Co-innovation by KIBS in Environmental Services: a knowledge-based perspective.

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CO-INNOVATION BY KIBS IN ENVIRONMENTAL SERVICES — A KNOWLEDGE-BASED PERSPECTIVE

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This paper investigates the ability of knowledge intensive business firms (KIBS) to engage in co-innovation with client firms. Co-innovation is related to the competitive advantage of KIBS as knowledge creators and sources of innovation. We apply a knowledge-based perspective where knowledge-related resources and learning capabilities explain why certain KIBS firms are able to co-innovate. We couple our theoretical expectations with qualitative evidence on three best practices in the Dutch market for environmental services.

Keywords: KIBS; co-innovation; knowledge-based; knowledge; learning.

Introduction

Knowledge intensive business services (KIBS) provide specialised knowledge to other sectors. Accordingly, KIBS function as an interface between their clients’ knowledge base and the wider knowledge base of the economy. Thereby, KIBS shape the resource distribution among client firms and play an important role in the development and commercialisation of new products, processes and services (Muller and Doloreux, 2009; Shearmur and Doloreux, 2009). In this light, KIBS are seen to function as catalysts in innovation systems (Castaldi, 2009; Castellacci, 2008; Muller and Zenker, 2001).
KIBS can act as sources of innovation for other firms, and through their strong relation with client firms, some KIBS act as co-producers of innovation (Den Hertog, 2000; Muller and Doloreux, 2009; Shearmur and Doloreux, 2009). Client firms with a deep commitment to innovation, a high absorptive capacity and large networking capabilities are more likely to use KIBS as specialised knowledge providers and engage in cooperative innovation (Tether and Tajjar, 2008). Co-innovation is defined as innovation occurring at a client firm with inputs of both the client and KIBS firm, which would not have occurred without the support of the KIBS firm (Wood, 2004). In the typology proposed by Gallouj and Weinstein (1997), co-innovation corresponds to ‘ad hoc innovation’, requiring changes in competences, technologies and an interactive construction of new outcomes (De Vries, 2006).

Previous studies have illustrated how KIBS and client firms are related to each other and which resources and capabilities a client firm needs in order to use external knowledge provided by KIBS (Muller and Zenker, 2001; Tether and Tajjar, 2008). Thereby, the focus has largely been on identifying properties of client firms that explain their use of KIBS and much less on properties of KIBS firms which explain their ability to act as sources of innovation. Specifically, it remains unclear which typical resources and capabilities KIBS firms need in order to go beyond knowledge diffusion and to be able to engage in co-innovation projects with client firms. Amara et al. (2010) analyse the complementarities between different KIBS firms’ innovative capabilities, but do not explicitly go into co-innovation. The focus on co-production of innovation is particularly meaningful for at least two reasons. First, external sourcing of knowledge, especially from customers (and competitors), is more conducive to new service innovations by KIBS firms than local and incremental learning by doing (Leiponen, 2005). Therefore the positive role played by KIBS firms as knowledge brokers is further enhanced by their ability to stimulate innovation in cooperation with client firms in term of changes brought about within those client firms (Muller and Doloreux, 2009). Secondly, co-innovations are complex interactive processes where KIBS firms show and train their abilities. Co-innovations are then of strategic relevance for KIBS firms to enhance their competitive advantage as knowledge creators. In this paper, we argue that co-innovation projects require a KIBS firm to deliberately invest in its knowledge resources and their management. The main research question addressed in this study is therefore: Which knowledge-related resources and capabilities shape the ability of KIBS firms to co-innovate?

In the next section, we discuss how co-innovation puts pressure on a firm’s ability to manage and release its knowledge. We apply insights from the knowledge-based perspective of the firm (Grant, 1996; Kogut and Zander, 1992;
Given that the topic of co-innovation is under-researched in the literature, we complement our theoretical discussion with exploratory qualitative insights from three cases of organisational best practices within a specific sub-sector of KIBS, namely Dutch environmental investigation services (EIS).

Next, we present our theoretical framework and propose a conceptual model to frame our research question. In the following section, we focus on the conceptualisation of the knowledge-based resources and capability. Then we illustrate the qualitative evidence that we have collected and discuss the exploratory insights stemming from that evidence. Finally we conclude.

**Theoretical Framework**

**The role of KIBS in the innovation system**

In the classic view of service innovation, the service firm is supplier-dominated (Pavitt, 1984). This view, however, does not apply to KIBS (Miles, 2005). Evidence shows that KIBS firms are specialised suppliers of knowledge responsible for innovations within client firms. In a national economy, the core function of KIBS is twofold (Castellacci, 2008; Den Hertog, 2000; Shearmur and Doloreux, 2009):

1. to develop fundamental and/or professional knowledge i.e., knowledge or expertise related to a specific (technical) discipline or (technical) function domain, and
2. to supply intermediate products and services that are knowledge-based solutions, through specialised products, training and/or consulting

Via this core function, KIBS firms are able to influence the innovation processes of other firms in different sectors. This influence is exerted via various means such as providing an expert manager, a tailor-made software package or written advice (Den Hertog, 2000). A rough distinction proposed in the literature is the one between technical and professional KIBS (Miles et al., 1995; Shearmur and Doloreux, 2009). More nuanced and empirically driven classifications suggest different degrees of innovation-orientation of KIBS firms (Corrocher et al., 2009; Freel, 2006). In fact, most innovative KIBS firms retain the option of differentiating their roles across client firms. Within specific groups of KIBS firms, innovation can take various forms reflecting different strategies (Corrocher et al., 2009). Depending on the vision and strategy of its management, a KIBS firm can perform at least three different roles. First, KIBS can facilitate the innovation...
process by supporting client firms with innovations that originated at the client firm. Secondly, KIBS can act as carriers of innovation, influencing the innovation process of client firms by implementing innovations developed elsewhere. Finally, KIBS can be a source of innovation, initiating and developing the innovation process of client firms (Den Hertog, 2000). The focus of this study is on which resources and capabilities determine whether or not KIBS firms perform this last role. Therefore, co-innovation is defined as an innovation occurring at a client firm with inputs of both the client and KIBS firm that would not have happened without the support of the KIBS firm (Wood, 2004).

Explaining the ability of KIBS firms to co-innovate

Where differences in roles can be attributed to different strategies, the ability of KIBS firms to co-produce innovation is expected to depend on the firms’ resources and capabilities. A service firm can be perceived as a collection of resources and capabilities which is in line with the resource-based view of the firm (Wernerfelt, 1984) and the more recent capability-based view of the firm (Dosi et al., 2000; Teece et al., 1997; Teece, 2007). Resources are seen as specific ‘stocks’ of tangible and intangible assets that are tied to a firm. Capabilities are process-oriented and emphasise the role of adapting, integrating and managing organisational assets, like resources, to gain a competitive advantage. A further specification of the relation between resources and capabilities is made within the knowledge-based view, by relating combinative capabilities to the creation of new knowledge (Grant, 1996; Kogut and Zander, 1992). A full-fledged knowledge-based view of KIBS firms has been proposed by Larsen (2001) and explored via case studies. Larsen views KIBS as ‘distributed knowledge systems’, where the knowledge embedded in employees and in their social relations shape organisational capabilities.

Strambach (2008) has advanced the conceptual characterisation of KIBS’ knowledge dynamics by mapping different types of knowledge used and produced by KIBS. She summarises three main properties of KIBS firms that relate to the key role of knowledge resources and learning capabilities. First, knowledge is not only the production factor that KIBS use most intensively, it is also what they sell (Gallouj, 2002). Secondly, selling knowledge to client firms requires complex and intense interaction with client firms where both parties engage in interactive learning (Den Hertog, 2000; Sundbo, 2001). Thirdly, the content of interactive learning relates to expert knowledge of the KIBS firms adapted to the needs of the client firms (Muller and Doloreux, 2009).

These three properties assume an even greater meaning when considering instances of co-innovation rather than the standardised provision of services. Based on these properties, we expect two main mechanisms through which resources and
capabilities explain the ability of KIBS firms to co-innovate. These two mechanisms govern the relations in the conceptual model that is visualised in Fig. 1.

On the one hand, the possibility for the KIBS firm to provide knowledge that is complementary to the knowledge possessed by the client firms is directly related to its available knowledge base (Amara et al., 2010; Strambach, 2008). We view the knowledge base of a KIBS firm to be embodied in its expert employees and technologies or, in other words, in its human and technological resources. We then expect a positive direct relation between knowledge resources and ability to co-innovate.

On the other hand, better knowledge bases also increase the absorptive capacity of KIBS firms and in turn increase their ability to process and create new knowledge (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998). This ability will be referred to as learning capability, a multi-dimensional concept aimed at capturing the extent to which firms are able to process, combine and adapt existing knowledge. It refers to a second-order organisational capability that exists beyond the level of accumulated resources. As explained by the absorptive capacity story, the processes underlying the learning capability will influence and be influenced by the quality of the stock human and technological resources. Thereby, we expect a positive relation between knowledge resources and learning capability.

It also follows that if a KIBS firm has a low level of absorptive capacity, it will not be able to adapt its knowledge to specific client firms and will in general, lack knowledge generation capabilities (Lane and Lubatkin, 1998; Zahra and George,
If the KIBS firm has the ability to translate the absorbed knowledge into a collective application of knowledge (through codification at the organisational level) instead of an individual application of knowledge (associated with individual tacit expert skills), the firm is more likely to create significant improvements in its services (Leiponen, 2005). Thereby, we envision a final positive relation between learning capability and co-innovation.

In sum, a better knowledge base captured in a KIBS firm’s resources is directly related to the quality and relevance of the knowledge transferred as a service. At the same time, a better knowledge base is indirectly related to the innovative potential of the KIBS firm since it enhances the firm’s absorptive capacity and learning potential.

In projects where innovations are co-produced by a KIBS firm and a client firm, the need for complex interactions is high, and the resources and capabilities of the KIBS firm come under pressure. It should be noted that by considering the ability to co-innovate, we implicitly assume that instances where co-innovation does not happen, put less pressure on KIBS firms regarding the quality of their resources and capabilities. For instance, in situations where KIBS firms only apply already available solutions to fulfill the client’s contract, there is no co-innovation and less pressure on the KIBS firm.

Next, we explain in more detail how the key elements of our knowledge-based model can be conceptualised starting from the literature on KIBS, but also on organisational learning.

Knowledge Bases and Learning

Human resources

The co-production of innovation requires the exchange of knowledge between the client and KIBS firm, which is facilitated by interactions between the individuals working for the two firms. Human resources form part of the interface and delivery system of the service itself (Den Hertog, 2000): They often interact directly with the clients and represent the physical channel through which expertise of the KIBS firm gets transferred to clients. Furthermore, a firm’s knowledge base is intrinsically linked to the knowledge of its employees (Larsen, 2001): the experts working for the KIBS firm represent the stock of available expert knowledge within the KIBS firm.

KIBS firms can decide to maintain and improve the knowledge base of expert employees through (mandatory) training activities. These will be focused on individual knowledge development and not part of internal R&D activities or the learning capability of the firm. Amara et al. (2010) find indeed that KIBS firms approach training activities and R&D activities as separate.
The customised investment in human resources also responds to the specific challenges of talent management. Traditional human resource management falls short of considering the very peculiarities of managing talented experts. These individuals are typically in constant need of novel and challenging tasks, get motivated by unusual projects and frown upon routine-like activities (von Nordenflycht, 2010). Given that experts form a major part of KIBS knowledge base, KIBS firms should put special effort in cherishing their talented experts (Teece, 2003).

**Technological resources**

To successfully complete their tasks, technical KIBS firms depend on both hardware and software, such as measuring equipment or specialised software packages to utilise measurement results. Next to human resources, specialised hardware and software further allow the KIBS firm to provide clients with expert, firm specific, complementary knowledge (Den Hertog, 2000; Gallouj and Weinstein, 1997). This is clearly illustrated by the fact that many of the technological assets owned by firms do not enter the market, due to unwillingness to sell them or due to difficulties in their transaction (Teece et al., 1997; Teece, 2007). Therefore, technological assets are clearly differentiators among firms and can serve as (technology-embedded) knowledge pools and/or facilitators for the service process. An important innovation source for service firms is the investment in and development of specific hardware and software (Sirilli and Evangelista, 1998). The production of hardware and software allows the KIBS firms to adjust even further to the specific needs of the client by altering existing technology assets or creating new ones. Technological resources can be inputs to as well as outcomes of the co-innovation process, thereby realising one of the key conditions of ad hoc innovations (Gallouj and Weinstein, 1997).

**Learning capability**

As co-innovations rely on sharing and combining knowledge and skills, the learning capability of a KIBS firm is expected to be strongly related to its ability to co-innovate. Some authors even define a firm’s innovative capability in terms of its learning capability (Amara et al., 2010). The boundaries of the concept are undoubtedly fuzzy and the place given to this capability depends very much upon the focus of analysis. Given our own focus on co-innovation and the knowledge-based perspective we take, we understand learning capability as the ability of the individual employees to efficiently feed and utilise the organisation’s internal and external knowledge pools (Kogut and Zander, 1992; Teece, 2007). We also embrace the idea that learning requires a deliberate and costly process to be built up. Learning starts from experience accumulation and can evolve to knowledge
articulation and even codification when firms strive at high levels of knowledge sharing and (re)combination across the whole organisation (Kogut and Zander, 1992; Zollo and Winter, 2002). The creation of shared collective knowledge forces those involved in the creation process to draw explicit conclusions about the implications of experience (Zollo and Winter, 2002) and de-contextualises knowledge (Acha et al., 2005). Thereby, it facilitates diffusion of existing knowledge as well as the coordination and implementation of complex activities (Zollo and Winter, 2002).

The evolution of these insights has gone hand in hand with the increasing use of knowledge management tools and strategies within firms. Still, firms differ in the extent to which they explicitly and pro-actively engage in knowledge management. Those firms that do invest in knowledge management activities have been found to achieve superior innovative performance (Darroch, 2005; Leiponen, 2005). Even though the literature has not converged on one definition of learning capability, a rich list of activities related to knowledge management can be referred to in order to operationalise the concept of learning capability. Here we suggest three key dimensions for KIBS:

(1) Knowledge gathering about clients, which can be indicated by the presence of a distinct market department and the use of market studies: the ability of the KIBS firm to design service offerings attractive for clients thanks to an assessment of clients’ needs is expected to be crucial for their ability to innovate.

(2) Knowledge management, which can be indicated by the presence of a dedicated knowledge manager, the active use of a client database and a project evaluation database: tools and activities related to knowledge management have been found to stimulate innovation at the firm level (Darroch, 2005; Leiponen, 2005);

(3) Knowledge sharing and combining, which is facilitated by the extensive use of teamwork and by other features such as brainstorming sessions or internal news updates: activities aimed at knowledge sharing promote the emergence of a shared collective knowledge, as discussed above.

An Empirical Exploration of Dutch Environmental KIBS

Methods

To explore the complex linkages between knowledge resources and learning capability, we conducted three case studies of Dutch environmental KIBS. We selected three best practices in terms of co-innovation: firms that conducted co-innovation projects and with high levels of learning capabilities.

Via several internet search engines, the VVM (Dutch association of environment professionals) member guide and the Dutch Chamber of Commerce, a list of
Dutch EIS firms was composed. A company is considered to belong to the EIS sector when it has a focus on services in (one of) the domains of air-, soil- and water quality, construction/facility quality measurements, vibration emissions and sound emissions, by providing a research and consultancy component. By focusing on a specific type of so-called technical KIBS (Miles et al., 1995), we control for sectoral differences and focus on firm-level sources of variety in arrangements. Furthermore, in the light of the recent rise of stricter environmental policy the focus on the EIS sector also becomes increasingly relevant; EIS firms may help to improve the environmental performance of new and existing companies through advice and innovation. The focus on Dutch firms facilitated our data collection because of spatial proximity.

No publicly released statistics are available regarding the EIS, or comparable sub-sectors such as ‘environmental management and consultancy’. However, searches with different Dutch online search engines produced around 500 hits for registered environmental consultancy firms in the Netherlands. Firms were selected based on age; firms active in the sector for at least one year were included. Start-up firms were not selected, because they did not yet have the possibility to develop capabilities and networks necessary to act as co-innovators. After application of the selection criteria of domain of activity and firm age the Dutch population of EIS firms relevant for this study reduced to 200 firms, of which 21 responded. These firms were invited to complete a questionnaire for another part of our research project. This questionnaire included indicators for the firm’s ability to co-innovate, their knowledge resources and learning ability, among others. Each firm was asked to consider the most representative innovation project of the last two years. Two characteristics of innovation projects were applied to identify co-innovation: the location of the co-innovation and the degree of standardisation.

In a co-innovation project, the location of the co-innovation should be at the client firm and the KIBS firm should function as the primary sender of knowledge. As part of the interactive learning process, the KIBS firm also receives knowledge, but only as feedback on the primary knowledge input. The degree of standardisation is taken into account to ensure that ‘off the shelf’ services are not identified as part of co-innovation projects (Tether et al., 2001). The degree of standardisation is measured by determining whether the innovation was designed to be in a standardised form and possibly customisable/adaptable to other environments (actors/markets) or whether it is specific for the project.

Only when the innovation is located at, and designed specifically for, the client firm, the KIBS firm is identified as being able to co-innovate. If the innovation is located at the KIBS firm, or if the innovation is not specific, the KIBS firm is not co-innovating. Only 10 of the 21 EIS firms were involved in co-innovation,
which is in line with the expectation that co-innovation is a demanding type of innovation activity.

As for the learning ability, this was measured with a set of indicators along the three dimensions indicated in the third section. Here it suffices to know that we selected the three firms that had co-innovated and had scored the highest on the learning capability indicators. Interestingly, these firms differ in size: company A is the smallest, with about 100 professionals, company B is the largest with 1000 professionals and company C has about 300.

We conducted open interviews with knowledge managers of the three selected EIS firms. The questions used to structure the interview are reported in Appendix A. Our broad empirical question was: How do these firms manage their knowledge? We relied on our theoretical discussion and review of the literature to cover the many facets of how KIBS gather, process and change their knowledge base.

The interviewee was given time and opportunity to explain in detail the specific activities done by the firm. The interviews were recorded and the transcripts were analysed to obtain the insights presented in the next section.

**Insights from the cases**

As EIS firms are knowledge based organisations, a large part of their absorptive capacity is made up not only by the quality of the knowledge of their expert employees but also by the sheer amount of professionals available. One knowledge manager (company A) clearly stated: ‘My responsibility is knowledge management, but I share it with the Human Resources department…. The management of human capital is the number one priority in my vision…. You cannot do it without the people’.

However, firms relying on a larger and more qualified pool of professionals are also the ones dedicating most efforts to build an organisation-wide knowledge base. Having more professionals seems to pose more challenges in combining their individual expert skills. In the three companies we interviewed we saw a clear progression from a medium-sized organisation (company A, about 100 professionals) still relying on informal and weakly structured knowledge sharing activities to a very large organisation which had put in place complex and formal structures to store, access and manage knowledge (company B, about 1000 professionals).

‘People talk to each other, at lunch, at the coffee machine. The sharing happens informally’ (company A)

‘We have different systems, there are division-specific knowledge management systems…. We have all kinds of activities to promote knowledge sharing at different levels’ (company B)
With a growing number of expert employees, knowledge sharing, combining and synthesising becomes increasingly inefficient when it depends upon the informal organisation of contacts and communication in and around the coffee corner. Consequently, EIS firms having larger numbers of expert employees will organise collective learning in a more structured way. Hence, the responsibility for knowledge gathering, archiving and diffusing will be assigned to distinct managers or even organisational entities. Furthermore, knowledge sharing, combining and synthesising will also become more structurally organised by means of planned and routine-based internal news updates, brainstorming sessions and teamwork. This implies that the degree of development of an organisational learning capability is associated with the sheer quantity of human resources (i.e., the number of expert employees) available within knowledge based organisations like EIS firms. The knowledge manager of one company (company C, 300 professionals) was particularly aware that knowledge management goes hand in hand with organisational structure development. By ensuring that divisions never exceeded a specific size (about 40–50 consultants) this large company still made it possible to rely on informal knowledge sharing. Once divisions became too big, they were split. This comment also highlights a challenge for theory development in considering intermediate levels of aggregation. In large, multi-divisional, firms the aggregation to division-specific knowledge is qualitatively different from the aggregation to organisation-wide knowledge and this last one may affect complex co-innovation projects requiring cross-divisional collaboration rather differently.

Company B, the largest we interviewed, declared to strive at organisation-wide knowledge sharing, the other companies did not seem to see added value for their service provision in the additional aggregation. In fact, the knowledge manager of the smallest company explicitly declared that they were different from ‘the McKinsey people’: ‘our strong point is that we have deep knowledge in many areas, that’s why people are less interchangeable’. The company thus believes in preserving the specific expertise of each professional. This might stem from profiling themselves as highly specialised niche players, a strategy that makes sense for a small firm. Instead, the larger KIBS firms will act as generalists and offer the broader and more complex service offerings typically demanded by larger clients (a similar mechanism has been found in the advertising industry by von Nordenflycht (2011)). Following this interpretation, a larger KIBS firm will strive at combining knowledge bases more actively than a smaller KIBS firm because the incentives to do so are dictated by the market.

The KIBS firms that we explored were all technical KIBS and the role played by technology resources is worth considering. We found that all the three KIBS had separated pure technology development from their core activities as service
providers. The manager of company C said: ‘Sometimes we develop new ways to use the tools but we are not the party that develops the hammer’. The same manager suggested that they think of technology in a broader meaning as the knowledge required to use a given tool that is what they are interested in improving. For company A, a similar approach had evolved in the last few years: they used to be quite active in developing own technology/hardware, but they have stopped that process and now they only focus on the applications. This separation of manufacturing and services indicates an increasing degree of specialisation of firms in the environmental sector. Thereby, KIBS experts understand the technology but specialise in using it rather than developing it. On the other hand, all managers made clear that the technology resources that they have available matter for their ability to provide ad-hoc innovations for their clients. In fact searching for innovative technological solutions seems more likely to be prompted by challenging client requests, rather than follow a technology-push rationale. In this sense technology, resources could be seen as necessary but not sufficient conditions for co-innovation.

Conclusions

While the literature on KIBS has extensively mapped different patterns of firm innovation, no attempt has been made to explain the ability of a KIBS firm to co-innovate with client firms. Our study contributes both a theoretical discussion and an explorative study of firms in a specific KIBS sector. The model presented in this paper is grounded in the knowledge-based view of the firm, where firm knowledge bases represent key resources and each firm is characterised by a specific portfolio of resources and capabilities. Given that the core activity of KIBS firms is to develop, adapt and transfer knowledge, the theoretical model attaches a paramount role to the learning capability. This capability is expected to be critical in instances of co-innovation that require not only sheer knowledge provision, but more importantly, knowledge generation capabilities.

Our exploratory investigation of Dutch environmental investigation service companies, offered a number of insights. In support of the prediction that co-innovation is a particular type of innovation that requires specific abilities, we found that not all KIBS firms engage in co-innovation. While interactivity is a generic property of service provision, not all firms engage in interactive learning and co-produce innovations.

As expected, human resource management was highly related to knowledge management. While all companies relied on some knowledge management tools, the larger companies were the ones dedicating more efforts at formalising learning activities and striving at organisation-wide knowledge sharing. One interpretation
of this result is that learning capabilities play an instrumental role in shaping the contribution of human resources to the ability to co-innovate. A complementary interpretation looks at the incentives for knowledge sharing coming from the clients: these incentives can be stronger for larger companies, typically facing a demand of broader service offerings and thus in need of integrating more pieces of expertise.

Finally, we witnessed a clear coming to maturity of technical service firms, where service provision is the key concern and technology manufacturing has been externalised. Still, all cases showed that effective co-innovation is enabled by the availability and understanding of the right technology by KIBS experts. An interesting question is then to what extent can different technologies be externalised and which are the most efficient ways to do so without undermining the ability of KIBS to co-innovate effectively.

We are aware that our results fuel many more questions than what they actually answer, this is why we believe that further research should strive at statistically testing in a large-scale study the many intuitions spurred by the discussion of our results. Recent attempts at conceptualising and measuring learning capability for service firms within the literature on dynamic capabilities (see for instance Criscuolo et al., 2007; Den Hertog et al., 2010) are paving the way for the development of consistent indicators which could be used as a basis for the quantitative analysis. The key hypothesis that ought to be tested is that the ability of KIBS firms to co-innovate crucially depends upon both their accumulated knowledge resources and their learning capability.

Appendix A. Open Questions for the Interviews

1. Please describe your job profile in the company.
2. You rely on technical expertise: How does the company keep track of advances in technology?
   a. Who is responsible?
   b. What sources are used?
   c. How is the information spread? Does each employee follow/receive information about a given technological field?
3. Are you also active in developing your own technology?
4. How does the company keep track of changes in the market (new client/user needs)?
   a. Who is responsible?
   b. What sources are used?
   c. How is the information spread?
5. How does the company keep track of changes in legislations and regulations?
   a. Who is responsible?
   b. What sources are used?
   c. How is the information spread?

6. Do you work in a project-based form?

7. How is the composition of project-teams decided? (do managers pick known experts in their division, do they consult a list of experts)

8. How has the scale and complexity of the projects changed in the last two years?

9. Do you follow general guidelines for project-team work?

10. How do project members access knowledge and experience from other ongoing projects?

11. How do project members access knowledge and experience from already completed projects?

12. What does a team do when it misses some knowledge to perform its job?

13. Do you classify employees by field of expertise? How? (yellow pages?)


15. Are the evaluation results accessible to all employees? How?

16. Is there a client database? How is this used?

17. To what extent do your employees meet to discuss problems/achievements together?
   How often? In what context (formal or informal) and at what organisational level does this happen?

18. How is the discussion managed?

19. To what extent do team members discuss problems/achievements with clients?

20. How does your company learn from its successes/mistakes?

21. If you have informal/formal discussion moments: How are the outcomes of the discussions used?

22. To what extent do you write manuals for internal use? For which activities?

23. To what extent do you develop tools (software or written instructions) to support project management?

24. Do you have a mentoring system? (senior/junior or other)

25. Do you wish to mention any other activity that your company does to manage its knowledge?

26. How has knowledge management changed in the last two years? Can you give us examples of activities that you now do differently?
References


Muller, E and D Doloreux (2009). What we should know about knowledge-intensive business services. Technology in Society, 31(1), 64–72.


Co-Innovation by KIBS in Environmental Services


