| Networking activities for eco-innovation after Ecoprofit | Low (partner in an industry-specific initiative to reduce energy costs in manufacturing) | None | None | ./ | Medium (e.g. state sponsored program, consultant) | Medium (e.g. environmental initiative of federal state, trade associations) | High (e.g. trade associations, family business network, local chamber of handicraft, participation in other environmental initiatives) |

| Activity level of local authority | Low | Medium | Low | ./ | Medium | Medium | High |

| Eco-innovation strategy after Ecoprofit participation | Reactive | Reactive | Reactive | Reactive | Anticipatory | Anticipatory | Innovation-based |

| Pattern | Hold-up | Hold-up | Hold-up | Hold-up | Step-up | Step-up | Frontrunner |

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* The club is offered by all local authorities with the exception of EN1 where the club ceased to exist in 2005 with program termination and EN3 where the program terminated in 2002.

* For time reasons, EN4 decided not to participate in the second round of interviews. Thus this case was not pursued further with the local authority and consultant.