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In the vanguard of openness: do KIBS need internal innovation capabilities?

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Abstract

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ABSTRACT

A major question in the research on openness concerns its connection to in-house innovation activities. Building on the notion of the innovation value chain, scholars have started to assess the relevance of external parties during the distinct phases in which knowledge is translated into business value. The possibility to substitute internal capabilities is particularly interesting in the domain of knowledge intensive business services (KIBS), which are relatively open by their very nature.

On the basis of a literature review and an in-depth case study, we assess the opportunities for KIBS to rely on the knowledge and competences of external partners when pursuing innovation. We argue that openness can substitute a KIBS' internal capabilities for both the explorative and exploitative aspects of service innovation, but is of less relevance for the intermediate translation of raw ideas into marketable service propositions. Using panel-data from a survey conducted in the Netherlands, we show that openness in KIBS only has an interaction effect with the capability of conceptualizing. Our contribution lays in the demonstration of a functional limitation to substituting innovation capabilities for openness.

1. Introduction

Although innovation scholars have a long history of studying topics like external knowledge search, partnerships, networking and inter-organizational learning, the interest in openness has raised enormously over the past decade (Gassmann et al., 2010; Laursen, 2012). A major question in this research field concerns its connection to in-house R&D (Dahlander & Gann, 2010; Cassiman & Veugelers, 2006). On the one hand, scholars argue and occasionally show that internal R&D capabilities can leverage the value of external knowledge sourcing (Chesbrough, 2006; Vandevrande et al., 2009; Caloghirou et al., 2004). This complementarity is in line with the idea of absorptive capacity (Cohen & Levinthal, 1990). On the other hand, several authors point at the downside of engaging in both internal and external R&D activities (e.g. Love et al., 2013). Here, the main argument for substitutability is that engaging in both activities is costly (Laursen & Salter, 2006; Leiponen & Helfat, 2010): having internal innovation capabilities reduces the need for relying on external knowledge and competences (Roper et al., 2008; Love & Roper, 2001).

Given these contradicting dynamics, a research tradition emerged in which authors followed a rather quantitative approach when trying to identify an optimal level of openness (e.g. Laursen & Salter, 2006; Berchicci, 2013). Only recently, scholars started to explore the mechanisms that underlie open innovation in more detail (Hsieh & Tidd, 2012). A notable and promising example is the study by Love et al. (2011), in which knowledge sourcing activities are related to the distinct phases of the innovation value chain (Hansen & Birkinshaw, 2007; Roper et al., 2008). Assessing the relevance of external parties during the acquisition, transformation, and application of knowledge provides fertile grounds for advancing our understanding of the limitations of openness: which are the aspects of innovation that better remain closed (Dahlander & Gann, 2010; von Zedtwitz & Gassmann, 2002)?

How firms can benefit from openness is believed to differ per technology and industry (Christensen et al., 2005). The question of complementarities is particularly interesting in the domain of knowledge intensive business services (KIBS). Already in 1990, Richard Barras noted that business services form the vanguard of novel modes of innovation. The service revolution he wrote about two decades ago is all the more prominent in current times, as firms from virtually all sectors try to escape the commodity trap by opening up the innovation landscape and adapting service-oriented business models (Chesbrough, 2006, 2011; Mina et al., 2013). Whereas the ‘interactive innovation process’ Barras discussed concerned alignment between various elements of techno-economic paradigms, subsequent studies have investigated the topic more literally by studying how service innovation arises from intensive client interaction (e.g. Edvardsson et al., 2001). Contrary to those firms where open strategies are really an alternative to traditionally closed models, KIBS operate practically always in close interaction with their customers as well as with other parties (Den Hertog, 2000; Leiponen, 2005; Tether & Tajar, 2008). The fact that daily activities by KIBS firms involve such extensive knowledge brokerage begs the question how openness affects (the relevance of) their own abilities to innovate. Recent contributions show that KIBS engaging in knowledge sourcing and R&D activity are more innovative (e.g. Mansury & Love, 2008; Leiponen, 2012), but until now the interaction of these key factors has hardly been investigated.

Generally, studies on innovative search and openness amongst service providers are found to be rare (Leiponen, 2012; Mina et al., 2013). Whereas most of the existing research on complementarities tends to investigate openness in relation to R&D investments or R&D capabilities, these concepts have only limited relevance in the domain of KIBS (Drejer, 2004; Leiponen, 2005). Service providers, be it knowledge intensive or not, are known for formalizing their innovation efforts only occasionally (Miles, 2007). The observation that they (somehow) do develop new services has led to an increasing interest in the innovation activities of service providers (Gallouj & Savona, 2009). One result is the development of an alternative for gauging how able and prone a KIBS firm is when it

comes to innovating. Rather than sticking to formal R&D, scholars are urged to study innovation in services by adopting the broader notion of dynamic capabilities (Teirlinck & Spithoven, 2013; Den Hertog et al., 2010). Depending on how dynamic service innovation capabilities (DSICs) are operationalized, they can be related to the phases of the innovation value chain (Janssen et al., 2013). So far, empirical exploration of the respective influence of DSICs on innovativeness and innovation performance is not available, and also the combination of dynamic capabilities and openness has hardly been touched upon (Vandevrande et al., 2010).

This paper aims to inform KIBS firms who face the decision whether to develop their own innovation capabilities or to rely on the skills and competences of external parties (be it through on-the-job learning or deliberate collaboration). Building on a case-study as well as earlier studies on the role of openness during the different stages of knowledge transformation (Love et al., 2011; Lehrer et al., 2012), we argue that openness can substitute internal capabilities for both the explorative and exploitative aspects of service innovation, but is of less relevance for the intermediate translation of raw ideas into marketable service propositions.

The quantitative investigation we present is based on panel-data from a survey deployed in the Netherlands in 2011 and 2012. An initial exploration of the data, in which five key DSICs are regressed on innovativeness, reveals that the capability to sense user needs is not discriminative for KIBS. This implies that developing a customer-focused sensing capability, as opposed to sensing (technological) options, is hardly complementary to KIBS firms' common tendency to interact with clients. All of the other capabilities are positively and significantly related to innovative output. However, only for conceptualizing we encounter a significant interaction effect with openness (deliberate partnerships) on both innovative output as well as innovation performance. This finding suggests that KIBS firms can benefit from knowledge sourcing - it relaxes the need to build innovation capabilities - but should consider to keep their conceptualization capability internally. Our contribution lays in the demonstration of a functional limitation to substituting innovation capabilities for openness.

2. Theory

2.1 The innovation capabilities of KIBS

According to the resource-, and knowledge-based view on economic and technological change, firms need to develop certain capabilities in order to translate knowledge into business value (Barney, 1991; Teece et al., 1997). These capabilities allow firms to sense developments and acquire promising ideas, transform them into new propositions, and reconfigure their organization so that the new offering can be commercialized (Teece, 2007; Zahra et al., 2006). Therefore, dynamic or innovation capabilities are commonly regarded as important antecedents for the renewal of both firms as well as the products and services they deliver (Crossan & Apaydin, 2010).

Due to its traditional focus on technological innovation, studies on openness tend to be biased towards R&D capabilities. Especially in the understudied-field of services, however, performing the processes that generate novel combinations of knowledge entail more than the availability of capabilities bound to R&D (Miles, 2007). Service innovation is argued to depend primarily on individuals' skills and professional knowledge, rather than on the narrow (and relatively rarely encountered) set of activities that fall under formal R&D (Leiponen, 2012). Because of service particularities like an intangible and interactive nature (Parasuraman et al., 1985; Gallouj & Weinstein, 1997), the continuous and organic innovation process in services occurs relatively close to the client (Sundbo, 1997; Tether, 2005). This is all the more true for KIBS firms, who often develop

new concepts by combining the knowledge and experience they acquire in their role as knowledge brokers (Den Hertog, 2000; Tether & Tajar, 2008).

Acknowledging the limitations of the R&D concept, scholars are adopting the broader notion of innovation capabilities when giving a comprehensive account of a KIBS firms' ability to innovate (Teirlinck & Spithoven, 2013; O'Casey & Sok, 2013; Hogan et al., 2011). Crucial in this respect is the availability of a comprehensive framework of innovation capabilities that allows for comparative analyses across different KIBS firms (Amara et al., 2010). Following the emerging synthesis approach to service innovation (Gallouj, 1994; Coombs & Miles, 2000), such a conceptualization and corresponding operationalization was recently developed (Janssen et al., 2013).

The framework of dynamic service innovation capabilities (DSICs), adapted from Den Hertog et al. (2010), combines elements of conceptualizations developed for specific service sectors. At the same time, it adopts the modern view on dynamic capabilities in general (Eisenhardt & Martin, 2000; Teece, 2007), stating that one should look at the micro-foundations of common capabilities rather than identifying idiosyncratic capabilities. In line with the leading work by Teece (2007), the operationalized set of DSICs therefore consists of capabilities that can be associated with the evolutionary properties of knowledge transformation as captured by the innovation value chain (Roper et al., 2008). In the development of a measurement scale, Janssen et al. (2013) argue that a firm's ability to 'conceptualize' depends partially on the extent it is able to 'sense user needs' and 'sense (technological) options' in the first place. Similarly, they find that the capabilities required for actual exploitation of a new proposition ('co-producing and orchestrating' and 'scaling and stretching') depend on the presence of the conceptualization capability in turn (see Figure 1).

FIGURE 1

2.2 Routine-like and deliberate openness in KIBS

The central question in this paper is whether firms in the forefront of openness should develop all five types of capabilities themselves when pursuing innovation, or whether they can be innovative as well by accessing the knowledge and capabilities of others.

By their very nature, KIBS are deeply involved in knowledge exchange (Den Hertog, 2000; Miles, 2005). Their core activity is to transfer information, design, experience or professional knowledge to client firms and assist in applying it (Leiponen, 2005). The type of knowledge that is being provided can range from science and technology (engineering services, computer services) to law, accountancy and management consultancy (Miles, 1995). Within the context of the knowledge economy, KIBS are considered as the bees that cross-pollinate knowledge throughout the innovation system (Den Hertog, 2000; Hipp & Grupp, 2005). Accordingly, innovation literature started with studying how KIBS contribute to innovation of others, before focusing on the innovation created and used by KIBS themselves (Drejer, 2004). Compared to the wider field of services, where innovation is commonly regarded as being fuzzy (Toivonen & Tuominen, 2009), innovation by KIBS is even harder to grasp (Tether, 2005). Since the main objective of KIBS is to solve their clients' problems, new service concepts often evolve out of solutions that once had an 'ad-hoc' nature (Drejer, 2004; Toivonen & Tuominen, 2009; Leiponen, 2005).

Increasingly, service innovation is regarded as emerging from innovation networks that are broader than customers (Bryson et al., 2012). Discussions on multi-agent frameworks (Gallouj & Weinstein, 1997; Windrum & Garcia-Goñi, 2008) have been revitalized with the rising interest in openness (Rubalcaba et al., 2012). Today, both service production and service innovation are regarded as inherently distributed phenomena, carried by a wide range of actors (Tether & Tajar, 2008).

Arguably, it is exactly because intensive interaction lies at the heart of their daily activities that it remains unclear to what extent innovating KIBS can truly rely on external parties. Whereas

open strategies can be clearly distinguished from closed R&D in the manufacturing of new goods (Chesbrough, 2006), this difference is far less obvious in the domain of (knowledge intensive) services (Chesbrough, 2011). Besides drawing on interactions that are part of the routines on which the core activities of KIBS rely, KIBS are also found to develop partnerships explicitly aimed at innovation (Leiponen, 2012). Whether increasing the level of openness is fruitful in firms that are inherently open has hardly been assessed so far (Mina et al., 2013). As a result, there is only a poor understanding of how the various levels of openness in KIBS affect (the importance of) its innovation activities and performance. At the same time, given the trend that firms from virtually every sector are increasingly part of multi-actor producing systems or ‘open landscape’ (Chesbrough, 2006), this research gap pertains to a topic that pre-eminently might enrich the broader innovation literature (Mina et al., 2013).

Knowledge sourcing for exploration

In recent years, a wide range of innovation studies has examined the benefits of (predominantly) inbound flows of knowledge (Gassmann, et al., 2010). Chesbrough (2006) stresses that external openness can increase the quality and quantity of ideas entering the innovation funnel on which the innovation value chain is based.

Within the more specialized literature on service innovation and service management, especially the role of customers and co-creation has been receiving extensive attention (Bryson et al., 2012). Almost unanimously, scholars find that involving customers contributes to service innovativeness (e.g. Leiponen, 2005; Tether, 2005). Close interaction with customer offers valuable opportunities to learn about both their explicitly expressed and latent needs (Den Hertog et al., 2010). Edvardsson et al. (2001), for instance, stress that inviting customers in service innovation processes leads to a better understanding of their preferences. When studying external links in UK business services, Love et al. (2011) confirm that customers are of significant importance in primarily the exploratory stage of innovation processes.

Also the involvement of suppliers is generally found to be supportive to gathering ideas for new service propositions. This is shown, for instance, in a study on KIBS by Leiponen (2005), in which knowledge sourcing from competitors is positively related to innovation as well. Although universities turned out not to be an important source for service innovation, this is contradicted by studies on the knowledge-bridging role of KIBS as the center of innovation systems (e.g. Amara et al., 2009; Muller & Zenker, 2001). Access to scientific and technical knowledge is an important complement to keeping up to date with the needs from actual or potential customers (Den Hertog et al., 2010; Mina et al., 2013).

Assuming that a larger variety of knowledge sources corresponds to more diversity in the ideas a firm can yield, breadth of knowledge search is often related to innovativeness (Laursen & Salter, 2006). Indeed, by using CIS-data on information flows used by KIBS, Leiponen (2005; 2012) shows that breadth of knowledge sourcing is an important determinant of service innovation as well.

In sum, KIBS firms can strengthen their explorative activities significantly by benefiting from the ideas and knowledge of external parties. When looking at the of DSICs by Den Hertog et al. (2010) en Janssen et al. (2013), this begs the question to what extent the capabilities to sense user needs and (technological) options should be developed internally. Possibly, it is more attractive to substitute innovation routines like client-profiling and trend analysis for an increased and better use of external linkages.

Co-production and collaboration for exploitation

On the other end of the innovation value chain, or funnel, we find activities aimed at the actual implementation and commercialization of a new proposition. Manufacturing-based studies on

openness in the innovation process tend to associate exploitative practices mainly with outbound knowledge flows, such as licensing and selling IP (Dahlander & Gann, 2010). Since the disembodied nature of service innovation hardly allows for such practices, they are less likely to be encountered in KIBS. Consistently, Love et al. (2011) find a reduction in the extent of external linkages KIBS use in later stages of the innovation value chain.

Despite modest possibilities to engage in exploitation by commercializing outward flows of knowledge, several recent studies suggest that openness can contribute to the actual creation of business value in service firms. Whereas the relevance of sourcing new ideas decreases when proceeding in the innovation value chain, the importance of detailing a new proposition increases. In the knowledge application phase, external linkages with notably customers and suppliers are found to be useful for KIBS. This is emphasized by Den Hertog et al. (2010), who build on several earlier studies when equipping their capability framework with ‘coproducing and orchestrating’. Kindström et al. (2009), for instance, argue that the ‘value network’ of services is based on service systems in which providers, service partners and customers jointly fulfill the tasks required for delivery of a service experience or solution. Interacting closely with clients, in this stage, might yield feedback on how to improve the newly developed service formula (Lehrer et al., 2012). This latter study shows that designers can increase the quality of their services by relying on client collaboration (e.g. for testing solutions), just like many studies on co-creation have done (Carlborg et al., 2013; Rubalcaba et al., 2012). Scholars also point at the value of involving different types of parties (e.g. other service providers) for optimizing and continuously redesigning new service concepts (Den Hertog et al., 2010).

Since intangibility makes services an experience-good, relying on tacit rather than codified knowledge, possibilities to stretch new concepts to other markets are limited. Also in this aspect of exploitation, however, customers can deliver a valuable contribution to (or even replace) internal capabilities. Similarly, interaction with parties like professional associations might relieve the necessity to possess own skills for rolling out and marketing a new service model (Love et al., 2011).

From the findings described above, we can conclude that deployment of (new) services often occurs in collaboration with external parties who possess skills and knowledge essential for both service production and improvement. Good examples of outward-openness remain scarce, but their existence represents possibilities for reducing the costs of own innovation capabilities on this account.

Translating raw ideas into detailed propositions

Adhering to the ideas of ambidexterity and absorptive capacity (March, 1991; Cohen & Levinthal, 1990), scholars tend to state that firms are fully open when using external linkages and boundary-spanning knowledge flows for both exploration and exploitation (Vandevrande et al., 2010). Doing so, however, neglects the importance of the intermediate stage of converting raw ideas into actual propositions (Hansen & Birkenshaw, 2007; Love et al., 2011). Research on openness has only briefly addressed the question how firms can integrate acquired external sources into their own operations and innovations (West & Bogers, 2013).

Den Hertog et al. note that the conceptual nature of services implies that this translation stage is peculiar: a service innovation cannot be researched, developed, prototyped and tested in a similar way as physical goods (2010, p. 500). Due to intangibility of the service product, possibilities to communicate codified knowledge are limited. Instead, it involves a high amount of tacit knowledge to assemble new ideas into an innovative knowledge combination. Apart from integrating new ideas (both needs and options) and past experiences, KIBS also face the challenge of aligning a novel service proposition with their current business activities. This element of service conceptualization requires a comprehensive understanding of what the new offering entails as well.

The description of the dynamic service innovation capability of conceptualizing provides relatively few suggestions for how to involve external parties (Den Hertog et al., 2010). In fact, the benefits of openness are mainly discussed as an intra-organizational issue: knowledge transformation ‘is mostly in the hands of a multidisciplinary project team’ (Den Hertog et al., 2010, p. 501). Indeed, Love et al. (2011) show that internal openness in the form of team working is important when encoding ideas into viable service offerings. Moreover, relying on three case-studies on customer-interaction by design services, Lehrer et al. (2012) find that the stage of knowledge transformation is performed best in isolation. They claim that separation between service firms and clients at this stage of service innovation can sometimes be beneficial for KIBS, especially when the innovation involves a high degree of creativity.

3. Case-evidence for openness along a KIBS’ innovation value chain

Existing literature research on innovation by KIBS suggests that the role of partners varies along the innovation value chain. The evidence we retrieved stems from a variety of studies, each of them typically focusing on solely one phase of the sequential steps through which knowledge is converted into marketable solutions. Relatively, empirical evidence for partner involvement in a single (service) firms’ chain of innovation activities is found to be rare. Before engaging in quantitative analyses, we illustrate and complement the findings from our literature review by reporting the open innovation practices of a single KIBS-firm.

Our in-depth case study, based on 10 interviews of one hour and additional desk research, concerns the innovation processes in a Dutch consultancy firm specialized in advising health-care institutions. In particular, ‘HealthKIBS’ offers services to create better safety and hospitality in (notably eye-care) hospital departments.¹ For example, it provides training aimed at breaking hierarchical barriers for communication and collaboration within medical teams. Other innovative propositions are the adaptation of a ‘time-out’ in which a one-minute check is performed before starting an operation, and a valet parking service that allows patients to feel welcome and comfortable without stressing about finding parking place.

Many of the offered solutions are unprecedented in the domain in which our focal firm is active. As will become clear, the services it offers are largely based on transferring solutions from other industries to the health sector. These solutions, which are practices to improve an organizations’ function rather than medical solutions, have mainly been developed by the management of a hospital from which our case-firm is a spin-off. Because the hospital’s management could not commercialize her innovations herself, she decided to establish the independent organization we focus on here. The services of HealthKIBS are offered via a franchise model in which various innovative procedures are bundled into a single package. After performing an initial screening, HealthKIBS develops a multi-annual plan in which she selects standardized practices that fit with the specific needs of the client (i.e. franchise-taker). During the execution of this plan, it remains closely involved for monitoring progress and providing additional guidance. Also beyond the domain of health, KIBS in the Netherlands have rarely a franchise-formula like the one described here.

The continuous development of HealthKIBS’s innovative propositions depends on the input of a wide range of external parties. Helping hospitals with optimizing the functioning of her organization provides rich feedback. In that way, HealthKIBS is able to learn about needs that she would not have identified herself. Apart from looking internally (i.e. at her parent company), it draws on extensive interaction with clients when extending her service portfolio. Rather than developing a pro-active sensing capability, it only ensures that signals from clients are captured and administered.

¹ For privacy reasons, the name of the focal firm is anonymized here.

A more original type of external linkages that led to new ideas is interaction with the airport Schiphol and the airline company KLM. The fields of health and airlines are similar in their search for safety and hospitality. In lack of any competitive threat, the parties were willing to exchange ideas and best practices. Indeed, the time-out and team-training that are unprecedented in the health sector were directly adopted from Schiphol and KLM. Also the implementation of lining on the operation room's floor, in order to ensure that equipment is stored in the appropriate places, is imitated from the lining on the airport. Instead of through a permanent intelligence function, HealthKIBS obtained the required knowledge by organizing only a couple of site visits.

As noted, openness in commercialization has been studied less than openness in the phase of idea generation (West & Bogers, 2013). Existing research, typically performed in a manufacturing context, suggest that commercialization requires secrecy rather than openness (Laursen & Salter, 2013). Meeting the demand for examples in a service setting, our case-study demonstrates how KIBS can rely on other parties when implementing and fine-tuning new services.

The services offered by HealthKIBS include assistance in implementing new practices for becoming safer. How to achieve this depends on the situation of each individual client. Due to the multitude of eye care specialists in the parent firm, it has not always been easy to implement a new practice there straight away. Instead, HealthKIBS 'experimented' with a new practice by deploying it first at a smaller client that might have been embracing the new solution more easily. Applying a new procedure at a client's site provides evidence of the functionality (which increases the chance for successful adoption in the parent firm), but was also found to improve the practice. Contrary to a product that is commercialized by laying it on a shelf, the guidance and consults provided by HealthKIBS require the experience of applying it under different circumstances.

Again, also other parties have been influential in shaping the service portfolio of our case-firm. New practices that could be incorporated in the franchise bundle were not just created by observing the airline industry. Instead, a service like mystery-guest visiting in order to have a pre-treatment impression of a client's safety and hospitality is being delivered in close collaboration with professionals (pursers) from KLM. The same holds for the afore-mentioned team training for medical teams, which is delivered by a partnering agency specialized in training pilots. By relying on these external parties, the focal firm herself does not need to have competences and knowledge that are required for delivering her services. Moreover, by adding services from partners to her own portfolio HealthKIBS increases her visibility as a one-stop-shop for innovative practices in the health sector.

A major reason for HealthKIBS not to avoid outward knowledge flows (in terms of secrecy) is the societal legitimation of her activities. Since the health sector is highly dependent on the politics of public policy, firms in this domain cannot be certain of their future. In order to emphasize its contributions in the domain of health care, HealthKIBS and her parent firm appreciate public attention for their qualities. This means that even without obtaining financial rewards, there is a willingness to diffuse some of the successful practices. For instance, the organization occasionally advises other sectors (banking, firefighting) on how to improve safety and hospitality. These forms of revealing are important for HealthKIBS' innovations. Deploying practices under other circumstances provides yet more opportunities to learn and to optimize. Secondly, building a wider reputation as a safety and hospitality expert augments the possibility that clients from both the health care sector and beyond are willing to enjoy services on a paid basis. The resulting revenues, in turn, are mainly invested in experiments with new practices.

Like in the case of HealthKIBS' explorative efforts, most exploitative activities rely on knowledge flows from daily business (and some incidental events) rather than on strong internal capabilities.

Finally, encoding appears to be an activity which is performed by HealthKIBS and her parent firm internally rather than in collaborative settings. Almost all innovations in this case originated from the two directors at the parent firm that established HealthKIBS. Together with a small staff, including for instance a quality manager, these managers have been making up the majority of improvements that led to such an innovative reputation. Since interaction with external parties causes abundant knowledge flows for idea generation and application, the core of the innovation activities lies in combining signals into new propositions. Interviewed stakeholders almost unanimously regard the creativity and visionary leadership of the managers involved as one of the key factors in innovation. Not only do the managers and their support combine ideas into a practice that can be deployed; they are also able to give the new concept a name and specify in detail what it is, what value it has, and how it can be delivered. This essential part of encoding makes that resulting innovations receive ample publicity, as opposed to improvements that are simply applied without becoming an innovation that can be deployed elsewhere.

Synthesizing these observations, we obtain a pattern which is similar to the one Lehrer et al. (2012) found when studying design firms. The variety of practices for engaging in both open knowledge generation and open knowledge application is rich, but possibilities for involving partners in conceptualizing are limited. For our case, this can be visualized as shown in Figure 2.

FIGURE 2

4. Hypothesis development

To what extent the encountered possibilities for relying on partners influence the need for internal innovation capabilities has not been assessed so far. According to the resource-based view, access to the knowledge and capabilities of others reduces the need to develop in-house strengths (Barney, 1991; Roper et al., 2008). In Figure 3, below, we complement our findings on partner-relevance with implications regarding the choice where to allocate capabilities. The vertical axis of the depicted box represents the balance between developing internal capabilities (upper part) versus relying on external capabilities and knowledge (lower part). As argued throughout this paper, the balance can vary per stage of the innovation value chain (shown on the horizontal axis). Ultimately, firms aim to ensure that activities for all parts of the innovation value chain are performed, which corresponds with less ‘white space’ in our visual representation.²

Research on knowledge sourcing by KIBS finds external linkages (be it routine-based interaction or deliberate collaboration) to be important for acquiring and generating ideas. Although the role of partners decreases as activities in the innovation value chain get less explorative, studies on commercialization and management of new services, as well as our own case study, have shown that partner importance reappears when the innovation funnel reaches the stage of actually deploying new formulas. In Figure 3, this is shown by the fact that there is only little room for KIBS to increase the strength of their innovation capabilities on the respective accounts of knowledge generation and application (hence the little arrows). Whenever KIBS invest heavily in innovation activities that might also be performed by relying on the input of external users, costly overlap might arise (Laursen & Salter, 2006; Roper et al., 2008). This is less likely to occur for activities related to transforming raw

² The figure assumes that there is an optimal level of innovation activities to be performed by either the firm itself or its partners. Our view on this point is that firms usually benefit from every additional innovation activity, but that extra efforts might have marginally decreasing returns. Thus, the conceptual illustration represents the quest to find an optimum between the effects as well as costs of developing internal capabilities, versus the effects and costs of relying on external partners. Finding an optimal solution in our simplified representation corresponds with elimination of ‘white space’ (unperformed activities with marginally positive returns) by developing sufficiently strong capabilities without creating overlap with the activities of external parties.

ideas in strong propositions; in the intermediate stage of the innovation value chain, the possible role of external parties is not self-evident. Recent case-studies, including our own, suggest that knowledge transformation occurs best in isolation. Therefore, we hypothesize that innovation-pursuing KIBS can complement an open strategy better with a strong conceptualizing capability rather than developing internal capabilities for exploration and exploitation.

FIGURE 3

5. Method

5.1 Dataset

The empirical analysis we present is based on a data-panel that was constructed by sending out a survey in two consecutive years. About 30% of the initially participating firms filled out the follow-up questionnaire as well, which is a reasonable rate for this type of research.

As described in previous studies using this data (Janssen et al. 2013; Janssen et al. 2014), the respondents consist of CEO's and top managers from Dutch firms (10+ employees) in the greater Amsterdam and Utrecht area. Previous studies have classified firms as KIBS when belonging to computer and related activities, research and development, or other business activities (Castaldi, 2009; Leiponen, 2012). In NACE Rev.2, this corresponds with information and communication services (sector J) and professional, scientific and technical activities (sector M). The table below shows how cases are distributed over the respective subsectors of these KIBS categories.

TABLE 1

5.2 Statistical method

We examine the influence of DSICs and openness on innovation by testing linear regression models in the statistical software package SPSS 20. Our approach follows the figure below.

First, we explore the relative influence of the five dynamic service innovation capabilities on renewal of the service portfolio (Model 1a). This exercise serves to give an empirical account of the respective importance of each of the capabilities for creating service innovation. So far, this essential step has not been made yet in the literature (Den Hertog et al., 2010; Janssen et al., 2013).

Secondly, we extend the model with the direct influence of maintaining external linkages for innovation purposes (Model 1b). Using information about deliberate partnerships with clients or other parties, we also create interaction terms with DSICs in order to verify our hypothesis (Model 1c). In order to avoid multi-collinearity, variables used for interaction terms are all mean-centered (Aiken and West, 1991).

Finally, we re-assess these relationships by taking a dependent variable later on in time (Models 2a,b,c). In order to explore more thoroughly which strategy is most beneficial for KIBS to follow, we are interested in the relationship between engaging in innovative activity (internally and/or externally) on the one hand, and ultimately receiving market recognition for being innovative on the other hand.

The additional test also enhances the robustness of our results in another way. By looking at a dependent variable that is not specific for services, contrary to our primary dependent variable, we are able to compare KIBS with other types of firms. Following the urge by Mina et al. (2013), we make a step in the research on open service innovation by avoiding to oppose KIBS to manufacturers. Instead, we acknowledge that open service innovation is pursued by firms from a wide variety of sectors: to verify to what extent our findings are specific for firms that operate at the forefront of openness, we chose to distinguish KIBS from other firms (non-KIBS) in general. As a representation of the region we surveyed, this group contains mainly other types of service-providers like wholesale (see Table 1).

FIGURE 4

5.3 Description of variables in the models

The dataset we rely on contains response to survey-questions adopted from the Community Innovation Survey (2010), as well as several items for new measurement scales. For the current study, particularly the items related to dynamic service innovation capabilities (DSICs) and service innovation are of relevance. Since both of them have been presented in previous studies, we stick to a brief description. All of the report scales are based on a 7-point Likert-scale, ranging from “strongly disagree” to “strongly agree”. Descriptive characteristics and correlations of the subsequently discussed variables are shown in table 2.

Dynamic service innovation capabilities form one half of the independent variables we are interested in (X1). As mentioned throughout this paper, they consist of sensing user needs, sensing (technological) options, conceptualizing, co-producing & orchestrating, and scaling & stretching (Den Hertog et al., 2010; Janssen et al., 2013). The measurement items for this new scale are based on underlying micro-foundations (Teece, 2007), identified in extensive literature and empirical research (Den Hertog et al., 2010). For more details on scale development, see Janssen et al. (2013).

Openness is the other focal point of this study (X2). To be consistent with the established body of research, we adapted a standard scale from the Community Innovation Survey (based on the Oslo Manual). Firms were asked to state to what extent they have been engaging in deliberate partnerships with an innovation objective. One minor modification we made is the inclusion of a question regarding the importance of freelancers, since they account for an important part of employment within the Dutch economy. The variable used in our analysis is the sum of scores given for all external parties. Note that this indicator concerns deliberately formed partnerships with the aim of innovation; they form an addition to the interaction a firm is naturally engaging in when delivering its products or services. Table 2 shows that KIBS draw only modestly on deliberate partnerships in comparison to non-KIBS (who are likely to have less ‘natural’ interaction).

Service innovation is the primary dependent variable (Y1). It was constructed by equipping the 2011 edition of the survey with questions regarding renewal of the business activities in the preceding three years.³ Since this concept is hard to grasp with traditional distinctions like process and product innovation, we adopted recent insights on the multidimensional nature of service innovation (Den Hertog, 2000; Carlborg et al., 2013; Janssen et al. 2014). Although this perspective is increasingly being accepted, no measurement scale was found to be readily available. The steps undertaken to operationalize the multidimensional framework by Den Hertog et al. (2010), including the items, are described in Janssen et al. (2014). For the current analysis, we constructed an aggregated measure by summing the scores on each of the six dimensions (Mina et al., 2013). Thereby, the resulting variable can also be regarded as a service-specific indicator for ‘innovation diversity’ (Love et al., 2011).

Innovation performance, the second dependent variable (Y2), is used for gauging whether innovation activity by KIBS and non-KIBS truly results in externally recognized innovativeness. As noted by Leiponen (2012), studies on R&D capabilities tend to neglect the time-lag between engaging in innovative effort and enjoying the benefits. Assuming that innovation can yield such benefits only once introduced on the market, the follow-up survey asked respondents to state whether the market saw them as innovative. The exact phrasing is included in Appendix A.

³ Asking respondents to look back is a common method for analysing the lagged effect of capabilities on innovativeness (e.g. Mansury & Love, 2008)

Control variables, as present in our analyses, include in the first place the logarithm of firm size. In line with similar studies, we also use a proxy for the extent a firm is oriented towards engaging in innovation (e.g. Leiponen, 2012). Since R&D budgets are an inappropriate measure in the context of KIBS, we asked them whether they had formal procedures for innovation in place. Items are shown in Appendix B. As confirmed by numerous studies (e.g. Mina et al., 2013), KIBS are less inclined to formalize their innovation activities than non-KIBS. Finally, our last two control variables concern the environment a firm is operating in. This aspect, which might affect our findings, is captured by the environmental turbulence (Laursen & Salter, 2006), and the degree of competitive intensity (Keupp & Gassmann, 2009). Competitive pressure ($\alpha = ,775$) and market dynamism ($\alpha = ,829$) were measured with scales developed by Jansen et al. (2006).

TABLE 2

6. Results

6.1 Regressions on service innovation

Before exploring the role of openness, we examine to what extent the five DSICs can be related to the creation of innovative services. Inspection of the descriptive statistics in Table 2 reveals that all of the individual capabilities are significantly correlated with the amount of changes a KIBS has been introducing in its service portfolio (i.e. service innovation). To study their relative influence, we simultaneously test the statistical correlations of all the capabilities in one single regression model. Although common method bias might be an issue if we were to prove the importance of dynamic service innovation capabilities, it is less problematic in analyses focused on their respective role.

Model 1a in Table 3 shows that for KIBS, dynamic service innovation capabilities have more predictive power for achieving innovative output than the control variables we retrieved from the same survey. Especially having the capability of sensing (technological) options appears to be strongly related to creating service innovation. An exception is the capability of ‘sensing user needs’; in comparison to having the other DSICs, this capability appears not to be discriminative for innovativeness.

Secondly, we look at the role of engaging in interaction with external parties. According to the results of Model 1b, maintaining deliberate partnerships (in addition to routine-based forms of interaction) does not contribute substantially to service innovation. When including the interaction effects between openness and the dynamic capabilities, however, we find that one of the interactions terms is (weakly) statistically significant. Although the model as a whole does not improve significantly, the interaction between conceptualizing and openness turns out to be positively related to achieving service innovation. The other capabilities, for the explorative and exploitive aspects of the innovation value chain, do not have an interaction effect with openness. This finding points at the expected trade-off between the use of internal and external competences.

TABLE 3

6.2 Regressions on innovation performance

Taking into account again the threat of common method bias, the question which DSICs really matter can best be tested by linking them also to the innovation performance as reported one year later. Moreover, this general measure enhances the robustness of our analyses by allowing for comparisons between KIBS and non-KIBS. Given the general tendency of firms from any sector, including R&D-focused manufacturing, to adopt service inclusive business models, it is worthwhile to verify whether having DSICs and openness have a different role in these distinct groups.

An initial analysis, not shown here, reveals that an aggregated measure for DSICs does have a significant relation with a KIBS' status as an innovative organization ($\beta = ,350$, $p = ,055$). The results for Model 2a, reported in Table 4, demonstrate that this does not hold for any of the individual DSICs. A remarkable result is found for non-KIBS. Here, we find that the capability of sensing user needs has a significant ($p = ,014$) and especially strong ($\beta = ,414$) relationship with innovative performance. For those firms not engaging extensively in external linkages by definition, sensing user needs has relatively more potential for helping them to become recognized innovators.

Openness does not appear to be of direct relevance for either of our groups, but this changes when repeating the procedure of adding interaction terms to the baseline model. Again, the capability of conceptualizing has a significant (and positive) effect for KIBS. Not only is this result consistent with our findings for innovative output, but the relationship appears to be even stronger. Despite a lower sample size, the overall model does now improve significantly when adding the interaction term. This finding does not appear for non-KIBS.

Jointly, the results of our analyses provide strong evidence for the hypothesis that KIBS, especially when maintaining extensive external relationships, might benefit mainly from an internal ability to translate acquired and generated ideas into marketable propositions.

TABLE 4

7. Discussion

By building on research concerning openness, the innovation value chain and dynamic capabilities, we examined when external linkages can substitute or complement internal innovation capabilities. To understand better the various ways external parties can be involved in open service innovation, we first performed an in-depth case-study. Investigation of a single KIBS, active in the health sector, illustrated which practices can be used for benefitting from both in- and outbound knowledge flows (thereby forming an alternative to internal innovation capabilities). This latter aspect has rarely been studied in services, and shows that commercialization does not necessarily require secrecy (e.g. Laursen & Salter, 2013).

Due to missing metrics, the relation between having dynamic capabilities and realizing service innovations had hardly been assessed so far (Den Hertog et al., 2010). According to our statistical findings, sensing user needs is the only capability not significantly related to a KIBS' innovation output. This counter-intuitive finding emphasizes the need to focus on complementarity when developing in-house capabilities. Our results do not object to common findings that customers have a major impact on (service) innovation (e.g. Love et al., 2011); they only suggest that for KIBS this is not the most promising area to target when developing innovation capabilities. Because professional service providers typically engage in 'on-the-job'-learning by engaging in close interaction with their clients (Leiponen, 2005), there appears to be relatively limited value in developing an intelligence function on this account. As Leiponen noted (2012, p. 1258), building an internal sensing function "cannot replace direct contact between clients and employees active in new service development". On the other hand, sensing (technological) needs turns out to be all the more important for realizing service innovations. The discriminatory property of this capability is in line with the common finding that many service innovations are based on especially ICT-technology.

For firms who are less used to face clients in their ordinary business activities (i.e. those who can be expected to have a lower 'openness baseline'), sensing user needs was found to be an important predictor for their reputation as an innovative firm. Indeed, when studying computer manufacturers, Bharadwaj & Dong (2013, p. 11) argue that "market sensing can serve as a core competence and thereby provide the foundation for differential advantage". This discriminative

advantage in comparison to other innovation capabilities is what might be absent in intrinsically open firms (KIBS), where especially links with universities might have high benefits (Mina et al., 2013). Future research could serve to clarify under which circumstances sensing user needs and customer behavior also allows this latter group to become more innovative than their competitors. In a service-oriented study, Salunke et al. (2013, p. 1093) state that “the use of dynamic capabilities in gaining and exploiting customer-based knowledge and its effect on sustaining innovation-based advantage remains a neglected area”.

Analyses on both service innovation and innovative performance in KIBS show consistently that conceptualizing is the only innovation capability having a significant interaction effect. When KIBS raise their level of openness by maintaining innovation-oriented partnerships rather than just engaging in operational interactions, they can distinguish themselves by being able to transform acquired ideas into detailed propositions. Especially for achieving innovative performance, this strategy seems to be more effective than developing capabilities that might overlap with activities that external linkages can take care of.

In the case of open non-KIBS, none of the capabilities turned out to be a good predictor for innovative performance. Our explanation for why conceptualizing is particularly relevant for open KIBS is largely based on the assumption that intangibility and tacit knowledge ask for encoding to occur in an isolated setting (Lehrer et al., 2012). Accordingly, the observation that conceptualization does not have its exceptional role in open non-KIBS might be caused by better possibilities to codify knowledge (e.g. plans for a new product). Further research on the (in)tangibility of co-produced service innovations can validate these expectations.

A more general explanation for why innovation capabilities in both KIBS and non-KIBS are limitedly related to the time-lagged indicator for innovative performance, is that innovation success can only partly be attributed to dedicated efforts and other organizational antecedents. For instance, earlier studies in the DCV have found contradicting results regarding their impact on innovativeness and firm performance (e.g. Zahra et al. 2006; Ray et al. 2004). One parameter that might affect our findings is the time-interval between our measurement of DSICs and the subsequent measurement of innovative performance. A limitation of our study is that our panel stretches only over two years. Using longitudinal datasets with a larger scope might be a fruitful way for assessing the role of DSICs in more depth.

8. Conclusion

The main contribution of our study lies in the demonstration of a qualitative limitation to substituting capabilities for openness. Whereas research on openness has focused primarily on identifying optimal levels of openness (e.g. Laursen & Salter, 2006, 2013; Berchicci, 2013), we presented evidence for the argument that there is a functional restriction in the extent to which firms can rely on the capabilities of others.

With respect to the discussion on innovation capabilities in KIBS, we provide explanation for the observation that they can be innovative without having strongly developed internal innovation activities. Not only is there an ‘innovation gap’ (Gallouj & Djellal, 2010) because we do not observe some innovation activities due to the narrow definition of R&D (which we address by demonstrating the relevance of dynamic service innovation capabilities); our study suggests that internal innovation activity is also less of a need for KIBS. Since business providers interact with their clients, suppliers and other external parties on a relatively intensive basis, they face ample opportunities to rely on the knowledge and capabilities of others. Although external parties can take over some of the innovation activities, the importance of being able to translate knowledge into concrete propositions might still be of major importance. On the basis of the current study we can state that highly open firms possibly

can rely on fewer internal dynamic capabilities (in terms of diversity), but the capability they do rely on is likely to be still very crucial for being innovative.

Looking beyond the domain of services, finally, our findings have important implications for any firm that takes part in adopting an open strategy (Chesbrough, 2011) and switching to service inclusive business models (Mina et al., 2013). When external parties can accommodate activities in the phases of idea generation as well as knowledge application, managers might consider focusing their efforts at the development of a strong conceptualizing capability. Whereas the notion of absorptive capacity is typically associated with the entire range of innovation capabilities (e.g. Boly et al., 2013), or even mainly the explorative and exploitative aspects (Vandevrande et al., 2010), our results suggest that especially the intermediate capability of conceptualizing allows open firms to benefit from knowledge flows. According to Den Hertog et al. (2010), firms can develop their conceptualizing capability by engaging in practices like prototyping, visualizing, (service) blueprinting, nurturing corporate entrepreneurship and out-of-the-box thinking.

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Tables

<i>Sector</i>	<i>2011</i>	<i>2012</i>
KIBS	147	58
J: Information and communication	46	17
<i>Publishing activities</i>	1	0
<i>Motion picture, video and television programme production, sound recording and music publishing</i>	8	3
<i>Programming and broadcasting activities</i>	1	1
<i>Telecommunications</i>	1	1
<i>Computer programming, consultancy and related activities</i>	32	12
<i>Information service activities</i>	3	0
M: Professional, scientific and technical activities	101	41
<i>Legal and accounting activities</i>	14	4
<i>Activities of head offices; management consultancy activities</i>	32	17
<i>Architectural and engineering activities</i>	24	7
<i>Scientific research and development</i>	4	1
<i>Advertising and market research</i>	21	7
<i>Other professional, scientific and technical activities</i>	6	5
non-KIBS		70
A: Agriculture, forestry and fishing		0
C: Manufacturing		10
D: Electricity, gas, steam and air-conditioning supply		0
E: Water supply, sewerage, waste management and remediation		1
F: Construction		11
G: Wholesale and retail trade, repair of motor vehicles and motorcycles		19
H: Transportation and storage		5
I: Accommodation and food service activities		1
K: Financial and insurance activities		5
L: Real estate activities		2
N: Administrative and support service activities		5
P: Education		1
Q: Human health and social work activities		8
R: Arts, entertainment and recreation		1
S: Other services		1

Table 1: Sectoral composition of the dataset

		KIBS												non-KIBS					
		Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	Mean	Std. Dev.		
1	Firm size (log)	3,54	1,30															3,58	1,26
2	Formal innovation activity	3,38	1,36	,02	,13*	,03	-,11	,13*	,03	,09	,03	,11	,12	-	,05		3,68	1,34	
3	Market dynamism	5,06	1,31	,02	,05		,15*	,32**	,34**	,38**	,30**	,29**	,14*	-	,24		4,91	1,31	
4	Competitive pressure	4,98	1,15	-,06	-,10	,170*		-,05	,05	-,01	,03	,07	,07	-	-,04		5,38	1,22	
5	DSIC 1: Sensing user needs	4,71	1,21	,04	,37**	,13	,11		,58**	,59**	,39**	,55**	,31**	-	,33**		4,54	1,28	
6	DSIC 2: Sensing (techn.) options	5,23	1,18	,00	,18*	,23**	,19*	,45**		,58**	,39**	,48**	,38**	-	,16		4,92	1,33	
7	DSIC 3: Conceptualising	4,82	1,13	-,12	,23**	,26**	-,13	,45**	,47**		,45**	,50**	,33**	-	,33**		4,50	1,27	
8	DSIC 4: Co-producing & orchestrating	4,61	1,28	,01	,17*	,16	,08	,20*	,24**	,25**		,30**	,34**	-	0		4,47	1,45	
9	DSIC 5: Scaling & stretching	4,34	1,33	,10	,31**	,07	-,08	,30**	,32**	,34**	,01		,42**	-	,00		4,30	1,51	
10	Openness (partnerships)	2,85	,96	,09	,18*	,22**	,13	,09	,22**	,23**	,41**	,09		-	,13		4,09	1,20	
11	Service innovation	4,42	,91	,02	,11	,33**	,08	,22**	,44**	,49**	,34**	,39**	,39**	-	-		3,14	1,06	
12	Innovative performance	14,74	3,54	-,16	,18	,11	-,30	,13	,15	,40**	,05	,37**	,03	,22			14,19	3,33	

Table 2: Descriptive statistics and correlations (KIBS below the diagonal, Non-KIBS above the diagonal). * = $p < ,05$; ** = $p < ,01$

KIBS						
	Model 1a		Model 1b		Model 1c	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)		,000***		,000***		,000***
Firm size (log)	,022	,769	,010	,897	-,014	,855
Formal innovation activity	-,072	,388	-,086	,305	-,067	,435
Market dynamism	,112	,165	,101	,213	,107	,197
Competitive pressure	,055	,500	,042	,609	,052	,542
DSIC 1: Sensing user needs	-,089	,342	-,077	,414	-,088	,380
DSIC 2: Sensing (techn.) options	,299	,004***	,276	,008***	,277	,015**
DSIC 3: Conceptualising	,228	,024**	,223	,027**	,228	,028**
DSIC 4: Co-producing & orchestrating	,174	,030**	,141	,090*	,136	,110
DSIC 5: Scaling & stretching	,187	,026**	,194	,020**	,208	,015**
Openness (partnerships)			,119	,156	,149	,102
DSIC 1 * Openness					-,126	,227
DSIC 2 * Openness					-,036	,747
DSIC 3 * Openness					,185	,086*
DSIC 4 * Openness					-,020	,822
DSIC 5 * Openness					-,117	,201
R2		,381		,391		,424
Adjusted R2		,332		,338		,345
R2 change		,381		,011		,033
Significance of change		,000		,156		,293

Table 3: Results from regression analyses on service innovation. * = $p < ,10$; ** = $p < ,05$; *** = $p < 0,01$

KIBS						
	Model 2a		Model 2b		Model 2c	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)		,000***		,000***		,003***
Firm size (log)	-,170	,248	-,146	,334	-,129	,407
Formal innovation activity	-,070	,693	-,036	,844	,149	,425
Market dynamism	,086	,602	,080	,630	,082	,615
Competitive pressure	-,250	,113	-,219	,178	-,103	,536
DSIC 1: Sensing user needs	-,133	,460	-,129	,475	-,209	,315
DSIC 2: Sensing (techn.) options	,217	,267	,244	,222	,445	,057*
DSIC 3: Conceptualising	,241	,220	,245	,214	,345	,092*
DSIC 4: Co-producing & orchestrating	-,155	,374	-,131	,461	-,175	,361
DSIC 5: Scaling & stretching	,177	,286	,183	,275	,228	,192
Openness (partnerships)			-,129	,436	-,493	,025**
DSIC 1 * Openness					-,219	,304
DSIC 2 * Openness					,293	,200
DSIC 3 * Openness					,526	,045**
DSIC 4 * Openness					-,242	,178
DSIC 5 * Openness					-,059	,773
R2		,311		,321		,494
Adjusted R2		,159		,151		,277
R2 change		,311		,011		,173
Significance of change		,058		,436		,057
non-KIBS						
	Model 2a		Model 2b		Model 2c	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)		,000***		,000***		,000***
Firm size (log)	,072	,582	,068	,615	,076	,615
Formal innovation activity	-,183	,216	-,185	,216	-,237	,155
Market dynamism	,079	,578	,082	,570	,147	,389
Competitive pressure	-,037	,793	-,041	,776	-,088	,586
DSIC 1: Sensing user needs	,414	,014**	,411	,017**	,429	,024**
DSIC 2: Sensing (techn.) options	-,128	,388	-,122	,425	-,101	,537
DSIC 3: Conceptualising	,254	,114	,249	,134	,261	,135
DSIC 4: Co-producing & orchestrating	-,112	,452	-,119	,445	-,075	,661
DSIC 5: Scaling & stretching	,095	,551	,096	,552	,081	,643
Openness (partnerships)			,024	,864	-,044	,778
DSIC 1 * Openness					,146	,458
DSIC 2 * Openness					,086	,599
DSIC 3 * Openness					,053	,796
DSIC 4 * Openness					-,109	,545
DSIC 5 * Openness					,028	,871
R2		,277		,278		,315
Adjusted R2		,147		,130		,082
R2 change		,277		,000		,037
Significance of change		,044		,864		,790

Table 4: Results from regression analyses on innovative performance (t+1). * = p < ,10; ** = p < ,05; *** = p < 0,01

Figures

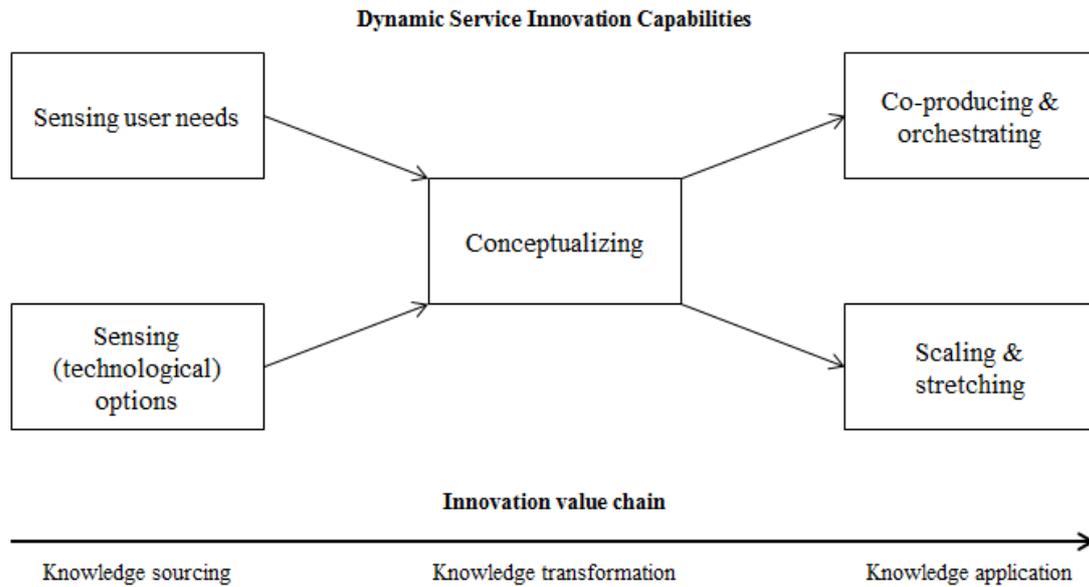


Figure 1: Link between dynamic service innovation capabilities (Den Hertog et al., 2010) and the innovation value chain (Hansen and Birkinshaw, 2007; Roper et al., 2008). Based on Janssen et al. (2013).

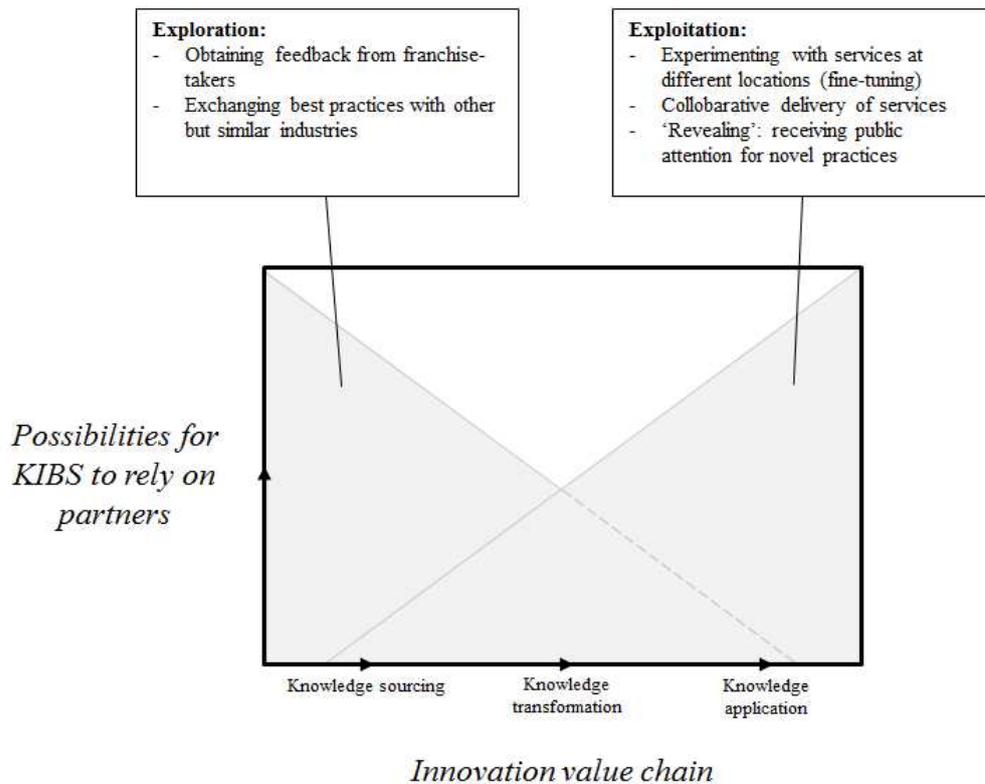


Figure 2: Schematic representation of HealthKIBS's possibilities to rely on knowledge and competences of partners. Based on Lehrer et al. (2012).

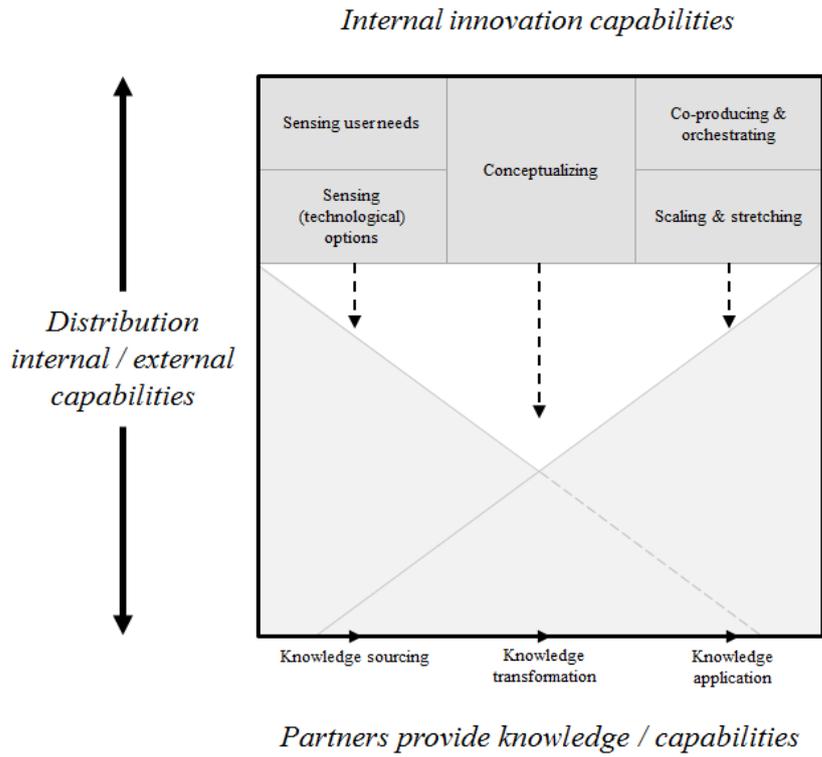


Figure 3: Hypothesized relationships between a *KIBS*' need for internal innovation capabilities and IVC-stages.

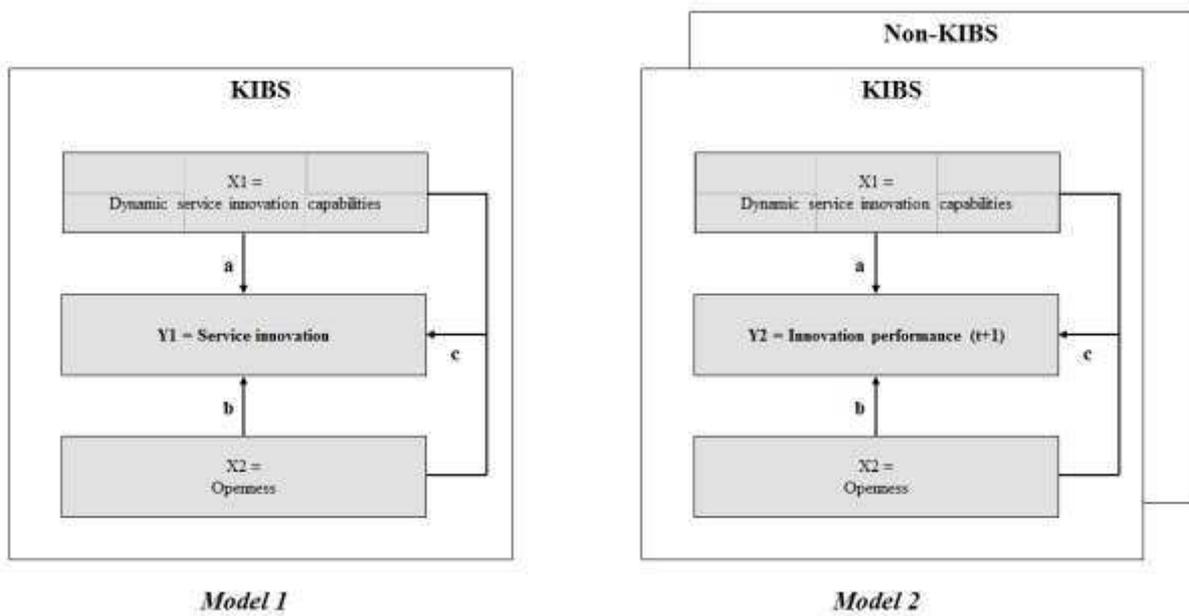


Figure 4: Structure of statistical analyses

Appendices

Appendix A: Measurement items for innovative performance

- Competitors in our market recognize us as innovation leaders
- We are first to market with new products or services
- Customers view us as an innovative company

Cronbach alpha = 0,826

Appendix B: Measurement items for formalization of service innovation

- We evaluate the progress of our development of new services systematically
- The development of new services occurs via specific guidelines and procedures
- The final decision to introduce a new service is the result of a formalized process
- New services are being developed according to a schematic plan
- Progress in the development of new services is documented in writing

Cronbach alpha = 0,907