Aalto University
School of Economics

The Possibilities of One-Time Project Collaboration in Company Challenge Resolution - A Study of IDBM KONE and PDP KONE Project Collaborations

Logistics

Master's thesis

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2012

Department of Information and Service Economy
Aalto University
School of Economics

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Inna Pirkanniemi k84272
Autumn 2011

Approved by the Head of the Department of Information and Service Economy

_____/_____ 2012,

and awarded the grade

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ACKNOWLEDGEMENTS

Time has flown quickly by and now the time has come to thank everyone that has been part of this process in one way or another.

First and foremost I would like to thank my two thesis instructors: Tomi Kommeri from KONE for giving me the freedom to set my objectives for the thesis and trusting in my way of working yet being always ready to go through, discuss and suggest improvements throughout the process. And Matti Rossi from Aalto University School of Economics for his interest in my topic, for his comments and for his help with questions regarding empirical research and scientific requirements.

Secondly I would like to say a big thank you to my mum who helped me greatly by being my objective eyes, the constructive criticizer and the mental support. Though the field of innovation and innovation intermediation was new for her, I admire the energy and dedication with which she approached this process.

I would also like to thank all of my interviewees for their time and thoughts as well as my colleagues at KONE for the interest and support they showed towards my thesis.

Last but not least, a thank you to Janne Korhonen who set me on the right path with my interview questions and for his opinions, and a big thank you to my friends for their mental support and for keeping my social life intact.

Helsinki, January 2012

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ABSTRACT

Today's business environment requires companies to constantly develop and introduce new products and services. With rising R&D costs yet increasing quality demands, companies are looking into the opportunities of open innovation. In essence, in order to improve the cost-efficiency of innovating, companies seek to reach sources that already hold knowledge and solutions to problems and opportunities the company is encountering.

In this thesis, the open innovation subject is approached from the point of view of innovation intermediaries. These Internet-based service providers offer a range of services to help companies to fill the case-specific capability gaps by reaching the resources of relevant knowledge providers.

The research model and its extension were built on the basis of the analyzed interview material. The matrix includes a process to show how the company's needs assessment leads to a challenge description from which the solvers identify the underlying problem and implement the solution proposition. The company evaluates the value-adding potential of the resulting outcome and decides whether it will be moved into the product development process.

The study shows that one-time knowledge providers transmitted by innovation intermediaries cannot be used in all cases. Supplier involvement depends on the complexity of the developed product, the capabilities of the supplier as well as positive past history which lead to an appropriate level of supplier development responsibility. In this light, one-time suppliers could be utilized in value-adding, discrete development tasks. This can be considered as beneficial to the company because it enables moving straight into the development phase of the best ideas having invested limited resources into research and ideation.

Following the empirical research which concentrated on what KONE gets from participating in the IDBM and PDP student development projects, the findings show that the value comes in the form of the opportunity to get ideas outside the KONE dominant logic and the potential added value that these may generate in the future. Diversity and motivation of the solver team members were discussed as to how they affect the commitment to working on the challenge and the innovativeness of the outcome.

Keywords: Open innovation, innovation intermediary, InnoCentive, product development, IDBM, PDP
Number of pages with attachments: 75

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Kertaluontoisen projektiyhteistyön mahdollisuudet yritystoimeksiannossa

Tutkielma IDBM KONE ja PDP KONE -projektiyhteistyöstä

TIIVISTELMÄ

Nopeatahtinen kilpailuympäristö edellyttää yrityksiltä jatkuvasti uusien tuotteiden ja palveluiden lanseeraamista. Samalla kun tuotekehityskustannukset nousevat, tuotteilta vaaditaan entistä korkeampaa laatua. Parantaakseen tuotekehitystoiminnan kustannustehokkuutta yritykset etsivät sellaisia lähteitä, joilla on jo se tieto ja ratkaisuehdotukset niihin ongelmiin ja mahdollisuuksiin, jotka yritys on kohdannut.

Tutkimuksessa lähestytään avointa innovaatiota innovaatiovälittäjien näkökulmasta. Nämä Internet-pohjaiset palveluntarjoajat tarjoavat erilaisia palveluita, joiden avulla ne auttavat yrityksiä saamaan sellaisia tietoja ja taitoja, jotka puuttuvat yrityksestä, mutta joita se tarvitsee eri projekteissa.

Tutkimusmalli ja sen jatke on kehitetty haastattelumateriaalin analysoinnin pohjalta. Matriisi sisältää prosessin, joka alkaa yrityksen omien tuotekehitystarpeiden kartoittamisesta ja projektitehtävän muotoilemisesta. Projektitehtävän kanssa työskentelevät selvittävät mikä yrityksen ongelma on ja tarjoavat siihen ratkaisuehdotuksia, jotka yritys arvioi. Jos yritys näkee lopputuotteessa potentiaalia lisäarvon tuottamiseen, se voi päättää aloittaa tuotekehitysprosessin.

Tutkimuksessa todetaan, ettei lähtökohta, jossa pyritään tavoittamaan ja käyttämään kertahyödyllistä tietoa toimi kaikissa tapauksissa. Toimittajan osallistaminen riippuu kehitettävän tuotteen monimutkaisuudesta, toimittajan kyvykkyydestä sekä aikaisemmista positiivisista yhteistyötuloksista, joiden pohjalta toimittaja saa vastuulleen tarkoituksenmukaisen tuotekehitysalueen. Kertaluonteisten toimittajien arvoa voidaankin tarkastella lisäarvon tuottamisen näkökulmasta erillisissä tuotekehitystehtävissä. Yritys hyötyy, kun se voi siirtyä kehittämään parhaat ideat, joiden syntyyn se on investoinut rajallisesti resursseja.

Empiirinen tutkimus keskittyi selvittämään mitä KONE hyötyy osallistumisestaan IDBM- ja PDP-tuotekehitysprojekteihin. Tulokset viittaavat siihen, että arvo muodostuu mahdollisuudesta saada uusia ideoita, jotka eivät noudata KONEen sisäistä ajattelumallia sekä mahdollisesta lisäarvosta, joita kyseiset ideat saattavat tulevaisuudessa synnyttää. Empiriassa tarkasteltiin myös miten tiimin poikkitieteellisyys ja moninaisuus sekä sen jäsenten motivaatio vaikuttavat työhön sitoutumiseen sekä luovuuteen.

Avainsanat: Avoin innovaatio, innovaatiovälittäjä, InnoCentive, tuotekehitys, IDBM, PDP
Sivujen lukumäärä liitteineen: 75

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1. INTRODUCTION

Companies are seeking for opportunities that generate new growth. Often this means that companies are expanding their business models towards adjacent growth in new areas which can take place in the form of new products and services, entering new geographies and addressing new customer segments by modifying a proven technology (Zook & Allen 2003; Johnson 2010, pp. 8). In an environment of decreasing development efficiency and fierce competition with shortening windows of opportunity for design-to-market of new products, companies cannot do everything themselves because it is not reasonable cost-wise and because they do not have all the skills.

At the same time, developing complex products characterized by technological and market uncertainty as well as importance of protecting intellectual property partly describe why companies take measures to prevent leakage of what they consider as sensitive information. This can be seen in that companies often restrict outsourcing undertakings to those development activities that alone are not of strategic value but rather value-adding. However, there is a trade-off between lower risks of performing development efforts in-house, and lower cost and time consummation when using external sources for innovation to source knowledge and opportunities for new technologies.

The strategic and operative capability of the company to explore and exploit the value of existing technologies that are faster and cheaper to develop outside the company add up to higher organizational innovative performance record measured as

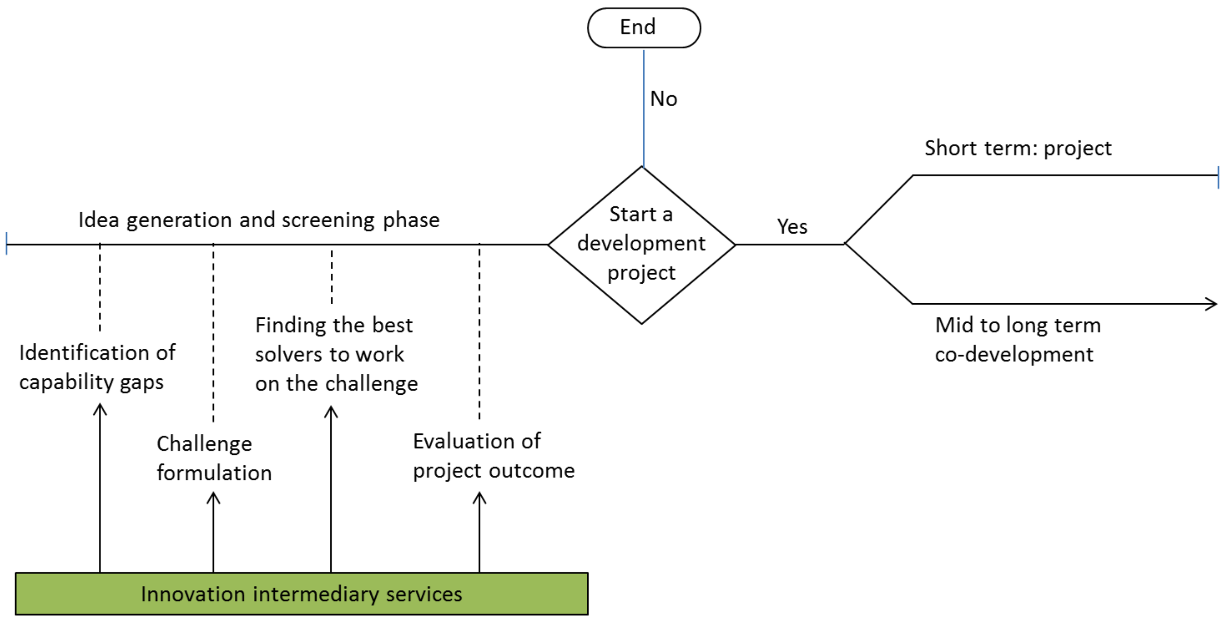
- structural and managerial commitment,
- investment from knowledge acquisition to production,
- qualitative and quantitative outcomes and
- innovation culture (Johnston 2008).

Many companies e.g. in the automotive, banking and consumer packaged goods sectors and industries are in transition to open up their business models to form a two-sided market with customers, researchers, universities and other potential knowledge suppliers (Chesbrough 2003, Introduction, pp. xxvii-xxviii) through for example innovation platforms such as P&G Connect + Develop or competitions such as Audi Award for Design and Innovation. A two-sided market can be defined as a network that has “two types of participants (“sides”), where each side derives positive externalities from the participation of members on the other side in the network” (Bakos & Katsamakas 2008).

In explaining the value of looking for opportunities outside the company boundaries, Chesbrough (2003, Foreword pp. 5) explains how "(…) today most of the world's really smart people aren't members of any single team but are distributed all over the place in multiple institutions. Similarly, we are now looking for innovations in the interstices between different disciplines (…)". Indeed, the privileged access to a variety of sources for innovation distinguishes successful companies from the less successful ones (Schiele 2006). In other words, the more links to a variety of multidisciplinary sources the company has, the more likely it is for it to encounter value-adding knowledge and skills even from other fields of industry. The dilemma of benefiting from open innovation is in finding the right balance: how much and what kind of information should the company give outside in order to enable external knowledge suppliers to deliver relevant input. This decision-making setting called the Arrow Information Paradox is what innovation intermediaries such as InnoCentive can help to manage through the services that they offer (Chesbrough 2010, pp. 139).

1.1. Research objective

Companies need to find new ways and channels to leverage innovation, promote growth and ensure competitiveness by utilizing the right external resources to fill the identified development needs and objectives. In a two-sided market the innovation intermediary acts as a platform that "brings together groups of users" through its service offering and "provides infrastructure and rules that facilitate the two groups' transactions" (Eisenmann 2006, pp, 94), the two groups being the solver network and the seeker network (Osterwalder & Pigneur 2010, pp. 77). Picture 1 depicts the different search and evaluation tasks that innovation intermediaries can facilitate (Chatterji 1996) during the idea generation and screening phase (Schiele 2010) to help companies evaluate the opportunities they have and select the most potential solutions to identified challenges. A decision is then taken to whether to take the idea forward and start a development project.



Picture 1 Development process flowchart elaborated from Chatterji in Törrö 2007, pp. 49

The main objective of this thesis is to research **how does a company benefit from utilizing the services of innovation intermediaries.** This can be broken down into two sub-questions:

1. In what ways do innovation intermediaries facilitate the company?
2. What makes one-time suppliers difficult for companies to accept as one alternative?

1.2. Motivation, stakeholders' interests and novelty of research

The motivation for research in the area of innovation intermediaries rose from two observations. Firstly, while web-based service platforms can reach large enough volumes in more populous countries such as the United States, in Finland companies need to use other channels to help then benefit from open innovation. Secondly, while for example InnoCentive was founded in 2001, in the local Finnish context, collaborative product development university courses have existed between companies and the current Aalto University since mid-1990s. International Design Business Management (IDBM) program and the Product Development Project (PDP) course are university product development projects in Aalto University lasting both one academic year. In them the students solve real-world challenges given by the sponsor companies ranging from start-ups to public institutions and to large Finnish corporations in interdisciplinary and multidisciplinary teams.

Combining these two observations in the empirical research, how do IDBM and PDP programs help companies benefit from open innovation in the Finnish context? Moreover, what does a company like KONE get from participating in these student projects? I have selected the IDBM and PDP for my research because I have completed them both (of which PDP for KONE) and will contribute my knowledge and experiences in the empirical section of this thesis.

There are two interest parties regarding the objectives and outcomes of this thesis. The commissioning company KONE and more exactly its Sourcing department is interested about sourcing’s role in product development as it plays a key role in the make-or-buy decision-making interfacing with internal R&D and suppliers. At the same time the empirical part is of interest to KONE employees that have either been involved in the IDBM or PDP projects or work with development issues. The interests of the university lie in the scientific cohesiveness and the validity and applicability of the research framework as well as concluding findings.

This research is novel in that very little empirical research has been conducted in the field of innovation intermediaries as they are a relatively new form of business in the un-established context of innovation and open innovation. Though the results are not of universal importance, this thesis introduces the concept of innovation intermediaries in an established local context while it synthesizes to KONE the benefits of continuing to use these external sources for innovation.

1.3. Structure of the thesis

The research is divided into two main parts: the literature review and the empirical part which concentrates on analyzing the material from the interviews conducted for this thesis. Chapter 2 introduces the open innovation setting and the idea of opting for adjacent growth from innovation. Chapter 3 describes what innovation intermediaries are, what kind of services they offer and what kind of critique has been presented against them. Chapter 4 discusses the subject of reaching new and relevant sources of knowledge and innovation through the links that innovation intermediaries provide between dispersed solver groups. Chapter 5 discusses the involving of suppliers that can best contribute the desired innovativeness and technological capabilities depending on the project type. The dual role of the purchasing function is discussed in Chapter 6.

The empirical part introduces the methodology used and the research model built based on the findings from the empirically gathered material. Chapter 8 focuses on assessing the dynamic and the underlying forces of the IDBM and PDP product development projects sponsored by KONE in order to determine the value that KONE gets from its participation, in addition, motivation and diversity of the solver teams and how these affect the innovative outcome of a project are briefly discussed. Chapter 9 discusses the current ways of working at KONE and how these can be and are being improved. Finally Chapter 10 discusses and collects the main findings of the whole thesis and presents areas for future research.

2. FIELD OF INNOVATION: status

When introducing a new technology, companies need to cope with technological uncertainty the management of which is further complicated by market uncertainty – successful introduction of a technology decreases market uncertainty but at the same time choosing the market that the technology is intended to serve is a critical decision. (Chesbrough 2003, pp. 11-12) Competitive innovations that have a relative advantage over existing solutions are a means to survive in an environment of constant and rapid change (Steiner 2009). To this Ali et al. (1995) suggest that the shorter the commercialization time, the earlier the company can expect positive cash flows and breaking even on the investment allowing it to rapidly re-invest into new development. At the same time decreasing development efficiency - rising costs and shortening product life-cycles yet end users' demand for continuously higher quality (Chesbrough 2010, pp. 11) - make it increasingly difficult for companies to justify investments into development of innovations, hence companies are looking into the opportunities of open innovation to leverage the cost-efficiency of innovation. In addition, by dividing development responsibility and risk, resources are not as heavily tied when the company does not develop everything in-house.

2.1. Defining innovation

Due to the lack of a universal definition for innovation it is difficult to compare or generalize research results with each other. Following this, Palmberg et al.'s (1999, pp. 10) proposition to define innovation as something that is new to the company regardless of if it is new to the world is general and usable enough regardless of being ambiguous. Furthermore, Verganti (2009, pp. 4-5) uses the technology-push versus market-pull model to explain the different starting points of radical and incremental innovations: technology-push drives radical innovations while market-pull demands for incremental innovations. Radical innovations are fundamentally new solutions that stand free from already satisfied needs and thus seek to satisfy the needs of the market that the solution creates. At the same time, the incentive for incremental innovation comes from the client users; in such case the fundamental solution to a problem is only improved and the target customer remains the same (Johnson et al. 2008, pp. 26).

An innovation includes the act of realization: an idea or invention must be successfully implemented in order to capture the commercial value of the innovation. This means that an innovation must be actionable and the idea-to-launch process structured. In addition, the fit or the unfit with the current business model determines how revenue is generated (e.g. Johnson 2010 pp. 86, Chesbrough 2003, pp. 69) – does the innovation generate new revenue adjacent to the core revenue stream or is it a field previously unexplored by the company that requires it to redefine its core and business model; this will be further discussed in Chapter 4. In the context of this thesis, the opportunity for added value generated by external sources of and resources for innovation is of interest when defining innovation as a combination of internal and external ideas and knowledge put together to deliver a solution to a problem or opportunity that is commercially viable.

2.2. Open innovation: reaching for external knowledge

The father of the terms 'open innovation' and 'open business model', Henry Chesbrough, discusses how open innovation is about "making the best use of internal and external knowledge in a timely way, creatively combining that knowledge in new and different ways to create new products or services" (Chesbrough 2003, pp. 52) for a fraction of the time and money that investing into in-house R&D would take. This is to say that following the proper identification of its knowledge gaps and innovation needs, the company can seek to reach the lacking expertise and skills through resourcing and outsourcing activities (Chesbrough 2003, pp. 52, Howells 2006). Following my interpretation of the concept, open innovation is a creative process in which a diverse, global network of knowledge providers delivers solution propositions to satisfy a company's discrete needs.

Due to the increasing complexity of product component systems and of bundled product-service mixes exceeding the capabilities of one company, companies cannot scan all information available across industries and deliver all parts of its offering. Being specialized in one industry, it may ***lack***

1. the internal ability to identify viable opportunities outside the dominant logic;
2. the organizational flexibility to put these opportunities forward even if it identifies them;
3. the culture that supports exploration and exploitation of external solutions.

Enabled by open innovation, companies seek to explore the technological landscape with the objective to exploit its vast resource base in order to:

1. find ideas and opportunities across industries for new applications of old technologies;
2. find knowledge that lacks currently in the development of a technology;
3. find up-to-date information with which to capture the value of the technology the company had put on hold because other development projects were more doable at the time;
4. find the source of existing technology the in-house development of which would be slower and more expensive.

A company may find it difficult to reach or gain access to the information sources of other industries. Hargadon and Sutton (1997) talk of a network of groups that hold different information and of the boundaries that stand between them preventing information exchange. Sourcing for knowledge produced outside a company can take place through intermediary service providers (Törrö 2007) that link these groups and enable their interaction and information exchange. The benefit of such intermediary agents is that they are in most cases not central in any field (Hargadon & Sutton 1997) and are thus not locked in any single dominant logic; on the contrary, being well connected to a range of disparate industries, an innovation intermediary can facilitate the emergence of innovations (Törrö 2007) because it provides the channel through which existing technologies are found and funded for further development by the interested technology buyer.

2.3. Adjacent growth from innovation

Though companies are still developing proper ways to measure internally and externally sourced innovation to find out if sourcing for external knowledge pays off in terms of return on investment (Linder et al. 2003), vertical disintegration and the increased lookout to expand through purchase-of-innovation instead of focusing on in-house development speak of adapting the idea-to-launch process to the open innovation context (Gadde &Håkansson 1994).

The company's absorptive capacity defined as "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal 1990, pp. 128) enables the company to be prepared and act to market changes quickly and efficiently. Moreover, the extent of exploring for new knowledge and the degree to which existing knowledge is exploited are indicators of the company's openness and absorptive capability towards new technologies. This implies that different levels in search scope and depth together result in varying accomplishments

(Katila & Ahuja 2002) in e.g. manufacturability of a product, consistency in quality, response time to market changes, and idea-to-market cycle time. However, even the best ideas are not value-adding if they are not actionable together with the rest of the company's offering and its strategy.

To promote sustainable development, the company's innovation sourcing and processing structures should be in line with systematically delivering product designs that are easy and cheap to produce. Following the recommendations of Schuh et. al. (2009; pp. 127-128):

1. Product development should start when the cost structure i.e. the way the product and its value proposition generate revenue following the company's business model, is known.
2. Suppliers are involved through purchasing so that their input can be included. Early involvement of specialized suppliers helps determine project-specific technical requirements as well as foresee and fix possible problem scenarios.
3. Involved departments understand the needs and interests of the other departments. A sourcing agent that interfaces with R&D and suppliers in a development project enhances intra- and inter-organizational communication and transfer of knowledge.
4. The service to customers must not be affected by cost reductions. Decreasing product complexity affects its usability, desirability and adoption by the end-user. Diffusion of innovation is enabled by increased relative advantage, compatibility, observability and triability, and by decreased complexity compared to existing offering (e.g. Zhu et. al. 2006).

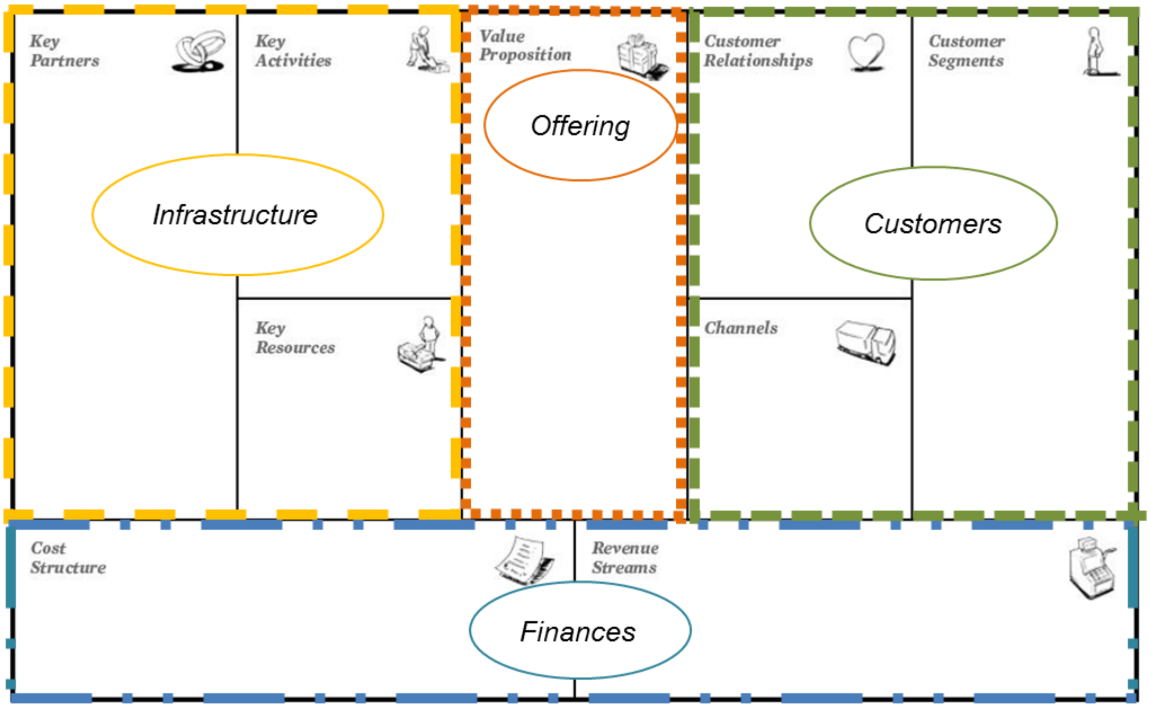
2.3.1. Fitting business model

According to Pulkkinen et al. (2005, pp. 17-18) business model is a representation of the business processes and activities needed to deliver the innovation strategy. Chesbrough (2003, pp. 69) places the business model in between the technical domain and the economic domain where the business model turns the technical inputs to take value-creating forms. In other words, a business model is a mediating structure that creates and captures the economic value of an innovation by concretizing what is being offered, to whom, how it is delivered, and the way revenue is generated.

The Business Model Canvas as visualized by Osterwalder and Pigneur (2010) is a single framework constructed on the basis of similarities found in numerous business model conceptualizations (Picture 2). The Canvas consists of four entities that can be further divided into nine building blocks:

- infrastructure: key partners, key activities, and key resources;
- offering: value proposition;

- customers: customer relationships, customer segments, and channels;
- finances: cost structure, and revenue streams.



Picture 2 Business Model Canvas adapted from Osterwalder & Pigneur (2010, pp. 44)

A unique mix of key resources and processes and access to network of players that have value-adding knowledge and expertise related to the technology differentiates a successful business model from others (Johnson 2010, pp. 41). Moreover, a business model that enables creation and capture of value is a critical driver of innovation when supported by:

- an innovation sourcing strategy that seizes opportunities from outside the company;
- organizational capacity to explore and exploit at the same time (Johnston 2008).

The concept of open innovation intertwines with the concept of open business model - a company that has an open business model is more receptive to leveraging external resources and the resulting joint capabilities in order to save time and money in expanding to new markets (Chesbrough 2010, pp. 16). Adjacency approach fits the needs of large, established companies that seek new growth by leveraging the current business model to capture the value of innovation. Adjacent growth i.e. growth in revenues on top of revenues from core business (Johnson 2010, pp. 12) can result from new products and services, entering new geographies and addressing new customer segments by modifying a proven technology (Zook & Allen 2003). For further reading see Chris Zook's book *Beyond the Core*: *Expand Your Market without Abandoning Your Roots* (2004).

2.3.2. Example of adjacent growth: servitization

Since the commoditization of Internet, servitization of products and the different integration levels of product-service mixes have introduced numerous growth opportunities into adjacent markets (Shelton 2009). In product servitization up to 50% of revenue can be generated by the intangible service that complements the tangible product it is integrated to in order to generate greater value to the customers; as a result the value proposition defined in the business model is expanded to support the product-service offering. In order to guarantee the fit between the product and the service, the product should be developed with the service potential in mind.

Traditional manufacturing industries such as wood, pulp and paper, and car machinery have added service extensions to their product offering; they have found that the price elasticity of demand for service solutions complementing the product is much less elastic, in other words changes in the service prices do not considerably decrease the demand for that service like it does for manufactured goods in general. Examples of service extensions include infrastructure optimization e.g KONE in designing an elevator-escalator solution to support building type and function, customer service and support for software and hardware, Electronic Data Interchange (EDI) -enabled Vendor Managed Inventory (VMI) service, and elevator maintenance service packages. In these the revenue source is many times based on a subscription pricing model where the service receiver provides a steady stream of revenue for continuous service agreements.

Xerox redefined its business model to support its innovative idea for a new product-service mix: it started to lease photocopy machines including all supplies, customer support and maintenance for a monthly fee of $95 and charging per copy. The preceding razor and razor-blade business model was based on the idea that supplier, customer support and maintenance generate an aftermarket revenue stream. The core of Xerox's business model was that it generated more revenue the more copies were made which promoted the development of faster and higher quality photocopiers. Xerox took the risk that the client company would stop the lease before reaching break-even, however, lowering the risk of the client company worked for its advantage. (Chesbrough & Rosenbloom 2002)

3. INNOVATION INTERMEDIARIES: facilitating information flow

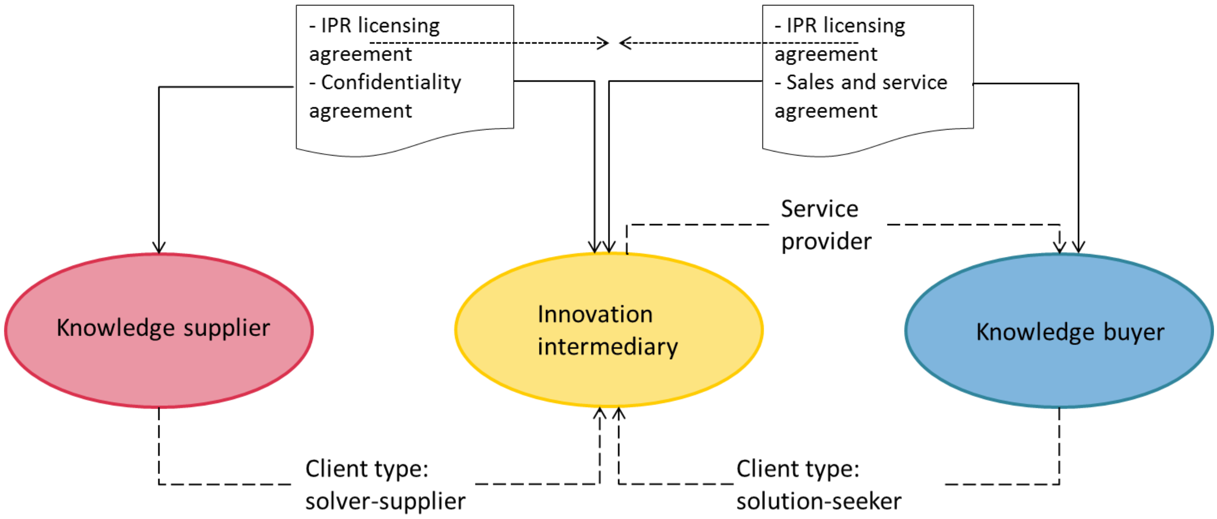
The term innovation intermediary was first introduced in 2006 in the article by Jeremy Howells (Howells 2006) following the emergence of web-based innovation intermediary platforms such as

InnoCentive and NineSigma. In the same year 2006, Verona et al. published their research called "Innovation and Virtual Environments: Towards Virtual Knowledge Brokers" where they categorized the above mentioned firms as virtual knowledge brokers. Without going into detail, it can be said that the line between an innovation intermediary and an intellectual capital broker is fine and often overlapping. One distinct difference is that while Hargadon and Sutton (1997) include in their definition of a broker the idea of the broker itself working to transform existing technologies into new ideas, innovation intermediaries help to find those knowledge providers in the solver network that can add value to the solution seeking company through the knowledge that they hold.

In this thesis the term innovation intermediary is used and it is distinguished to refer to "an organization or body that acts as an agent or broker on any aspect of the innovation process between two or more parties" (Howells 2006, pp. 720). Following my interpretation, an innovation intermediary is a service provider that performs various functions to facilitate the transfer of knowledge and technology between the supplier and the buyer as its core function; furthermore, it helps companies develop and implement solutions thus adding value to a technology indirectly.

3.1. Clients and functions of innovation intermediaries

Picture 3 depicts the separate relationships between the solution seeker, the knowledge provider and the innovation intermediary. The seeker companies on the right search for solutions to specific problems or opportunities while the solver network of knowledge suppliers on the left supplies solutions to the given challenges. A challenge is a discretely defined problem or opportunity whose solution has value. The two types of clients interact in the common marketplace held by the innovation intermediary with which the two parties have separate contracts. What links the solution seeker and the knowledge provider together is the reciprocal agreement over transferring the intellectual property rights of the solution to a challenge for the set challenge reward. Innovation intermediaries manage the legal issues and oversee that the solution providers get a compensation for their solutions before these can be used, as well as guarantee confidentiality to the company.



Picture 3 Representation of the relationships and contractual relations in the two-sided market

Two types of innovation intermediaries are of special interest. The first type is discussed throughout the theoretical part of this thesis. The second type will be discussed in the empirical analysis. Both types are about the company identifying a gap in its competence or resources which it seeks to fill by finding and involving parties that are used for the project-specific knowledge or skill that they have.

1. Innovation intermediaries that operate as Internet marketplaces (e.g. Lichtenthaler and Ernst (2008)) such as InnoCentive and NineSigma are founded to provide companies with a quick and low cost channel to reach a large community of potential solvers for specific problems; at the same time innovation intermediaries provide inventors and solvers more markets for their ideas (Chesbrough 2010, pp. 139).
2. Various product development study programs, case competitions and innovation contests seek to harness the capabilities of university students from different fields in real-world challenges. In these the organizing body rewards the students with study credits or other rewards while the companies get new ideas and basic prototypes for a fraction of in-house development costs.

Howells (2006) identifies innovation intermediaries as more than just a bridge between the previously unconnected groups - the functions that build the favorable conditions for transferring intellectual property from sounding to final evaluation show the comprehensiveness of the relationship between the intermediary and its clients on both sides. The functions of innovation intermediaries as determined by Howells 2006 (pp. 720) are:

- foresight and diagnostics
- scanning and information processing
- knowledge processing, generation and combination

- gatekeeping and brokering
- testing and validation
- accreditation
- validation and regulation
- protecting the results
- commercialization
- evaluation of outcomes.

By carrying out some or all of these functions in the set order or other following the client company's needs, innovation intermediaries expedite the problem-solving process by helping companies find and reach the best knowledge and the most competent suppliers quickly and by providing a secure transfer of Intellectual property rights (IPR). By helping companies to evaluate and pick the best ideas or the most potential ideas innovation intermediaries save them in the time and resources of employees. "The presence of these firms [innovation intermediaries] enables other companies to explore the market for ideas without getting in over their heads (…) (Chesbrough 2010, pp. 139)". At the same time the intermediary platform has created a channel for various technology providers to sell their solutions to previously in-house R&D centered companies.

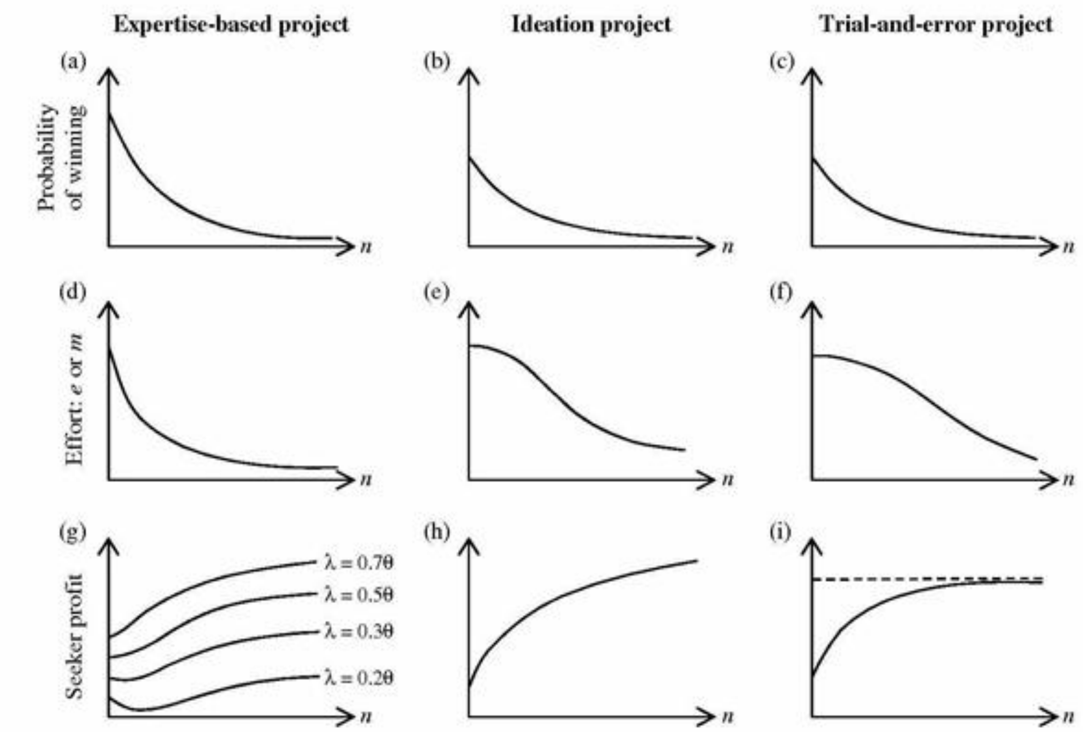
3.2. Critique and the Arrow Information Paradox

In their research, Lichtenthaler and Ernst (2008) found out that the success rate of technology transactions has been low with both technology source and recipient companies having not realized any transactions via web-enabled platforms. Following the Arrow Information Paradox, one of the reasons behind this includes the concern of the companies over the misuse of the sensitive knowledge about a technology. Due to this some solution seeking companies have aimed to leverage the value of mostly unattractive technologies which does not raise the interest of potential solvers. As a result companies experience low probability of coming down to a technology transaction because the solver network and thus the range of relevant solution propositions are limited, and decide to direct their resources in other channels. (Lichtenthaler and Ernst 2008)

According to the Arrow Information Paradox the client company needs to know enough about how a supplier's technology works before making a decision on whether to buy it or not; however, once the supplier discloses information in sufficient enough detail to show its capability, the technology is effectively transferred to the client company before any compensation occurs (Chesbrough 2010, pp.

136). At the same time the paradox works other way round as well: client companies seeking for solutions to specific technological challenges guard their core technology to prevent leakage of sensitive knowledge to competitors which makes it harder for the solvers to provide focused solutions for target market. Lichtenthaler and Ernst (2008) specify that the descriptions of challenges posted on web pages often do not indicate where the technology will be applied which makes it difficult to identify if a technology is in fact the sought after solution to a challenge. Both of the above situations lead into limiting the amount and nature of information provided which forces the parties to make decisions based on incomplete knowledge (Chesbrough 2010, pp. 136).

Regardless of the above discussed, Lakhani and Jeppesen (2008) noticed that out of the problems posted on the InnoCentive web-enabled innovation intermediary platform between 2001 and 2004, each challenge received attention from 200 people and 10 solution submissions on average. The diversity of solver base increases the likelihood of solving a challenge (Chesbrough 2010, pp. 145) which explains better why most companies interviewed by Lichtenthaler and Ernst (2008) planned to continue posting challenges despite their experiences so far. Picture 4 shows how regardless of project type: expertise-based, ideation, or trial-and-error, the probability for one solver to win the challenge reward decreases the more there are other solvers (a - c); this decreases the individual's motivation which shows as underinvestment in the effort of the solver (d - f) (Terwiesch & Xu 2008). Nevertheless, Terwiesch and Xu (2008) concluded that higher solver diversity balances the underinvestment in the effort of individual solvers and so leads to increased expected return on investment for the knowledge buyer (g – i). InnoCentive's average success rate i.e. times of coming down to a transaction of IP rights against an award in Q2 2011was 50% (InnoCentive: Statistics).



Picture 4 Balance in seeker-solver environment, Terwiesch and Xu 2008, pp. 1536

3.3. A reply to critique

To address the Arrow Information Paradox, many client companies decompose development and engineering into separate modules that are of low value on their own. This means that in order to exploit the value of the core technology, all of the data of the separate development tasks would have to be combined by the different suppliers which is not very probable. Another solution is to use the services of innovation intermediaries (Chesbrough 2010, pp. 139). However, Lichtenthaler and Ernst (2008) say that these have not yet succeeded to remove market imperfections; instead they argue that innovation intermediaries have failed to create a functioning two-sided market. The contrariness is much due to the limited amount of unbiased empirical research on measuring the success and growth of intermediary services.

The limitations of using innovation intermediaries can be more obvious in patent-heavy industries where every company is developing solutions to the same issues – in these even modularity-based and loose challenge-formulations may be too revealing. However, in these the question of who launches the best solution first is equally important. In order to leverage new opportunities without risking leakage of sensitive information, a description of a technological challenge should be formulated so that it is informative enough for the knowledge provider to identify the purpose of the technology and thus the underlying problem but so that it is limited in specific details. In addition, the identity of the seeker could be protected and disclosed when confidentiality agreements are in place. A functioning two-sided market with lots of buyers and sellers is a key issue for the operability of an innovation intermediary whose responsibility it is to build the reputation that draws the attention of the solution-seeker and solver-supplier clients.

For a two-sided market to function and cross-side positive network effects to occur, both sides benefit the more there are participants on the opposite side until the marginal benefit of adding one more starts to decline (e.g. Bakos & Katsamakas 2008). Seekers benefit from a larger solver base because then there is a larger variety of solutions and the probability of finding a fitting one increases. At the same time solvers have more market for their ideas the more there are companies that are potentially interested in their innovations. It is in the best interest of all parties to enable the effective functioning of an equally ample two-sided market (Chesbrough 2010, pp. 137).

To give an example of collaboration, a 13-month Pilot Program of seven pilot challenges was conducted between InnoCentive and NASA. In it all of the challenges were fully or partially rewarded suggesting that such an intermediary platform can be a viable way to finding quality solutions to research and technology gaps. For detailed interviews of solvers and NASA representatives on their incentives and satisfaction, cost and benefit analysis and lessons learnt, please refer to InnoCentive's report: InnoCentive Investigation of the Challenge Driven Innovation Platform at NASA: An Evaluation of the Open Innovation Pilot Program between NASA and InnoCentive, Inc. (*InnoCentive Investigation* 2010). It should be noted that the value of the services the innovation intermediary performed might be difficult to show because the transfer of knowledge is only one part of the whole solution.

3.4. Case study: InnoCentive

Founded in 2001 as a spin-off of the pharmaceutical company Eli Lilly, InnoCentive was originally set up under the name BountyChem. Its purpose was to answer to the need to manage all of the opportunities for new developments that could not be handled inside Eli Lilly's normal flow because of lack of resources from development projects that were ranked higher in importance. Thus the objective was to exploit external solutions in getting issues resolved sooner and at a lower cost. After Eli Lilly recognized the potential of opening the two-sided market so that other companies could also post their challenges and attract more solvers, InnoCentive was separated from Eli Lilly to become a standalone company that operates through an Internet-based marketplace. (Chesbrough 2010, pp.

141-142). Following its foundation and success many other Internet-based innovation intermediaries have been founded to serve different or more specialized areas of industry (see Attachment 1).

InnoCentive is a global open innovation platform where R&D-driven seeker companies post challenges which are viewed and undertaken by a global network and community of over 200,000 solvers for financial awards ranging up to $1 million. Commercial companies from various industries as well as government and non-profit organizations use the services of innovation intermediaries including Procter & Gamble, NASA, SAP, The Rockefeller Foundation and Toyota with challenges covering e.g. pharmaceutical, chemical, packaging, consumer product and automotive industry related cases. (InnoCentive: Partners) It facilitates companies to benefit from open innovation by providing a ready solver network and an expert staff to identify challenges appropriate for posting on the network and to promote finding the best solvers for the challenges (Lakhani & Jeppesen 2007). InnoCentive's solver network includes engineers, scientists, inventors, students and university faculty, business people and research organizations among others (Chesbrough 2010, pp. 145) that have, in as much as 30% of cases, been able to deliver solutions that could not be solved using the internal resources of the client company (Lakhani & Jeppesen 2007).

At the core of its functions, InnoCentive uses the framework it calls the Challenge Driven Innovation (CDI) which can live alongside or can even replace a stage-gate like development process.[1] It is based on the idea that a part of the innovation is formulated as a challenge which represents the problem for a block of work. Because of its modular nature, this block of work can be outsourced or insourced as an integral unit, and the solution integrated to fit the whole innovation. (InnoCentive: CDI) Companies can also post challenges to a selected group of people through private networks in cases where the development is of such specific nature that it is unlikely to find solutions in the larger solver network; example includes innovations that have a clear target area of usage instead of being applicable for a number of purposes revealing little to competitors. The process to reach relevant information sources starts from listing hundreds of challenge abstracts that serve to attract interest while the more detailed overview screens out the first party of non-eligible solvers; the rest continue on to register to the solver community and agree to the confidentiality agreement before seeing any confidential information. Put otherwise the process works so that the solvers have in the end selected themselves as the most capable to solve the challenge. Throughout the process the seekers'

[1] For more on CDI and on the dynamics of Internet-based innovation intermediary platforms, please read *The Open Innovation Marketplace: Creating Value in the Challenge Driven Enterprise* (2011) by Alpheus Bingham and Dwayne Spradlin.

identities are anonymous and only InnoCentive and the posting seeker company can see the proposed solutions and all other communication. (Dean 2008)

For its services to the seeker company InnoCentive charges a posting fee of $35 000 per posted challenge (Hagel & Brown 2009) and a 40% commission of the reward to the solver if the problem is solved (Dean 2008) while solvers are subsidized and do not need to pay for searching and solving challenges in order to encourage more of them to join. To attract the best solvers and guarantee high standards to both seekers and solvers, InnoCentive estimates the complexity of the problem, the resources needed to find a solution and the value it generates to the seeker company in order to set the award appropriately while rejecting those problems that do not meet the challenge criteria and are worth too small of a reward. While some challenges require practical technology with rewards ranging typically from $25 000 to $50 000 and more, others require only a written proposal worth $5 000 - $10 000 (Chesbrough 2010, pp. 142). It can also be assumed that the "most expensive" challenges are also of higher importance to the client company that thus seeks to disclose solutions fast. InnoCentive oversees that while seeker companies must agree to intellectual property audits in order to control that no intellectual property is used before the company awards it, as well as imposing the seeker company to award a solution if it meets the challenge requirements, the winning solvers must transfer their intellectual property rights before they can claim the award for it.

InnoCentive helps companies formulate the challenges so that they inspire solvers to volunteer meaningful solutions which is a key function to building a successful technology transfer. Instead of overwhelming solvers with a too large and complex high-level assignment it should be decomposed into more efficiently solvable sub-challenges each worth a separate reward relative to its complexity. Problem decomposition yields better results because smaller parts are more approachable to the solvers and the solution propositions are easier to assess by the seeker as well as implement in products. In addition, breaking the challenge into separate modules protects the seeker company's strategy and other proprietary information (Lakhani & Jeppesen 2007). While a too tight definition can produce a restricted range of similar solutions, a too loose definition i.e. detachment from the core problem generates high coordination costs (Ulrich & Ellison 1999 in Terwiesch & Xu 2008). In general, a well-defined open innovation challenge best benefits the seeker when it is directed at enhancing the overall performance of the whole product rather than generating cost savings (Terwiesch & Xu 2008).

4. NEED OF EXTERNAL SUPPLIERS: filling a knowledge gap

A core or strategic competence contains unique technology or has the ability to produce high customer value; it is characterized by strategic importance to the company in question and by the higher relative capabilities of the company to produce it in-house (Schuh et. al. 2009; 134-135). Because it is impossible for one company to have all the required knowledge and expertise, the activities that reside outside the core competence of a company are sourced from those suppliers that hold the best capabilities to deliver added value. Suppliers that add value to a technology can help the company to reach old customers in a fundamentally different way or attract new customers both with less time and money spent on R&D in order to generate adjacent growth.

The innovation intermediation business idea is based on ‘crowdsourcing’ (Howe 2006). The widest definition of crowdsourcing incorporates the notion that a task or problem is outsourced to an undefined open public. However, innovation intermediaries limit the crowd by formulation and requirements of challenges to gather those that are most apt to contribute novel, relevant input – community of solvers includes experts from different fields, freelancers, entrepreneurs, academics, scientists, retirees and students among others (InnoCentive: Groups of solvers; Chesbrough 2010, pp. 145). It follows that the extended view of a supplier goes beyond the traditional definition of a supplier as a business operator that supplies goods and services to the client company. In the world of open innovation**,** a solver-supplier may be defined more broadly as an actor that provides any kind of theoretical or practical intellectual input that adds value to the client company. This definition acknowledges one-time solvers that are used on a single project-basis for the knowledge and skills that they have that the company lacks.

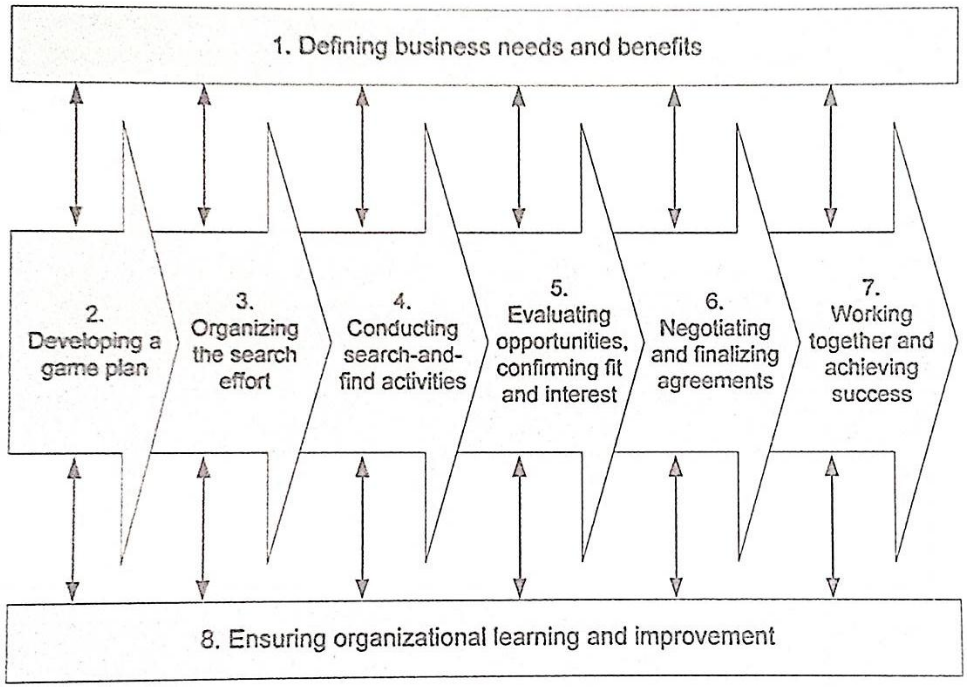
4.1. Reaching out to networks of knowledge providers

Following the growing tendency to manage business horizontally, vertical in-house R&D-centered business is being opened to networks of innovation sources and chains of buyers and suppliers (Humphreys et al. 2007). Jolly and Thérin (2007) found out that the more access points a company has to external sources, the more innovative combinations of internal and external knowledge it can identify, source and introduce to the market faster. To this Linder et al (2003) suggest taking the transaction-based sourcing approach further by establishing channels that cross the different development process stages in order to have consistent availability of resources when needs arise. Innovation intermediaries build favorable conditions for innovation transfer by providing access to such channels using their established relations to link companies and knowledge providers.

While it has been assumed that suppliers initiate and push their innovations to client companies a growing number of these client companies also approach potential suppliers (Chesbrough 2010, pp. 137; Howells 2006). For example, in the wave of increased environmental awareness of the 1990s, IKEA confronted its supplier Haindl to print the IKEA catalog on chlorine-free paper made partly from recycled fibres; Haindl refused to supply IKEA by investing into new technologies and developing this new paper, a task that was taken by an Italian and two Finnish suppliers (Ford et al. 2002). Today the IKEA catalog that fulfills the requirements IKEA posed is one of the most widespread publications in the world reaching a volume of around 175 million copies annually (Wikipedia: IKEA). In order to build the basis for future technological collaboration, influencing supplier decisions on the technologies to invest in is a common tactic of the client company; it promotes long-term relationship building and enables the client company's access to the technological knowledge of the suppliers (Wynstra et al. 2001).

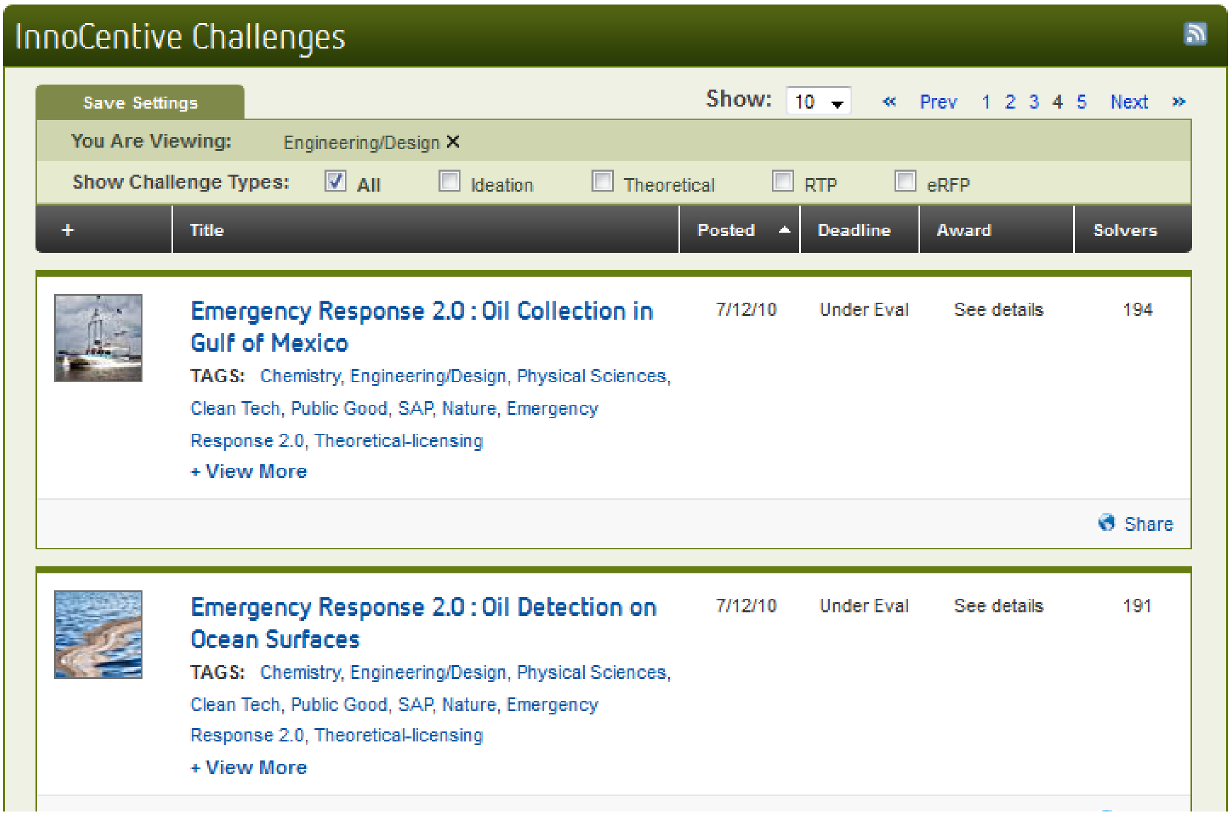
4.2. Innovation intermediaries: a bridge to network of solvers

McGinnis and Mele Vallopra (1999, pp. 14) explain that companies should "involve suppliers in the process when they are needed" and "involve them at the stage of development needed". From the point of view of innovation intermediaries, lack of specialized knowledge or skill can be filled by a one-time supplier assigned to do just that at any point of the development process, i.e. when the need occurs. Finding the right balance between search and implementation activities promote achieving and sustaining successful product development (Laursen & Salter 2004). Chatterji's (1996) conceptual technology sourcing process model (Picture 5) suggests that a company can outsource the search and evaluation tasks (2.-6.) to the innovation intermediary in the process of identifying and gaining access to suitable knowledge or technology.



Picture 5 Chatterji's technology sourcing process model (Törrö 2007 pp. 49)

The Exxon Valdez oil spill case is a good example of how innovation intermediaries can provide additional or lacking knowledge and resources needed to solve a case: the 30-year-old problem of how to collect the near-frozen oil sludge that was posted to InnoCentive website by the Ocean Spill Recovery Institute in 2007 was solved within two months by a chemist who used his knowledge of working with a similarly challenging material: cement (Bonadio 2011; Hagel & Brown 2009). Following the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, further demand for innovations in the area has generated new challenge posts on the InnoCentive platform (Picture 6).



Picture 6 Example of challenge posts on InnoCentive (InnoCentive: Browse challenges)

To fill the lacking non-core knowledge, a company benefits from working with suppliers to a different extent. At the same time, in order to reduce the complexity of managing different levels of supplier involvement in development projects, activities should be firstly prioritized and secondly assigned to the most appropriate suppliers based on the match between their capabilities and the task requirements (Petroni & Panciroli 2002). Establishing a longer term relational collaboration with an innovation intermediary is one option to gaining constant access to an extensive resource pool following the innovation channel approach – allowing innovation intermediaries to learn the needs and weaknesses of the client company, they can help to identify the knowledge gaps that would be beneficial to fill with external capabilities in the long run, and to continuously map suitable suppliers.

5. CHANGING ROLE OF THE SUPPLIER: empowering external sources

The role of the supplier is changing: the scope of development activities trusted to suppliers has enlarged to include the utilization of their intellectual input in development, design and engineering activities. Indeed, when discussing the topic of exploiting resources that reside outside the company, Schiele (2010) specifies that it is about the successful integration of the right knowledge and utilizing the emerging window of opportunity that enables the client company to respond to market changes quicker. In addition, as modular design decreases the complexity of the product because the modules it consists of are not interdependent, each block of work can be given to the supplier that has the best value-adding capabilities for delivering the task. In general, the more critical the needed skills and knowledge are to the client company, the more important it is to guarantee access to them.

There is no holistic model on how to maximize the contribution of external sources to innovation generation, only guidelines (Schiele 2010). By finding the right resources from the vast network of solver-suppliers companies can leverage the benefits of outsourcing development responsibilities instead of doing everything in-house (Wagner and Hoegl 2006). Purchase-of-innovation on a project-basis enables using the innovative capacity of one-time suppliers especially when the strength of having cross-industry perspective can open new opportunities to the client company – following the strength of weak ties theory best ideas can arise from parties with the least professional expertise in the field (Granovetter 1973). Moreover, the capabilities and development ideas of a supplier whose competence springs from its own research initiatives are a good source for additional knowledge when they complement the in-house development efforts of the client company.

5.1. Types of development projects

Wagner and Hoegl (2006) distinguish between know-how projects and capacity projects that pose different requirements and expectations on the necessary supplier qualities. The development of highly innovative products requires specialized know-how which is often complemented by supplier competences that the client company lacks. Moreover, as know-how projects are characterized by unclarity and ambiguity resulting in high levels of uncertainty and risk, communication and trust between the client company and the supplier are essential to enabling successful cooperation. At the same time in capacity projects the use of supplier resources is characterized by that they fill in the shortage of internal R&D resources i.e. their role is not to contribute something that the company would not already have but to help to solve a capacity bottleneck. From this follows that capacity projects are not as innovative and critical to the client company as know-how projects. The challenges posted in Internet marketplaces could be argued to fit the nature and aims of a capacity project - even the challenge related to the Exxon Valdez oil spill was not as critical to Exxon anymore: though solving it had a substantial significance to the oil industry, Exxon’s existence was not dependent on it.

Wagner and Hoegl (2006) found out that the majority of R&D directors and project managers they interviewed for their research felt that it is advantageous to integrate suppliers as early as possible while fewer found that the stage of integration depends on whether the project is a know-how or a capacity one. However, the complexity of the product requires that the suppliers that have valuable assets contribution should be integrated as early as possible in order to prevent, reduce and manage changes and problems earlier which reduces development cost and shortens development lead-time of a specific project (Wynstra et al. 2001). Because know-how projects are about highly innovative critical products, from this follows that the suppliers with the critical skills should be involved earlier than in capacity projects where supplier contribution is not as irreplaceable. Terwiesch and Xu (2008) found out that expertise-based and ideation projects are most suitable for intermediary-administrated open innovation projects whereas

5.2. Sorting knowledge suppliers

Identifying sources for innovation that can promote the client company's innovation performance is a challenging task which explains the number of various supplier segmentation taxonomies. What is common among them is the idea of ranking and sorting who to work with in order to better separate the candidates with the best capabilities and potential to add value to the company. The value of the supplier depends on the qualities that are necessary to improve the effectiveness and efficiency of development and engineering activities in short and long term. Short-term perspective encompasses the goals set for a specific development project while long-term goals are to do with ensuring access to technological resources of the supplier now and in the future. Wynstra et al. (2001) argue that supplier selection is conducted on too narrow basis if the criteria focus on price, instead a larger scope of influential aspects should be considered such as the two following:

- competence and ability to push innovation based on their own R&D efforts;
- technological input they can provide that the client company lacks.

5.2.1. Classifying external innovativeness

According to Azadegan and Dooley (2010), innovativeness defined as the supplier's efforts into developing its resource base, the willingness to share its knowledge on new technologies and the ability to learn from the client company positively affects manufacturer performance in terms of cost, quality, product development, delivery and flexibility performance. Schiele (2006) provides a framework in which he lists three sets of qualities that promote supplier innovativeness: supplier-specific, inter-organizational and enabling factors (Picture 7). However, he does not specify if being innovative means having all of the qualities, a minimum number or at least certain ones.

- The first group lists characteristics that make the supplier itself a desirable source for innovation: such a supplier is specialized in a specific area while it continuously develops and expands its competence, it is also actively involved in multiple development projects simultaneously which promotes its learning and value as an information source;
- The second group defines that in order to get the most out of the innovative supplier, the optimal buyer-supplier relationship should be built on open communication, mutual commitment and joint development efforts towards a common goal;
- The third group is a collection of various factors that enable and support the establishment of collaboration and can also help in distinguishing between suppliers that might otherwise prove equally fit to fulfill the requirements of a task.

In addition, learning style could be taken into consideration when the capabilities of two suppliers are otherwise indifferent and when it promotes inter-organizational learning. In the case of low design-intensity activities, companies that are explorative in their R&D activities benefit from contrasting exploitative learning style which is a form of directed search inside defined boundaries while with high design-intensity activities explorative suppliers that bring in ideas outside the dominant logic can be more valuable. (Azadegan and Dooley 2010)

Supplier characteristics and activities promoting its innovative nature

1. Is specialized: the supplier that has and is willing to share specialized knowledge is desirable to the client company due to the key industry information it holds.
2. Has high own development capabilities: the supplier that has built strong technological expertise and knowledge to support its area of specialization is compelling.
3. Has an open innovation culture: the supplier that actively participates in several collaborative relationships at the same time can speak for its higher capacity to innovate.

Characteristics of the buyer-supplier relationship

1. Is based on trust and commitment: the quality of collaboration can be more important than technical competence because it can promote openly innovating and jointly developing outcomes that were not originally included in the contract.
2. Includes mutual participation in joint improvement programs: the supplier wants to expand its potential to contribute and the client company encourages this by promoting physical presence at the supplier's premises which enhances two-way learning and recognizing and fixing early enough the problem points that have appeared in the development process.

Factors that enable and support collaboration

1. Physical and organizational proximity: direct, face-to-face communication sets the understanding of both parties to the same level while increased probability for unplanned and informal exchange of thoughts and ideas may lead to improvised associating and new combinations; moreover, physical proximity facilitates supplier integration. For example, in Science Parks all around the world (e.g. Otaniemi in Espoo, Finland could be considered as an innovation hub) technological expertise is highly concentrated where the geographical proximity of various collaborators enables network-innovating activities that are highly dependent on interdisciplinary knowledge (Freeman and Soete 1997).
2. Partnership advantage: also the supplier wants to choose a client company it finds desirable and more important than competing companies to collaborate with.
3. Positive past experience with the supplier: past successful collaborations show that the supplier can be entrusted with development responsibilities that correspond to its level of expertise and technological knowledge.

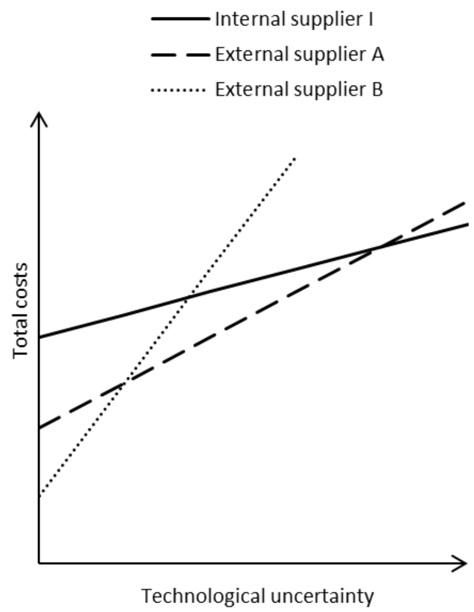
Picture 7 Innovative characteristics of suppliers, elaborated from Schiele (2006)

5.2.2. Taking technological uncertainty into account

Different levels of technological uncertainty and the positive correlation with communication and governance costs needed to decrease the risks affects supplier selection. As technological uncertainty increases, it is for the critical skills that a supplier is selected while when developing simple products, suppliers are selected more for their supporting capabilities (Linder et al. 2003; Hoetker 2005). At the same time, giving a supplier wrong tasks, e.g. allowing a supplier to develop something that can be bought of-the-shelf or assigning tasks and responsibilities that exceed the capabilities of a supplier leads to waste of resources (Petroni & Panciroli 2002).

Picture 8 shows the trade-offs of the make-or-buy decision-making as technological uncertainty increases i.e. as availability of timely and relevant information regarding the development of an innovation decreases.

- In the case of low-uncertainty innovations, an external supplier with high technological capabilities (A) is the dominant selection criterion.
- As uncertainty increases, external supplier with a prior relationship with the client company (B) outweighs an external supplier with high technical capabilities but no prior history with the client company (A).
- In the case of very high uncertainty, both external suppliers A and B prove to be more expensive in terms of total cost (production + communication + governance) than internal supplier (I) and the development is likely to be conducted in-house. (Hoetker 2004) Terwiesch and Xu (2008) found out that this is the preferred approach in trial-and-error projects that are characterized by high technological uncertainty because there are no obvious value-adding or cost saving benefits of using external suppliers.



Picture 8 Internal versus external suppliers, adapted from Hoetker 2005, pp. 80

Wagner and Hoegl (2006) refer to Monczka et al. (2000) who propose that in the case of complex and critical products with high technical and market uncertainty, suppliers should be involved in the development process already during idea generation and business/technical assessment phases. However, distinguishing between when to utilize external or internal suppliers can be difficult. For example, in developing the A380 "Superjumbo" airplane, Airbus Industries involved its major suppliers from early on in order to benefit from their critical know-how (Wagner & Hoegl 2006). Despite this, Airbus encountered major delays resulting from technical issues such as interoperability failures of common design tools and Rolls-Royce engine availability problems; however, miscommunication in a high uncertainty setting was much due to the lack of top down management (Shore 2009, Wikipedia: Airbus A380). The greater the innovation and product development responsibility given to suppliers, the greater the interdependence and the managerial complexity (Petroni & Panciroli 2002; Wynstra et al. 1999) – hypothetically speaking A380 could have reached its performance, quality and price targets if its joint development had been managed in respect to the very high level of uncertainty and the large number of suppliers.

Choosing a supplier that cannot be evaluated on direct historical data is riskier - past positive experiences of collaborating with a supplier positions that supplier as a prospective candidate for more collaboration. Empowering one-time suppliers with critical development tasks is problematic because of the time that it takes to build trust and get the supplier on the same page regarding the technology even with the presence of an innovation intermediary. Instead, the client company can pursue to build a relationship - letting the innovation intermediary learn about the where using a one-time solver would be beneficial in long-term allows the innovation intermediary to build a positive track record of successful facilitation.

6. PROCUREMENT'S ROLE IN PRODUCT DEVELOPMENT

The sourcing department of a company has a mediating role in-between the R&D department and the material and service suppliers. Literature suggests that there is a positive dependence between early inclusion of purchasing and suppliers. The earlier purchasing agents are included in a development project, the earlier they can contact the most appropriate suppliers as a result of being up-to-date on project objectives and requirements in each project stage (Tracey 2004). Actually, the function carries a dual role: it supports product development by selecting suppliers with those capabilities that are needed in each project while controlling company-wide costs (Schiele 2010).

The purchasing function is often organized in a matrix form which Schiele (2010) argues to limit purchasing from accomplishing its dual role when purchasers are included to support only individual projects in which they either handle all purchasing-related activities or answer only for their commodity group. Moreover, the decentralization of purchasing function into profit centers that handle their own purchasing decisions though facilitates relationship building, adds to coordination complexity on the company scale (Gadde & Håkansson 1994). Moreover, Wynstra et al. (1999) demand that procurement should not only manage supplier involvement on a project-by-project basis but also carry out tasks in-between projects such as searching for information on new technologies, preparing develop-or-buy decisions and maintaining supplier relations.

Purchasing function should be reorganized so that the focus would shift towards more integrated problem-solving: decisions on purchasing in New Product Development (NPD) should be made by a team containing people who work closely with the product and can recognize technical problems, as well as people who understand what kind of resources are needed from production and logistics points of view (Gadde & Håkansson 1994) to guarantee technical feasibility and commercial sustainability. In other words, NPD teams should be cross-functional and include members from design, purchasing, manufacturing and supplier groups (Humphreys et al. 2007). Based on the positive experiences in the automotive industry, Schiele (2010) suggests segregating the purchasing function into (1) operative procurement, (2) advanced sourcing and (3) life-cycle sourcing.

Advanced sourcing team consisting of engineers or purchasers with a technical background, should be involved right from the start of the project at concept stage and focus on purchasing activities relating to product and project management until life-cycle sourcing takes over supplier management when moving into production phase. Life-cycle sourcing should focus on purchasing activities relating to development and supplier interface management in-between projects (Schiele 2010; Wynstra et al. 1999). In other words, life-cycle sourcing should manage the innovation channel by analyzing how different transactions affect other internal and external development projects and how different transactions relate to transactions carried out in other stages of the project as well as in the whole innovation chain (Linder et al. 2003) By having a holistic view of the development efforts, purchasing can deliver also its second role: to better manage total costs of ownership (TCO) throughout product life-cycles by for example, agreeing on cost benefits with a supplier in the upgrade project (Schiele 2010).

From the perspective of innovation intermediaries, advanced sourcing team, which interfaces with R&D, can turn to innovation intermediaries for help in finding and reaching project-specific one-time suppliers to be included where a technical knowledge gap exists from the company's side. Moreover, life-cycle sourcing can engage in deeper relation building with the innovation intermediary in order to allow the innovation intermediary to participate in defining the company's technological core competencies and to identify the non-core competence gaps that are best filled with external suppliers in the medium to long run (Hargadon & Sutton 1997, Howells 2006, Wynstra et al. 1999).

Summary of literature review

The literature review described from the company point of view the possibilities that the services of innovation intermediaries offer in order to benefit from open innovation i.e. how innovation intermediaries help in reaching the knowledge residing among various groups and information sources. It mainly covered the challenge-driven setting but also incorporated important aspects such as procurement function's role and some guidelines on assessing the best suppliers in light of their innovative capabilities and the effect of technological uncertainty. The literature review introduced one-time suppliers that companies can use to complement their own capabilities through their project-specific specialized expertise. These can be efficiently reached by using the short and long term services of innovation intermediaries. In the following empirical research, two Aalto University-based programs are discussed as the second type of innovation intermediaries (page 12) and as a channel for KONE to reach the knowledge of talented university students on a one-time project basis.

7. EMPIRICAL SETTING

In order to investigate the functionality of innovation intermediaries in a limited local context and more so the benefits of using the services for a company that represents a patent-heavy machine industry, two product development and industrial design based programs operating under Aalto University are focused on in the empirical part of this thesis. The International Design Business Management (IDBM) minor program and the Product Development Project (PDP) course are looked at as two examples of an innovation intermediary in a challenge-driven setting between companies and the community of one-time knowledge suppliers i.e. university students and project teams.

IDBM and PDP programs provide an established and thus lower risk channel for KONE to benefit from the resourcefulness and range of skills of the one-time suppliers in value-adding activities. IDBM and PDP are multidisciplinary programs that bring together students studying engineering sciences, business and industrial design; all of the project teams generally include a member from each study field in order to guarantee a multi-angle perspective and approach on the development task.

Though this thesis does not investigate the relationship between business and academia, it is important to remember that IDBM and PDP are primarily university courses with academic requirements and purpose to serve the educational interests of the students as part of their study programs in Aalto University. Thus ultimately, the projects need to satisfy the objectives of three main interest groups listed in no particular order:

1. The company representative: looks after the interest of KONE and determines the novelty value and fit of the innovation to KONE.
2. The IDBM/PDP study program: oversees that the academic criteria of the program are met.
3. The project team and its members: should stand behind their product and sell its value proposition to the client company in light of the given challenge.

Because this thesis is commissioned by KONE, in my empirical part I concentrate on analyzing data from IDBM and PDP projects that have been conducted for KONE between the academic years 2003-2011 with the objective to map what added value has KONE gained from participating in these programs. What we can recognize already is that KONE has established a longer-term relationship with both programs, an option that has been suggested in . Attachment 2 includes general data on the two programs.

7.1. Methodology

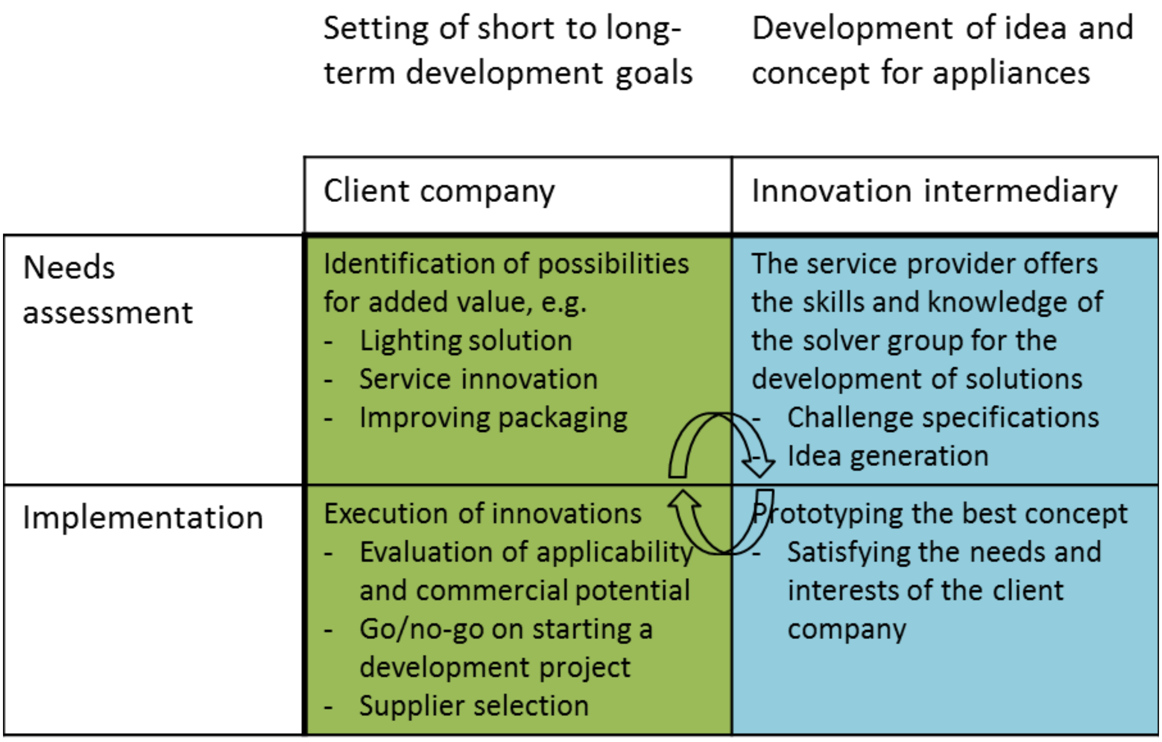
The empirical material was collected through interviews of three different focus groups in order to form a total picture based on the information from various angles. The three focus groups included IDBM and PDP alumni who were members of KONE project teams in different years, the founders of IDBM and PDP programs and the KONE representative of two PDP projects (see Attachments 3 and 4). My experiences from the PDP KONE 2010-2011 project are also incorporated in the work. The interviewed alumni include two engineers and one industrial designer while I represent the economics student perspective. In addition, to map the current practice of supplier integration from purchasing function point of view, a separate interview was conducted with a KONE representative.

Interviews were selected as the most comprehensive methodology because compared to quantitative methodologies such as questionnaires, interviewees were encouraged to answer the presented questions freely and enabled the interviewer to ask additional questions and clarifications. This way more in-depth data was received for the purpose of analyzing the unestablished field of open innovation and innovation intermediaries in practice.

7.2. Research framework

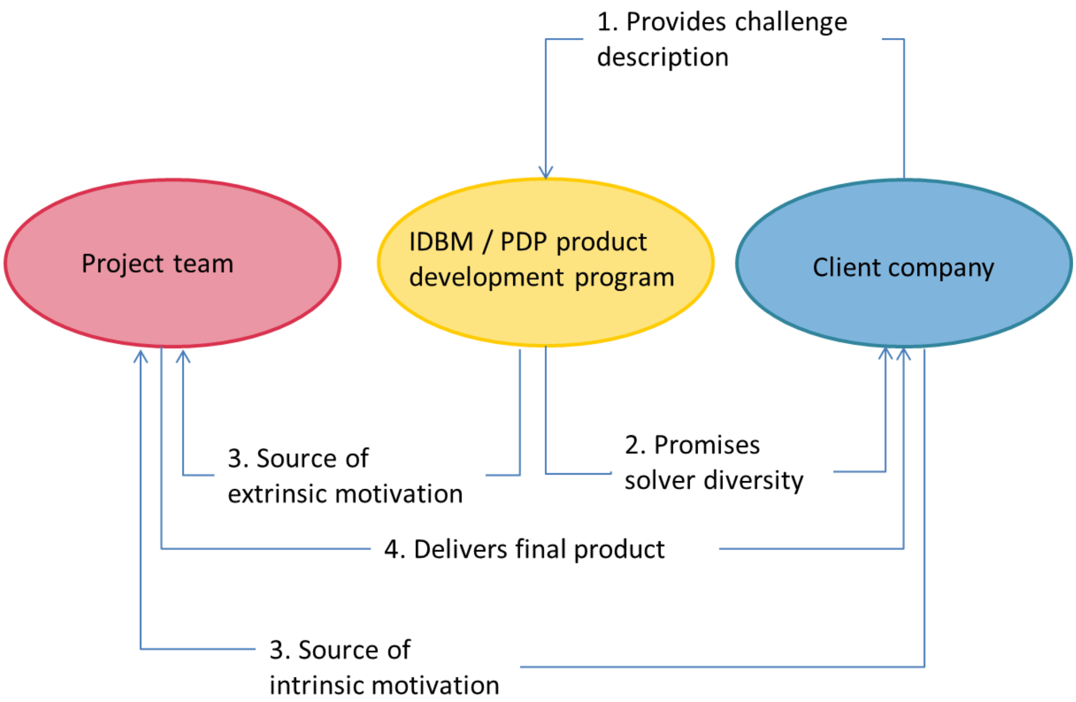
The empirical research is conducted as a qualitative explanatory study. It aims to discuss why KONE participates in these programs, in other words, what kind of value KONE seeks from participating in the projects, and what motivates solvers to work to generate that value in the form of news ideas to KONE. In addition, a more general objective is to assess how well one-time suppliers fit the KONE development process from supplier involvement point of view.

The following quadrant (Picture 9) is based on the analysis of the material from the interviews conducted for this thesis. It gives a comprehensive picture of the division of activities between KONE and the KONE project teams and how they follow and build on each other. The quadrant is a matrix that includes the activities that take place inside the client company (green column) and the activities that are carried out by the IDBM/PDP program and project team (blue column). From the two rows the upper row describes the initial needs assessment in the company followed by generation of a fitting idea conceptualization by the IDBM/PDP project team. The lower row then describes the implementation of the solution into a prototype as the project outcome which the company evaluates and decides on its execution inside the company.



Picture 9 Research framework

Furthermore, Picture 10 is an extension to the above research framework in which the main drivers of the reciprocal relationship between KONE and the project team as mediated by the IDBM/PDP program are shown. the basic process goes as follows: KONE provides the IDBM / PDP program a project description (1) while IDBM / PDP provides a diverse solver team (2) that has the capability to look at the challenge from many perspectives, and at the end of the project a final outcome (4) is delivered to KONE. Two types of motivation affect at the background: the grade and study points received for the project are an external motivator (3); personal interest towards the project and appreciation of the company is a source of intrinsic motivation (3).



Picture 10 Research framework: extension

8. THE VALUE OF IDBM/PDP TO KONE

The first aim of the empirical research is to determine whether IDBM and PDP programs fulfill the role of an innovation intermediary through the service of providing capable solvers to work on creative solution development on company tasks. In addition, the second aim is to analyze the value that participating in IDBM and PDP programs generates to KONE. In general it can be stated that for KONE the pressure to report on successful innovations is not as high as for smaller companies whose proportional investment into the IDBM or PDP project can be significant, and thus also the pressure for positive results is lower. However, KONE presumably finds IDBM and PDP to be a good channel that provides access to a capable network from where to source for innovative ideas as it has participated in both product development programs multiple times.

> ”Somehow I’ve gotten a picture that KONE invests something like 10 000€ [with the objective] to see what comes out of it: ‘if it’s good then great, if it’s not good then at least we’ve learned a bit more about this particular project topic’. In other words, there is no distinct need for the final outcome.”

8.1. NEEDS ASSESSMENT: challenge description

Based on the interview of the KONE representative that has been involved in two PDP projects and facilitating one IDBM project, the description of the project challenges are of general nature for a reason. Unlike in the case of web-based innovation intermediaries where client companies seek solutions to specific problems or opportunities, in IDBM and PDP the challenges have a larger scope and scale. KONE is primarily interested in future-oriented ideas outside its own dominant logic yet inside certain limits - on top of being creative the final outcome has to be actionable, applicable and cost-efficient to produce. This is a good starting point since also Stähler (2010) states that the lack of freedom of action imposed by the company's current dominant logic can block the emergence of truly innovative solution propositions.

> ”Our approach has been an open problem setting - identify the core issue and solve it; for example, the starting point for the [packaging project] was bluntly put that our packaging are really bad, make them better. And for the [modernization project]: what is most problematic for the residents during the modernization of an old elevator – find out what bothers them most and we'll fix that.”

> ”To start off, I don't tell anything about what we do [at KONE] because otherwise it directs the project to follow the same thinking logic as us right from the beginning. Instead we present the problem, or better yet: make the team find out what the problem is and then we'll see which problems could be solved.”

> ”Open challenges make also my participation a lot more interesting because I get to genuinely ideate together with the team: what to do here, which way to go, how to approach this. If I just give the specifications, what do I get from it? The job gets done but I don't personally gain anything from it because I don't get to learn.”

> ”KONE's design briefs haven't necessarily included the kind of problem that is solvable as such. Instead these indicate a kind of playground and direction for exploration: go play for a while and then come back to tell about what you have come up with. I personally think that this is a much more responsive way to generate innovations compared with having a ready problem that needs to be solved.”

When thinking about short to long-term objectives, KONE assesses the needs for added value that can be given as a project topic for IDBM / PDP program and teams to work on. The project descriptions are not of specific nature as can be understood from the above quotes and from Picture 11 which is a collection of five different IDBM and PDP KONE project briefs. Based on the challenge briefs the teams go on to assessing what is the problem and need in the particular KONE challenge.

KONE project	Project focus	Challenge brief
PDP 2003–2004	Deaf people	To simplify the orientation of deaf people inside buildings. The task was to come up with something around the critical points such as intersections of the building to make people's moving more intuitive and convenient.
PDP 2008–2009	Elevator modernization	The challenge setting was a situation where the everyday life of inhabitants is affected and disturbed by an elevator modernization project. The challenge was to come up with how to ease the inconvenience and make the modernization period more satisfactory to the inhabitants.
PDP 2009–2010	Packaging	As a starting point the team was given the elevator parts that need to be packed in a new and convenient way to make it easier to transport and handle by the installers.
IDBM 2010–2011	Localization in Shanghai	To deliver guidelines about the Shanghainese market to help KONE localize its offering to fit the local taste and values.
PDP 2010–2011	Lighting	To use lighting to support People Flow. The task was to create a concept to be used inside or outside the elevator to inform people and make their moving smooth and intuitive.

Picture 11 IDBM and PDP project briefs

For the project teams, this open playground is somewhat problematic during the first half of the academic year during which team members get themselves organized and find their place in the team. At the same time the teams are seeking to identify the fundamental problem, brainstorm and ideate on it followed by exploration of possible solutions but the loose description makes it hard for the team members to understand what it is that they are wished to deliver. The scope is large in the beginning without many points of support and narrowing it down is a critical process: information and ideas should be carefully evaluated so that no value-adding aspects are excluded; at the same time ideation and idea development cannot go on endlessly, instead the decision to move on and concentrate on certain aspects needs to be made at some point in order to fit the time constraints.

> “Especially the first quarter or third was very slow-paced and difficult for us partly because of us, partly because of IDBM. (…) At some point during winter we realized that we simply have to start doing something, pull out a method or a framework - some tool with which to plot our data.”

> ”It was constantly at the back of our heads that we have a difficult brief: we were at no point told what it was that they [KONE representatives] wanted us to do. There were talks about visual guidelines but [the brief] was left very open which made it challenging – because it is difficult to stop to think during the process, it is easy to get lost causing uncertainty and mixed feelings.”

There are some common means of getting background information on existing practices and recent publications that help identify gaps for development possibilities. The findings of web search, trends and discussions in media, observation of behavioral patterns, and user surveys and focus group interviews material are benchmarked with the team’s own ideas in order to come up with something new yet fundamentally significant and realizable. These are a way to cut through existing information landscape and synthetize it which would be a time-consuming and an expensive task if done by a KONE employee who would be taken off other work. Attachment 5 is an example of the user survey that was conducted as part of the PDP KONE 2010-2011 lighting project; the survey aimed to map what kind of light and light effects people prefer at different times of day.

> “(…) [I]t is worthwhile to look for product development innovations from extreme ends i.e. trying to find out the reasons why those that definitely do not use some system don’t see value in it, and then those that use it a lot.”

Many times the problem does not lie in finding and collecting task-related information from various sources, in addition, the IDBM and PDP program staff follows up on the progress in regular check-point meetings and the KONE representative gives feedback in company meetings on the team’s findings and the evolution of thought as well as helps evaluate the ideas and encourages the further development of the best alternative. Rather the two problems are:

- Having collected a lot of information, the teams face the challenge of developing ideas based on their findings i.e. analyzing the data to retrieve relevant points of interest and thus narrowing the scope. This is closely linked to the looseness of the challenge description giving little guidance. The engineers often use a practical and efficient problem-based approach: they identify one problem and start working on that, however, there is a risk that the chosen problem might not be the right one i.e. that in the task there is a more relevant problem. An iterative process is more effective if time allows: through testing and building of mock-ups, the ideas are realized and the ones that do not work can be left out.

- Communication between the team and the KONE representative is not intensive enough – there is practically very little exchange of information outside company meetings. Concluding feedback has included the criticism of the KONE representative not knowing what is happening and what the team is planning to do which can mean that the team has been concentrating on something that KONE does not want. Trying to make a good impression by presenting ready ideas might backfire because the KONE representative wants to see and evaluate alternatives and choose the best fitting ideas from them or encourage further idea creation. KONE desires the teams to be more proactive especially in PDP KONE projects.

It seems that there is a risk of the team getting lost when they are given little to start off from but considering that the KONE representative has made a conscious decision on this, getting off the track must be included in the risk analysis from KONE's side, in other words the erroneous alignment must be permitted considering the loose setting. However, giving out information on KONE's current solution is two-fold: on one side it enables the team to avoid coming up with the same idea but ideate on the next generation solution:

> "When we were in a deadlock situation and couldn't move forward, [our KONE representative] gave us tips and showed some tools that they had used in previous projects, which helped us greatly. For example we started to construct more developed versions of the visual guidelines using a tool called Style Mapping that KONE had used in earlier projects."

> "It [the innovativeness of the solution] was fully the result of our team's effort and work – all of the input and all stimuli were brought about by the team. We also received some, or better yet, enough directions from KONE to keep the project feasible."

On the other hand giving out information on KONE's current solution might limit the team to incrementally improve the current solution instead of coming up with creative, new ideas. To demonstrate this, the company representative described how the KONE internal ideation process is sometimes locked-in and thus why it is desirable to prevent the teams to enter the same thinking patterns and dominant logic. In the end, IDBM and PDP projects provide KONE with the opportunity to receive new perspectives and broaden the thinking inside KONE even if the idea is not that radical.

> ”Too easily the starting point is to take an existing solution and start improving it. This results in that if we have a bad packaging, then to improve it the nails are replaced with screws and if it’s still bad then it’s wrapped in thicker plastic or made of different kind of board. The thought of using different materials is a difficult process when there is already an original solution.”

> ”We do it like this because we have done it like this for 100 years, and when we start to think about how to do something differently, our perspective enlarges by five degrees and then we celebrate how we have looked at things from a very wide angle.”

> ”When [the packaging solution] was presented at Hyvinkää [to KONE people] before the PDP Gala, it had elements that people discussed as in that ‘oh wow, packaging doesn’t necessarily need to be of wood, plastic and nails!’.”

In a large company like KONE, employees hold a vast amount of information that is difficult to track down or reach by KONE employees that would be interested in it and that could be communicated to the teams because of inadequate intra-organizational and cross-department information exchange. For example, in one of the projects, the team set out to improve a KONE core competence before finding out that firstly there are legal obstacles that prevent them from properly testing the product and secondly that a Master’s Thesis on that subject had been under work at the same time which undermined the sensibility of the development project because it could not have been applied; the team had to change direction mid-way which affected the finishing of the final product.

> ”Yes [our final product could have been more innovative]! If we would have started developing a communication solution from the beginning then I believe that we would have. Because the decision on the concept that we realized was made in a rush and so it goes that if there are many engineers that have to come up with something innovative fast, then it affects the innovativeness [negatively].”

Regardless of the insecurity the team members feel about the loose challenge descriptions, in the end when the final idea is clearer and its further development is under work, the teams look back and are satisfied with the freedom that was given to them in the beginning. When the pressure to invent something new has diminished, the team members come to appreciate the then vague starting point that gave them the opportunity to create something completely new and something that the team can claim to be the result of its own innovativeness.

> ”It was most probably intentional from KONE’s side to keep the brief open enough especially in the beginning. I got a feeling like ‘let’s give this cool team of students a great project and good resources and let’s see what happens’. And we delivered.”

8.2. IMPLEMENTATION: final outcome

To execute their propositions, the project teams have limited budgets provided to them by KONE through the programs as part of its participation fee. These investments into the projects enable the teams to explore the given challenge in different ways. The build-up towards the final product consists of three main phases which overlap in time:

1. Research phase: the team collects background information and direct data from the focus group(s) for further analysis and as basis for brainstorming and idea creation.
2. Ideation phase: brainstorming before much researching restricts as little as possible and helps the team to let loose: quantity overrides quality. Brainstorming that follows research enables the team to narrow down the scope and ideate inside more focused areas.
3. Mock-up and prototyping phase: the team tests the ideas and gets preliminary information on whether they are at all practical before setting out to develop the final prototype.

In the ideation phase the teams develop ideas and concepts through brainstorming aided by ideation methodologies such as the PD6; PD6 is a workshop in which the team and the company representative(s) go through the product development process from ideation to building quick-and-dirty prototypes in just 6 hours. The phase includes evaluation and selection of ideas which is done together with the KONE company representative who as the Challenge Owner makes sure of the compatibility and desirability of the idea for the intended use at KONE.

In PDP, the mock-up and prototype phase can be divided into two stages that altogether form an iterative trial-and-error type development process: In the mock-up phase the teams build mock-ups and quick-and-dirty prototypes in order to test and evaluate the different ideas; these give preliminary indication on the idea in practice and whether it is worth developing further. In the prototype phase the teams concentrate on developing the chosen idea into a partly or fully operating prototype that demonstrates its functionality.

In IDBM, idea and concept alternatives are developed theoretically and the best idea is generally chosen for further development later than in PDP where the team starts building the final prototype at around half point. In addition, the budget is allocated for a trip that the team makes as part of the project: teams travel to one or more locations such as the project's focus market or a trade exhibition to collect information and get ideas that add up to achieving the project objective(s). For example, IDBM KONE 2010-2011 team travelled twice to Shanghai in order to get first-hand material on the Shanghainese market for the development of localization guidelines for KONE.

> ”Travelling twice to Shanghai was indispensable in order to get anything worthwhile out of this project. I would argue that by prolonging these trips by X weeks or by going there for a third time we would have gotten much more out of it.”

Though the building of the prototype takes up a bulk of resources as in time and budget in the PDP project, the fundamental idea and its documentation can be regarded as having more value to the company especially if the solution fits what it was designed for and if it supports the rest of the company's offering. For example, the communications solution answered to the underlying problem that people experiencing elevator modernization were facing - not being informed on what is happening each day and what is the overall status of the modernization project - and decreased their dissatisfaction regardless of the circumstances. Though some parts of the prototype are currently not being adopted by KONE, the fundamental idea of an interactive information communication board is currently under development. The team also delivers a final report in which the process that led into the development of the specific idea is explained as well as relevant technical details and instructions to guide further development and application. As the prototypes are not ready products, their value lies in the demonstrability of the fundamental idea which helps in selling the idea inside KONE and in the educational value to the students.

> ”Successfulness has definitely to do with novelty and being something different whereas less successful outcomes are difficult to apply because they don't fit the company's strategy or because the company's capabilities or resources do not enable the realization of the product that was development in one of our teams.”

In general the characteristics of the final outcome developed for KONE include that

1. it is not commercially ready as such but needs further work
2. it is of non-core nature: a product or service meant to support a KONE core competence
3. it is the result of iterative idea developing, building mock-ups and testing prototypes

> ”As a concept the communication solution was successful but as a product it was still relatively rough. (…) We drew the structural model of the IT infrastructure as a basis for easy coding if that is desired [in the future]. But we put more emphasis on making such a demo with which we can demonstrate the functionality.”

> “(…) [T]he technical execution isn’t economically sensible but the concept is something that we will actually put into use. In that sense it was a very valuable project.”

> “Building the prototype serves primarily the learning experience while the ideas that arise along the way might be more what the company is after; the prototype itself is of less use to the company.”

The final outcomes developed on the basis of the five project briefs described in Picture 12 are presented in Picture 12 (see also Attachment 6 for photos of one final project outcome).

When asked from the team representatives whether they think that KONE could have come up with the same idea, the general feeling was that yes. However, it is a key issue to recognize that though KONE probably could have invented the same solution, at the same time it maybe would not have. There are numerous development propositions pending at every moment but to allocate people to them instead of other work is restricted due to scarcity of resources and lower priority and criticality of development efforts compared to something that has greater potential for added value. In other words, if the given challenges would be of critical value and thus have higher priority, KONE could have come up with similar solutions for price Y and in X time.

> ”New development ideas or ideas to be explored can come up easily and naturally inside the company and are on the list [of issues that need to be looked in to], however, there hasn’t been time to go into them because of everyday tasks that need to be done.”

At the same time, considering the open innovation environment and the possibilities that sourcing for innovation from outside presents in terms of shorter time and lower cost, KONE’s aspirations to participate in IDBM KONE and PDP KONE projects can be justified as being a low-risk, goodwill-type investment target which in the best-case scenario exceeds the expectations towards the investment.

> ”The [demo] didn’t have a so called wow-factor; there were no fireworks and such because it was so easy and simple [to comprehend]. In a way all of the functions - anybody could have done it but the point was that even though anybody could have done the same, no-one has.”

KONE project	Project focus	Final product
PDP 2003–2004	Deaf people	The final destination in a building is programmed into a tag that uses RFID technology that places the person onto an electronic map and directs towards the set destination. Screens placed at an angel promote the intuitive reading of the map at e.g. crossings or near the elevators to help.
PDP 2008–2009	Elevator modernization	The electronic information board provides a two-way information communication channel between the inhabitants and the installers without increasing their workload. It includes a spotlight feature: the board does not require touching but reacts to a person stepping into its observation radar. It is a service produced by an IT system.
PDP 2009–2010	Packaging	The resulting packaging for different elevator parts was one cardboard box where the parts fit the interior supporting structure made also from cardboard so that they did not move. The box is easy for one person to handle which is especially convenient on-site and it can be used for storing.
IDBM 2010–2011	Localization in Shanghai	The team collected all its observations into a trend tree and identified four big future trends that the guidelines were based on. The guidelines were delivered on large posters.
PDP 2010–2011	Lighting	The final solution included two parts: the light bar communicates the relative waiting time to the user as well as the direction in which the elevator will continue while the general light becomes stronger the closer the elevator is which supports the light bar’s message. Two versions were delivered to fit premium and standard elevators.

Picture 12 IDBM and PDP project outcomes

8.3. Evaluating benefits to KONE

While in the case of web-based innovation intermediaries, the prevailing assumption is that specific solutions exist already and need only to be located and exploited, the value of IDBM and PDP lies in the opportunity to get <u>workable data and material</u> on different ideas and concepts developed by a group of talented people. Put otherwise, while innovation intermediaries facilitate the transfer of solutions to discrete problems, in IDBM and PDP programs KONE sees the potential of giving the teams guided and controlled explorative freedom in order to receive value-adding ideas for which it does not have an immediate need but that could prove beneficial in the future.

> "The idea is to get innovative thoughts of young and smart people relatively cost-efficiently; thoughts that are not constrained by the dominant logic like those of internal employees automatically are in practice because they have to play by the rules of the company whereas students do not."

> "Let's put it this way: if the initial ideation is very open then some of the ideas are very radical and very much new, while some are more conventional. But it depends on the steering whether the team is encouraged to continue to create something radical or whether it is directed to focus on incremental development."

> "The decision-making process where KONE project steering group to whom the ideas and concepts are presented and who makes the choices in the end, is a mechanism that cuts short the wildest of ideas. On one hand it is good that the least executable ideas are discarded, on the other hand if given twice the amount of resources they could turn into something really great. These mechanisms restrict the innovativeness or the radical type conceptualization that deviates from the middle ground. In that sense our project had parts that could have been more innovative."

> "It is more like a challenge to companies that they should find a way to direct the project towards the right way. But they should not be fixed in a way that 'this means this' and 'that needs to go there' because that is what kills creativity. On the other hand if there is no direction then the creativity can lead to a totally wrong outcome."

In the end, despite the sometimes fuzzy challenge description and though the solutions are many times not readily integrable without further development, according to feedback, KONE has been satisfied with the final outcomes that generally evolve into more or less concrete solutions to fit the conceptualization the team has come up with. To back this, IDBM and PDP demonstrate a good success rate though there are sometimes large variances between the more and less innovative product development projects sponsored by different participating companies.

> ”Out of 154 projects about six have failed magnificently (…), little under 10 have resulted in a commercially ready product, and all the rest are in between which means that if [the final outcome] has potential, then in one, two or five years it may be seen integrated to an actual product in some way.

> ”We have a good track record that the companies have been satisfied with our student projects. In addition, we are able to say that students with a background in IDBM have been very successful in Stanford [ME-310] projects. We have good references: if you want to hear any company representative’s feedback, then just call that person.”

> ”If collaboration in a [company] project functions primarily through meetings and surveys and the actual doing takes place separately and there are multiple projects and supplier management and so on, then maybe that’s the thing about these [PDP] projects. Even if it’s only one day a week with other courses taking place at the same time, the project has a kind of special status [to the students] compared to an employee who has worked on the topic for five years and has a whole lot of other pressure.”

When assessing what KONE gets to fulfill the needs it has identified, it is clear that the value of the idea and thus the value of participating in these development projects is hard to estimate because the final outcomes are not ready products or services. In other words, the final outcomes are concept suggestions that do not necessarily have a readily available application area in the KONE product and service portfolio. In the end the value of the conceptualization can be larger than the original cost but for a large company like KONE, the sunken cost is not that critical even if the results turn out less innovative. In general to have a project team to think about a problem in a way that is different from KONE’s dominant logic is an opportunity to discover new insights with low risk and investment. This can help KONE justify the usefulness of its participation in IDBM and PDP.

> “In my opinion new viewpoints originate more from the outside than from the inside because the fact is that when you do the same thing day after day, your perspective with which you look at things shrinks.”

”Our product development should be able to move more in the same direction that is possible in these student projects – setting off from the problem: identifying the problem and solving it in the best possible way and not so that we find the problem and solve it in a way that builds on the previous solution. This I would say is the biggest difference.”

”The novelty value [of the final outcome] was greater to KONE than it was as an invention or as a product.”

”I’m satisfied with the projects because even though we do not get ready products that could be directly commercialized as such, we get ideas that are well worth developing into products i.e. discovering and putting into use the underlying valuable idea.”

Depending on how well the idea and its fit to the underlying problem is documented, and its functionality demonstrated, if KONE finds that the solution has the potential to add value being part of existing or under-development product or service, then it can be taken for further development inside the company (go back to Picture 9 bottom row).

”After 2 years, the idea is now on paper to show that it is under development. It is a big part of how we will handle communication in the future. It was clearly an idea that we decided to adopt.”

To conclude, the value of the IDBM and PDP project is not solely dependent on the final outcome as such, but it is rather measured as an opportunity for KONE people to get a fresh viewpoint on familiar matters and new workable ideas. After this, in order to best benefit from such input, proper innovation culture, structured procedure to take the idea forward, a person or team in charge and investment organization need to be in place in order to process the project documentation and make appropriate arrangements for value capturing. Other indirect benefits include networking opportunities, building of positive good will reputation and a channel for recruiting capable workers.

8.4. Diversity and motivation as enablers of creativity

Following the research framework extension (Picture 10), two secondary drivers are identified as having an impact on building the kind of setting that promotes creativity and dedication to work on a project that takes considerably more time than it is worth in study credits: diversity originating in the unique mix in background, skills and social capital of the project team members, and sources of motivation. At the same time group dynamics and leadership skills of the project manager also affect how well the team works together during the project, these however, are not covered in this thesis.

8.4.1. Diversity

University students are generally well up-to-date on the newest research and inventions through their studies and the university's network of official and non-official information and communication channels. The community they form is a collection of numerous access points – each individual's unique mix of educational, professional and social background provides a cross-industry perspective that surpasses the company's own industry field and its dominant logic and raises the probability to recognize the opportunity to transform existing knowledge to fit a new application area.

The capability of the team of university students is a sales argument from the programs to the company: IDBM and PDP promise to provide a diverse multidisciplinary team of students that takes into consideration the technological, business and industrial design perspectives to work on a given challenge. In reality the team encompasses much more than that: it is a collection of knowledge and information accrued from everything each team member has done before: for example, at least two KONE projects have had a team member that has completed the Stanford University based ME310 product development project and could bring in learnings of good and not so good methodologies and practices from there. In addition, each individual provides links to various networks and pools of resources: friends, colleagues, people from different faculties and family members. This means that by providing a project for IDBM and PDP, the company actually gains access to a much wider network of information channels that extent from the project team, and from IDBM and PDP programs.

> "In an open challenge description know-one knows in advance, or even suspects what the end result will be. There is a chance for an opportunity to arise for example because there is a skateboarder in the team and because another person has lived in Brazil for three years. And there are many other elements that seem irrelevant in the beginning but as the project moves forward, there are chances and conjunctions that match and something new that could not be predicted is created."

> ”What the students have is this personal experience from these [electronic] devices and social media. It’s something that in many companies the middle-aged middle and upper managers do not have: personal understanding of social media.”

> ”We IDBM tutors hope to encourage the student groups to take a more radical approach because that is their strong area. Student groups are generally not at their best working on issues that require conventional professional skills.”

On top of being multidisciplinary, the teams may also have Finland-based foreign team members or remote members that add an international element and thus a fourth point of view to complement academic orientations. IDBM and PDP KONE teams have had members from e.g. Sweden, China, India, Portugal and Japan. However, the true diversity of the teams can be questioned because of the apparent differences but at the same time clear similarities between university students.

> ”If the team consists of members that have similar backgrounds, then no, the solution rarely turns out to be genuinely innovative. It is of considerable value that people have notably diverse backgrounds with international asset being one way but by no means the only way to add diversity.”

> “Yes, the intention of PDP is to bring together students with backgrounds in economics, engineering and industrial design. But at some point you will notice when you talk and do things together, that the only separating factors between everyone is in fact the four years of university studies (…). Human character is human character and being an economist, an engineer or an industrial designer constitutes a very small portion of that. From this point of view there could be more variance in the PDP teams.”

Nevertheless, industrial designers are highly valued by the companies and they and engineers have a somewhat clearer role in PDP projects than economists when judged solely by educational background and not by personal aspirations that are independent from such classification. The nature of the industrial designer’s education includes the kind of tools as well as experience from working on real-world projects since the start of their education that prove to be a strong asset in many teams. The roles are more universal in IDBM teams because the program focuses on theoretical solution development in wide topics such as process improvement and development of a marketing strategy and does not include prototype building which requires specialized skills in engineering and industrial design.

“Industrial designers are valuable in a product development project simply because their education includes retaining certain innovativeness under pressure and having systematic tools with which to build solutions to relevant problem areas. Whereas engineers are good at problem-solving; together they make up a good combination. “

”Almost all companies have generally more technological expertise than we [at IDBM] have as well as marketing and management know-how. Very often companies lack design know-how and that is the new thing for them.”

8.4.2. Motivation

Two types of motivation provide different reasons for why the challenge-driven approach of innovation intermediaries appeals to solver clients: extrinsic and intrinsic (Davila et al. 2006, pp. 181-182). In extrinsic motivation, external drivers such as money reward, status or study points and grade lead a person’s motivation. However, money as an incentive is an unstable measurement of motivation because people that go after the financial reward are other than those that seek personal fulfillment and acknowledgment; as a result the solutions these two sets of people deliver are different. To explain this, the Candle Problem, a cognitive performance test created in 1945 by Karl Duncker and applied by Sam Glucksberg in his article published in 1962[2], shows how people working without money pressure come up with more innovative solutions faster.

Intrinsic motivation is about individual fulfillment and enjoyment through passion towards and meaningfulness of a task as well as recognition by others (Davila et al. 2006, pp. 181). For example, having an appreciated company evaluate and reward a solution and so recognize the value of the work is a powerful driver of motivation. As a partly awarded InnoCentive solver expressed: “’… having NASA scientists evaluate my work was a primary motivation … It is a dream to be recognized by the scientific level of NASA quality.’” (*InnoCentive Investigation* 2010, pp. 5) Similarly, from year to year large, established Finnish companies such as KONE, Nokia and Wärtsilä are appreciated by the IDBM and PDP students who feel privileged to work on projects for them. Indeed based on the interviews, good motivation of the individual team members depends to a large extent on being able to apply existing skills and learn new ones in an interesting real-world challenge setting conducted for a valued company without profit responsibility.

[2] Glucksberg, Sam (1962) The influence of strength of drive on functional fixedness and perceptual recognition, *Journal of Experimental Psychology* **63**, pp. 36–41

"Motivation arises easily when there is an appropriate channel through which to reach interesting challenges. And of course if there is such a channel that you know you can solve, and especially if you know that no-one else can solve it, it is an intriguing situation where the biggest prize is the satisfaction of being able to solve the problem yourself."

"We were a group of young, fresh minds that do not carry any kind of professional ambition or workload. There was no profit responsibility in that even if we would have failed, we wouldn't be responsible which gives a certain sense of freedom."

"Extremely motivated work groups and company representatives, active participation and getting both positive and negative feedback when it was needed all contributed to well-functioning interaction [in the 2010-2011 project sponsored by Dyke Automations]. It required a sort of guts and boldness in decision-making to make decisions in big matters that are not 100% sure whether this is right or can this even be calculated."

However, following feedback, there could be more diversity in the range of participating companies with regard to getting projects that seek to benefit from the multidisciplinarity of the project teams instead of being more strongly focused on one field such as engineering and less on the two others, in this case economics and industrial design.

"It's a little silly to say that it would be good to have bigger and better companies, and now I'm not talking about KONE because I think that we had the best project this year. But if we look at school in Sweden, a friend of mine studies design there, they did a project for NASA for example. This could be hot and fun and it would have more value in the media, I mean other than in some specialized engineering magazine."

Students want to make a good impression on the company representatives involved in the IDBM KONE and PDP KONE projects by presenting themselves as credible, creative and capable young professionals. This can also be seen in the team's interest to deliver something useful.

"Of course it would have been awesome to be able to say that we're doing a project that will halve the time of elevator installation or cut into a quarter of the time or turn it into two days instead of two months. (…) [B]order terms didn't allow it no matter how innovative it would have been. (…) [T]hat was when we decided that it is wiser to do something that could actually be used instead of simply looking or sounding cool."

> ”We acknowledged that something simple would work well but as [our KONE representative] wanted to get new ideas meaning what kind of technical solutions could be utilized in the future instead of concentrating on how things are done now, we decided to go for something more complex to build and to demonstrate.”

> ”The glancing screen which played a major role in our final concept was actually patented in the end.”

Though correlation between the impact of diversity and good motivation on creativity cannot be drawn unambiguously without relevant quantitative research, it can be argued that these help build a fruitful project work environment. Diversity ensures that relevant perspectives are covered and raises the probability of finding workable ideas at the intersections of every team member's unique pallet of knowledge, experience and skills. The right balance of extrinsic and intrinsic motivation ensures that each team member is satisfied through the acknowledgement of the personal effort by other team members and by the company which encourages further input towards a common goal.

9. KONE PROCESS: current way and development steps

KONE uses two types of suppliers: contract manufacturers and material/solution suppliers for its various needs and to fill the capabilities or the resource capacity it lacks. Though always project-specific, the requirements for supplier innovativeness differ for these two: in general, subcontractors are valued for their compliance with the set requirements and the consistency of their input while material/solution suppliers have more freedom - and necessity - for suggesting new, alternative solutions proactively. In general it can be argued that one of the biggest stumbling stones on the innovation path for companies reside inside the companies themselves. In order to capture the value of good ideas, companies should support supplier innovativeness by

- identifying needs
- identifying knowledge gaps that could be filled by supplier capabilities
- leveraging of supplier capabilities
- encouraging supplier innovation by showing interest and attentiveness
- having a systematic way to process suggestions and solutions

It is also necessary to acknowledge that KONE is operating in a patent-heavy elevator and escalator industry which poses certain restrictions to openness with regards to R&D. The following chapter discusses the topic of leveraging supplier capabilities from KONE's point of view and KONE's preparedness to deal with and take forward ideas and solutions that it has set out to find or in which it sees application possibilities and value potential.

9.1. Supplier innovativeness and patent restrictions at KONE

The research framework (Picture 9) showed how a project follows needs assessment – the company has identified a need or an opportunity it seeks to fulfill and determines the requirements that should be met in the end product as a result of the project. Similarly the objective of the project affects what kinds of suppliers should be involved and at what stage, e.g. developing a new material or a new technology are complex processes that require specific expertise already during ideation. It has already been discussed in Chapter 8 how in the case of technologically complex products suppliers should be integrated at an early stage in order to benefit from their innovative input and expertise. Furthermore, in case the existing supplier base cannot fulfill what the project requires, KONE looks for new suppliers that can provide the lacking resources or contribute good ideas.

> "The phase in the R&D project in which we generally include suppliers depends on whether the project outcome is something that requires a new set of suppliers or is it something that fits the product assortment of existing suppliers. (…) If we are developing a new technology, then the suppliers we need to collaborate with should be involved at a very early stage when we are only starting to build concept prototypes."

> "We have [subcontractors] (…) that have worked for us on product development projects for 20 years (…). But when there is a project that requires other resources than what we have, then we know already at an early stage, that we need input from somewhere else.

> "When we need a material that is 5 mm thick and that has to endure these kinds of forces (…) but as we don't know materials, we can only provide the specifications: 'With these specifications, come up with a good material solution'. If this is the starting point for the project, then the material suppliers are involved right from the start as we cannot come up with the solutions because we do not have the needed competence."

”Some companies are good when asked to manufacture something, and when they do exactly that then we know that from there we get exactly what we have ordered. But we cannot really make good use of these kinds of companies in the ideation phase.”

Throughout the empirical part, the observation that development efforts should start from identifying the underlying problem that the solution is meant to solve has come up. KONE seeks for different input from its design subcontractors and its material or solution. In general their innovativeness from KONE’s perspective is closely linked to the supplier’s proactive initiative to offer alternative solutions that generate for example savings in cost or time and improve production cost-efficiency. This means that KONE appreciates suppliers that when possible develop their own solutions especially in areas that are not directly KONE’s core competence.

“Those that boldly challenge [us] by noting that ‘ok, if [KONE] wants to use this kind of material in this place, then what if we do it differently so that we get these kinds of good qualities’. If material suppliers do exactly what is told, then it is us that have determined the end product. Instead of delivering our answer, [the suppliers] should look for the problem and seek to answer the question behind.”

”[F]irms that have their own products that they set off to modify to fit our needs (…) are more apt to come up with new innovations when possible; every once in a while this happens.”

“Probably [what makes a supplier innovative is] the pressure to stay in the game. If a design company doesn’t evolve, it doesn’t raise any interest in client companies. But if during collaboration it can deliver such suggestions that give us insights that ‘hey, we got a really good idea from this [design company] (…), we need to collaborate [with them] again’, then in this way innovativeness is a competitive asset with which partners can build our customer loyalty towards them.”

“There are many opportunities to innovate when refining [materials] if the supplier is interested to understand how and where we use it. The supplier might say that the sheet metal used in this product is too thick, that making it half a millimeter thinner generates this much savings. Or that the production of this particular product is rather complex but by fixing the design it is possible to save half an hour in production time.

> This is what we hope to get from our suppliers, and those that do have an asset with which they can increase their competitiveness in our eyes."

The technologies and innovations that interest KONE from investment and development point of view are such that most probably interest competing elevator companies as well: "There is a constant challenge to be on track of what we [at KONE] do and what our competitors are doing", thus competition and patent weight pose certain restrictions. Coming back to the project briefs discussed in Chapter 11.1, though the loose description approach was supported by all interviewees, it must be acknowledged that the indiscreteness is also a way not to tell too openly what kind of development opportunities are being explored and tested by KONE through IDBM and PDP projects.

> "(…) [PDP and the company] decide on the kind of topic that supports the company's business in a way that it is worth investing money, time and effort and where the subject is of such nature that it doesn't benefit competitors even if they know that this kind of project is in the doing."

> "In a way the divide between the educational and the business aspect is sometimes very clear which from the point of view of PDP facilitates stressing that all of the projects are public. It is a game rule that if you want to do something that cannot be public, then this [PDP] is not the thing [for your company]."

> "[Challenge-driven innovation] can work well in solving separate problems because the technical field allows various ways to solve the same challenge meaning that it is not necessarily of any use that one separate part is patented because there has to be a lot more around it [to make it valuable]. This kind of approach works for KONE in some areas, maybe more in areas of added value rather than in core activities."

9.2. KONE: self-evaluation and Innovation Tool

There are aspects that KONE could improve in its approach to encourage suppliers to be innovative and come up with valuable new ideas and suggestions. While KONE wishes that its suppliers would proactively approach the company with their suggestions and even exceed what has been agreed in the contract, it must acknowledge two points. First, KONE's innovation culture should be open to and encourage suggestions that come from both inside and outside the company and not only be receptive to solutions that correspond to KONE's existing understanding and ways of doing. Second, there should be a team of people in charge of an established process to take suggestions forward.

> ”The first step is that when we get an innovative proposition, we should process and take it forward as quickly and dependably as possible so that the supplier gets a feeling that we have listened to him. The first mistake we easily do is to say that 'I don't have time to think about that right now so stop fussing'. If we behave like this, we discourage the supplier to propose anything worthwhile to KONE anymore.”

> ”If we ask for example our material suppliers for a solution to a problem, then what happens is that even if they offer just ideas instead of ready solutions, still the elimination would take place on the basis of 'that's not possible', 'we've tried that already 20 years ago and it didn't work then', 'you can't do that with those materials', 'that is too expensive'. The elimination would take place because it is known in advance that no other alternative is acceptable but that one but let's just ask everyone for something just for the sake of it.”

> “We should start off from the problem and go to the subcontractor with that problem asking how it could be solved. And not so that we have a problem which we decided is best solved like this so produce us exactly that. We should involve the suppliers in answering the question and not just delivering it.”

> ”It surely sometimes happens that we in practice determine the product specifications and what we want [from our suppliers] too tightly which means that we direct them from project introduction to follow the same KONE path.

The idea of using the services of an innovation intermediary and the one-time suppliers it transmits is a relatively new approach that requires a different stance from established companies in traditional industries than from for example explorative start-ups. The process of accepting this method to be a recognized practice is not straight-forward because of the changes it requires in how people think.

> ”When we are at the point of starting the actual product development, sourcing, production and logistics are already included. But the thing is that all of these have their own interests towards the project: logistics looks at it from logistics point of view and sourcing from sourcing point of view but at no point does sourcing look from logistics or

installation point of view. (…) If we think about project follow-through, it is a good thing that every department has its responsibilities but on the other hand it is a bad thing because now we all follow the same KONE path and swing through the project following the defined roles.”

[In order for R&D to get interesting input from other departments], ”the pack should be first mixed so well that people would forget their own roles and forget the approach that ‘as I’m not an expert in this, then it is better that I don’t say anything’.”

Put otherwise, there should be place for self-assessment on where is the line between protecting confidential information and relying on in-house R&D, and missing out on viable business and revenue opportunities because of holding tightly on to intellectual property but not having enough resources or interest to work on it in-house.

”If I understood it correctly, [innovation intermediaries] could provide a solution to an age-old dilemma where in larger companies such as Metso, KONE or ABB numerous very good ideas are disregarded [or put on-shelf] every day simply because the even better ones are selected. In a way there is no mechanism for putting eliminated ideas into use.”

”I feel that the ideas that get eliminated in the product development wheel of larger companies are actually so good that they could be utilized for doing business.”

“Many inventions are such that everyone seems to think they are impossible to execute - until some does. If inside the firm there is a perception of what is possible and what is not, then of course no one will even try for the impossible. In PDP people don’t know what is possible and what is not - they just do things that we thought were impossible.”

To address the two development areas identified in the beginning of this chapter, KONE is working on a tool that offers a channel to share, comment and take most potential new ideas of KONE employees and external suppliers forward. The Innovation Tool has potential to leverage internal employee and external supplier capabilities if adopted by relevant KONE people to the extent that it functions smoothly in that it generates active enough discussion in the tool and that the Challenge Owner and the team in charge have the time to execute its function.

> "We have an online Innovation Tool with currently about one thousand registered KONE users primarily from the technical side. There is currently discussion in the organization on how we can include the innovative suggestions that come from suppliers into the handling process so that a larger group can see, comment and process the suggestions that come in so that at the end, a decision on whether to do a change in a product or start a product development project can be made."

> "[With] this [Innovation Tool] we're trying to enable the idea that anyone can ideate anything."

Consequently, the possibilities of Innovation Tool are currently being investigated, tested and developed as a step forward towards capturing the possibilities of open innovation. In addition, since limited cross-functional communication hinders the identification and capturing of opportunities for added value in a timely way, introducing an innovation champion or a champion team in every function could help a company to methodologically collect ideas that arise inside the company and ideas that end up at different departments from external suppliers.

10. MAIN FINDINGS: discussion

Throughout the thesis, the objective has not been to say that one-time suppliers can be used in all situations; rather they are an additional resource with which companies can complement their competence and fill specific knowledge gaps fast and cheap by utilizing external knowledge in a single project. Put otherwise, innovation intermediaries have turned the open innovation setting into a business where they save companies time and energy by providing access to one-time suppliers to work on case-specific problems presented in the form of discrete challenges.

10.1. Theoretical insights

Coming back to the research questions that were presented in Chapter 1, the main objective of this thesis was to research **how does a company benefit from utilizing the services of innovation intermediaries.** To help address this topic, two sub-questions were defined:

1. In what ways do innovation intermediaries facilitate the company?
2. What makes one-time suppliers difficult for companies to accept as one alternative?

The first question mapped the ways in which innovation intermediaries can facilitate the client company to benefit from open innovation in a cost-efficient and safe way. Since innovation intermediaries have an established process to explore the technological landscape and the existing knowledge of the dispersed groups of suppliers, they have the structural means to help the client company find relevant innovation sources. Because innovation intermediaries have the appropriate channels and access to innovation sources ready, using intermediary services can be faster and more cost-efficient than if the company would get its head deep in the search and evaluation tasks (Lakhani & Jeppesen 2007; Wagner and Hoegl 2006). The findings also encompass a guarantee and sales argument since the client company only pays for results - the company rewards, i.e. buys the intellectual property rights to the proposition that fits the challenge requirements best. The Arrow Information Paradox and challenges related to protecting sensitive information are real which explains why companies are reluctant to rely on other than internal R&D in innovating – sharing information can lead to capturing valuable opportunities but the risk of critical information leaking to competitors is a turn-off. To tackle the Arrow Information Paradox, using the intermediary services helps the client company protect confidential information yet get relevant solution propositions because of the confidentiality terms that the solvers need to approve; in addition, anonymity of the client company decreases the risk of competitors recognizing the type of technological opportunities it is looking for (Dean 2008).

Following the above findings, the second question addressed the issue of why companies may nevertheless find it difficult to accept one-time suppliers as a valid alternative even if these can produce results cheaper and easier. As a company cannot do everything itself it should leverage the capacity of capable suppliers to which it can assign development responsibilities (Petroni & Panciroli 2002). The issue of trust between the company and the supplier is very important - as trust develops through successful collaboration and positive past experiences, suppliers with which a company has no track record are considered riskier. Based on the general feeling among interviewees, innovation intermediaries were estimated to be of more use in industries that are not constrained by patents while the potential for KONE to look into the possibilities in value-adding activities was also acknowledged.

Based on this thesis, it can be generalized that the benefits of using innovation intermediaries depend on how technologically uncertain the product is, how critical it is to develop solutions fast and the client company's risk assessment i.e. benefits of capturing opportunities versus damages if information leaks out. While little research has been conducted on the successes and failures of innovation intermediaries such as InnoCentive apart from their own (bias) reports, many companies have utilized the services of innovation intermediaries during the past 10 years. Though this does not mean that lucrative results are always delivered, the services and channels that innovation intermediaries provide to reach relevant one-time suppliers can open viable opportunities. It can be generalized across industries that one-time suppliers could be utilized for their ideas and other resources in less critical tasks, in other words, in the form of value-adding non-core extensions to which a company can expand to in search of adjacent growth.

10.2. Limitations and future research

The sample of KONE sponsored IDBM and PDP projects that have been investigated in this thesis through interviews is adequate in that it represents over half of the KONE projects made over the years. Moreover, the interviews took into account four different perspectives, and the saturation in the interview answers confirms the validity of the qualitative research from KONE's part. However, the KONE projects represent only one sponsor company in the middle of many other projects that have different starting points, objectives, difficulties and success rates; from this follows that the KONE company- and project-specific findings cannot be generalized as such.

The work combines my own interests, the academic requirements and the needs of the commissioning company KONE. From this follows that the literature review includes many smaller topics that are more or less linked to the role and functions of innovation intermediaries. Because this thesis is among the first ones in this field, the wide angle opens many possibilities for more focused interest. Possible areas for further research include

- Mapping the different knowledge supplier groups and their incentives to innovate and work on challenges and investigating the value network formed by knowledge supplier groups, the innovation intermediary and the client companies.
- Examining how to valuate and reward intellectual property appropriately since it is difficult to estimate the true value of the ideas and solutions that a company gets; this is because the input of knowledge is firstly difficult to allocate per unit, and secondly because it anyway forms only a part of a product or service if implemented.

10.3. Conclusion

Today's fast-paced development and new product launch cycle requires companies to be able to continuously renew themselves and their offering to differentiate themselves from competitors.

Leveraging supplier capabilities is important because it allows companies to release resources to areas where it is more cost-efficient or critical for the company to carry development in-house while the supplier takes on development responsibility of value-adding activities. To have an innovation intermediary assess the knowledge gaps of a company and search for the best knowledge providers to fill those gaps can turn out to be a considerable competitive advantage. Due to the range of services that innovation intermediaries offer, a company can choose to collaborate on a project-specific or on a long-term basis and choose to utilize only those search and evaluation services that answer to the identified needs.

While the innovation intermediary facilitation service approach is more usable in some industries than in others, the general implication is that a company should be present in the same forums as its competitors in order to know and understand what is happening in the competitive business environment. A company cannot afford a competitor leverage opportunities and launch new technologies in a short period of time since making use of the services of innovation intermediaries (Chesbrough 2010, pp. 163). From this follows that the services that innovation intermediaries provide should be at least looked into in order to properly evaluate whether these could be of use to the company in one or more areas – the secure, low-cost and fast access to a network of solvers can be a valuable source of ideas and cross-industry information even if it does not result in the transfer of intellectual property.

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Attachment 1: Open innovation platforms

Intermediary platforms	
Research & Development platforms	Marketing, Design & Idea platforms
Innocentive - open innovation problem solving TekScout - crowdsourcing R&D solutions IdeaConnection – idea marketplace and problem solving Yet2.com - IP market place PRESANS - connect and solve R&D problems Hypios - online problem solving Innoget - research intermediary platform One Billion Minds - online (social) challenges NineSigma - technology problem solving	RedesignMe - community co-creation Atizo - open innovation market place Innovation Exchange – open innovation market place ideaken - collaborative crowdsourcing Guerra Creativa - crowdsourcing anything from logos to websites Battle of concepts - student challenges Brainrack - student challenges crowdSPRING - creative designs BootB.com - custom creative ideas for any creative need Myoo Create – environmental and social challenges 12designer - marketplace for creative solutions LeadVine - crowdsourcing lead generation 99designs - pioneer in design crowdsourcing OpenIDEO - collaborative design platform Challenge.gov – crowdsourced solutions for government problems eYeka - the co-creation community
Intermediary open innovation services Big Idea Group – organize innovation contests and idea hunts Idea Crossing - organize innovation quests Pharmalicensing – open innovation for the life sciences Chaordix - crowdsourcing engine for innovation DataStation - complete innovation platform	
Corporate initiatives	
Product Ideas crowdsourcing	Branding & Design crowdsourcing
Fiat Mio - create a car P&G Open Innovation Challenge - external idea sourcing in Britain Ideas4Unilever - corporate venturing BMW Customer Innovation Lab LeadUsers.nl & Live Simplicity – Philips' crowdsourcing platforms Kraft - innovate with Kraft InnovationJam* - IBM's more internally focused idea generation project Dell IdeaStorm - external idea sourcing Vocalpoint - P&G's network for women Betavine - Vodafone's mobile app community	LEGO Factory - LEGO co-creation tool Peugeot - Peugeot's design contest Muji - improving and suggesting new designs Electrolux Design Lab – annual design competition for students LEGO Mindstorms - open source robots GoldCorp - the famous GoldCorp Challenge

Source: www.openinnovators.com

Attachment 2: Basic data on IDBM and PDP

Founded	Faculty	Program status	Team size	Team set-up	Team structure	Final outcome
			IDBM			
1995	Marketing, Aalto School of Economics	Master's Minor program 24 ECTS, also a Master's Major program since 2010.	3 - 5	The program matches the students for each project based on their interests and skills that they have provided. The placement is revealed in a kick-off meeting where the company representatives introduce the projects.	Teams do not necessarily have a project manager and no other roles are required either, instead the team members organize themselves as they see fit.	To the company: Conceptualized idea presented in the final presentation and final report (+ additional material requested by the sponsor e.g. posters). To the program: project plan, literature review, mid-term report, final presentation and final report.
			PDP			
1997	Mechanical engineering, Aalto University School of Engineering facilitated by Design Factory	Master level elective course 10 ECTS	7 - 10	The companies present their projects in a special event at the end of which the students submit the projects of interest in an order of preference and indicate if they are interested in being a Project Manager who selects the rest of the team members from the applications.	The team decides on at least a vice-manager, a security officer and a finance officer. Also a communications officer could be appointed.	Conceptualized idea and a working prototype presented in mid-term presentation and final presentation + final report. To the program: additional documents produced by the Project Manager.

Attachment 3: Interviewees

KONE1: Ari Hänninen, Project Manager, KONE, 20.5.2011

KONE2: Jorma Rantala, Sourcing Manager, KONE 16.6.2011

IDBM1: Markku Salimäki, founder of the IDBM program, 18.5.2011

IDBM2: Pyry Taanila, KONE IDBM project team member, 21.5.2011

PDP1: Kalevi Ekman, founder of the PDP program, 10.6.2011

PDP2: Lauri Tolvas, KONE PDP project manager, 9.5.2011

PDP3: Matti Hämäläinen, KONE PDP project manager, 9.5.2011

Attachment 4: Interview question sets

4A Interview Questions - KONE

1. KONEen näkökulmasta, miksi se on lähtenyt IDBM/PDP-ohjelmaan? / Mitä KONE on projekteista saanut? (esim. parempia / enemmän ideoita / ideoita halvemmalla, mainosta, uusia työntekijöitä)
2. Hakeeko KONE ennemmin täysin uusia ideoita vai erilaisia käyttömahdollisuuksia / sovelluksia vanhalle?
3. Mikä on tehnyt projekteista onnistuneita?
4. Asteikolla 1-10, kuinka ainutlaatuisia KONE-projektien lopputuotteet ovat olleet?
5. Voisiko KONE keksiä vastaavanlaisia ideoita kuin mitä lopputuotteena saavat? (ottaen huomioon kaikkien ajankäyttö, tuote, joka saadaan annetuilla resursseilla)
6. Mitä tietoja / taitoja opiskelijoilla on mitä KONEella ei ole?
7. Ovatko tiimien oppimiskokemukset ja ideointi hyödyllisiä KONEelle? (esim. kokeilut, epäonnistumiset)
8. Miten opiskelijoiden tuotekehitysprojektit eroavat KONEen omista tuotekehitysprojekteista?
9. Miten KONEen toimittajien halutaan vaikuttavan tuotekehitysprojektissa?
    a. suunnittelualihankkijat
    b. materiaali/ratkaisutoimittajat
10. Missä vaiheessa R&D-projektia toimittajat on tyypillisesti otettu keskusteluun mukaan?
11. Minkä tyyppiset toimittajat ja kenen aloitteesta (sourcing vs. R&D)?
    a. Mitä voisi parantaa?

12. Miten opiskelijoiden panostus eroaa toimittajien panostuksesta tuotekehitysprojektissa?
13. Saadaanko toimittajista samanlaista innovatiivisuutta? (suunnittelualihankkijat vs. materiaali/ratkaisutoimittajat)
    a. Millainen on innovatiivinen toimittaja?
        a.i. suunnittelualihankkija?
        a.ii. materiaali/ratkaisutoimittaja?
    b. Mitä KONEen tulisi tehdä / parantaa, että toimittajista saataisiin puristettua innovaatioita irti?
14. Miten kommunikointi eri osastojen (esim. sourcingin) kanssa vaikuttaa KONEen omaan tuotekehitysprojektiin ennen / aikana?
    a. Mikä on tilanne nyt?
    b. Mitä tulee parantaa?
15. Onko Suomessa kysyntää (nettipohjaisille) seeker-solver markkinapaikoille?
16. Millaisissa tilanteissa KONE ratkaisun etsijänä voisi hyötyä seeker-solver palveluista? (esim. ongelmatyyppi (pieni, spesifi yms.), vakuuttavampi tulos, nopeampaa)
17. Mitä vahvuuksia IDBM/PDP-ohjelmalla on innovaatiovälittäjänä?
    a. Entä heikkouksia?
    b. Miten kehittäisit IDBM/PDP-ohjelmaa innovaatiovälittäjänä?
18. Olisiko seeker-solver-tyyppinen palveluntarjoaja houkutteleva kanava KONEelle tavoittaa oikeat toimittajat olemassa olevasta toimittajakannasta tai laajemmalta?
19. Miten suuri merkitys projektitiimeillä on ollut lopputuotteen innovatiivisuudesta?
20. Onko muita kanavia päästä samanlaisiin tuloksiin? (proto, opittua) (esim. kilpailut, venturointi)
21. Onko tehtävänanto parempi rajata / määritellä tarkemmin vai löyhemmin? Miksi näin?
22. Mikä on mielestäsi IDBM:n/PDP:n rooli yliopistomaailman ja yritysmaailman välillä?
23. Päätyykö projektien lopputuotteita käyttöön joko sellaisenaan tai muunneltuna?

4B Interview Questions - PDP/IDBM project members

1. Mikä oli se lopputuote, jonka yritys sai projektin lopuksi?
2. Mikä siinä oli uutta?
3. Mistä ideat nimettyihin elementteihin tulivat? (käyttäjäkyselyt, luennot, yrityksestä, oma tutkimus)
4. Mistä haitte / saitte tietoa ideoihin ja niiden kehittämiseen?
    a. Oliko sopivien tietolähteiden tunnistaminen helppoa?

b. Saitteko yritykseltä riittävästi tietoa projektin alussa? Millaista tietoa? (esim. tekninen tieto, käyttäjätutkimustieto)
5. Oliko projektin lopullinen tavoite alusta alkaen selkeä vai pitikö se määrittää?
6. Haettiinko tehtävänannossa selkeästi jotain uutta vai uusia käyttömahdollisuuksia vanhalle?
7. Mikä lopullisessa konseptissa / protossa oli onnistunutta?
    a. Mikä teki nimetyistä elementeistä onnistuneita?
    b. Miten arvioitte ideoiden sopivuutta lopputuotteeseen?
8. Mitä huonoa / epäonnistunutta lopputuotteessa oli?
    a. Miksi nimetyt elementit olivat huonoja?
    b. Miksi ne jätettiin lopputuotteeseen?
9. Vastasiko ratkaisu mielestäsi annettua tehtävänantoa? Miksi kyllä / ei?
10. Mikä oli tiiminne osuus lopputuotteen innovatiivisuudesta? / Paljonko lopputuotteen innovatiivisuus oli oman ideointinne lopputulosta?
11. Olisiko lopputuote olla vielä innovatiivisempi?
12. Mitä mieltä olet, olisiko sponsori voinut keksiä saman itse? Miksi kyllä / ei?
13. Miten sponsorin sitoutuneisuus tuli esille läpi projektin? (esim. tietolähde)
14. Mikä on mielestäsi PDP/IDBM:n rooli yliopistomaailman ja yritysmaailman välillä?
15. Onko Suomessa kysyntää (nettipohjaisille) seeker-solver markkinapaikoille? Miksi kyllä / ei?
    a. Millä aloilla seeker-solver-tyyppistä lähestymistapaa voisi mielestäsi hyödyntää Suomessa?
16. Minkälaisissa tilanteissa kuvittelisit kääntyväsi ongelmanratkaisupalveluntarjoajan puoleen ratkaisun etsijänä? (esim. ongelmatyyppi (pieni, spesifi yms.), vakuuttavampi tulos, nopeampaa)
    a. Entä ratkaisun tarjoajana?
17. Yrityksen näkökulmasta, mikä muu kanava voisi toimia vaihtoehtona PDP:lle/IDBM:lle innovaatiovälittäjänä? (esim. kilpailut, venturointi)
18. Miten kehittäisit PDP/IDBM-ohjelmaa innovaatiovälittäjänä?
19. Millaisia haasteita kohtasitte tietojen ja taitojen soveltamisessa / yhteensovittamisessa tehtävänantoon?
20. Mikä oli PDP/IDBM:n hyötyarvo sinulle?
21. Olisitko halunnut jatkaa lopputuotteen kehittämistä projektin loputtua?

4C Interview Questions – program founders

1. Mikä on IDBM:n/PDP:n tavoite? / Mitä IDBM/PDP myy?
    a. Miksi yrityksen kannattaa lähteä mukaan IDBM/PDP-ohjelmaan?

    b. Miksi yritykset osallistuvat IDBM/PDP-ohjelmaan? (palaute)
2. Onko tehtävänanto parempi rajata / määritellä tarkemmin vai löyhemmin? Miksi näin?
3. Hakevatko yritykset ennemmin täysin uusia ideoita (irrottelua) vai erilaisia käyttömahdollisuuksia / sovelluksia vanhalle?
4. Asteikolla 1-10, kuinka ainutlaatuisia projektien lopputuotteet ovat?
5. Miksi toisten projektien lopputulokset ovat ”hullumpia” / uskaliaampia / yllättävämpiä kuin toisten?
    a. Tekeekö ”hulluus” / uskaliaisuus jne. niistä ”innovatiivisempia”? Jos ei niin mikä?
6. Mitä tietoja / taitoja opiskelijoilla on mitä yrityksellä ei ole?
7. Miten suuri merkitys projektitiimeillä on ollut lopputuotteen innovatiivisuudesta?
8. Voisiko yritys periaatteessa keksiä vastaavanlaisia ideoita kuin mitä lopputuotteena saavat?
9. Milloin projekti on onnistunut?
10. Mitä ominaisuuksia onnistuneissa lopputuotteissa on yleisesti ollut
11. Mitä ominaisuuksia vähemmän onnistuneissa lopputuotteissa on yleisesti ollut?
12. Mikä on mielestäsi IDBM:n/PDP:n rooli yliopistomaailman ja yritysmaailman välillä?
13. Onko Suomessa kysyntää (nettipohjaisille) seeker-solver markkinapaikoille? Miksi kyllä / ei?
    a. Millä aloilla seeker-solver-tyyppistä lähestymistapaa voisi mielestäsi hyödyntää Suomessa?
14. Millaisissa tilanteissa ratkaisun etsijä voisi hyötyä seeker-solver palveluista? (esim. ongelmatyyppi (pieni, spesifi yms.), vakuuttavampi tulos, nopeampaa)
    a. Entä ratkaisun tarjoaja?
15. Mikä muu kanava voisi toimia vaihtoehtona IDBM:lle/PDP:lle innovaatiovälittäjänä? (esim. kilpailut, venturointi)
16. Mitä vahvuuksia ohjelmalla on innovaatiovälittäjänä?
    a. Entä heikkouksia?
    b. Miten kehittäisit IDBM/PDP-ohjelmaa innovaatiovälittäjänä?
17. Miten sponsori tuo esiin sitoutuneisuuttaan?
18. Päätyykö projektien lopputuotteita käyttöön joko sellaisenaan tai muunneltuna?

4D Interview Questions – KONE Sourcing

1. Hakeeko KONE toimittajilta ennemmin täysin uusia ideoita vai erilaisia käyttömahdollisuuksia / sovelluksia vanhalle?
    a. Voisiko tai kannattaisiko KONEen keksiä vastaavanlaisia ideoita itse?
2. Miten KONEen toimittajien halutaan vaikuttavan tuotekehitysprojektissa?

    a. suunnittelualihankkijat
    b. materiaali/ratkaisutoimittajat
3. Missä vaiheessa R&D-projektia toimittajat on tyypillisesti otettu keskusteluun mukaan?
4. Minkä tyyppiset toimittajat ja kenen aloitteesta (sourcing vs. R&D)?
    a. Mitä voisi parantaa?
5. Millainen on innovatiivinen toimittaja?
    a. suunnittelualihankkija?
    b. materiaali/ratkaisutoimittaja?
    c. Mitä KONEen tulisi tehdä / parantaa, että toimittajista saataisiin puristettua enemmän innovaatioita / innovatiivisuutta irti?
6. Miten kommunikointi eri osastojen (esim. sourcingin) kanssa vaikuttaa KONEen omaan tuotekehitysprojektiin ennen / aikana?
    a. Mikä on tilanne nyt?
    b. Mitä tulee parantaa?
7. Olisiko seeker-solver-tyyppinen palveluntarjoaja houkutteleva kanava KONEelle tavoittaa oikeat toimittajat olemassa olevasta toimittajakannasta tai laajemmalta?
8. Millainen olisi koostumukseltaan ideaali tuotekehitystiimi?

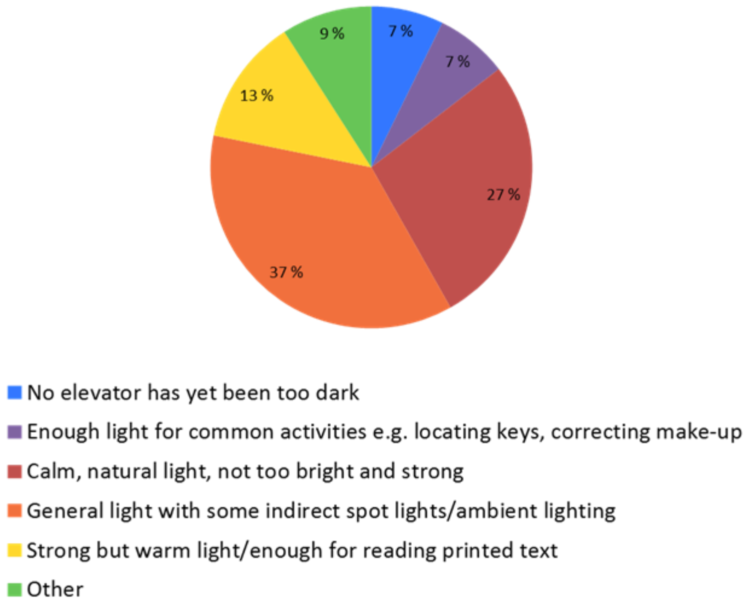
Attachment 5: Example from PDP KONE 2010-2011 user survey

User Study / Survey

KONE

- A user survey was conducted in weeks 45/46
  - Participants included friends of team members, IDBM + PDP posting lists, and some KONE employees
  - The survey resulted in 59 answers / 300 requests
  - The survey was conducted in Finnish
- Following statistics is a rough representation drawn from the qualitative open answers given by the respondents

What kind of lighting is enough inside an elevator?



Firefly | PDP 2010-2011

Attachment 6: Final outcome of PDP KONE 2010-2011 project

Attachment 6A shows the final outcome of PDP KONE 2010-2011 project. The prototype included the front panel (Attachment 6B) in which the light bars on both sides shown in green and the led lights for general white lighting were integrated. The prototype included a simple interface for simulating the functionality of the light bar and of the lighting solution as a whole. Based on the feedback and comments received upon demonstration, the functionality was interpreted as clear to understand.

Attachment 6A: Premium (left) and standard (right) elevator lighting solution

Attachment 6B: Illustration of front panel structure