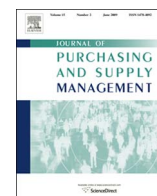




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journal homepage: www.elsevier.com/locate/pursup

Can supplier innovations substitute for internal R & D? A multiple case study from an absorptive capacity perspective

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ARTICLE INFO

Keywords:

Absorptive capacity
Supplier innovation
Open innovation
Multiple case study
R & D intensity

ABSTRACT

Prior literature suggests that significant internal R & D resources are needed to leverage suppliers for innovation and that external knowledge sources can be used to complement the internal knowledge base. Based on the analysis of four inbound open innovation projects at Fortum, a multinational energy utility company, we argue that companies with low R & D intensity may adopt an alternative approach which aims at substituting – not merely complementing – internal R & D with external innovations. We adopt the absorptive capacity perspective while investigating the cases and focus on four distinct capabilities: acquisition, assimilation, transformation, and exploitation. We find that the substitution approach consists of short-term research on new technological areas in order to gain the ability to identify and evaluate alternative technologies, as well as joint business models and operations based on complementary capabilities between the parties. The cases also suggest that the innovation process requires significant collaboration and the buying company's supplier management capabilities may improve the success of inbound open innovation projects of this type.

1. Introduction

Innovation is increasingly the outcome of a collective effort rather than a product of a single firm. The open innovation (Chesbrough and Crowther, 2006) approach suggests that it is often beneficial for firms to collaborate with others in developing and commercialising innovations. Increased linkages to external partners, such as suppliers, customers, universities, and competitors, are considered to lead to better innovation outcomes (Felin and Zenger, 2014). The benefits of *inbound* open innovation, where companies scan the external environment in search of interesting ideas or scout new technologies, are especially thoroughly researched (Bianchi et al., 2016; Sisodiya et al., 2013; West and Bogers, 2014).

Recently, the innovation potential of suppliers has gained a lot of attention (Brem, 2010; Sjoerdsma and van Weele, 2015; Yan et al., 2017), and in fact they have been found the most important open innovation partners (Un et al., 2010). Tapping *supplier innovation*, i.e. accessing suppliers' innovation and product development capabilities (Wagner, 2012), may provide their customers access to new technologies (Ellis et al., 2012) and innovative ideas about products and processes (Wagner and Bode, 2014). Collaboration with suppliers has been found to lead to a shorter time to market, improved product quality, and reduced development costs (Johnsen, 2009), which is why companies are increasingly looking for ways to leverage their suppliers'

innovation potential (Smals and Smits, 2012).

From an organisational perspective, absorptive capacity is considered an important requirement for inbound open innovation (Azadegan, 2011; Cheng and Huizingh, 2014; Christensen et al., 2005; Geum et al., 2013; Sáenz et al., 2014). Absorptive capacity, defined as the ability to recognise new knowledge, assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1989, 1990) can be understood as a high-level organisational capability which considers a firm's ability to gain innovation benefits from interactions with external parties. Without absorptive capacity, suppliers' innovativeness does not transmit to the buyer (Ettlie and Pavlou, 2006; Knoppen et al., 2015; Lawson and Potter, 2012; Sáenz et al., 2014). Absorptive capacity can make buyers more agile and flexible, since they may respond to environmental changes by combining both internal and external competences (Tavani et al., 2013).

The majority of the open innovation studies have focused on a context where the focal firm has significant internal R & D resources (Dahlander and Gann, 2010; Schoenherr et al., 2012; Spithoven et al., 2011; West and Bogers, 2014). The potential of external sources is seen in their ability to complement internal knowledge resources (Hung and Chou, 2013). Similarly, studies on absorptive capacity have emphasised how the ability to assimilate and exploit new knowledge is a result of internal R & D investments (Cohen and Levinthal, 1990). A strong focus on external technology acquisition in place of internal R & D has been

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<http://dx.doi.org/10.1016/j.pursup.2017.08.002>

Received 8 December 2016; Received in revised form 4 August 2017; Accepted 18 August 2017

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considered a weakness (Kim et al., 2016). So far, the question of whether (and how) companies with low internal R & D resources can successfully substitute internal R & D with open innovation has remained poorly understood (Dahlander and Gann, 2010; Tanskanen et al., 2017). The study adopts absorptive capacity as a theoretical framework and focuses on its four distinct capabilities: acquisition, assimilation, transformation, and exploitation (Todorova and Durisin, 2007; Zahra and George, 2002). To explore how internal R & D may be substituted with open innovation, we define a research question to guide our study:

How do the capabilities of acquisition, assimilation, transformation, and exploitation manifest themselves in substituting internal R & D with supplier innovations?

First, we present a review of previous studies on open innovation and absorptive capacity. Then, in the methodology section, we describe the case selection principles and methods for the data collection and analyses. Next, findings from the cases are presented. Finally, we answer to our research question by formulating propositions and discuss the significance of the results from theoretical and practical viewpoints.

2. Theoretical background

Open innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation respectively” (Chesbrough et al., 2006, p. 1). The first part of this definition is referred to as inbound open innovation, which is defined as the acquisition of external knowledge to improve internal innovation (Ritala and Huizingh, 2014). Firms may generate ideas from their internal technology and knowledge base, but they can also systematically scan the external environment in search of interesting ideas. Technology-based innovation includes a high level of technological and market uncertainty, which is why flexibility in terms of openness is valuable for companies (van de Vrande et al., 2006). Various recent empirical studies have evidenced the positive overall effects of openness on innovation performance (Alexy et al., 2016; Cassiman and Valentini, 2016; Cheng and Huizingh, 2014; Laursen and Salter, 2006) and financial performance (Du et al., 2014; Noh, 2015).

Open innovation theories address various external stakeholders, such as end users, suppliers, governments, environmental agencies, research institutes, and competitors, while the most extensively researched collaborators are suppliers and customers (Gassmann et al., 2010). Research related to collaborative innovation between a buyer and a supplier has grown during the last 30 years (Johnsen, 2009) and the potential of involving suppliers in the innovation process has been widely recognised (Azadegan and Dooley, 2010; Mazzola et al., 2015; Schiele, 2010). The innovation potential of suppliers is strengthened by their familiarity of their customers' needs and a position where mechanisms for knowledge transfer may already be in place (Un et al., 2010). Increasing competition in many industries has led companies to rely on their suppliers not only as sources of products and services, but also of ideas and innovations (Luzzini et al., 2015; Phillips et al., 2006).

In their review of the open innovation literature, Dahlander and Gann (2010) conclude that most of the studies consider open innovation as a complement to internal R & D and that intensive internal R & D is often considered necessary to engage in open innovation. If companies invest a large portion of their income in R & D resources (high R & D intensity), for example by allocating personnel into R & D activities, they may be able to understand and use external technological knowledge for introducing new products (Cohen and Levinthal, 1990; Hung and Chou, 2013). There are several proposed explanations for this. First of all, integrating new knowledge and co-creating innovations with external partners is considered to require some overlap in competences and knowledge bases (Hung and Chou, 2013; Mowery et al., 1996). To understand each other, organisations must have moderate cognitive distance to each other (Nooteboom et al., 2007). On the one

hand, if the knowledge bases are too similar, learning opportunities are limited. On the other hand, if they are too distinct, knowledge transfer becomes difficult. High internal R & D may also increase the buyers' attractiveness as partners, leading to more fruitful collaborations (Dahlander and Gann, 2010). However, due to their limited internal resources, collaboration may be more critical for companies with low R & D intensity (Barge-Gil, 2010). It is argued that all organisations should seek a balance between closed and open innovation (Kim et al., 2016; Rothaermel and Alexandre, 2008). Kim et al. (2016) propose that relying too strongly on others should be considered a significant weakness because the lack of internal R & D resources may limit an organisation's ability to explore new knowledge domains. Furthermore, external knowledge is often also accessible to others, which makes it difficult for companies relying on it to maintain a sustainable competitive advantage.

The level of absorptive capacity has been linked to successful open innovation performance in multiple investigations (Bianchi et al., 2016; Enkel and Gassmann, 2008; Randhawa et al., 2016; Saebi and Foss, 2015; West and Bogers, 2014). Similar ideas about the role of internal R & D can also be found from studies on absorptive capacity. In the seminal studies in this research stream, Cohen and Levinthal (1990, 1989) define two justifications for investing in internal R & D: 1) generating new innovations internally and 2) gaining the ability to explore and exploit knowledge from outside the firm's borders, that is, the absorptive capacity. The linkage between absorptive capacity and internal R & D has been so strong that in many quantitative studies the level of absorptive capacity has been measured by looking at variables such as R & D expenditures or R & D intensity (Bianchi et al., 2016; Lane and Lubatkin, 1998; Rothaermel and Alexandre, 2008; Stock et al., 2001; Tsai, 2001). This connection has been justified by theories of individual learning, which suggest that prior related knowledge is needed for memorising, accessing, and organising new knowledge, and establishing linkages with pre-existing concepts (Cohen and Levinthal, 1990). Therefore, to commercially benefit from external knowledge, companies have to integrate it and combine it with existing knowledge and investing in R & D resources is a good way to make sure that the employees are able to do that.

Most open innovation studies focus on high-tech industries where high investments in internal R & D are common. However, a couple of exceptions can be found. Chesbrough and Crowther (2006) examine the use of open innovation practices in traditional industries, such as chemicals, home improvement hardware, and consumer packaged goods. They found out that – similar to high-tech industries – those companies which engaged in open innovation did not use it to substitute for internal R & D; instead they maintained or even increased their R & D investments. Spithoven et al. (2011) investigate similar traditional industries in Belgium. They conclude that while the absorptive capacities of the investigated companies remained low due to the lack of R & D investments, collaboration with collective research centres allowed them to build collective absorptive capacity.

While there is a lot of evidence which suggests that significant internal R & D investments are important for absorptive capacity and inbound open innovation, due to the limited number of studies which investigate low R & D contexts, it can be argued that the question of whether open innovation can replace internal R & D is still unresolved (Dahlander and Gann, 2010). Investigation into the collective research centres, for example, shows that there may be alternative ways of building absorptive capacity (Spithoven et al., 2011). In this study, we look at inter-organisational processes between a buyer and its suppliers to find out how internal R & D may be substituted with inbound open innovation.

3. Conceptual model

The absorptive capacity process has been conceptualised by distinguishing between four capabilities that comprise it: acquisition,

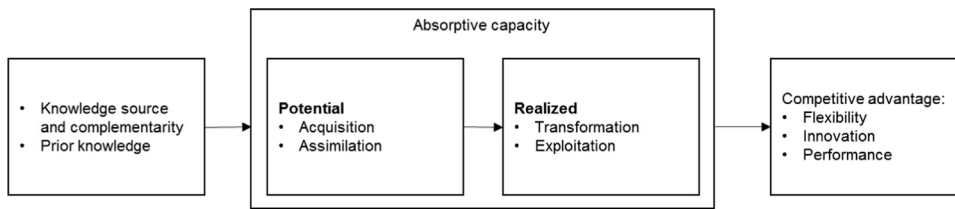


Fig. 1. The absorptive capacity process. Modified from Zahra and George (2002).

assimilation, transformation, and exploitation (Todorova and Durisin, 2007; Volberda et al., 2010; Zahra and George, 2002). Fig. 1 illustrates how absorptive capacity mediates the effect of external knowledge on innovation outcomes.

First, acquisition refers to the ability to identify and gain access to external knowledge. It can vary according to speed, intensity, and direction (Zahra and George, 2002). Acquisition capability reflects a company's openness towards its environment (Camisón and Forés, 2010) and the ability to detect opportunities in the environment (Noblet et al., 2011).

The second capability, assimilation, is about analysing, processing, and interpreting the acquired knowledge (Zahra and George, 2002). Companies with high assimilation capability are able to use their employees' knowledge, experience, and competency for internalising new knowledge (Forés and Camisón, 2016).

The third capability addresses the transformation of knowledge. For the new knowledge to be able to have an impact it needs to undergo transformation, where it is combined with the existing knowledge base (Zahra and George, 2002). New knowledge often challenges existing cognitive schemes (Noblet et al., 2011) and sometimes obsolete knowledge needs to be removed or reinterpreted to ensure compatibility (Forés and Camisón, 2016). This may lead to significant insights and recognition of new opportunities (Zahra and George, 2002).

Finally, the assimilated and transformed knowledge may be exploited. The fourth capability, exploitation, stands for the incorporation of the new knowledge into the company's operations (Zahra and George, 2002). Typical outcomes of exploitation are patents (Camisón and Forés, 2010; Forés and Camisón, 2016), new products (Todorova and Durisin, 2007), or the achievement of other organisational goals (Noblet et al., 2011).

The first two capabilities reflect potential absorptive capacity, the capability to value and acquire external knowledge (Cohen and Levinthal, 1990). Potential absorptive capacity is considered a necessary but insufficient condition for achieving performance benefits (Zahra and George, 2002). In addition, realised absorptive capacity – the ability to leverage the acquired knowledge – is needed. Realised absorptive capacity consists of transformation and exploitation. An imbalance between these two forms of absorptive capacity is considered to reduce the effectiveness of individual capabilities (Leal-Rodríguez et al., 2014a, 2014b). Focusing on acquisition and assimilation may induce costs of gathering new knowledge without any commercial benefits (Jansen et al., 2005). Conversely, emphasis on transformation and exploitation may generate fast profits but limit the company's flexibility and ability to introduce major innovations.

These four capabilities can be understood as strategic processes which explain how companies may realise the benefits from exposure to external knowledge (Zahra and George, 2002). By looking at how companies enforce these capabilities, it is possible to gain an understanding of how inbound open innovation should be managed in different contexts. Despite of the popularity of the absorptive capacity construct, there have been surprisingly few studies which address how different phases of the process should be managed and what kind of interactions exist between the four capabilities (Volberda et al., 2010).

4. Methods

This study is conducted as a case study aiming to elaborate the theories on inbound open innovation and absorptive capacity (Ketokivi and Choi, 2014). This is a suitable strategy as the context of low R & D intensity is poorly understood within both research streams. Furthermore, case research is an effective strategy in seeking to satisfy the criteria of methodological rigorosity and practical relevance simultaneously (Ketokivi and Choi, 2014). This study follows a multiple case study design (Yin, 1994), as it includes four inbound open innovation projects managed by a single buying company. We adopt the absorptive capacity process as a theoretical framework and examine how the projects are managed in each of the process phases.

4.1. Case selection

For the purposes of the study, we sought for a company which introduces innovative products and services and relies on its suppliers instead of internal R & D in doing so. We selected Fortum, a multinational energy utility company on the basis that it is innovative, has low R & D intensity, and puts a high priority on collaborating with suppliers for innovation. Fortum can be described as a scale intensive company (Trott, 2005), whose assets mainly consist of process technology and whose internal capabilities involve design, engineering, and operations, rather than intensive R & D. New products and services typically emerge through the commercialisation of technologies developed by suppliers. The competitive advantage of a scale intensive company is derived from lower operating costs compared to competitors. According to the OECD definition (IPTS, 2015), Fortum qualifies as a low R & D intensive company on the basis of having R & D expenditures of less than 1% of sales (0.9% in 2014). In general, high R & D intensive companies may invest well over 10% of their sales in R & D. The R & D intensity of Google, for example, was as high as 14.9% in 2014 (IPTS, 2015).

Fortum produces and markets energy and heat for consumers and business customers, the main market being in the Nordic countries. Its production portfolio utilises several energy sources, such as hydro-power and nuclear power, and it runs combined heat and power plants. Fortum aims at improving its competitiveness in climate issues and reductions in CO₂ emissions. The company's strategy is to strengthen and streamline its core businesses, but at the same time it has a strong need to find new business areas based on various emerging technologies and energy sources, pressured by environmental legislation and international agreements. The company actively searches for ways to build new environmentally-benign power generation based on renewable energy sources: solar, wind, and wave power.

Fortum has chosen to maintain internal technology development in one of the core business segments but new business development relies solely on suppliers' technological solutions. The corporate R & D unit focuses on designing and piloting new product types and business models instead of developing new technologies. Fortum considers open innovation as a means to introduce innovations at a rapid pace without major investments into internal R & D.

The selection of the cases was initiated through discussions with the Vice President of Procurement, Chief Technology Officer, and other personnel related to innovation and supply management. First, an

Table 1
Case selection.

| Criteria | Technological novelty | Strategic importance | Supplier involvement |
|--------------------|--|---|---|
| Case Heat | The case should concern an innovation project with technological innovation with commercial targets. New technology that reduces customers' energy costs. | The case should be of strategic importance to Fortum. New business area connected to the energy consumption of households. | The case should involve a supplier with a significant innovator role. Supplier Bravo was the sole technology provider and has patented the solution. |
| Case Solar | New technology that lowers the threshold to apply solar power. | New business area, connected to utilising solar energy in households. | Supplier Charlie developed the actual technological solution, the original idea and need for it came from Fortum. |
| Case Bio | New technology that refines a side stream of a raw material into a saleable product. | Core business area, connected to power plant efficiency. | Supplier Delta developed the refining process. |
| Case Carbon | New technology that saves the environment and lowers EU emission trading costs. | Core business area, connected to power plant emissions. | Supplier Echo developed a process to cut the emissions. |

initial list of 50 major collaborative innovation projects with suppliers during the years 2009–2015 was gathered from public sources, such as company stock exchange releases. The projects were then reviewed with the company representatives and shortlisted based on three criteria: *technological novelty*, *strategic importance*, and *supplier involvement* (Table 1), to fit the topic of substituting internal R&D with supplier innovation. Four case projects were selected, two of which aimed at the renewal of the company's core businesses (Cases Bio and Carbon) and two, which aimed at the introduction of new business areas (Cases Heat and Solar). In all cases new technology developed by a supplier, was applied.

4.2. Data collection

Multiple data collection methods were combined. Informal meetings, presentations, and company reports were used to ground the research. Interviewing was the main data collection method; the main data consists of qualitative data from 18 interviews (Table 2). Informants were selected using a purposive sampling technique – i.e. identifying key people related to the innovation projects. Typically, these people were located in the case company's R & D and procurement units. Furthermore, the informants were asked to identify subsequent informants from the supplier companies, who were also interviewed. This was considered important since the literature on open innovation with suppliers is dominated by studies which consider only the buyer's perspective (Chung and Kim, 2003) and one-sided investigations may

Table 2
Interviews.

| Number | Case | Company | Interviewee Position | Date | Length (min) |
|--------|--------|---------|----------------------------------|-----------|--------------|
| 1 | Heat | Fortum | Project Manager | 20.4.2015 | 40 |
| 2 | Heat | Fortum | Supply Manager | 21.4.2015 | 45 |
| 3 | Heat | Bravo | Head of Sales | 5.5.2015 | 45 |
| 4 | Solar | Fortum | Project Manager | 15.4.2015 | 50 |
| 5 | Solar | Fortum | Technology Manager | 20.4.2015 | 40 |
| 6 | Solar | Fortum | Supply Manager | 21.4.2015 | 60 |
| 7 | Solar | Charlie | Head of Sales | 6.5.2015 | 60 |
| 8 | Bio | Fortum | Project Manager | 15.4.2015 | 55 |
| 9 | Bio | Fortum | Supply Manager | 21.4.2015 | 40 |
| 10 | Bio | Delta | Head of Technology | 11.5.2015 | 45 |
| 11 | Carbon | Fortum | Project Manager | 20.4.2015 | 50 |
| 12 | Carbon | Fortum | Supply Manager | 8.5.2015 | 45 |
| 13 | Carbon | Echo | Sub-area Director | 8.5.2015 | 45 |
| 14 | All | Fortum | Chief Technology Officer | 28.2.2015 | 30 |
| 15 | All | Fortum | Manager, Innovation and Patents | 5.3.2015 | 40 |
| 16 | All | Fortum | Manager, External R & D Networks | 21.5.2015 | 40 |
| 17 | All | Fortum | Material Technology Expert | 12.5.2015 | 40 |
| 18 | All | Fortum | Strategic Purchasing Manager | 27.5.2016 | 90 |

result in limited or biased understanding about the impact of the buyer's actions. The positions of the interviewees vary from case to case due to different compositions of the project teams of a) Fortum and b) of the suppliers, and c) varying levels of access to the suppliers.

The interviews were semi-structured and conducted in the spring of 2015, apart from one supplementary interview, which was conducted in May 2016. Four researchers participated in data collection. Data collection instruments included the following sections: interviewee information, case background, and semi-structured questions about the collaborative innovation project. The interview guide covered questions about the novelty of the innovation and its significance to Fortum's strategy, the capabilities of each party, and how each phase of the projects was managed (see Appendix).

4.3. Data analysis

The data analysis proceeded in three phases. First, a within-case analysis was conducted based on the interview data and supplementary material. The cases were processed into the form of detailed case study write-ups. We aimed to understand different phase of the innovation processes, what the innovations were about, how they were managed, and what each party's role was.

After the initial analysis, we shifted our attention back to the literature and looked for theory which would explain our emerging findings. Consequently, we adopted the absorptive capacity process framework (Zahra and George, 2002). Our view of what our cases are, therefore, evolved throughout the process as our understanding of the empirical context and its compatibility with theoretical concepts increased (Dubois and Araujo, 2007; Dubois and Salmi, 2016). At this point, we also conducted the additional interview to find answers to questions that had arisen during the process. This interview focused particularly on Fortum's capabilities and how they might be utilised differently in cases when internal R & D is substituted with supplier innovations compared to areas where Fortum has strong internal R & D. We then revisited the case descriptions and matched our initial findings to the four capabilities related to the absorptive capacity process. To ensure construct validity, we relied on existing operationalisations to link the interview data and themes which emerged from the interviews with corresponding capabilities (Table 3). In this manner, the analysis process moved back and forth between theory and data and thus resembled the abductive process of inquiry (Dubois and Gadde, 2002).

In the third phase, we compared the findings across cases. We focused on the four capabilities derived from the framework, and used a technique of pattern coding to enable cross-case comparisons (Miles et al., 2013). The coding was based on spreadsheets, tables, and graphical presentations, where the cases were compared according to the selected categories to create in-depth understanding of each case and their similarities and differences. Four researchers participated in the coding and analysis of the cases. The roles of individual researchers varied throughout the process, but in the end, the analyses were a highly interactive collaborative effort with frequent discussions to

Table 3
Indicators of absorptive capacity capabilities and related interview themes.

| Indicators proposed in the literature | Interview themes |
|---|---|
| Acquisition – Ability to detect opportunities in the environment (Noblet et al., 2011). – Openness towards the environment (Camisón and Forés 2010) – Proactive discovery of new opportunities to be exploited (Forés and Camisón, 2016). | – Supply market intelligence. – Technology scanning. – Identifying and evaluating external technologies. |
| Assimilation – Ability to use employees' knowledge, experience and competency in the assimilation and interpretation of new knowledge (Forés and Camisón, 2016) – Integration of external knowledge (Noblet et al., 2011). – Individuals that are highly capable at understanding external technologies (Nemanich et al., 2010). | – Internal technical competences. – Sharing of technological knowledge. – In-depth learning about new technologies. |
| Transformation – Firm's capability to adapt technologies designed by others to its particular needs (Forés and Camisón, 2016). – Ability to understand the consequences of changing market demands in terms of new products and services (Jansen et al., 2005). – Ability to challenge established thinking or practices (Noblet et al., 2011). | – Formulating a business model. – Agreeing on a commercial vision. – IPR ownership. – Contract negotiations. |
| Exploitation – Application of external knowledge (Noblet et al., 2011). – Achievement of organisational goals (Noblet et al., 2011). – The project has clear division of roles and responsibilities (Popaitoon and Siengthai, 2014). | – Product introductions. – Project success. – Operational roles and responsibilities. |

Table 4
Methods to ensure validity and reliability (Gibbert et al., 2008; Yin, 1994).

| Criterion | Method |
|--|--|
| Construct validity: identifying correct operational measures for the concepts being studied. | Research framework explicitly derived from literature. Recording interviews. Multiple data types. Multiple data sources (Fortum and suppliers). Multiple interviewers. Chain of evidence. |
| Internal validity: seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships. | Member checks (confirming emerging findings by company members). Matching patterns across cases. |
| External validity: defining the domain to which a study's findings can be generalised. | Explicit sampling criteria. Description of company characteristics. Connecting findings to prior theory. |
| Reliability: demonstrating that the operations of a study –such as the data collection procedures – can be repeated, with the same results. | Case study database. Case study protocol. Interview guide. Organisation's actual name is given. |

reach consensus in coding and in drawing conclusions. Several measures were taken to ensure the validity and reliability of the findings (Table 4).

5. Within-case analyses

In this section, we report how Fortum was able to substitute internal R & D with technology developed by suppliers in four innovation projects. We examine the projects through the lens of the four absorptive capacity capabilities and investigate how they manifest themselves in the cases. In particular, we look at the management methods and organisational capabilities used to promote the projects and overcome challenges, and the roles of Fortum and its suppliers in different project phases.

5.1. Case Heat

Case Heat was about developing an intelligent heating control system, which reduces the heating costs of private households by giving

the occupant the means to monitor and optimise their energy consumption and choose the desired heating methods. The system continuously monitors the price of electricity and compares it to heating oil prices, and chooses the cheapest way to heat the house. The project started at an initiative of Fortum who identified a business opportunity in the consumer market and was implemented in collaboration with a start-up who was proficient in relevant technological solutions.

5.1.1. Acquisition

Case Heat was started based on Fortum's interest in extending its business in the in-home energy management market. Suppliers with relevant technological solutions were scanned from Europe and the US, and sample products for small scale testing were ordered from several companies to validate the feasibility of the technologies. The tests were promising and, based on a technologically distinctive solution and geographical proximity to the market, closer collaboration was suggested to Bravo. Since there were many technologies available, supply market intelligence was considered important for identifying the best alternative:

“We inspected many foreign companies, even big ones, with different perspectives to home automation... We took the initiative in asking suppliers in the market about their solutions and ordered a small amount for testing.” [Supply Manager, Fortum]

5.1.2. Assimilation

Fortum did not aim to assimilate Bravo's technology, and Fortum's current organisation has no expertise in the technology that is used in the system. Instead, Fortum relies on Bravo's technological capabilities while concentrating on reducing commercial uncertainties. The goal of the project was to combine the parties' complementary capabilities while keeping them in separate organisations. An interviewee described the complementary responsibilities of the companies:

“The product development was our process, and the commercialisation was implemented through Fortum's process... Fortum brought everything related to end customer.” [Head of Sales, Bravo]

5.1.3. Transformation

Some difficulties were faced in resolving conflicting commercial views between Fortum and Bravo, although there was an agreement that Bravo is the sole owner of IPR (intellectual property rights). A Bravo representative described how the commercial visions needed to be aligned before the technology could be exploited:

"We had significant trouble along the way in agreeing on what the product should be like. The most important thing was to understand what the customer wants, what is Fortum's vision of the customer needs, and finally, on our side, what is the product and value proposition. All had to agree on what the product to be developed was." [Head of Sales, Bravo]

Furthermore, the negotiations were complicated by contractual issues. At first, Fortum, being a much bigger company, put forward too complex and detailed contracts, which Bravo did not have the capability to process. Eventually, Fortum had to draft new contracts that were much lighter and more suitable for the start-up. There were also tensions over the division of risks. To ensure the completion of the project, Fortum agreed on a close partnership model instead of an arm's length model. A key reason for this was to ensure the small supplier's ability to develop the product:

"We carried a lot of the risk because the start-up had trouble in financing and was not able to." [Supply Manager, Fortum]

5.1.4. Exploitation

The product was, in the end, commercialised and has generated new revenues for both parties. It is marketed and sold under Fortum's brand while Bravo is in charge of the installations and operations. Fortum is also able to leverage the product in its other business areas by linking it with consumer electricity sales contracts. It was agreed that Bravo was allowed to commercialise the technology through Fortum's competitors after a six-month head start. The roles of the parties are complementary and closely integrated:

"Fortum took over responsibility over customer interface and we are in charge of the technology, delivery, and systems." [Head of Sales, Bravo]

5.2. Case Solar

The innovation in Case Solar was a new turnkey solar power production solution, including a new electricity service contract, aiming to increase customer involvement and generate new revenues from sales. Following the contemporary trends to utilise renewable energy sources, Fortum was the first company in the market to offer turnkey solar kits including the needed technologies, consultation, and installation. The project was based on the technological solution developed by a start-up supplier.

5.2.1. Acquisition

The corporate technology team carried out internal pre-studies to search for new technologies and created a technology roadmap for developing solar technology based new products. Low internal capabilities in solar energy were not considered a problem, since:

"The technology search didn't require any specific technological competences, but rather a strong will to learn." [Strategic Purchasing Manager, Fortum]

The suppliers were identified based on the technology search and evaluated by their financial performance, technological capabilities, product and manufacturing quality, and sustainability, and eventually Charlie was chosen.

5.2.2. Assimilation

Fortum did not aim to build internal competences in solar technologies and therefore there was no need to transfer the supplier's knowledge on solar technologies. Instead, Charlie's existing solutions were packaged into products that could be marketed for Fortum's electricity customers. Fortum had a clear managerial focus on creating new products and getting a grip on new technology, while Charlie was looking for credible marketing and sales partners. Charlie's technological capabilities were complemented with Fortum's sales and

marketing capabilities:

"This was similar product to what we have sold before. However, with Fortum we have a good brand and are able to create a simple solution for the consumers." [Head of Sales, Charlie]

5.2.3. Transformation

The contract negotiations were heavy for Charlie, which had limited resources to spare. Experience of previous collaborations was, however, considered to facilitate the interactions:

"We knew that when new business is created there will be heavy contracts, but we already knew their ways of working so it wasn't too bad for us." [Head of Sales, Charlie]

A key challenge in the project was agreeing on a business model which would enable the commercial exploitation of the technology. At first, a standard Fortum supply contract was used as a basis for commercialising the turnkey solar power production solution. Later, the contract was significantly modified several times to refine and resolve issues related to the business model. The difficulties can be accounted to the difference in size between the two organisations:

"What was interesting for us was to learn how to work with big customers, and how to make our systems 'contractable'." [Head of Sales, Charlie]

5.2.4. Exploitation

Soon after the product commercialisation, a strategic supply management project was initiated to create a category strategy for the solar power production technology. Fortum was the first company to introduce such product in the market, and successful collaboration between the organisations has led to continuous development of the product family. An interviewee at Fortum emphasises the capability to manage supplier relationships in ensuring successful operations:

"Supplier relationship management is very important... With the chosen supplier, we have a good and open dialogue about future development and the potential of new solutions. This is enabled by our internal competences. Communication is always better if you now the suppliers well and have personal contacts." [Supply Manager, Fortum]

5.3. Case Bio

In Case Bio, the innovation was a new technology related to a power plant process. The technology, developed by the supplier Delta, enables the refining of a side stream of the plant's raw material into an environmental-friendly new product. In the long term, the technology allows Fortum to increase its business revenues through the sales of a new product in business-to-business markets without an increase in the operating costs. It also supports Fortum's sustainability agenda. The technology in question originated in a research institute which further developed it with supplier Delta. The outcome of the project was a full scale pilot power plant which validated the feasibility of the technology.

5.3.1. Acquisition

Since the technology was just emerging at the time, no ready solutions were available. Fortum scanned for suppliers globally, and identified an ongoing research project formed by supplier Delta, a research institute, and a Finnish forest industry company. The supply market intelligence process was described as light but efficient:

"[Supplier] scanning was done in a short time, but the research was thorough in searching existing solutions." [Project Manager, Fortum]

Due to the low maturity of the technology, Fortum could not be sure that consortium partners had superior technology compared to other

options. Therefore, the project involved high risks, and supplier selection was made partly on the basis of existing ties:

“Of course it was easier to deal with a known supplier.” [Project Manager, Fortum]

5.3.2. Assimilation

The case was based on complementary assets, instead of assimilating the supplier's technology. Fortum was not proficient in the technology that the project was based on, as described by an interviewed Supply Manager:

“The [Case Bio] is basically about this chemistry process. Hence, the project included lot of areas on which Fortum didn't have deep expertise.” [Supply Manager, Fortum]

Fortum and Delta were aiming at different areas of the value chain for the new product, which was why there was a good complementarity in the strategic goals of the companies and no intensive technological knowledge sharing was required:

“Fortum has end customer responsibility and we take care of the process technology. Thus, we have separate roles in the value chain and we complement each other.” [Head of Technology, Delta]

5.3.3. Transformation

As a new-to-the-world product, the project involved high uncertainties related to technology development. Therefore, a close partnership including significant risk-sharing was agreed on. This was considered an important antecedent of successful future collaboration:

“When we take over a big challenge involving new technology, we partner – for risk-sharing, competence, and end customer knowledge... If you go into typical supplier-customer mode in a new business development project, it ruins the trust between companies.” [Head of Technology, Delta]

Nevertheless, the costs were significantly underestimated in the beginning which created stress between the partners as Fortum become doubtful of the project's profitability. Negotiation capabilities were needed to resolve the disagreements:

“The problem was that [Delta's] development costs increased after the specifications were completed, which was unexpected. Then the challenge was to negotiate the prices down... When innovating, you will always encounter obstacles, but the question is if you are willing to overcome them. In the negotiation situation, it was proved that both parties wanted to achieve a win-win situation.” [Supply Manager, Fortum]

Fortum's primary goal was not to aim for IPR ownership and by not demanding a stake in the IPR it was able to gain a better overall negotiating position:

“We had a chance to get part of the IPR for ourselves, but decided not to fight for it and prioritise other needs.” [Project Manager, Fortum]

Also, no business exclusivity was granted to Fortum. Nonetheless, learning opportunities from orchestrating the project and selling a new product were considered valuable, since:

“Fortum's business interest was in reproducing the solution in 5–10 other plants.” [Supply Manager, Fortum]

5.3.4. Exploitation

A pilot project at a full power plant scale was completed, which demonstrated that the technology was of sufficient quality. An interviewee at Delta considered close relationship and congruent interests to be important in realising the project:

“One thing that must be always noted is the complementarity of company

goals in the collaboration project... It is great that we have been able to collaborate in an open manner, there is no hiding of information between companies. This is definitely different to many other companies.” [Head of Technology, Delta]

After the pilot project, Fortum went on to utilise the innovation also in other power plants. However, a wide-scale introduction of the end product in the B2B markets is still a work in progress. Fortum is also considering collaboration with its competitors to reduce the financial burden of large-scale commercial implementation, as Fortum's advantage is not derived from the ownership of the technology but from adopting the technology in its power plants and selling the end product:

“In summary, the overall grade [of Case Bio] is not bad, since this was a first-in-the-world project, with a promising end result. In the end, what is important is that we can easily copy the technology into other systems.” [Supply Manager, Fortum]

5.4. Case Carbon

Case Carbon aimed at implementing a new technology which captures a CO₂ sidestream from a power plant in order to reuse it. Therefore, it is a means for reducing carbon emissions. The technology was known to exist but it had not been commercialised so far and the project aimed to be the first full scale demonstration of it.

5.4.1. Acquisition

In the early acquisition phase, Fortum conducted some internal research before hiring a consultant to support creating a request for information (RFI) documentation. The RFI process was used to gain knowledge of the supply market and identify potential suppliers of the technology with the goal of starting a pilot commercialisation project at one of Fortum's power plants. Around ten suppliers with relevant technological solutions were identified, and finally Echo was chosen. Good reputation as a partner was an important selection criteria:

“We were actively scanning the technologies and suppliers; we had a consultant that made an initial questionnaire for potential suppliers. Since as was no market price for such technology, we had to put the emphasis on partner qualities. We made a TCO [total cost of ownership] type of evaluation and then assessed the capabilities of the companies.” [Supply Manager, Fortum]

5.4.2. Assimilation

Fortum and Echo were aiming for different parts of the value chain and thus there was a natural complementarity in their aims. Echo was responsible for the CO₂ capturing technology, while Fortum was in charge of creating the supply chain needed for reusing the material. Since Fortum did not have relevant technological capabilities, developing the technology internally would have been difficult and costly. Therefore, Fortum and Echo established a joint venture partnership in which both could contribute in ways that are consistent with their respective strengths:

“Since the technology was not ready, we had to partner. We were aiming to create a competitive advantage through business exclusivity. It would be simpler to tender, but we didn't have resources for development and it would be too expensive for us. We know how to create contracts, but we don't have engineering knowledge.” [Supply Manager, Fortum]

5.4.3. Transformation

The commercial contract negotiations were described as challenging for both parties. While both companies had similar interests towards commercialisation, because of the novelty of the innovation existing contract templates could not be used:

“The negotiations were not easy. This is a special case, since we are

making a new solution, and all issues, including IPR and terms and warranties, were tailor-made.” [Sub-area Director, Echo]

A key point of disagreement was the technology exclusivity demanded by Fortum:

“We created the contract from scratch and it was a really hard negotiation involving many parties. The key point was the exclusivity. It was a big question for Echo. We wanted to have exclusivity in the technology, but they didn't give it to us.” [Supply Manager, Fortum]

Later, a compromise was formed: Echo granted a preferred customer status to Fortum to compensate for the absence of technology exclusivity. Fortum did not push for IPR ownership, since:

“The whole idea was that IPR and rights stay at the technology supplier. Fortum's business idea was to be the leading utility in commercialising it among the first ones.” [Project Manager, Fortum]

5.4.4. Exploitation

To implement the project, the supply chain to transfer the captured CO₂ to the end customer, including harbour operations and logistics, and end use, needed to be designed in detail. This was Fortum's responsibility and one of the company's main tasks in the project. Eventually, the project was cancelled before the commercialisation phase, due to a change in Fortum's strategy, which reflected large-scale changes in industry trends. The project was, however, considered successful by the interviewees, since it started from an internal small-scale research project and concluded with a mature business concept including the whole value chain for the new technology:

“Definitely a success. It was a brilliant project, but there were many factors affecting it, like politics and so on. I think it is only a matter of time before it becomes relevant again.” [Director, Echo]

The project was challenging due to its high novelty and ambitious scope which covered the whole supply chain. Nevertheless, collaboration within the project and relationship with the supplier were managed well which facilitated its implementation:

“The project progressed very fluently – we had clear project goals and excellent communication with all of the stakeholders.” [Supply Manager, Fortum]

6. Cross-case analysis

Following the theory-elaboration phase of the case study methodology (Ketokivi and Choi, 2014), we conducted cross-case analyses of the four cases from an absorptive capacity perspective. When comparing the cases, we found significant similarities with respect to the four key absorptive capacity constructs: acquisition, assimilation, transformation, and exploitation. The cases all point towards similar manifestations of the absorptive capacity capabilities, that is, similarities in how the absorption processes proceeded and how they were managed (Table 5). We also point out when the cases indicate that a certain absorptive capacity capability did not manifest in ways that are suggested by the literature to contrast the general theory with the specific context of low R & D intensity (Ketokivi and Choi, 2014). Some differences related to the size of the suppliers and the novelty of the innovations are also noted.

In this section, we compare our findings from the analysis to the extant literature on absorptive capacity and present propositions on managing inbound open innovation in a context where the buyer firm has low R & D intensity and thus scarce in-house R & D resources. The section is structured in the following way. We address each absorptive capacity capability by first providing relevant theoretical background from the extant literature. The purpose of this is to provide a point of comparison to our propositions. We then present our findings, noting

similarities and differences across the cases. Then, we formulate a proposition concerning the absorptive capacity capability in question to capture our contribution in a concise form.

We begin by taking a closer look at the acquisition phase. Previous literature maintains that the capacity to absorb external knowledge is dependent on prior investments in related knowledge (Cohen and Levinthal, 1990). Typically, this is understood to develop cumulatively and to be strongly path-dependent (Lane et al., 2006). Without prior knowledge, the organisations are not able to evaluate new information and fail to absorb it (Todorova and Durisin, 2007). Possession of relevant knowledge is considered to facilitate learning by enabling “the ability to store new knowledge into one's memory and to recall and use it” (Van den Bosch et al., 2003, p. 280). In a low R & D intensity firm, scarce R & D resources are hence a potential barrier to effective utilisation of open innovation. However, our findings suggest that if the innovations are based on complementarities instead of assimilating the suppliers' technologies, in-depth understanding of the technologies is not necessary and acquisition can be based on short-term investments in learning about new technologies before starting the collaborative innovation process.

While in two cases (Solar, Bio) there was some existing knowledge about the supply market and its opportunities, investments in learning about new technologies were an important antecedent of the open innovation process of all four cases. In Case Heat, suppliers with relevant technological solutions were scanned from Europe and the US, and sample products were ordered for small scale testing. In Case Solar, the corporate technology team carried out internal pre-studies for the technology search and created a technology roadmap for developing solar technology based new products. In Case Bio, Fortum scanned for suppliers globally, and identified an ongoing research project formed by supplier Delta, a research institute, and a Finnish forest company. In Case Carbon, Fortum first carried out internal early research and then a systematic and extensive request for information (RFI) process among suppliers with the support of an external consultant. These similarities suggest that proactive efforts to scan potential suppliers for innovation opportunities is required for substituting internal R & D with supplier innovations, which leads us to our first proposition:

Proposition 1: When the buyer firm has low R & D intensity, sufficient knowledge and understanding about the acquired technology need to be gained before starting the open innovation process. Supply market intelligence is an important capability for supporting this process.

Now we move to the assimilation phase. It is notable that much of the absorptive capacity literature takes it for granted that a capability to assimilate the external knowledge or technology is a prerequisite to exploiting open innovation (Cohen and Levinthal, 1990; Lane et al., 2006; Todorova and Durisin, 2007; Volberda et al., 2010). It is reasonable to assume that assimilation requires in-depth understanding of the technological area since without related competences new knowledge cannot be analysed, processed, and interpreted (Zahra and George, 2002).

Our findings contrast with the existing studies in indicating that the assimilation of the new technology is not necessary, which enables firms with scarce R & D resources to effectively utilise open innovation. Fortum did not want to assimilate its suppliers' technological knowledge in any of the four cases (see Table 5), since maintaining and developing the technology would have required significant investments in R & D. The focus in all four cases was on combining the complementary capabilities of the parties while keeping them in separate organisations. In Cases Heat, Solar, and Bio, Fortum's role was to bring customer knowledge and commercialisation capability to the joint innovation project. In Case Carbon, Fortum aimed to be a pioneer in applying the supplier's new-to-the-world technology in its power plants, and to support its commercialisation by creating the supply chain needed for reusing the material. Since intensive technology exchange was not required in any of the cases, Fortum did not develop internal expertise in

Table 5
Case summaries.

| Case | Case Heat | Case Solar | Case Bio | Case Carbon |
|-------------------------------|--|--|---|--|
| Innovation description | Intelligent home heating control system. | Residential solar energy kit. | Bio-oil production. | CO ₂ emissions reduction in power plants. |
| Business purpose | New product to consumer markets. | New product to consumer markets. | New product to B2B markets. | To radically reduce CO ₂ emissions in Fortum's power plants. |
| Innovation novelty | New-to-the-market product. | New-to-the-market product. | New-to-the-world application of an existing technology. | New-to-the-world application of an emerging technology. |
| Supplier size | Small | Small | Large | Large |
| Acquisition | <ul style="list-style-type: none"> - Global supplier scanning. - Ordering of sample products. - Main selection criteria: technology, geographical location. - No existing knowledge of the supply market. | <ul style="list-style-type: none"> - Internal pre-studies. - Creation of a technology roadmap. - Technology and supplier search. - Main selection criteria: technology, sustainability, financial performance, production quality. - Some existing knowledge of the supply market. | <ul style="list-style-type: none"> - Global supplier scanning. - Main selection criteria: technology, familiarity. - Some existing knowledge of the supply market. | <ul style="list-style-type: none"> - Internal research. - Use of external consultants in RFI process. - Main selection criteria: technology, partner qualities. - No existing knowledge of the supply market. |
| Assimilation | <ul style="list-style-type: none"> - No intensive technological knowledge exchange. - Fortum's current organisation has no expertise in the technology. - Complementary roles of Fortum and the supplier. | <ul style="list-style-type: none"> - No intensive technological knowledge exchange. - Fortum's current organisation has no expertise in the technology. - Complementary roles of Fortum and the supplier. | <ul style="list-style-type: none"> - No intensive technological knowledge exchange. - Fortum's current organisation has no expertise in the technology. - Complementary roles of Fortum and the supplier. | <ul style="list-style-type: none"> - No intensive technological knowledge exchange. - Fortum's current organisation has no expertise in the technology. - Complementary roles of Fortum and the supplier. |
| Transformation | <ul style="list-style-type: none"> - Main issues: customer needs, suitable contracts, division of risks, partnership model. - Specific challenges in negotiations: contract mode, division of risks. - External and internal knowledge bases complemented each other, but technological knowledge was not combined. | <ul style="list-style-type: none"> - Main issues: suitable contracts, business model. - Specific challenges in negotiations: supplier's limited resources for negotiating, contract mode for companies of different sizes. - External and internal knowledge bases complemented each other, but technological knowledge was not combined. | <ul style="list-style-type: none"> - Main issues: division of risks, partnership model, business exclusivity. - Specific challenges in negotiations: increased commercial risk due to underestimating the supplier's development costs. - External and internal knowledge bases complemented each other, but technological knowledge was not combined. | <ul style="list-style-type: none"> - Main issues: suitable contracts, business exclusivity. - Specific challenges in negotiations: creating a new contract template for a new business model, IPR ownership. - External and internal knowledge bases complemented each other, but technological knowledge was not combined. - Cancellation before commercialisation. - Close collaboration. |
| Exploitation | <ul style="list-style-type: none"> - Introduction of a new product. - Close collaboration. | <ul style="list-style-type: none"> - Introduction of a new product. - Close collaboration. - Continuous development. | <ul style="list-style-type: none"> - Building a full scale pilot power plant. | <ul style="list-style-type: none"> - Cancellation before commercialisation. - Close collaboration. |
| IPR ownership | Supplier | Supplier | Supplier | Supplier |
| Outcomes | New business model and product sales to residential customers. New revenues, business model, and reference product for Bravo. | New revenues, business model, and technology competence for the buying company. Supplier: new revenues, reference product, and business model. | Successful pilot. Delivery project is delayed and still ongoing. Potential new revenues for Fortum; a reference product for Delta. | Not commercialised. A new business concept for the whole value chain. New competences for the buying company. |

the technologies, and complementarities played significant roles in their implementation, we formulate our second proposition as follows:

Proposition 2: When the buyer firm has low R&D intensity, joint innovation with suppliers is based on complementary assets and the buyer does not need to assimilate the supplier's technology.

Whereas transformation is typically discussed as an internally-focused capability, in this study the conflicts were interorganisational and hence their resolution required the ability to successfully carry out interorganisational negotiations. In all four cases, Fortum and the suppliers carried out extensive and challenging contract negotiations for transforming the complementary capabilities into joint commercial business models. In the end, close partnerships were formed (in contrast to transactional arm's length relationships) in all cases. Since Fortum had no interest in investing in the development of the technologies, in each case the IPR ownership was granted to the suppliers to increase their motivation to join the projects and continue developing the technologies.

Case Heat and Case Solar concerned new-to-the-market products. In these cases, the focus in contract negotiations was in reducing commercial uncertainties, sharing risks, and finding business models that would maximally exploit the commercial potential of the suppliers' technologies. In both of the cases, the suppliers were small, the initial contract templates were too heavy, and there were conflicting views of customer needs and business models.

Case Bio and Case Carbon dealt with very ambitious new-to-the-world technologies and were associated with high uncertainty. Consequently, it was difficult to agree on how to share the risks and rewards. In Case Bio, a pilot project in the power plant scale was initiated to address the high uncertainties related to technology development. In Case Carbon, disagreements considering exclusive access to Echo's technology and the lack of an existing supply chain to transfer the captured CO₂ to the end customer brought additional challenges to the transformation phase, putting high requirements to Fortum's negotiating and contracting capabilities.

These findings are consistent with the extant literature which describes transformation as the ability to create new business models (Vanhaverbeke et al., 2008) which considers the "consequences of changing market demands in terms of new products and services" (Jansen et al., 2005, p. 1014). Some differences can, however, be found: as the knowledge is not integrated in the buying company, there are no major issues in combining new technological insights with the existing knowledge base (Zahra and George, 2002). Instead, the transformation phase is about commercial knowledge: commercial vision for the new product and the roles and responsibilities of each party. Since the views on the commercial arrangements can be conflicting, there may be a need to "recognise two apparently incongruous sets of information and then combine them to arrive at a new schema" (Zahra and George, 2002, p. 190).

Our observations are also in line with a recent suggestion that key activities in the transformation phase include deciding on the rules and

objectives that govern the development of a market-ready product based on the initial technology (Patterson and Ambrosini, 2015). Our findings suggest that capabilities for finding suitable contract types for sharing risks and rewards, and helping small suppliers collaborate with a larger partner are needed in the transformation phase. All four cases in our study demonstrate the importance of negotiating and contracting capabilities for transforming the complementary capabilities to joint commercial business models. Thus, we formulate our next proposition:

Proposition 3: When the buyer firm has low R&D intensity, agreements on commercial visions and business models need to be reached before a joint innovation with suppliers can be commercialised. In this process, negotiating and contracting capabilities are important for promoting the resolution of conflicting views.

Exploitation is generally considered as a firm's internal effort for incorporating the new knowledge into the company's business and for introducing new products (Zahra and George, 2002). Furthermore, it is understood to concern the fine tuning of business models and expectations to adjust to market changes or new knowledge (Demil and Lecocq, 2010; Poulymenakou and Prasopoulou, 2004). Our findings suggest that when a buyer and its suppliers aim for different parts of the value chain, exploitation is a collaborative effort, which benefits from intensive collaboration in the form of close partner relationships. Both in Case Heat and Case Solar, Fortum and the supplier commercialised the joint innovation through Fortum's sales channels. In Case Bio, a research institute and an industrial customer were also involved in the consortium which supported Fortum and the supplier in commercialising the new technology. However, the project proved to be very ambitious and to require such significant investments that no large-scale implementation has yet taken place, and Fortum considers inviting additional partners to the consortium. Fortum's supply management professionals had a vital role in managing the collaboration and relationships with the suppliers and other external partners in all four cases. In particular, supplier relationship management capability was required in Case Solar in building a category strategy for the solar technology. Furthermore, Case Carbon showed that incongruent interests of the buyer and the supplier might hinder effective exploitation of the joint innovation. While the interest of Fortum was to gain competitive advantage over its competitors, the interest of the supplier was to leverage the joint innovation with Fortum's competitors as soon as possible. Although a compromise was found, the project was cancelled before the commercialisation. In all cases, close collaborative relationships were considered important for the exploitation of the technologies because the utilisation of complementary capabilities required the tight integration of the operations and aligned interests. We therefore propose that:

Proposition 4: When the buyer firm has low R&D intensity, the buyer and the supplier need to have congruent interests and collaborate closely in commercialising the innovation. In this process, supplier relationship management and collaboration capabilities are important for ensuring fluent operations.

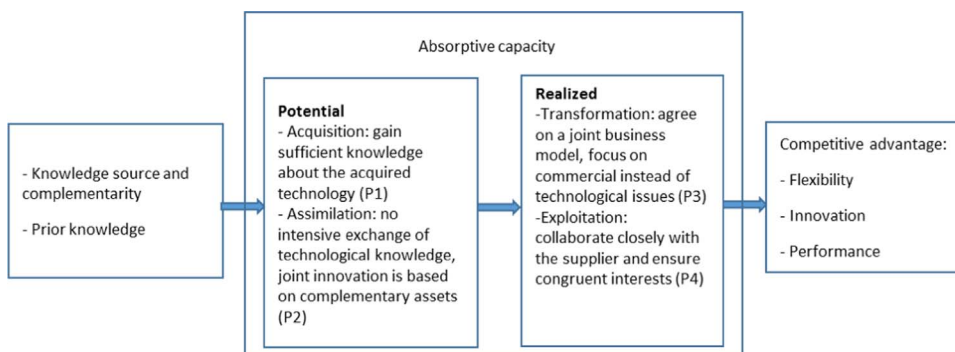


Fig. 2. The proposed absorptive capacity process in the low R&D intensity context.

In Fig. 2, we summarise our propositions and elaborate the absorptive capacity theory (Cohen and Levinthal, 1990; Zahra and George, 2002) by suggesting how the four absorptive capacity capabilities manifest themselves when a low R&D intensity company aims to leverage its suppliers' knowledge for reaching innovation outcomes. Based on the observations from the four cases of our study, we propose that in the low R&D context there are idiosyncrasies in all four capabilities of the absorptive capacity that must be taken into account in the open innovation process. Since the firm has limited prior knowledge of the acquired technology, major efforts are required for gaining the sufficient knowledge about the new field before starting the open innovation process. It is also found that inbound open innovation with suppliers is possible without high assimilation capability making it possible for low R&D companies to benefit from new external technologies. In the low R&D context, transformation does not include merging incompatible technological knowledge sets, but instead focuses on reaching an agreement on how the technologies should be commercialised. Exploitation, in turn, is more complicated in the low R&D context since it is a collaborative effort with the supplier.

In this section, we have proposed that the capabilities of supply market intelligence, negotiating and contracting, and supplier relationship management and collaboration are important for managing the inbound open innovation process with suppliers in a low R&D intensity context. All of these capabilities fall into the category of *supplier management capabilities*. Extant literature suggests that supplier management capabilities, such as the abilities to manage supplier relationships, supplier risks, and supplier development (Day and Lichtenstein, 2006; Foerstl et al., 2010; Reuter et al., 2010), are needed to establish and manage successful buyer-supplier relationships (Wagner and Boutellier, 2002). According to our findings, different supplier management capabilities are needed in different phases of the absorption process. Supply market intelligence capability is needed at the acquisition phase, negotiating and contracting capabilities in the transformation phase, and supplier relationship management and collaboration capabilities in the exploitation phase. The study therefore takes a step in filling the gap in the current understanding of the processes and policies that firms can use to manage the use of external knowledge sources in low R&D contexts (Lane et al., 2006).

7. Conclusions

Our study challenges the traditional view of open innovation as merely a complement to strong internal R&D by reporting how an incumbent energy company with low R&D intensity is able to introduce new innovations based on its suppliers' technologies. By investigating the company's absorptive capacity process, we are able to describe how such innovation projects can be managed. Inbound open innovation is widely understood as a strategy to complement internal R&D (Dahlander and Gann, 2010; Hung and Chou, 2013). In addition to companies' internal resources, they are able to tap into external sources for knowledge, ideas, and capacity (West and Bogers, 2014). It is often implied that the company in question has the main responsibility for managing the collaborative innovation projects and, for doing so, a certain level of technological proficiency is necessary (Cohen and Levinthal, 1990). Previous studies have, however, ignored situations where the buying firm has low R&D intensity and therefore a limited capacity to learn new technological insights and implement them in development projects (Dahlander and Gann, 2010). The implicit assumption is that inbound open innovation cannot take place in such contexts.

Can supplier innovations substitute for internal R&D? Our study indicates that they can, but it sets new requirements to acquisition, transformation, and exploitation, which all emphasise the role of supplier management capabilities in the open innovation process. Since absorptive capacity is widely considered essential to inbound open

innovation, it is interesting to investigate if absorption processes may take place in a low R&D context. Our findings suggest that while the assimilation capability does not strongly manifest itself in this context, the other three capabilities associated with the theory are still relevant. We propose that certain supplier management capabilities are important for successfully carrying out inbound open innovation projects with suppliers as they facilitate the assimilation, transformation, and exploitation of the suppliers' innovative technologies. The acquisition phase requires supply market intelligence that provides deep insights to suppliers' technologies and R&D resources. Furthermore, the transformation phase relies on buyer-supplier negotiations that are very demanding, involving complexities on agreeing on the business model, exclusivity, and risk and reward sharing. The contracts required for transformation are complicated and strategically important for both parties. Finally, supplier relationship management and collaboration capabilities promote the exploitation phase in the low R&D context. These findings contribute to the discussion on inbound open innovation and absorptive capacity as they suggest that by developing proficiency in supplier management companies may be able to build the ability to exploit external sources of innovation without high investments in internal R&D (Ateş et al., 2017). Low R&D intensity companies have been suggested to have a great need for external inputs to innovation but a low ability to benefit from it (Barge-Gil, 2010; Kim et al., 2016). As open innovation activities diffuse beyond the high-tech industries it is valuable to identify processes which do not rely on high R&D investments (Chesbrough and Crowther, 2006; Spithoven et al., 2011).

By contrasting our empirical findings with the extant theory on open innovation and absorptive capacity, we propose a distinction between two alternate forms of inbound open innovation: the first of which aims for learning and the second for accessing external knowledge. The first approach involves the assimilation of external knowledge and is therefore limited by the level of internal R&D intensity. The latter approach does not result in significant technological learning outcomes but allows companies to introduce new products by substituting internal R&D with inbound open innovation, making it a suitable strategy for low R&D intensity companies. Similar type of distinction can be found for example in the studies of different forms of strategic alliances (De Clercq and Dimov, 2008; Grant and Baden-Fuller, 2004). Thus, support to our suggestion of the existence of two alternate forms of inbound open innovation can be found from earlier literature, and these findings support each other. Our result is also in concord with the suggestion that adopting a "knowledge accessing approach", in which the partners' knowledge bases remain differentiated, enables companies to be involved in a large number of diverse innovation projects (Grant and Baden-Fuller, 2004).

7.1. Managerial implications

Several implications for managers may be derived from our study. If innovation based on internal resources is not a realistic option, internal R&D may be substituted with inbound open innovation with suppliers. In doing so, the first issue is to develop high acquisition capability. This can be promoted by finding methods to scout new technologies, suppliers, and markets to identify new opportunities. If there is no intensive R&D which would generate the capability as a by-product, it needs to be built deliberately. Second, sufficient negotiating and contracting capabilities should be ensured. Especially when collaborating with innovative entrepreneurial companies, finding suitable contracts and other governance mechanisms is critical (van der Valk et al., 2016; Zaremba et al., 2017). It is also vital to construct a shared view of the goals of the collaboration and set up the necessary formal governance mechanisms. Third, close partnerships with the suppliers should be formed. Launching products based on novel technologies often requires long-term commitment to a single supplier. Especially with new-to-the-market and new-to-the-world products the level of uncertainty is high, and the relationship needs to be able to survive unexpected obstacles

and changes of course.

7.2. Limitations and suggestions for future research

The scope of our study was limited to a buyer of a significant size. It remains unresolved whether small companies are able to operate in a similar manner. The small size of the suppliers was also acknowledged as a source of complications in two of the projects. Since small start-ups are generally considered important sources of innovations, further research would be warranted of how to ensure successful collaboration between companies of different sizes. Our findings also suggest that the ability to orchestrate networks of many companies is needed when working on complex projects. We, however, did not focus on this line of inquiry. Another interesting observation was the buyer company's ability to systematically scan potential suppliers for novel technologies. Our informants referred to activities such as internal pre-studies, internal research, and supplier scanning. Practical insights on how to carry out such activities is, however, still scarce which warrants future research.

Appendix. Interview guide

Interviewee profile

1. Name, title, and organisation
2. Position in the organisation during the case project
3. Work history

Case profile

4. Describe the innovation project.
5. What business area and supply management category does this project belong to?
6. Who is the primary customer for this innovation?
7. Who was (were) the primary supplier(s) for this innovation?
8. What was the origin of the innovation idea (e.g. internal party, existing supplier, new supplier)?
9. Describe the novelty of this innovation
10. How did this innovation effort relate to the company's technology strategy?
11. Who at your organisation and your supplier's organisation were involved in establishing the business relationship?
12. How was the process of supply market intelligence conducted?
13. What tools/processes were used with suppliers in creating and evaluating the business case?
14. What kind of formal contracts were in place before a formal investment decision?
15. When and how was final investment decision made?
16. Who at your organisation and your supplier's organisation were involved in the project?
17. What did each party bring to the project?
18. What was the contractual model used for this project?
19. How was IPR managed, and what was the role of IPR in the case?
20. How the supplier relationship was managed?
21. How did the level of technical competence in your company affect the collaboration?
22. How systematic was the collaboration between the project and the supply management employees?
23. How useful was supply management knowledge regarding the innovation case?
24. How much did the collaboration with a supplier affect the outcome of the project?
25. How did your company culture affect the collaboration?
26. How would you evaluate the success of the project?
27. What could have been improved in this collaboration?

The same questionnaire in a modified form was used when interviewing the supplier companies.

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