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Structured Abstract

Purpose: Firms need to develop absorptive capacities to effectively source and exploit knowledge relevant to environmental behaviour for their own innovation activity. Business-to-business interactions can represent a significant route through which knowledge and resources about environmental innovations are transferred along the supply chain. The purpose of this paper is to explore how firms exploit business partnerships in order to build capacity for environmental innovation. In order to do so, it investigates two elements of B2B interactions – partner alignment and compatibility – and their influence on absorptive capacity-building.

Design/methodology/approach: This paper is based on a qualitative interview study of knowledge intensive business services (KIBS) operating in the environmental goods and services sector and their clients involved in adopting environmental innovations. Matched pairs of engineering consulting firms and their clients – tourism accommodation establishments - were selected as a sampling frame in order to study the influence of partner alignment and compatibility on the exchange of environmentally-relevant knowledge and competencies.

Findings: The findings show that the synergistic attributes of business partners influence absorptive capacity-building and give rise to different patterns of interaction of KIBS with their client. The B2B interactions investigated are characterised by alignment along multiple objectives about the relevance of environmental behaviour. Furthermore, the compatibility of the partners' competences is a key determinant of environmental innovation outcome.

Practical implications: The study highlights the role of managers in identifying and selecting those business partnerships that accrue greater potential benefit for accessing resources and competencies for eco-innovation.

Originality/value: The study contributes to the literature on absorptive capacity and innovation by demonstrating how B2B interactions – in this study, the interaction of KIBS with their clients - influence the capacity of firms to adopt environmental innovations which is an area of study that deserves further attention.

1.0 Introduction

Firms are increasingly resorting to cooperation with external partners when implementing environmental innovations (Cainelli et al., 2015; de Marchi and Grandinetti, 2013; del Río et al., 2015). In particular, business-to-business relations are becoming a locus for information and competences about environmental innovations to be exchanged amongst partner firms (Fraj et al., 2013; Hofmann et al., 2012; Liu and Zhang, 2014). This study explores how resources and competencies about environmental innovation are transferred between firms in a B2B context. There may be specific challenges that firms encounter when implementing environmental innovations, including sourcing relevant competencies about environmental technologies or practices, which are often very different from the technology and market domains within which they usually operate (Cainelli et al., 2015; de Marchi and Grandinetti, 2013). The larger degree of novelty and uncertainty associated with environmental innovations also makes them more knowledge- and information-intensive than many other innovation types.

This study draws from the resource-based view of the firm, which underscores the contribution of resources and capabilities for value-creating activities, such as the development of new products and services that are more able to meet customer demands and the identification of new technological opportunities (Eisenhardt and Martin, 2000). In particular, firms need to develop absorptive capacities to source and exploit knowledge from external sources for their innovation activity (Cohen and Levinthal, 1990; Dyer and Singh, 1998; Ferreras-Méndez et al.,

2016). The literature on dynamic capabilities has analyzed how a firm's structural and organizational characteristics influence absorptive capacity, focusing on aspects such as prior available knowledge, R&D capability and the availability of skilled personnel (Cohen and Levinthal, 1990; Lane et al., 2006). The extent to which firms exploit B2B interactions in order to gain access to resources and competences to build absorptive capacity for environmental innovation remains under-researched (Liu and Zhang, 2014; Nyaga et al., 2010).

Firms source external knowledge through several routes. Research on knowledge intensive business services (KIBS) and innovation, shows that KIBS act as brokers between the client's resources and capabilities and external knowledge bases and they can be a source of innovation for their clients (Cabigiosu and Campagnolo, 2019; den Hertog, 2000; Tether and Tajar, 2008). Moreover, KIBS have also been shown to be a primary source of environmental knowledge amongst "green" innovators (de Marchi and Grandinetti, 2013). Aarikka-Stenroos and Jaakkola (2012) are among those who view the KIBS-client interaction as a "collaborative process" (p.17), in which each partner contributes its competences and knowledge for joint problem-solving. In practice, KIBS can face challenges in effectively assimilating and transferring knowledge, related to how well they understand the client's needs and expectations (den Hertog, 2000; Miles, 2005; Rodriguez et al., 2017). Likewise, clients vary in their knowledge needs and range of competencies which influence their ability to tap into this specialist knowledge (Castaldi et al., 2013; Eisingerich et al., 2009; Ferreras-Méndez et al., 2016). This study addresses a gap in understanding how elements of the KIBS-client interaction influence knowledge transfer for absorptive capacity-building in connection with knowledge about environmental innovation. The study makes the following contributions to the literature.

First, it advances an understanding of absorptive capacity in a B2B context, by considering a specific source of external knowledge coming from a selected partner. Studies of the role of B2B interactions have tended to focus separately on the buyer's or the supplier's perspective

(Aarikka-Stenroos and Jaakkola, 2012; Sáenz et al., 2014). This study takes the perspective of both partners – the KIBS and the client – in understanding those elements of the interaction that contribute to absorptive capacity-building for environmental innovation. Second, the study explores how specific elements of the interaction influence absorptive capacity for environmental innovation. KIBS-client interactions are heterogeneous, involving differences in the partners' skills, knowledge bases, motivations to interact and approaches to innovation (Cabigiosu and Campagnolo, 2019; Eisingerich et al., 2009; Miles, 2012). Building on the literature on KIBS and their role in client innovation, the study focuses on two elements contributing to the process of knowledge transfer amongst business partners: (1) the goals and objectives for implementing environmental innovations, and the extent to which these goals are aligned amongst the partners; and (2) the compatibility of the partners' competencies for environmental innovation. These elements are discussed further in the literature review.

Studies of the adoption of environmental innovations have tended to focus on polluting manufacturing industries, such as the chemical or the automotive industries, either because these are subject to stricter environmental regulation and stakeholder demand or because of their high potential for introducing environmental innovations (Díaz-García et al., 2015). This study investigates service industries which have received much less attention, perhaps because they are perceived as less-polluting. However, Cainelli and Mazzanti (2013) demonstrate that services contribute an important share of carbon dioxide emissions and envision that in future, they will face stricter environmental controls. Amongst the service industries, tourism is facing pressures to shift towards more sustainable practices (Molina-Azorin et al., 2009; WEF, 2017). As with firms in other low- (and medium-) tech industries, tourism businesses are generally characterised by limited internal capabilities for research and innovation, using non-R&D-related activities when trying to improve their overall performance. The presence of weak internal resources for innovation makes tourism firms reliant on external knowledge sources to

build an absorptive capacity for innovation (Alvarez and Iske, 2015; Martínez-Pérez et al., 2019); this is likely to be the case for the adoption of environmental innovations as it is for other aspects of business performance. In this study, we examine the interaction of tourism accommodation establishments with engineering consulting firms and how this facilitates the adoption of environmental innovations mainly in energy and water management.

Environmental innovations, hereafter referred to as eco-innovations, are generally characterized by their reduced impact on the environment - being either less resource demanding or producing lower waste outputs. They are broadly described in terms of combinations of such elements as: type (product vs. process; technological vs organisational); novelty (incremental vs. radical); and systemic nature (end-of-pipe vs. clean tech, Carrillo-Hermosilla et al., 2010; Hellström, 2007). Innovations are not limited to new to the market products or services. We adopt the definition of eco-innovation as "new to the firm" innovations, whether developed internally or adopted from the outside (del Río et al., 2015).

The paper is organised as follows. Section 2 first reviews the literature on absorptive capacity with a focus on low-tech sectors and then it characterizes the elements of the KIBS-client interaction that this study is based upon and that influence absorptive capacity-building. The methodology in Section 3 describes the criteria for sample selection. Section 4 presents the results and an analysis of the findings. A discussion in the final section considers implications for managers and policymakers and directions for future research.

2. Literature Review

2.1 Elements of absorptive capacity

Absorptive capacity underscores a firm's dependence on external knowledge sources for the innovation process. Cohen and Levinthal (1990) define a firm's absorptive capacity as the "ability to recognize the value of new, external information, assimilate it, and apply it to

commercial ends" (p. 128). Three elements of absorptive capacity are highlighted. One is the ability of a firm to recognize new external knowledge – this is exploratory learning. The second is the ability to assimilate or combine new knowledge with existing knowledge or transformative learning. The third is the application of such assimilated knowledge for innovation - exploitative learning (Lane et al., 2006; Zahra and George, 2002). Todorova and Durisin (2007) emphasize the value of external knowledge, arguing that acquisition is not an automatic process. On the one hand, firms may assimilate external knowledge readily if this is 'close' to their own knowledge structures or search zone. On the other hand, they may fail to identify useful knowledge, either because of cognitive biases and rigidities, or because the criteria used for evaluating external knowledge are tied to current market trends and neglect perceived future needs (Todorova and Durisin, 2007; Zahra and George, 2002)

Absorptive capacity has been described as a learning dyad that depends on establishing a match in the relative characteristics of partner firms (Dyer and Singh, 1998). Grönroos and Voima (2013) describe interactions between service providers and their customer as "situations in which the interacting parties are involved in each other's practices" (p. 140). Both partners actively contribute to and influence the outcome of the exchanges occurring in the interaction (Grönroos and Voima, 2013). The interaction between business partners can serve as a route through which knowledge about innovative products and services is exchanged in B2B relations (Dyer and Singh, 1998; Liu and Zhang, 2014; Nyaga et al., 2010). The premise is that B2B interactions have an impact on innovation activity that firms would not be able to generate simply by using their internal capabilities (Dyer and Singh, 1998; Kotabe et al., 2003). The relations of firms across their supply chains can help bridge knowledge gaps such as when confronted with identifying solutions to environmental problems or when co-producing environmental innovations (Paulraj, 2011). In order to exploit linkages with external partners, firms need to mobilize specific capabilities that facilitate the transfer of information and

knowledge (Dyer and Singh, 1998; Kotabe et al., 2003). These absorptive capabilities relate to the knowledge sourcing and assimilation strategies that firms deploy in their interaction with supply chain partners (Kotabe et al., 2003; Vachon and Klassen, 2008).

Following this perspective, the inter-organizational context becomes a key aspect to investigate absorptive capacity-building, in line with the arguments of Dyer and Singh (1998) and others (Knoppen et al., 2011; Lane et al., 2006; Sáenz et al., 2014). Firms have been shown to exploit B2B relations in order to implement environmental solutions and improve their environmental performance (Fraj et a., 2013; Vachon and Klassen, 2008). In this study, we analyse elements of the B2B interaction that facilitate the transfer of knowledge and resources about eco-innovation between the partners (Kotabe et al., 2003). We focus on low-tech firms which unlike those in high tech sectors, undertake little R&D and therefore have limited absorptive capacity (Hirsch-Kreinsen, 2008; Spithoven et al., 2010). Thus low-tech industries are not typically the source of innovative technologies; rather firms rely on obtaining external knowledge about available technologies from third parties and integrating this into their own innovation processes (Hirsch-Kreinsen, 2008; Santamaria et al., 2009; Spithoven et al., 2010).

2.2 The context of absorptive capacity in low-tech firms

Low-tech firms seek to obtain external resources and knowledge to compensate for inherent weaknesses in their innovation capacity and to improve their innovation output (Alvarez and Iske, 2015; Moilanen et al., 2014). They have been shown to exploit external relations as a source of new knowledge and as a means of acquiring resources for development activities (Forsman, 2011). Focussing on the hotel industry, this study explores how low-tech service firms mobilise B2B interactions to compensate for their limited capacity for eco-innovation.

There are several sources of knowledge that firms access through interactions with other firms in the market. A principal source of knowledge about technical innovation for low-tech firms

comes from suppliers (Hervas-Oliver et al., 2011; Hirsch-Kreinsen, 2008). However, they may collaborate with research entities including universities and research centres to support R&D-related activities such as technology road mapping and intelligence (Hervas-Oliver et al., 2011; Maietta, 2015; Spithoven et al., 2010). Studies of the innovation performance of hotels, in particular, have demonstrated the positive influence that external knowledge sources have on the firms' innovation activities, especially in relation to process and marketing innovations. Martínez-Pérez et al., (2019) show that hotels that maintain relations with external agents have greater access to exploratory knowledge, defined as new knowledge which is used to generate new ideas and for problem-solving. These relations are established with diverse actors including such tourism businesses as tour operators, as well as with institutional actors such as universities and other entities offering research and training activities in tourism-related areas (Marco-Lajara et al., 2018). Moreover, Thomas and Wood (2014) working with tourism firms and hotels highlight the importance of networks (of suppliers and other businesses in the value chain) and personalized channels as valuable sources of external knowledge. Nonetheless, hotels require absorptive capacity in order to exploit external knowledge and internalise it into business processes (Marco-Lajara et al., 2018; Martínez-Pérez et al., 2019).

A broad category of business-related knowledge beyond the original emphasis on the appropriation of R&D knowledge is considered relevant to building absorptive capacity for innovation in low-tech industries. This includes knowledge related to managerial practices and production know-how (Lane et al., 2006); and that about the market and the range and quality of products and services (Hervas-Oliver et al., 2015). Knowledge can also be acquired through training and learning-by-doing (Freel, 2016). Low-tech firms generate knowledge inputs for product and process innovations by combining knowledge about existing technologies or by integrating new elements into existing technologies (Alvarez and Iske, 2015; Santamaria et al., 2009). Consultants and other KIBS providers can serve as sources of these different forms of

knowledge. Consultants have been shown to support the development of both product and process innovations in low-tech firms (Santamaria et al., 2009) and can assist their clients in building absorptive capacity within the context of market transactions, as will be discussed in this study.

2.3 Absorptive capacity for eco-innovation

What characteristics of eco-innovations may pose specific challenges to firms and their absorptive capacities? Integrating eco-innovations in core business activities requires firms to develop a long-term vision and commitment towards an environmental strategy, which in turn hinges on the presence of a culture for eco-innovation and an environmental capability (Bossle et al., 2016; Chen et al., 2012). These internal factors together reflect a proactive stance i.e. one where the firm will take the initiative and seize opportunities to develop eco-innovations (Chen et al., 2012).

In practice, eco-innovation in many firms is usually undertaken as a one-off activity, rather than reflecting a long-term commitment (Bossle et al., 2016). Hellström (2007) argues that even in such circumstances, improvements could be considered radical - or as characterized by a high degree of novelty - when they enable a "quantum leap to a higher level of environmental performance" (p. 157) compared to that achieved with incumbent technologies and practices. Additionally, Petruzzelli et al., (2011) note that eco-innovations are often characterised by a higher degree of complexity compared to other innovations, since diverse knowledge bases are required for example, knowledge about how to assimilate eco-innovations in different phases of product lifecycles and processes and about their impact on various operational aspects such as energy and water consumption and waste production. To improve their environmental performance, firms are required to integrate environmentally-relevant knowledge with existing knowledge concerning opportunities for new or improved products and processes (Bossle et al., 2016; Hellstrom, 2007; Vachon and Klassen, 2008). Klewitz et al., (2012) for example,

demonstrate how different levels of external support – obtained mainly from consultancies and local authorities – contribute to building an absorptive capacity for eco-innovation in SMEs, enabling them to integrate knowledge about sustainability practices into their business operations.

Cohen and Levinthal (1990) argue that exploration and exploitation of knowledge constitute the essence of absorptive capacity. Such exploration and exploitation depend upon the firm's receptiveness to environmentally-relevant knowledge, and an ability to assimilate this into its practices and routines (cf Todorova and Durisin, 2007). The present study will consider the interaction between KIBS and their clients, in order to analyze how such a capacity for eco-innovation is developed (Cainelli et al., 2015; Vachon and Klassen, 2008).

2.4 The KIBS-client interaction as a locus for absorptive capacity-building

KIBS-client interactions involve the development and exchange of knowledge. The establishment of *effective* linkages between the firms influences the innovation outcome of their interaction (Miles, 2012; Tether and Tajar, 2008). KIBS interact with the client in the process of delivering a service which is a solution to a problem or challenge faced by the client (den Hertog, 2000; Miles, 2005). The nature of the interaction may range from simply sharing information about needs and expectations, to close co-operation in order to manage tensions and achieve both pre-set and emerging goals.

The service is coproduced, rather than being solely created by the KIBS firm; it is "delivered" through some degree of interaction between the professional service provider and the client. The degree of interaction between KIBS and their clients has been shown to influence the type of knowledge exchanged as well as the level of customisation of products and services developed. Accessing knowledge from a wide pool of external sources enhances exploratory

learning (Ferreras-Méndez et al., 2016). However, the exchange of tacit knowledge becomes more likely as the strength and duration of the ties with the client increases (Landry et al., 2012); and trust is a critical factor in promoting the transfer of this form of knowledge (Hu et al., 2018).

Considerable resources are needed to develop client-specific solutions. KIBS need to have access to a variety of knowledge sources and can establish strong cooperative 'ties' with customers, especially when developing radically new solutions, such as new-to-market innovations (Rodriguez et al., 2017). However, customised solutions are not always easily replicated with different clients. In their analysis of the factors influencing the growth of small KIBS firms in the Veneto region, Cabigiosu and Campagnolo (2019) demonstrate that dedicating resources to develop customised solutions across a broad client base, may limit the positive growth effects that KIBS reap from client-supplier relations. This may influence the type of knowledge exchanged with business partners for the development of innovation and the extent of collaboration between KIBS and their client (Miozzo et al., 2016). As a result, KIBS may need to balance service customisation and standardisation, by managing resource allocation and making careful decisions as to the breadth and scope of collaboration with their clients.

KIBS firms provide expert advice, sharing information and specialist knowledge, and drawing on experience obtained from previous projects (Castaldi et al., 2013; den Hertog, 2000). They deliver valuable knowledge i.e. knowlege which may lead to innovation activities in the client. However, clients also serve as a source of knowledge about new technologies and markets: interaction with the client can be a significant route for KIBS to access valuable intelligence when developing innovative solutions (Rodriguez et al., 2017). Nonetheless, clients are

heterogeneous and need to be equipped with their own internal resources to engage in knowledge transfer for innovation. Based on a study of the characteristics of enterprises procuring KIBS activities in Northern Britain, Freel (2016) indicates that a precondition for innovation-led cooperation with KIBS is the presence of resources that go beyond investments in science and technology and include the availability of skills and expertise and workforce training. Thus, KIBS firms need to recognize their clients' specific needs and gaps in know-how in order to develop solutions - including diagnosis of what the problem is and the location of relevant knowledge (Miles et al., 2019). KIBS may facilitate innovation processes within the client-firms by stimulating access to new sources of information and new ideas and by compensating for or strengthening the client's existing capabilities for innovation (Doloreux and Shearmur, 2013; Miles, 2012; Tether and Tajar, 2008). Alternatively, they may act more as carriers of innovations developed elsewhere, in other firms or industry settings (den Hertog, 2000).

Certain aspects of the KIBS-client interaction have been shown to influence the client's innovation performance. These include the KIBS' proximity to, and frequency of interaction with its client (Muller and Doloreux, 2009). The level of client commitment and trust can also be critical (Eisingerich et al., 2009; Hu et al., 2018). In a study of KIBS operating in the Canadian manufacturing sector, Doloreux and Shearmur (2013) demonstrate that clients utilizing different knowledge sourcing strategies from KIBS experience different innovation outcomes. An unfocused information seeking strategy enabled the implementation of product innovations in the client; whilst targeted knowledge and know-how sourcing strategies resulted in broader innovation outcomes in terms of the range of innovations implementing in the client-firm. These aspects have often been studied independently by taking the perspective of one of the partners in the dyad. This study considers the perspectives of both partners and explores

how two elements of the KIBS-client interaction influence the process of knowledge exchange and absorptive capacity-building. One is the alignment of the partners' goals and objectives (in our case, especially concerning environmental behaviour). Another element is the compatibility of the partners' competencies to implement eco-innovations (Sáenz et al., 2014; Sarkar et al., 2001).

2.4.1 Alignment

Achieving alignment around the goals and objectives of the business interaction is an important element of interorganisational relations. It contributes to building cooperation amongst the partners, and facilitates sharing of information and competences (Dekker, 2004). Alignment may also involve the business partners' receptivity to and agreement on the value of external knowledge sources for innovation, an intrinsic element of absorptive capacity (Todorova and Durisin, 2007).

The degree of cognitive alignment between business partners is likely to influence the direction of search for new information and the way managers interpret and assimilate information within the organisation (Grandinetti, 2011; Nooteboom, 2000). Managers may vary in their perception of opportunities and problem-solving approaches. Helfat and Martin (2015) discuss the role that managers' prior knowledge has in decision-making, referring to how managers rely on familiar 'knowledge structures', be this technology- or industry-specific knowledge and firm-specific experience. Entities sharing cognitive proximity possess 'similar' knowledge bases facilitating knowledge exchange and learning (Boschma, 2005). Physical separation contributes to creating a cognitive distance between managers in KIBS and client-firms that has been shown to influence the mode of service delivery and the stages in the service delivery process in offshoring activities (Mol and Brandl, 2018).

Cognitive alignment denotes how entities develop a 'shared' sense of the world in order to achieve "a common goal" (Nooteboom, 2000:71). Beyond the purely cognitive elements, when discussing strategic alliances, Dekker (2004) characterizes business partners with a 'good fit' as those sharing a similar value system, in terms of what motivates them to perform the task at hand. Alignment of organisational norms and values influences business relations by also encouraging the exchange of skills and competencies that leads to successful execution of a project (Sarkar et al., 2001). In the context of eco-innovation, the sharing of goals and values that shape environmental behaviour in firms may be critical (Fraj et al., 2013). The role of top managers in building an environmental vision and having internal stakeholders committed to the firm's environmental strategy has been shown to facilitate the exploration of opportunities (Chen et al., 2012). The corollary is that partners are 'mis-aligned' when driven by individual opportunism that prevails over a common need or objective. This generates mismatches in both the service provider and the client expectations and understanding of the roles that they need to play in order to implement a product or service solution (Dekker, 2004; Sjödin et al., 2016). Thus, the ways in which KIBS and their clients align objectives about a task at hand and the influences this has on the client's absorptive capacity to acquire and exploit knowledge about eco-innovation, are important topics to consider.

2.4.2 Compatibility within the business interaction

There can be different elements to describing partner compatibility within B2B interactions. Nyaga et al., (2010) point to the need for business partners to develop a level of trust and commitment in buyer-supplier relations. In his study of professional services, Tordoir (1995) presupposes that only business partners having certain internal professional 'capacity' can adequately appropriate external professional services. This is congruent with the business partners sharing a level of similarity in their capabilities and competencies which has been

shown to enhance the quality of B2B relations in terms of increasing the efficiency of project execution (Sarkar et al., 2001). Different from resources that refer to the firm's tangible and intangible assets, competencies describe how a firms utilises its resources to develop organisational processes and routines to implement environmental strategies (del Río et al., 2016). Competencies can include the firms' technical capabilities, management skills and organisational capacity and how these are deployed to acquire new information and assimilate it within the organisation (Sarkar et al., 2001).

The above perspectives could underpin strategic elements such as the partner firms' openness to knowledge and learning about environmental practices that could influence absorptive capacity (Liu and Zhang, 2014). Due to their professional competencies and experience, KIBS are likely to take the lead in managing knowledge and competencies for innovation (Aarikka-Stenroos and Jaakkola, 2012). However, the competencies of the client may also influence knowledge exchanges with KIBS (Freel, 2016). For example Sjøholt (2001), interviewing both transnational consultancy firms and their clients in Norway, concluded that more sophisticated clients (those that had already accumulated knowledge helping them to absorb service inputs) learned most from, and made most effective use of KIBS.

In B2B interactions, partners need to become familiar with each other's knowledge base, establishing "who knows what", in order to be able to leverage similar assets (Dyer and Singh, 1998: 665). KIBS transfer knowledge to the client by integrating knowledge from different domains in order to deliver innovative solutions, thus creating value for the client (Pina and Tether, 2016). In so doing, KIBS bridge between the generic knowledge pool, represented as different stocks of knowledge and the specific context of the client. Similarly, KIBS can de-contextualize knowledge and the experience accumulated from a particular project with one client to develop new products with a new client. Potentially, these aspects of KIBS

intervention support the assimilation and exploitation of external knowledge by the client-firm, enhancing its absorptive capacity. However, absorptive capacity also rests on the client's capability to integrate external knowledge with internal capabilities to implement innovative solutions. Thus client-firms possessing internal capabilities - technical and organisational capabilities for eco-innovation - are better able at mobilising resources and learning from interaction with their business partner (Hofmann et al., 2012).

Another aspect is the business partners' organisational capacity to implement eco-innovations (Sáenz et al., 2014; Sarkar et al., 2001). Management support for issues around corporate social responsibility and sustainability more generally, which are reflected in the firm's environmental culture, can help build organisational capabilities for eco-innovation (Fraj et al., 2013; Hofmann et al., 2012). By investing in human resources through training programmes and fostering career development, managers stimulate employees to explore and pursue environmental solutions and integrate these into organisational practices (Chen et al., 2012; Fraj et al., 2013). This organisational capacity contributes to generating a proactive behaviour towards eco-innovation and can influence the extent to which firms establish relations with other environmentally-responsible business suppliers and transform environmental values into specific actions (Fraj et al., 2013; Liu and Zhang, 2014; Pace, 2016).

Based on the above review, this study focuses on the extent to which partner alignment and compatibility influence the process of knowledge exchange between KIBS and their clients and contribute to absorptive capacity-building.

3.0 Methodology

Investigating absorptive capacity requires to assess how firms capture value from external knowledge sources for their own business processes. In practice, this can be achieved by employing different methodological approaches. A quantitative approach typically relies on

the analysis of large-scale data that link absorptive capacity to specific measures of (eco-) innovation activity and business performance more generally (Freel, 2016; Harris and Yan, 2018). Alternatively, a qualitative analysis, such as that used in this study, focuses on collecting observations and developing descriptions about the processes through which firms incorporate external knowledge into their own practices and operations and develop absorptive capacities for eco-innovation. In this study, an interpretive approach was undertaken to obtain rich descriptions about the elements characterising the KIBS-client interaction through the lens of both the service provider and the client and how these influence absorptive capacity for eco-innovation (Miles et al., 2014). With interaction a key focus for the study, matched pairs of KIBS and clients, within a given sector or industry, were sought. We focussed on the interaction between engineering consulting firms and tourism accommodation establishments and elaborate below on the motivations for selecting this sampling frame.

3.1 The client: tourism accommodation establishments

As major tourism actors, accommodation establishments, in particular hotels, require inputs of both natural resources (water and energy) as well as other materials in the form of food and beverages, cleaning products etc. and generate such outputs as waste and emissions (Della Volpi and Paulino, 2018). Hotels were considered a valid unit of analysis for a number of reasons. First, the activities within hotels can have a significant impact on natural resource use (Molina-Azorin et al., 2009); and through the management of these activities, hotels can help preserve a destination's natural resources. Second, adopting environmental practices can be a means for hotels to reduce their operational costs and improve performance thus providing a source of competitive advantage (Molina-Azorin et al., 2009; Orfila-Sintes and Mattsson, 2009). The Mediterranean island of Malta is a convenient research setting, due to the island's thriving tourism industry and the authors' knowledge of the local context.

The selection of hotels was based on two main criteria concerning their environmental behaviour. The first required the hotels to have adopted a national eco-certification, recognized by the Global Sustainable Tourism Council, which assesses the hotel's environmental performance based on key criteria including energy consumption, water and waste management, and community engagement in sustainability initiatives. The second was that the hotels had adopted innovative environmental measures thus providing cases for the study. The empirical data showed that these innovations were mainly in energy and water technologies and management practices.

Firm size is known to influence environmental behaviour (de Marchi and Grandinetti, 2013), but this was not controlled for a priori: the 16 hotels sampled spanned a range of different sizes. There was also variance in ownership structure, with the high-range hotels including principally subsidiaries of multi-national groups. Appendix A provides an overview of the hotels' profiles and competencies for eco-innovation.

3.2 KIBS: engineering and environmental services firms

Given the aim of studying KIBS that functioned as sources of environmentally-relevant knowledge, we focused on engineering and environmental services firms. These are classified within the environmental goods and services (EGS) sector supplying activities that limit or prevent environmental damage and that contribute to more efficient use of natural resources (Eurostat, 2016). This sector is diverse in the type of economic activities supported. It includes firms that exclusively provide environmental services such as designing environmental projects, risk and impact assessment, and the management of resources including water and energy. Some firms are not purely "environmentally-oriented", while supplying combinations of environmental, architectural and engineering services that support activities linked to environmental protection and resource management such as environmental certification

processes. The diversity of economic activities in the EGS sector makes it somewhat problematic to map these to corresponding industry sectors. Generally, providers of environmental-related services are included within the NACErev2[1] divisions M71, architectural and engineering activities, and M74, other professional, scientific and technical activities (Eurostat, 2016).

The 14 engineering consulting firms selected for this study were nominated by the corresponding hotel-clients. In Appendix B, the profile of the firms is summarised, including the market orientation and competencies for eco-innovation. The firms' profiles showed them to constitute a mixed sample. Eight (E1-E8) were environmental services firms - specialised in the provision of environmental management solutions. The other six (E9-E14) were building services engineering firms which specialised in architectural and engineering activities including the design and implementation of the facilities servicing the building (heating, ventilation and air conditioning, HVAC systems), and incorporating environmental management as part of their portfolio of services.

3.3 Data Collection

The study involved selecting pairs of KIBS and clients that were actively engaged in a business relation. This purposive sampling approach enables study of "matched dyads" of knowledge service providers and buyers (Nyaga et al., 2010). The hotels were asked to nominate engineering consulting firm(s) which they contracted to oversee the 'facilities management' function involving regular and continuous inspection and monitoring of operations; or which they specifically engaged to implement environmental management services.

[1] NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities.

The respondents selected for the semi-structured interviews were managers or directors from both sides of the KIBS-client interaction who were directly involved in implementing eco-innovations. The use of key informants, based on the informant's position in the organisation, was considered the best way to obtain specialist and practical knowledge about absorptive capacity-building (Bagozzi et al., 1991). 32 face-to-face semi-structured interviews, of average duration 50 minutes, were conducted with senior partners and directors in 14 engineering consulting firms and with general managers/directors or technical managers in 16 hotels. In two of the hotels (H2 and H12), interviews were organized with both the general manager and technical manager of the hotel.

The interview questions for the KIBS and the hotels broadly covered similar themes. The interviewees were asked to share their experiences about the implementation of environmental technologies and practices. They were asked about the decision-making process involved in the adoption of such innovations, and the managers' level of expertise and knowledge and how this developed within the firm; as well as the partners' respective roles in delivering environmental solutions.

Obtaining responses from both sides of the KIBS-client dyad and from matched-pairs assured the validity of the data and enabled us to triangulate key observations about absorptive capacity for eco-innovation (Berg, 2007). Furthermore, we utilised online information and documents about environmental initiatives implemented by the sampled firms to corroborate data obtained from the interviews about environmental behaviour.

3.4 Data analysis

Firstly, for the thematic analysis, the principal dimensions characterizing the KIBS-client interaction were derived from the literature reviewed in Section 2 and enriched with themes from the interview data (Miles et al., 2014). For 'alignment', themes relating to the objectives

and motives for implementing eco-innovations were identified across the matched dyads. For 'compatibility', aspects linked to the partners' competencies and capabilities to implement eco-innovations were identified. Secondly, by matching the data from KIBS with data from the corresponding hotel-clients, we sought to obtain a comprehensive analysis about how these two aspects of the KIBS-client interaction influence absorptive capacity-building. Finally, by looking across the dyads, we attempted to identify different patterns of KIBS-client interactions (Berg, 2007; Miles et al., 2014). This interpretive phase forms the basis of the findings and analysis in the next section.

4.0 Findings & Analysis

The business interactions investigated between the engineering consulting firms and hotel-clients concerned the provision of environmental and engineering services, focussing on aspects related to energy saving and management, renewable energies and the management of water supplies. Table 1 identifies key elements of partner alignment and compatibility that influence the KIBS-client interaction; these are discussed in the sections that follow. The scope of the interaction ranged from the diagnosis and provision of pre-packaged solutions (such as for monitoring energy consumption patterns and implementing waste management strategies), to problem-solving and collaboration that often involved the co-production of environmental solutions. As seen in Table 1, there were several instances where the same hotel was connected with different engineering consulting firms.

- {insert Table 1 about here}

The findings indicate a range of environmental behaviour in the hotel-clients based on an assessment of their environmental profile and competencies for eco-innovation (refer to Appendix A). The hotels with proactive environmental behaviours have a well-developed environmental profile in terms of internal technical and organisational competences to

implement eco-innovations; these are mainly mid- and high-range establishments. Hotels with reactive environmental behaviours (low-range type) generally lack specific environmental measures and possess limited competencies for eco-innovation. We focus our analysis on understanding how the hotel-clients mobilise elements of their interaction with KIBS to exchange knowledge about eco-innovation.

4.1 Partner alignment around environmental objectives

The findings reveal strategic, economic and functional objectives to be shaping environmental behaviour. Table 2 illustrates how these dimensions were derived from the interview data and provides interview excerpts that exemplify the key informants' perceptions for each of these three dimensions. Achieving alignment along one or more of these different dimensions can influence the outcome of a business interaction and, largely determines the extent to which the partners' expectations from the interaction are fulfilled.

- {insert Table 2 about here}

4.1.1 Strategic alignment

One aspect of alignment is the firms' shared understanding about the strategic value of adopting an environmental behaviour. For the hotel-client, this may be linked to delivering an environmental standard as part of its corporate sustainability image or to conform to the national eco-certification scheme – refer to interview excerpts from the H12-E9 dyad in Table 2. Partner alignment along strategic objectives has a positive influence on eliciting an open search or exploration of environmentally-relevant knowledge by the client. The client (mainly the high-range hotel type) is apt to explore opportunities to tap into the KIBS specialist knowledge and exploit this in order to develop innovative environmental solutions. The technical manager of a high-range hotel explained how:

> "*We collaborated with an engineering firm to install a prototype system whereby treated water from our sewage treatment plant is purified to potable water standards. We were also in contact with a German company that provided specialised membranes for water purification; and the health department monitored the water quality to check it was of the required standard. The results seem to be encouraging*." (H12)

KIBS firms with a mission to deliver environmental management solutions, mainly interact with hotel-clients that share similar strategic objectives about environmental behaviour. These are mainly environmental service firms (E1-E8) and a sub-group of building services engineers (E9-E11). The development of innovative environmental services is often discussed in the contract negotiation stage such as for new building developments or refurbishment projects, as described by the senior partner of an environmental service firm:

> "*We approach clients whom we know are preparing tender documents for a new development, to gauge their interest in sustainable design, low carbon features etc……We involve the* [hotel] *directors in visioning workshops and negotiate with them when discussing the feasibility of* [environmental] *projects*." (E9)

Strategic alignment enables the KIBS firms to identify the client's needs and expectations in the early stages of the service delivery process. This is more likely to enhance the assimilation and exploration of specialist knowledge in the hotel-client and the development of customized environmental solutions.

4.1.2 Economic alignment

A second aspect of alignment common across the range of firms sampled involves maximizing the economic benefits from implementing environmental measures. The hotel sector is highly competitive and largely driven by pricing strategies and narrow profit margins. Mid- to high-range hotels link sustainability and environmental behaviour to a competitive advantage

(Molina-Azorin et al., 2009). They demonstrate an enhanced ability to assimilate environmentally-relevant knowledge, driven by a motivation to improve resource efficiency in their operations and increase profit margins – refer to illustrative quotes from the H4-E11 dyad in Table 2.

However, achieving alignment solely along the economic dimension affords for a narrower range of exploration of environmental solutions, compared to when partners are aligned along strategic objectives. In such instances, environmental behaviour is often limited to one-off activities aimed at substituting existing equipment with resource-efficient alternatives that reduce cost margins. The senior partner of an engineering consulting firm explained that:

> "*Energy efficiency is not a topic that we discuss regularly during routine monitoring of the* [hotel facilities]. *For example, the* [hotel-]*client will discuss with us fuel cost in a particular month and if this is high, the manager will tell me: let's look into this. We then need to see how to cut down on fuel cost which is essentially about cutting down on energy consumption*." (E12)

From the KIBS perspective, the range of potential interventions is limited to instances where the client, mainly the low-range hotel category, provides specifications for the introduction of these interventions during routine monitoring and maintenance of the hotel's operations.

4.1.3 Functional alignment

A third element of alignment is functional, concerned with achieving technical improvements in the service delivery process. This dimension requires business partners to identify and assimilate technical solutions for improving the efficiency of the service or modifying or replacing equipment that enable aspects of service delivery. Interview excerpts from the H8-E14 dyad in Table 2 are illustrative of functional alignment. Functional aspects of

environmental practices are perceived with different levels of importance by the partners. An example is reference to the use of "smart technologies" such as building management and smart refrigeration systems for remote monitoring of resource consumption, which represent an improvement over manual 'switch-on and switch-off' operations. Yet, the director of an environmental services firm claimed that:

> "*The technical manager* [in the hotel] *has a system that he knows how to run and he is getting into a situation where he might have to install and work with a new system and new equipment that may need more attention and maintenance. So normally many, not all, technical managers do not show much enthusiasm - they resist change.*" (E2)

Misalignments may arise along the functional and economic dimensions that inhibit the client's capacity to assimilate and exploit environmentally-relevant knowledge for innovation. The owner of an environmental services firm explained how such misalignments may arise:

> "*Most chillers run at low efficiency and would need replacement in order to half the* [energy] *consumption in the hotel. However, hotels spend double to install photovoltaic systems rather than replacing inefficient chillers because they can get funding for the PV. My view is that first hotels need to install efficient equipment and then invest in renewables*." (E1)

The engineering firms maintain links with different levels of management within the hotel-client - in our study, with top managers (directors and general managers) and technical staff (technical managers). The commitment of the client's top management appears crucial in aligning the firm's strategic and economic goals about environmental behaviour with the services provided by the KIBS firms. Strategic alignment is more likely to accelerate the learning process within the client-firm, and to enhance exploitation of specialist knowledge about eco-innovation. The engineering firms also interact with the client's technical staff along

the functional dimension in order to exchange knowledge about innovative technological applications as well as in organisational aspects e.g. those related to implementing an environmental management strategy.

4.2 Partner compatibility

We explored the compatibility of business partners in terms of the level of similarity of their resources and competencies to implement eco-innovation. Developing an absorptive capacity for eco-innovation requires the client-firm to source and exploit broad types of resources and competencies. As indicated in Table 1, the findings demonstrate that these include technical resources about the implementation of innovative technological systems; organisational competencies about the implementation of innovative environmental practices (e.g. environmental management strategies and corporate social responsibility programmes) and management support. Table 3 illustrates how these aspects of compatibility were derived from the interview data.

- {insert Table 3 about here}

4.2.1 Developing competencies for eco-innovation

Environment-related information derives from diverse knowledge-bases related to engineering and architecture, design and environmental management. 12 of the group of 14 engineering firms sampled were members of professional networks where information and expertise about eco-innovations is exchanged (refer to Appendix B). 10 of the engineering firms claimed that their managers underwent formal training on environment and energy standards, as well as on-the-job training about innovative technology applications such as on building energy simulation models and eco-design modelling.

Integrating eco-innovations in the hotel-client involves making various modifications in operational activities. These include improvements in routine operations and engineering activities (such as in the heating and ventilation systems). Broader organisational practices related to awareness raising and training amongst employees are also significant. These included new organization of management responsibilities in the back-office around achieving environmental targets (e.g. for waste reduction and energy and water consumption – refer to interview excerpts from the H7-E12 dyad in Table 3).

13 out of the 16 hotels sampled (principally mid- and high-range hotels) provided training opportunities for technical staff on environmental management systems and standards. However, much of the environmentally-relevant competence in the hotel-client is obtained on the job through a learning-by-doing approach. Thus, the environmental behaviour of the hotel-clients relates to the capabilities of managers for learning and innovation. These include their openness to explore external opportunities for eco-innovation, as well as to problem-solving around environmental issues that enhance absorptive capacity. The technical manager of a mid-range hotel explains that:

> "*In my previous job, I felt that the director was less ready to invest; and the job became too much of a routine, of doing the same thing. So I moved on.* [In the current hotel], *the Directors push for new projects to be implemented and are keen on making new investments which makes my job more dynamic and interesting. We have always had very good feedback from the Directors regarding investments in energy conservation and the staff is more motivated to work*." (H5)

As illustrated above, the role of the top management in supporting environmental behaviour enhances the opportunities of the technical staff to come forward with proposals to implement environmental practices. This openness to exploring environmental solutions and to problem-

solving increases the compatibility of technical competencies between the client with the engineering firms and facilitates the exchange of technical knowledge about environmental solutions - Table 3 provides illustrative quotations from the H14-E1 dyad. Low-range and a portion of mid-range hotels, however, tend to be reactive when it comes to environmental behaviour. In part this is because of restricted resources (mainly of qualified personnel). Technical managers are less inclined to explore environmental solutions and to assimilate the learning about eco-innovation from engineering consulting firms. Lack of an environmental vision and support from the top management for implementing environmental practices leads to low-range hotels implementing environmental solutions as one-off activities. This could also have an impact on their environmental performance in the longer term.

4.2.2 Deploying competencies for eco-innovation

In the group of engineering firms sampled, environmental service firms (E1-E8) take up the role of facilitating innovation in hotel-clients with proactive environmental behaviour. An environmentally proactive client is better equipped with competencies to exploit KIBS' specialist knowledge to implement eco-innovations. Shared problem-solving and experimentation are conducive to the co-production of innovations and to mobilising client's internal technical and organisational competencies as well as the skills and capabilities of KIBS firms. A hotel owner described the process that went into designing a new hotel:

> "*I put together a team consisting of an international architectural firm, engineering and landscape consultants, interior designers, in what was really a collaborative approach to design resource conservation measures for the* [new] *hotel*." (H12)

Building services engineering firms (E9-E14) mainly function as carriers of eco-innovation in providing general environmental management support to their clients (a range of both high- and low-range hotels). This support involves assimilating knowledge about compliance with

environmental regulations such as on energy and waste management criteria and with implementing the national eco-certification scheme – refer to interview excerpts from the H3-E13 dyad in Table 3. A sub-group of innovative building services engineering firms (E9-E11) are apt to explore innovative technology applications, such as energy simulation models and eco-design methods, and to integrate these into engineering and architectural services. These services are implemented in collaboration with clients that develop technical and organisational competences to assimilate and exploit the engineering firms' knowledge in order to develop environmental solutions.

Hotels with limited internal technical and organisational capacity are dependent on the KIBS firms for sourcing specialist knowledge and competencies. Building services engineering firms consider this type of client, mainly low-range hotels, to lack the competencies needed to assimilate environmentally-relevant knowledge into their operations leaving a narrow corridor for potential intervention. The senior partner in an engineering firm explains how:

> "*Some* [hotels] *would not normally have access to technologies for energy conservation or renewable energy technologies. They may not have the knowledge…. or they do their own thing without perhaps worrying about or thinking about energy consumption.* [We] *are specialized in this field and therefore we can do the job quicker, cheaper and better; we have the expertise to do just this in fact.*" (E12)

Management capabilities are deployed to support these clients in more practical aspects of implementing environment-related projects, such as obtaining funding support for the installation of renewable energy systems and fulfilling permitting requirements. The findings however demonstrate instances where KIBS interact with clients with limited technical capacity for eco-innovation (these were mid-range hotels), but which share similar strategic and functional objectives about environmental behaviour. In such instances (e.g. H8-E14 and

H7-E12 dyads in Table 1), building services KIBS develop skills to support the client's innovation process, compensating for the client's lack of technical competencies and enhancing the client's exploration and assimilation of environmentally-relevant knowledge.

4.3 An analysis of B2B interactions and their influence on absorptive capacity-building

The findings concerning business partner alignment and compatibility point to further understanding how B2B interactions influence absorptive capacity for eco-innovation. Figure 1 links these partner attributes with the three dimensions of absorptive capacity, that refer to the exploration, assimilation and exploitation of environmentally-relevant knowledge. The model identifies combinations of partner attributes that give rise to different patterns of interaction between KIBS and client-firms.

- {insert Figure 1 about here}

Exploration of environmentally-relevant knowledge is contingent on the relative perspectives of the partners about environmental behaviour. Strategic alignment about environmental objectives impacts positively on the client's openness to exploring innovative environmental solutions which is a key element in developing an absorptive capacity for eco-innovation. In such instances, the KIBS-client interactions are highly collaborative and often characterized by the co-creation of eco-innovations, mainly involving environmental services firms and proactive clients.

When partner alignment is based mainly on identifying functional improvements and economic gains from environmental performance, this results in a narrower search for environmental solutions and limits the exchange of knowledge between the client and KIBS firms. In such cases, the client (low and higher-rated hotels) engages in cooperative interactions with both

building engineering services and environmental services firms. In the interaction, the client may assimilate specialist knowledge from KIBS to implement incremental improvements in operational efficiency rather than redeploy resources from core operations to develop innovative environmental solutions. Although the search for eco-innovations is limited in scope, the client effectively assimilates specialist knowledge, such as that relevant to upgrading water and energy management systems, into its own operations.

Assimilating and exploiting knowledge for innovation requires the client to invest significant resources for reorienting staff responsibilities and for managing the interaction with KIBS firms. This implies that absorptive capacity hinges on the compatibility of the partners' technical and organisational competencies and skills to implement eco-innovations. When the competencies of the client do not match those in the KIBS firms (mainly the case for low-range hotels), the client is unlikely to achieve significant improvements in environmental performance through interaction with the KIBS. The KIBS firms in question (building engineering services in our study) compensate for the client's limited absorptive capacity, by providing advice and support on the performance of environmental technologies during the course of more routine services.

5.0 Discussion & Conclusions

This study investigated how B2B interactions are mobilised to build absorptive capacity for eco-innovation. A dyadic perspective on the interaction is developed, considering the perspectives of both KIBS and their clients in order to obtain deeper insights about how elements of the interaction influence the client's absorptive capacity. These elements include the alignment of the partners' objectives around environmental behaviour, and the compatibility of the partners' resources and competencies to implement eco-innovations.

The context of a low-tech service sector, that of the hotel sector in the tourism industry, presents a number of specificities: clients tend to be more reliant on external sources of knowledge about environmental practices. In this study, KIBS were found to bridge gaps in basic knowledge about eco-innovations and to facilitate knowledge transfer about innovative solutions. In practice, the interaction with KIBS supports the client in dealing with the complexity associated with adopting eco-innovations related to the broad knowledge base needed to integrate these innovations into different aspects of the firm, including operational processes, new management approaches and organisational practices (Chen et al., 2012; Hellström, 2007). In addition, the client's absorptive capacity determines the extent to which the firm integrates this knowledge into different aspects of its operations and routines; whilst generally lacking internal capacity to develop innovative technologies itself.

5.1 Building absorptive capacity for eco-innovation: the role of partner alignment and compatibility

Adding to previous literature concerning structural and organisational influences on firms' environmental performance, this study has considered how specific characteristics of business interactions influence absorptive capacity for eco-innovation. Our findings support arguments that both partners actively contribute to shaping knowledge exchanges about eco-innovation in a B2B interaction (Knoppen et al., 2011; Lane et al., 2006). The study demonstrates that the synergistic combination of attributes of the business partners – in this case, partner alignment and compatibility - has an impact on absorptive capacity-building for eco-innovation in the studied sample (Dyer and Singh, 1998; Grönroos and Voima, 2013; Kotabe et al., 2003). It builds on Dyer and Singh (1998) who consider absorptive capacity as more than a sum of the features of the two firms and adds relevance to the notion that fostering business partnerships in the supply chain can be a route to building absorptive capacity for eco-innovation. In these instances, it means identifying compatibility between business partners that in turn influences

the pattern of client interaction with KIBS firms (Aarikka-Stenroos and Jaakkola, 2012; den Hertog, 2000; Miles et al., 2019). Thus, whereas partner compatibility may be inherent in the interaction, it needs to be managed by the firms in order to achieve goals for environmental behaviour.

The literatures on innovation in services, and on the roles of KIBS, consider partner attributes as central to influencing the KIBS-client interaction; they address, for the most part, how complementary knowledge and resources affect innovation output or performance in the client and KIBS firms (Ferreras-Méndez et al., 2016; Lane et al., 2006; Rodriguez et al., 2017). However, the role of partner characteristics in influencing the client's absorptive capacity-building is an aspect that has not gained sufficient attention in the context of research on eco-innovation. The study contributes to further deconstructing the elements of the KIBS-client interaction that influence absorptive capacity. It demonstrates how combined elements of the KIBS-client relation give rise to different interaction patterns; which in turn have an impact on absorptive capacity-building for eco-innovation. The KIBS-client interactions are characterised by alignment along multiple objectives, since there are different perceptions about the relevance of environmental behaviour. Strategic and functional alignment of partners with shared competencies for eco-innovations results in collaborative interactions that enable both partners to expand their range of competencies in environmental practices. In the B2B interactions investigated in the sample, partner alignment along strategic objectives and resource compatibility have a positive influence on enhancing exploratory learning and absorptive capacity. The findings also indicate that clients with limited inherent competencies for eco-innovation are able to engage in cooperative interactions with KIBS if there is strategic and functional alignment of the partners' goals around environmental behaviour. In these cases, KIBS support the client by facilitating access to specialist knowledge related to identifying innovative technological opportunities which is assimilated in the firm to improve operational

efficiency. The findings confirm the key role played by top managers in seeking to achieve strategic alignments and in mobilizing inhouse resources to implement environmental behaviour in collaboration with KIBS firms.

Compatibility of the partners' competencies and resources for eco-innovation is critical in shifting the locus of the KIBS-client interaction - from simply assimilating knowledge in order to implement improvements in resource efficiency, to engaging in exploitative learning (Todorova and Durisin, 2007) that translates into innovative environmental behaviour. Following from Vachon and Klassen (2008), the findings show that clients with internal technical and organisational competencies to implement eco-innovations are able to assimilate and exploit specialised knowledge to develop eco-innovations. Nonetheless, it takes significant internal resources for clients to learn to exploit expert knowledge for innovation (Fraj et al., 2013; Freel, 2016). Indeed, not all clients are equally equipped with these resources, and structural issues (related to size, human resources, training, and environmental orientation) limit capacity-building. A low absorptive capacity, characterized by a focus on economic gains from environmental behaviour over strategic and functional elements of the interaction, limits the client's exploration and assimilation of expert knowledge. KIBS help compensate for the client's limited absorptive capacity and support the client by sharing information in other aspects such as management of a project and compliance to environmental regulations.

5.2 Implications for managers and policy-makers

The business partnerships investigated in this study involved managers from both the client and KIBS firms who were dealing with various aspects of implementing operational and management efficiency – their activities and interactions were not dedicated solely to eco-innovation adoption. The practical implication of the conceptual approach applied in the case investigated in this study indicates that, in order to better harness the benefits of B2B relations

for eco-innovation, managers on both sides of the dyad should seek to better align their internal competencies as well as their strategic and functional orientations for adopting environmental measures. Firms on both sides can prioritize those B2B relations that support absorptive capacity-building for eco-innovation. This means them being more selective, identifying partners from whom they can accrue larger potential benefits in terms of accessing relevant resources and competencies.

Managers in client-firms play a particularly pivotal role in fostering interactions with business partners. By paying greater attention to the choice of partnerships, based on signalling more strategic alignments, they may be better able to recognize opportunities for learning about eco-innovation. In particular, hotel managers may need to focus on particular elements of absorptive capacity, to address specific weaknesses or gaps in the firm's capabilities for eco-innovation, such as exploring innovation possibilities or assimilating environmentally-relevant knowledge within business operations (to stimulate transformative learning).

This study focused on technical managers in hotel services with responsibility for overseeing the operations and on top managers (directors and general managers) occupying a strategic position in decision-making about environmental behaviour. Technical managers are typically dedicated to routine business operations in their interaction with KIBS and need to be encouraged to engage with business partners on aspects of environmental management that go beyond sourcing information about eco-efficiency to exploring opportunities to implement innovative environmental management practices in hotel services. This could be achieved by providing incentives to managers to explore opportunities for eco-innovation taken outside of day-to-day functions, including through engagement with external partners. Moreover, there need to be formal channels through which technicians and engineers are involved in strategic decisions about the adoption of environmental innovations such as when designing new-development and refurbishment projects. These mechanisms would help to better align the

client-firm's environmental orientation with the firm's internal capabilities and resources to implement environmental practices. They could also serve to identify resource gaps and assist managers in recognizing the value of business partnerships based on immediate resource needs for eco-innovation.

In turn, as KIBS firms give attention to the development of environmentally-related services, they must develop not only technical capabilities to implement eco-solutions but also identify new approaches to marketing these solutions as part of the portfolio of services they offer. KIBS provide different levels of support for eco-innovation, and developing client solutions can involve a considerable investment of resources. They need to manage resources strategically, by balancing the depth and level of engagement with the client, such as in deciding how far to deliver client-specific solutions or more standardized services (Cabigiosu and Campagnolo, 2019; Ferreras-Méndez et al., 2016).

There are also policy implications of this analysis. Currently, policies that stimulate eco-innovation adoption are mainly either supply-side measures, aimed at supporting the adoption of eco-technologies, such as through the provision of grants, or diagnostic measures that aim to generate useful information about resource efficiency, such as through the implementation of an environmental audit. At the firm level, policies could target hotels with a low innovation capacity, such as by supporting training for managers on relevant approaches to testing and validating eco-technologies. By developing internal capabilities, hotels (and low-tech firms more generally) develop enhanced absorptive capacities, becoming better equipped to engage in cooperative relations with supply-chain partners on eco-innovation initiatives. Furthermore, since specialised knowledge about eco-innovative solutions may not be readily accessible to many hotels, policy measures could support cooperation with suitable knowledge sources and external partners from which low-tech services such as hotels could reap benefit.

At a sectoral level, policies could foster collaborations that are likely to have a significant impact on enabling a transition to eco-innovation in a low-tech sector. This could be achieved, for example, by designing cluster policies that promote specific collaborations amongst hotels and business partners around new-to-market innovations, rather than distributing resources across a broad range of eco-innovation initiatives that are unlikely to have more than a minimal impact on capacity-building in the sector.

5.3 Limitations and areas for further research

The empirical study reveals interesting associations about eco-innovation adoption and the interaction of knowledge intensive business service providers with their clients. Several limitations should be noted, however. Our results may be highly contingent on the specific context of the study, both in terms of the selection of the B2B interaction as well as the focus on particular elements of this interaction (Hofmann et al., 2012; Vachon and Klassen, 2008). Moreover, the small sample size, and the focus on specific aspects of eco-innovation, principally these were innovations in business operations and practices, limit the inferences drawn from this empirical study to a similar context of a low-tech sector implementing process innovations. Further study, involving different types of firm structure and ownership and that considers distinct cultural and policy contexts, is certainly in order. We expect partner attributes to influence absorptive capacity in different types of B2B relations; and a broader analytical lens that considers a range of service sectors and firm-relations in the supply chain could shed light on absorptive capacity-building for eco-innovation in services more generally.

Many avenues for further research are suggested by the findings of this study. Further dimensions of B2B interactions in the context of absorptive capacity-building for eco-innovation is one topic that deserves further pursuit. One such is investigating the complementarity of partner resources and therefore the unique skills and assets that each

partner brings to the interaction that may be influencing absorptive capacity-building. Another is understanding how the level of commitment characterizing these interactions and their duration influence knowledge exchange. Multivariate analysis, using a larger sample and controlling for firm size and sector, would allow us to examine multiple dimensions of B2B interactions, and to assess their impacts on absorptive capacity-building for eco-innovation. In particular, such analysis could identify those elements of B2B interactions that have most significant (positive or negative) impacts on absorptive capacity. For example, a quantitative approach could shed further light on the significance of our finding that client-firms with low internal capacity for innovation, are able to engage in collaborative relations with KIBS when the partners are aligned in terms of functional motives, and that such relations have a positive influence on enhancing the client's absorptive capacity.

In the present study we made no distinction between degree of novelty of eco-innovations; our analysis focussed on the characteristics of B2B interactions and how these influence absorptive capacity-building. Future research could evaluate the influence of B2B interactions on the adoption of different types of eco-innovations, distinguishing in particular between incremental innovations and radical (and/or between new-to-firm and new-to-market) innovations.

The contribution of KIBS to more sustainable business practices is a topic of great practical significance. Our focus on environmental engineering and related services could be complemented by examination of a wide range of other business services - R&D services, waste management services, training, and others that could be making meaningful contributions. Furthermore, interactions with other stakeholder groups, including equipment suppliers, may be important for capacity-building. Business relationships may be more than dyadic, and large projects often involve numerous partners. The addition of partners may aid - or problematise - knowledge exchanges and fruitful working arrangements. Study of how such interchanges are best managed for eco-innovation would be valuable. It would also be relevant

to analyse the mechanisms through which firms use experiences from previous business interactions to recognize and exploit the value of environmentally-relevant knowledge when establishing new partnerships.

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Table 1: Findings on partner alignment and compatibility from the Matched Pairs of Hotel-clients (H) and Engineering Consulting Firms (E)

Matched Pairs	Alignment			Compatibility		
	Strategic	Economic	Functional	Technical competences	Organisational competences	Management support
H1-E12*		x				x
H2-E10		x	x			x
H2-E12		x				x
H3-E13		x				x
H4-E11		x		x		
H4-E12		x		x		
H5-E8		x	x		x	
H5-E12		x		x		x
H6-E5		x		x		x
H6-E7		x	x	x	x	
H6-E10		x	x	x	x	
H7-E12		x	x		x	x
H8-E14	x	x	x			x
H9-E13		x	x	x		
H10-E12		x	x	x	x	
H11-E12		x	x	x		
H12-E1		x		x		
H12-E3		x	x	x		
H12-E4		x		x		
H12-E8	x	x	x	x	x	
H12-E9	x	x	x	x	x	
H12-E10	x	x	x	x	x	
H12-E11		x	x	x		
H12-E13		x	x	x		
H13-E13		x	x	x		x
H14-E1	x	x	x	x	x	
H14-E3	x	x		x		
H14-E4		x	x	x		
H14-E5		x		x		x
H14-E6		x		x		
H14-E8		x	x	x	x	
H14-E9	x	x		x	x	
H15-E2		x	x	x		

H15-E4		x	x	x		
H15-E9	x	x	x	x	x	
H15-E11		x	x	x		
H16-E5		x	x	x		x
H16-E8		x	x	x	x	
H16-E9	x	x		x		

*H: hotel (code); E: engineering consulting firm (code).

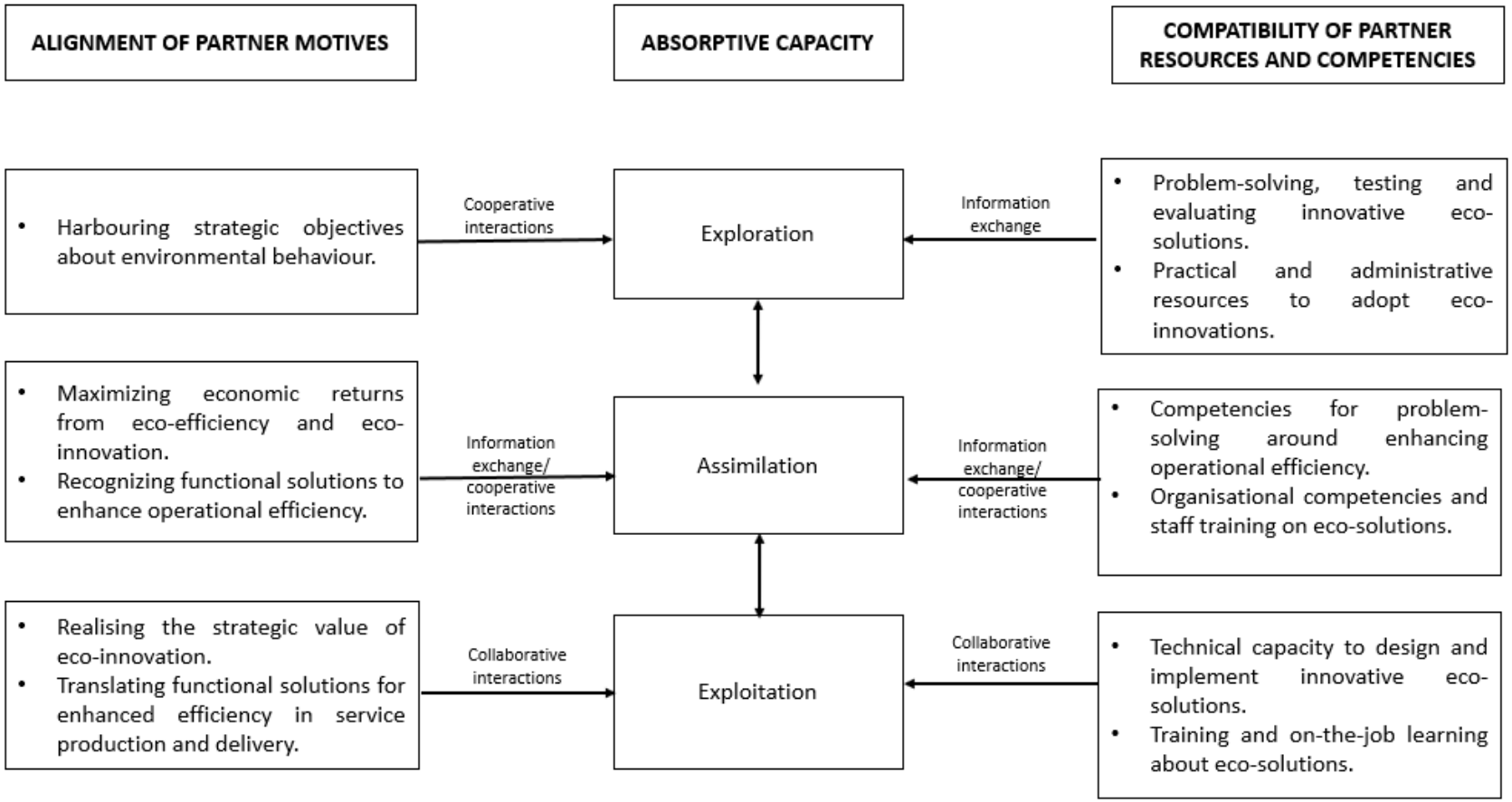
Table 2 – Dimensions of partner alignment that influence absorptive capacity-building

Dyads	First-order themes describing partner alignment (illustrative quotes)		Second-order (aggregated) themes	Dimension of partner alignment
	Hotel-Client (H)	Engineering Consulting Firm (E)		
H12-E9	"I believe that environmental issues and sustainability are intrinsic components of the tourism product alongside a mix of characteristics including beaches, safety, world heritage sites etc." (Director, H12).	"Companies need to show that they are green and doing something for the environment. Basically my work involves designing a tailored system for the client that helps offset costs and meets the client's requirements." (Senior partner, E9)	Shared objectives aimed at building an environmental standard/corporate image.	Strategic alignment
H8-E14	"I grew up in a resource-saving culture which reflects how I manage the hotel. This culture has motivated in large part the investments in energy saving technologies." (Director, H8)	"Apart from cost considerations, having a green image is one of the latest marketing trends." (Owner, E14)		
H4-E11	"Investments in energy technology are high on the agenda; since energy can 'make or break' our business……The audit carried out by the [engineering] consultants helped raise awareness about measures to reduce resource consumption." (Technical manager, H4)	"Energy efficiency is not a new concept in the hospitality industry. Ten to twelve years ago we weren't going green, but we were very cost conscious. Today we are going green. A good payback will stimulate client investment in energy efficiency." (General manager, E11)	Interventions driven by the goal to reduce operational costs and improve profit margins.	Economic alignment
H8-E14	"Initially, we weren't sure whether the [innovative] water heating system would perform up to the standard of the more traditional solar water heating systems. And this was a new system which had never been used locally; but we listened to what the engineer was telling us about the superior performance, and we went ahead." (Director, H8)	"Today a water chiller in a hotel consumes energy that is equivalent to 80% of its capital cost in one year. So, the capital cost is not the unique decision on which the client bases a decision to invest. When we carry out an energy feasibility study, we consider the running cost of equipment over a number of years which becomes a major consideration in the client's decision to invest." (Owner, E14)	Shared goal to develop technical improvements aimed at enhancing resource efficiency in the service delivery process.	Functional alignment
H16-E5	"When deciding which [energy] project to embark on finally we look at the ability to save in cost. But the question also is what are our priority needs: is it the change of glazing on the windows? Is it about PVs? There are other priorities to consider such as guest contact, smartness of hotel, and the actual operation of the hotel." (Technical manager, H16)	"We use smart metering systems to obtain the before and after energy data and often find big problems [of energy consumption]. This helps us compare different years of consumption." (Director, E5)		

Table 3 – Dimensions of partner compatibility that influence absorptive capacity-building

Dyad	First-order themes describing partner compatibility (illustrative quotes)		Second-order (aggregated) themes	Dimension of partner compatibility
	Hotel-Client (H)	Engineering Consulting Firm (E)		
H14-E1	"We refer to specialised engineers and other consultancy agencies when we require expertise on specific [environmental] projects. For example, when assessing the potential of installing combined heat and power we worked with [E1] to determine the types of technologies available on the market, how they operate, what difference they would make for the hotel." (Technical manager, H14)	"I am involved in a research project to develop domestic-scale concentrated solar power for the generation of electricity and water heating. Well, these are all existing technologies; it is about trying to put together some improvements in technologies. The trials will be carried out at hotel [H14]. I know the management is very much into these activities and it was like a natural course of things." (Owner, E1)	Competencies to implement innovative technical solutions	Technical competencies
H7-E12	"The aim of bringing all department representatives together [as a green team] is because each department tackles the environment issue from a different point of view……. and every department has its own best practice in terms of environment initiatives." (Director, H7)	"The staff in a hotel changes quite fast….so this affects the awareness on environmental issues. There needs to be constant training. However, once you convince the directors that the project is viable, they will go for it….also the technical staff normally will look at change positively if they are improving on current systems." (Senior partner, E12)	Competencies to develop innovative organisational practices	Organisational competencies
H6-E7	"I was in property maintenance when I worked in manufacturing in the UK and we already took care of energy management at the time – that was 15 years ago. So I started looking at energy management strategies in this hotel a long time ago." (technical manager, H6)	"I help hotels to also achieve the voluntary criteria for eco-certification. For example, we assist the management in communicating the environmental strategy to the staff by making suggestions to reduce waste generation in the back-office." (Owner, E7)		
H3-E13	"Typically, we hear about upcoming measures such as the eco-labelling scheme and the consultant interprets these measures and tells us what needs to be done, for example, whether there is need to replace particular equipment with new eco-friendly equipment." (Director, H3)	"Compliance with the national eco-label scheme requires firms to monitor resource consumption. We typically undertake a comprehensive [energy] audit and measure the energy loads and lighting over a given period. Sometimes we find there are clashes between the engineering knowledge and non-technical knowledge such as when taking decisions about energy efficient lighting." (Senior partner, E13)	Competencies to assist in compliance with environmental targets and regulations	Management support
H6-E5	"[E5] carried out an energy audit – the engineer gave me a guarantee on the amount of savings that we'll have. Ok so you have to do quite intensive energy consumption calculations to evaluate choices for power saving equipment." (Technical manager, H6)	"I do assist clients in preparing proposals for the energy grant scheme. Sometimes the client goes for more than one technological solution so it could be an energy saving solution or a renewable energy installation; having more than one solution makes the proposal more robust." (Director, E5)		

Figure 1: Partner attributes and their influence on absorptive capacity-building for eco-innovation



Appendix A: Hotel-clients' environmental profile and competencies for environmental innovation

Theme	Description	Hotel Code*		
Hotel Category		Low-range (3-star rated)	Mid-range (4-star rated)	High-range (5-star rated)
Hotels Sampled		H1, H2, H3	H4, H5, H6, H7, H8, H9, H10	H11, H12, H13, H14, H15, H16
Environmental Measures implemented	Lack specific environmental measures.	H1, H3	H4, H6	
	Environmental measures implemented in guestroom (e.g. laundry reuse policy; waste separation strategy).	H2	H5, H9	
	Well-defined environmental mission statement and environmental policy.		H7, H8, H10	H11, H15, H16
	Sustainability as a brand standard.			H12, H13, H14
Nature of service relation with KIBS	Project-based contracts for the evaluation, testing and implementation of environmental technologies.	H1, H2, H3	H4, H5, H6, H7, H9, H10	H11, H12, H13, H14, H15, H16
	Short- and long-term contracts to develop customised solutions, including through co-creation with KIBS.		H8, H10	H11, H12, H13, H14, H15, H16
Competences related to implementing environmental technological innovations	Integrate environmental technologies (including energy efficiency and water conservation measures) into preventive maintenance and monitoring of operations to reduce operational costs.	H1, H2, H3	H4, H5, H6, H7, H8, H9	H11, H12, H13, H14, H15 H16
	Design customized environmental technologies to improve efficiency of business operations and contribute to the firm's environmental goals.		H9, H10	H12, H13, H14, H15
	Research and development activities on environment-related projects.			H11, H12, H14, H16
Competencies related to implementing environmental organisational innovations	Staff training on environment and/or energy systems and environmental standards.		H5, H6, H7, H9, H10	H11, H12, H13, H14, H15, H16
	Members of professional networks	H3	H5, H8	H11, H12, H13, H14, H15, H16
	Implement innovative organizational practices (e.g. waste management and environmental strategy).		H6, H9, H10	H11, H12, H13, H14, H15, H16
	Inter-departmental committee/team for green affairs.		H7, H10	H12, H13, H14, H15, H16

*The hotels are classified as low-range (3-star rated), mid-range (4-star rated) and high-range (5-star rated), based on the type of services offered. Sources: company website; interview data; online media reports

Appendix B: Engineering consulting firms' environmental profile and competencies for environmental innovation

Theme	Description	Environmental Services Firms	Building Services Engineering Firms
Company description (based on company's mission statement)	Environmental and energy management consultancies involved in designing and implementing environmental technologies to reduce resource consumption and supporting clients in fulfilling environmental regulatory requirements.	E1-E8	
	Engineering companies and consultancies specialised in the design and implementation of mechanical and electrical engineering services.		E9, E10, E11, E12, E13, E14
Size	sole-ownership or self-employed, 1-5 employees	E1-8	
	Board of Directors, 15-30 employees		E9, E10, E11, E12, E13, E14
Market-orientation	Support clients by providing advice on compliance with environmental regulations and implementing environmental solutions in business operations.	E4, E5, E6, E7, E8	E10, E11, E12, E13, E14
	Design environmental solutions tailored to the clients' needs (over off-the-shelf solutions).	E1, E2, E3, E4, E5	E9, E10, E11
Nature of service relation with hotel-client	Short-term, contracts for service on the evaluation, testing and implementation of feasible environmental technologies.	E1, E2, E3, E4, E5	E12, E13, E14
	Project-based and/or long-term assignments to develop customised solutions, sometimes through co-creation with the client.	E1, E3, E6, E7, E8	E9, E10, E11
Environment-related services	Implement environmental technologies (including energy efficiency and water conservation measures) in the client's preventive maintenance programmes to improve operational efficiency and reduce costs.	E2, E5, E6, E7	E9, E10, E11, E12, E13, E14
	Develop and implement customized environmental technologies and measures to contribute to the client's environmental goals and performance.	E1, E3, E4, E5, E8	E9, E10, E11, E14
Competencies for environmental innovation	Members of professional networks (chamber of engineers)	E1, E3, E4, E6	E9, E10, E12, E13, E14
	Involvement in environment-related networks (national renewable energy association)	E2, E3, E5, E7	
	Research and development activity on environment-related projects	E1, E3	
	Staff training (including accreditation as energy assessors; training on environment and/or energy systems and standards e.g. ISO9000, ISO14000)	E1, E2, E3, E4, E7, E8	E9, E10, E11, E12

Sources: company website; interview data