Commercialization Barriers and their Characteristics in Innovation Projects

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ABSTRACT

Innovation research most often focus on innovation barriers from a firm-level perspective, and it is well-recognized that commercialization barriers are an important hurdle for innovating firms. However, current research lacks to investigate the more fine-grained characteristics of specific commercialization barriers occurring in firms' innovation projects. Based on a multiple case study of 12 firms, this study dives into commercialization barriers experienced during innovation projects to provide a detailed picture of their characteristics. This is important as commercialization is a particularly challenging part of innovation projects. The findings characterize 16 specific commercialization barriers and order them in accordance to their occurrences across cases. Furthermore, the study demonstrates which innovation project-specific barriers are related to the firms' internal organizational structure and which ones are related to their external environment.

Keywords:

Commercialization; Commercialization barriers; Case study; Innovation

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Introduction

Commercialization of innovations is recognized as particularly challenging for firms, and most innovations do not reach or stay long on the market after they have been developed (O'Connor & Rice, 2013; Chiesa & Frattini, 2011). Therefore, managing commercialization barriers to successfully commercialize innovations is strategically important for firms, as it supports them in dominating current industries and develop new ones, which contributes to industry leadership and firm survival in the long run (Datta et al., 2013; Wallsten, 2000). Existing literature on commercialization of innovations suggests how barriers may be managed. Achieving market information is emphasized as a way to gain insight into customers to understand how to offer a proper value proposition that fits their problems and needs, and to prepare the market for the innovation (Talke & Hultink, 2010; Crawford & Di Benedetto, 2008; Möller, 2006). Also, establishing end-user networks may be a way to support launching an innovation (Harrison & Waluszewski, 2008; von Hippel, 2007), and lead users may be used as champions that support an innovation, and support its further development and improvement for a future market (Berthon et al. 2007; von Hippel, 1986). Besides interaction with end-users and customers, interaction with suppliers, distributors, influents etc. is also regarded as central factors to focus on to support commercialization (Perks & Moxey, 2011; Partanen et al., 2014), e.g. by securing the right distribution channels (Woodside & Biemans, 2005) or collaborating with firms that may provide to access to new markets (Chesbrough, 2017; Möller & Svahn, 2009). However, through research on management of commercialization barriers is valuable, it does not tell us about the characteristics of specific commercialization barriers.

Furthermore, innovation research seems to generally lack a focus on commercialization and its related barriers. As pointed out by West & Bogers (2014), innovation research

'*more often focus on obtaining innovations, rather than the phases of integrating and commercializing those innovations*' (West & Bogers, 2014: 27). As such, there is a need to dive into the phase of commercialization to provide a clearer picture of the characteristics of the barriers arising, when firms aim to commercialize innovations.

In relation to this, research on barriers in innovation research lacks focus on a project perspective, as most research has mostly focused on the firm-level perspective to identify and explain innovation barriers. E.g. focus has been on barriers such as lack of management support and motivation (Lee et al., 2010; Mortara et al., 2009), insufficient adaption to user needs (Thomä, 2017; SaatCioglu & Özmen, 2010) and technological uncertainty (Bigliardi & Galati, 2013). Current research seems to offer a static 'blueprint' of innovation barriers that seems decoupled from the firms' innovation projects.

Based on the above, this study aims to investigate what characterizes commercialization barriers that firms experience, as they arise during firms' innovation projects. The research question is: *What are commercialization barriers characterized by as they are experienced during innovation projects?*

Diving into the very characteristics of commercialization barriers is central, as it is well-recognized that commercialization is particularly challenging and entering the market is sometimes referred to as 'Valley of Death' (Aarikka-Stenroos et al., 2014; Markham et al., 2010; Beard et al., 2009).

The study is based on a multiple case study of 12 firms across industries that have had innovation projects within their firms. To make a theoretical contribution to theory on commercialization of innovations, the study investigates the characteristics of commercialization barriers experienced by the firms during their innovation projects.

Theory

Commercialization is included in the overall stages in an innovation process, which tend to cover R&D, idea development, conceptualizing and design, manufacturing, test and commercializing the fully developed innovation at a market (Data et al., 2013; Cooper, 2008). However, the innovation process does not have to take place in a linear way, and commercialization is not merely a latter phase of the innovation process manifested in successful launching. Taking a processual perspective, it is recognized that there may be numerous possible paths and feedback loops during the phases of an innovation process (Aarikka-Stenroos et al., 2014). As such, commercialization may be integrated across the process phases in firms' innovation projects.

Commercialization of innovations may be defined as the first sale of the innovation (Nerkar & Shane, 2007). However, after an innovation is launched and introduced at a market, successful commercialization at a broader market is not guaranteed. Typically, only technology enthusiasts purchase in the early stage after launching, and they comprise of less than three percent of the market (Moore, 1991, 2000). To mobilize diffusion of an innovation, firms need to scale up production and distribution channels, and integrate the innovation into the existing business and production system (Story et al., 2011). Furthermore, external relationships need to be activated and sustained in the firm's entire value chain and in the external environment (Aarikka-Stenroos & Sandberg, 2012; O'Connor & Rice, 2013b; Talke & Hultink 2010). As such, commercialization is not merely regarded as launching a new product or service in the end of an innovation project. The threshold for 'successful' commercialization tends to lie somewhere between making a single sale or few sales on the one hand, and reaching the mainstream market on the other may (Datta et al., 2013).

Commercialization barriers

Commercialization of innovations present barriers and risks for most firms because of the value of new technology and target markets often being unclear and ambiguous (Anderson & Tushman, 1991). Nevertheless, the commercialization of innovations is strategically important for firms to secure survival in the long run (Datta et al., 2013; Wallsten, 2000). Also, the importance of commercialization is reflected in academia through the attempts by researchers to understand the phenomenon (Linton and Walsh, 2008; Corkindale, 2010). However, the very characteristics of specific commercialization barriers occurring in innovation projects seems unexplored in existing research. Most research on barriers related to innovation tend to take a firm-level perspective. For instance, identified barriers in firms that aim to develop and commercialize innovations include lack of management support and motivation (Lee et al., 2010; Mortara et al., 2009), insufficient financial resources and access to knowledge and competences (Lee et al., 2010), insufficient adaption to user needs and problems (Thomä, 2017; SaatCioglu & Özmen, 2010), technological uncertainty (Bigliardi & Galati, 2013) and reluctance towards knowledge, ideas or technologies of external origin (Burcharth et al., 2014; Bohner & Dickel, 2011; Herzog & Leger, 2010). Diving into to specific commercialization barriers occurring in innovation projects will provide a more thorough understanding of the specific barriers related to commercialization.

Commercialization include several primary features, which is connected to a number of market-related activities. Carrying out the market-related activities is central in bringing innovations successful to market (Coviello et al., 2012; Crawford & Di Benedetto, 2008). The activities include abilities to collaborate with external partners who can support the process of bringing an innovation to the market. These may be actors in the firm's value chain such as suppliers and distributors who can support to create an infrastructure of channels that support the launching of an innovation to a market (Woodside & Biemans, 2005; Shamise et al., 2004;

Shankar et al., 1998). Also, external partners engaged in open innovation activities with the firm may be supportive, e.g. to provide access to markets (Chesbrough, 2017; Chesbrough & Bogers, 2014). Such partners may include other firms, customers and end-users (Harrison & Waluszewski, 2008; von Hippel, 2007). An essential part of commercialization also includes targeting the right market and customer segments (Slater & Mohr, 2006). This includes analyzing market structure and customer needs and demands to generate a clear picture of the market conditions and customers in focus.

As market-related activities are central to commercialization, they are included in the traditional stage gate models used for innovation processes. Linear innovation processes, like Cooper's Stage-Gates systems (Cooper, 2008, 1997) have proven effective at driving ideas through new product development and to the market. However, applying stage-gate models, including their market-related activities, do not seem to guarantee successful commercialization, as this also depends on organizational structure in the innovation project and the environment external to the single firm (Nafi et al., 2015; O'Connor & Rice, 2013).

Organizational structure in a firm's innovation projects typically include several organizational individuals and business units within the firm. The structure is defined as ties (relations and links) across individuals and a firm's departments that are somehow involved in the same innovation project (Markham et al., 2010). If the ties are *not* strong during the course of an innovation project, there tends to become a gap between individuals and departments – particularly a gap between the departments that are engaged in development and commercialization, and this gap may cause that the innovation never enters the market (Branscomb & Auerswald, 2001; Markham, 2002). Also, a firm's innovation experience and size, may influence its experience of commercialization barriers. For instance, firms with large financial resources are in a good position to bear the costs related to innovation projects and

acquire more resources for commercialization. On the other side, small and novel firms tend to lack the necessary resources and innovation experience and therefore need support from external relationships (Partanen et al., 2011; Tolstoy & Agndal, 2010).

Furthermore, the single firm's external environment may cause commercialization barriers. Particularly, barriers may arise if no customers are buying the innovation as expected after it has entered the market (Nafi et al., 2015; Lam et al., 2013). In relation to this, competitors may have developed other similar innovations which position themselves better at the targeted market (Hooley et al., 2001; Brooksbank, 1994). Especially if the market has changed, competitors are usually given the advantage to capitalize on the R&D and development efforts made by the innovating firm and they use this to imitate and further develop the innovation, so it fits the new market demands (Shankar, 2008). Also, external non-market related factors may cause commercialization barriers. Governmental rules and regulations have proven to be a barrier deterring firms to commercialize innovations (Janevski, Davitkovska, & Petkovski, 2015; Greis et al., 1995). This factor is related to the political system and is therefore subject to election cycles affecting the political decisions on laws and regulations. Apart from the political system, the social system may trigger commercialization barriers. Commercializing innovations into otherwise stable social systems, like a mature market, is a challenging endeavor. Where the introduction of an innovation provides something new, it also tends to disrupt existing markets and it is not easy for firms to achieve acceptance of innovations, because they suggest change (Hargodon & Douglas, 2001).

Method

To answer the research question a multiple case study of 12 cases is chosen, as case studies are particularly useful to explore a topic in-depth (Yin, 2003).

Case selection

Theoretical sampling is used with focus on the theoretical gaps in order to choose cases that are likely to extend theory (Eisenhardt, 1989). The selected cases should further provide rich data to answer the research question.

The cases consist of 12 manufacturing firms located in Denmark. The cases included in the study are selected on the criteria that the firms should have run one or more innovation projects within the last 5 years and that firms are represented across different industries. The purpose with the last-mentioned criteria is to include different types of innovation projects, which provide information richness and heterogeneity across cases (Neergaard, 2007).

The table shows an overview of the case firms.

INSERT TABLE 1 ABOUT HERE

Data collection

Qualitative interviews

As a method, semi-structured interviews are particularly suitable when prior knowledge about theory on commercialization of innovations has already been obtained but where answers cannot be anticipated (Morse, 2012).

A total number of 24 interviews are conducted. The respondents consisted of one or more employees that had been in charge of and involved directly in one or more of the firm's innovation projects. The interview guides were organized into pre-determined themes focused

on innovation barriers in innovation projects with a particular focus on commercialization. Questions related to this were centered on finished innovation projects that had taken place in the firm.

Each interview lasted for about 1 ½ to 2 hours and was recorded and transcribed. The firms were interviewed twice. The first interview took place at the firms' headquarters. The focus during the first interviews was centered on the firms' innovation projects and the barriers they experienced during these projects. As such, the first interviews covered all sorts of barriers where commercialization barriers were also a part of these. The focus during the second interviews was particularly structured around the barriers related to commercialization in the innovation projects.

Project documents

Several different documents were gathered in all the cases on a continuous basis. The documents consisted of material about the firms and their innovation projects. Access to the documents was gained from the firms, through the firms' webpages and from other sources such as reports about innovation and newspaper articles about the firms. The documents were collected to provide background information about the firms and give additional insight into how their innovation activities.

Data analysis

The collected data is coded with the support of the software program Nvivo. This means that the texts containing the interview transcripts are indexed. Codes usually are attached to 'chunks' of varying size—words, phrases, sentences, or whole paragraphs, connected or unconnected to a specific setting. Following Miles & Huberman (1994), an abductive approach is used, which

means that the researcher moves back and forth between the empirical and theoretical world. In relation to this, the coding is based on the theoretical framework and the research question, while also remaining open for new themes to emerge from the empirical data during the coding process.

All the interview transcripts are coded according to the following two categories: Commercialization activities and commercialization barriers. First, all sorts of commercialization activities experienced during the firms' innovation projects are coded. This includes coding commercialization activities derived from the theoretical framework, while also coding for other similar ones derived from the firm respondents. Second, specific barriers related to commercialization are coded.

The following table shows all the coded commercialization barriers and their number of occurrences across all cases.

INSERT TABLE 2 ABOUT HERE

Findings

Totally, 16 different commercialization barriers were identified across all cases. These barriers have been experienced by the firms during the course of innovation projects. The findings aim to demonstrate the characteristics of the commercialization barriers occurring in the projects to provide a more fine-grained understanding of their nature. Not all firms have experienced all barriers, but all firms have experienced some of the barriers. In the following sections, the commercialization barriers are divided into an organizational and environmental category, and furthermore, each commercialization barrier is characterized within these categories.

Organizational category

Sales & Marketing does not prioritize new products to the same degree as R&D

The commercialization barrier is characterized by a mismatch in the prioritization of innovations across the R&D and Sales and Marketing department. It is one of the barriers that are emphasized most by the case firms.

Where innovations are highly prioritized by the R&D department, they are less highly prioritized by sales and marketing departments. The reason for this is that sales and marketing employees sometimes avoid selling new products or services, as they are not familiar with the these because of their newness and as the sales success of innovations is more uncertain.

The commercialization barrier is also connected to one of the other commercialization barriers concerned with lack of communication between sales and marketing departments and the R&D department. As illustrated in the following interview quote, the firms experience that their innovations lack internal 'broadcasting', so the sales and marketing employees within the firm are motivated to prioritize selling innovations.

This is due to, I think, the lack of a launch approach. Meaning it has not been broadcasted internally: now we also have this (a new product) and we can do good business if you choose to do it (sell it). And tell them we have costumers for this (the new product).

Firm interview

As illustrated in the quote, communication about the potential benefits about commercializing an innovation (such as making a good business) is lacking and may explain why innovations are not necessarily prioritized as high by the sales and marketing employees compared with the

R&D employees. For some firms, this commercialization barrier is related to geography as the departments are separated geographically.

Structural deficiencies

The commercialization is one of the barriers that are emphasized most by the case firms.

First, structural deficiencies are characterized by the firms' lack of experience entering new markets to commercialize an innovation. This means that the firms have to go through a massive learning curve. For instance, this included learning how to enter international markets.

Second, structural deficiencies include lack of procedures supporting commercialization. Particularly, this involves insufficient launching and marketing procedures for innovations within the single firm, which may leave an innovation 'stranded' after development. As illustrated in the following quote lack of procedures are manifested in unstructured ways to commercialize.

Marketing is also a new exercise for us, thus the salesmen have an individually based experience of what they are to sell. This have led to a huge portfolio and many different machines, of which we don´t have a complete overview.

Firm interview

Thirdly, structural deficiencies are also characterized by a lack of strong ties between the sales and marketing department and other departments. It seems that when collaboration across departments is not structured it becomes more difficult to involve sale and marketing in innovation projects.

Forth, deficiencies are also characterized by a dearth of resources. This characteristic is is two-sided. First of all, it is characterized by a lack of financial resources allocated to an innovation

project. Also, time deficiencies are characterized by the challenges related to time-allocation which employees may face, when they are both involved in their regular tasks and in innovation projects. If there is an imbalance between the two on behalf of the regular tasks, there is less time to be involved in the innovation project.

Insufficient access to the end-user

Establishing access to the end-user is an activity that may support commercialization. However, insufficient access is experienced as a commercialization barrier, when the firm loose contact with the end-users. This particularly occur when sales go through independent sales agents or distributors, who conduct all the contact with the end-user leaving the firm isolated. When the firm do not have access to the end-users it is challenging to make user-tests and gain inputs from users.

Cultural differences

Firms that operate across locations experience cultural differences which may be considered a commercialization barrier. Its characteristics are centered on maneuvering between different cultures, hierarchies and roles across departments located far away from each other – especially internationally.

Insufficient strategic focus on innovation

An insufficient strategic focus on innovation within the firms may hamper commercialization of an innovation. The innovation projects risks being decoupled from management and the firm strategy, which may cause that commercializing an innovation becomes downgraded, as it often involves several resources (e.g. time and financial resources) which management does not prioritize to spent.

Internal resistance to change

Employees within a firm are sometimes resistant towards innovations. When it comes to commercializing these, some employees may protect already existing solutions and downgrade the innovation to be commercialized. This may be an expression of avoiding cannibalization of the firm's existing solutions by new ones developed by the firm.

Lack of information

Lack of market information is characterized by insufficient collection of information needed to commercialize an innovation. This include central market-related activities such as identifying the customer segments and their needs, while also gathering market information to investigate existing solutions at the market. This commercialization barrier also includes non-market-related activities including lack of internal information about employees' skills within the firm contains a barrier to commercialize and lack of knowledge about new technologies external to the firm (e.g. within universities).

Insufficient communication between R&D & other colleagues

This commercialization barrier is related to the first mentioned barrier emphasizing that sales and marketing departments does not prioritize new products to the same degree as R&D. Lack of communication between the two types of departments does not support commercialization of innovations. Nor does it seem to support that sales and marketing departments prioritize innovation more.

Environmental category

Stakeholder resistance

Stakeholder resistance becomes a commercialization barrier when they avoid making the changes necessary for the innovation to be commercialized. This typically involves suppliers, distributors and sales agents who may need to adapt to new ways to collaborate with the innovating firm. If they resist this may have negative consequences in the firm's ability to commercialize an innovation.

Open innovation and external partnerships

When firms include external partners in their innovation projects commercialization barriers are related to challenges to absorb the knowledge gained from outside the firm itself. This may be called the Not-Invented-Here (NIH) syndrome and describes a bias toward knowledge (e.g. ideas and technologies) derived from actors external to the single firm or individual. Furthermore, commercialization barriers related to external partners include disagreement in goals, allocation of resources and patent rights.

Lack of skilled personnel

Lack of qualified labour is characterized by firms' need for certain skills which cannot be obtained. For instance, this is particularly the case for firms located in remote geographical areas far away from the larger cities. Also, lacking to educate existing employees also impose a challenge in relation to make their employees qualified to solve tasks in innovation projects.

Governmental & institutional rules & regulations

The firms are subject the existing rules and regulations. These may be security and quality standards and environmental regulations. Especially, when new standards and law requirements influence ongoing innovation projects it may become barrier to commercialization if the

innovation is nearly ready to launch but does not live up to the new law requirements. In relation to this, it may be to costly to change the innovation.

Buyers' bargaining power

Buyers' bargaining power refers to the pressure that customer can put on firms, e.g. to lower prices and offer higher quality. The bargaining power especially becomes a commercialization barrier, when the firms experience a pressure from the competitors who may offer similar solutions to the customers at a lower price or higher quality. As such, the barrier is characterized by the power customers gain when they have many opportunities to purchase solutions from other firms, and this seems to weaken the innovating firm's ability to succeed in bringing new solutions to the market.

The costumer does not demand the new product

This commercialization barrier is one of the barriers that are emphasized most by the case firms. It is characterized by the firms' relations to customers which it already knows. Particularly, the barrier arises when firms seek to develop an innovation that is adapted to the needs of the customer, but somehow does not deliver what is expected from customer. This seems to be due to a mismatch between the customer's expectations of the quality of the innovation and the actual quality delivered. This mismatch is illustrated in the interview quote.

There are also products where we must admit: this was not what we expected. That may be because the product was not as good as we thought or because the market changed from when we started the project.

Firm interview

The quote also illustrates that the innovating firm is aware that the innovation does not meet the current expectations of the customer. Either because it not turned out as good as the firm initially aimed for or because the market has changed leading to different customer expectations. The last mentioned is related to the next commercialization barrier.

The market has changed during the project period

This commercialization barrier is the last of the barriers that are emphasized most by the case firms. If the marked-premises has changed during the course of an innovation project, new or changed needs among customers seem to become a commercialization barrier. The firms experience that this is caused by changed needs and expectations to new-to-the-market products. In relation to this, the firms experience that competitors have been quicker to enter the market with their new solutions and when the firms fail to continuously track the market premises and adapt their innovation to these, commercialization seems to be hampered.

Sub-category to The market has changed during the project period: Industry-specific barriers

Some industries are change faster than others. Particularly, the firms embedded in industries dependent on using technology experience that a fast pace of new technologies may become a barrier to commercialization. When they seek to commercialize newly developed innovations the technology used in these innovations are considered ‘old’. As such, commercialization may be hampered if the firms do not continuously gain information about the technological development and continuously adapt their innovations to new technology.

Discussion

Innovation research tends to focus more on obtaining innovations, rather than commercializing those innovations (West & Bogers, 2014). However, literature on commercialization of

innovations do provide a clear understanding of what commercialization contains. In relation to this, an emphasis is made of the challenging aspects of commercialization, as literature shows that commercialization is particularly challenging (Aarikka-Stenroos et al., 2014; Chiesa & Frattini, 2011; Beard et al., 2009). However, there is a need to improve our understanding of the characteristics of commercialization barriers occurring in firms' innovation projects. The findings of this study add new insights to theory on commercialization of innovations by investigating project-related commercialization barriers more in detail. Particularly, four barriers stand out from the empirical findings. These are labeled, 'Sales & Marketing does not prioritize new products to the same degree as R&D', 'Structural deficiencies', 'The market has changed during the project period' and 'The costumer does not demand the new product.' The first two are related to the internal organizational structure in the firm. The last two are related to the firms' external environment.

In the category of organizational structure, the findings point to a certain structure which characterize the most occurring commercialization barriers. This structure is the relationship between two types of departments in the firms: R&D and Sales & Marketing. The structure between the two becomes a commercialization barrier, as there are no strong ties between them during innovation projects. Tensions between R&D and the commercial activities of firms are well documented (Fisher et al., 1997; Gupta et al., 1986; Souder, 1988). However, the findings of this study provide more detail about these tensions as they occur in innovation projects. Especially, the incitements to commercialize innovations in the sales departments are not built to prioritize innovations in the same way as R&D. Lack of communication between the two seems to reinforce this if sales employees are not motivated and encouraged to sell innovations. As such, it does not seem to be enough simply to include both R&D and the sales and marketing department in innovation projects. Their collaboration needs to be structured and incitements

must be built into the sales channels, while also making sure that sale becomes a subject in the R&D departments, particularly in the early phases in an innovation project (Sandberg & Aarikka-Stenroos, 2014). However, this requires a less linear approach to innovation projects than the traditional stage-gate-models where innovation proejcts typically starts with R&D, then conceptualized, developed and tested, and handed over to sales personnel in a latter phase of the innovation process (Cooper, 2008; Hadjimanolis, 2003). Stage-gate models are widely used but the characteristics of commercialization barriers may require that the phase of commercialization is integrated more in R&D during innovation projects.

Though, internal structures are central to support commercialization, other structural deficiencies may be less controllable to the firms. Particularly, dearth of knowledge and lack of innovation experience are found to be barriers to innovation (Bakan & Yildiz, 2009; Clausen, 2008). Looking into the external environment to find actors who may complement the firm with competences about new market entry and sales may be a way to manage such barriers and succeed in commercialization (Aarikka-Stenroos et al., 2014).

In external environment category, the findings particularly point to a changing market and lack of customer demand as main commercialization barriers. When firms experience that no customer demand an innovation, it naturally becomes a commercialization barrier. Particularly, when the firm does not have direct contact with the end-user, they may lose the ability to track what the customer demand, and this especially occur when sales occur through an agent, purchasing agent, distributor or the like (Foss et al., 2008). Lacking direct contact with market actors in the external environment seems to be a central characteristic of a commercialization barrier, which leaves the firm with an innovation not in demand. In relation to this, research has shown, that market gatekeepers within a firm represent the firm's link to the customers (Markham et al., 2010), but if no actors are assigned this gatekeeper role, firms may lose insight

into the changing demands of customers. A gatekeeper's role is to secure continuous dialogue about their expectations, as changing customer expectations may leave firms with an innovation that is no longer demanded, even though the very same customers may have previously requested the innovation. Changes in customers' demands (e.g. for specific product requirements) and expectations may follow the changes that take place at a market. Their new expectations may reflect new market trends, new technological developments and the market entry of competitive innovations, which also changes the market conditions for the innovating firm. As such, it is central for a market gatekeeper to keep track of both customer expectations and demands, and the general market conditions. The last mentioned is particularly important in fast changing technological markets, and it may include that the firm engage in relationships with different kinds of external actors other than customers (Chesbrough, 2017). Furthermore, even though changes in customer demands and market conditions may become a commercialization barrier, firms may still benefit from this, if the barrier filter out unrealistic innovation projects or trigger further innovation (Hölzl & Janger, 2012).

Conclusion

The study makes a contribution to literature on commercialization of innovations. First, the study demonstrates the characteristics of commercialization barriers during innovation projects. Current research tends to focus on innovation barriers from a firm-level perspective, neglecting to go into detail with the features of commercialization barriers as they occur in innovation projects. This is important, because particularly commercialization is one of the most challenging parts of innovation projects, where new product and services are developed. Second, the study demonstrates which innovation project-specific barriers are related to internal organizational structure and the external environment. This provides a clearer picture of whether the barriers are related to internal factors within a firm or external factors in a firm's

environment. Whether a commercialization barrier is linked to the one or the other category may influence the potential strategies on how to manage specific barriers.

Based on the study, a suggestion for further research is made. This study covers many different innovation projects within the case firms including the commercialization barriers experienced in these projects. However, in the study each barrier is decoupled from the contexts and types of innovation projects in which they occurred. Therefore, further research should go into depth with few innovation projects and link the characteristics of commercialization barriers with the context. This includes the type of project, firm, industry etc.

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Table 1: Overview of cases

Cases	Description
Müller Gas Equiptment	The firm produces ventils for the industry. It was founded in 1930 and has 400 employees. The firm's innovation projects are especially focused on improving the ventils, so they fit customer demands and quality standards.
Elvstrøm Sails	The firm is a producer of materials for ships, especially sails. It was founded in 1954 and has 100 employees. The firm's innovation projects are especially focused on improving the quality and durability of sails.
Gram Commercials	The firm is a producer of cooling products like frigerators and freezers for professional use. It was founded in 1901 and has 200 employees. The firm's innovation projects are especially focused on a developing more energy efficient products.
KMC	The firm produces starch based and other processed products from farming (e.g. potatoes). It was founded in 1977 and has 200 employees. The firm's innovation projects are especially focused on applying their products in new types of food and acquiring new segments in new industries for their products.
Haarslev Industries	The firm produces machines which is able to break down organic material and transform it into proteins among other things. It was founded in 1973 and has 400 employees. The firm's innovation projects are especially focused on improving their machines, e.g. to break down biowaste.

Exhausto	The firm is a producer of ventilation systems. It was founded in 1957. The firm's innovation projects are especially focused on improving their ventilation solutions, e.g. to create an improved indoor climate.
Royal Greenland	The firm obtain and process fish and seafood. It was founded in 1990 and has 2000 employees. The firm's innovation projects are especially focused on improving the quality of their products, which also aims to heighten the food safety.
Bech & Jørgensen	The firm is a producer of paint. It was founded in 1892 and has 90 employees. The firm's innovation projects are focused on hypoallergenic and environmentally friendly paint.
Nielpeter	The firm is a producer of printing solutions.It was founded in 1919. The firm's innovation projects are especially focused on improving the quality of their printing products to customer as they aim to deliver high-performance printing.
Novo Nordisk Pharmatech	The firm is a supplier of pharmaceutical products. It was founded in 1923 and is owned by the large pharmaceutical firm in Denmark, Novo Nordisk. There are 170 employees. The firm's innovation projects are especially focused on improving and make new pharmaceutical products.
Skamol	The firm is a producer of isolation systems. It was founded in 1912 and has 400 employees. The firm's innovation projects are especially focused on creating isolation material which can withstand high temperature.
CP Kelco	The firm is a producer of chemicals and processed natural ingredients which is used in laundry detergent or dish detergent, in food etc. It was

	founded in 1929 and has 380 employees. The firm's innovation projects are focused on chemistry in ingredients.

Table 2: Commercialization barriers

Commercialization barriers	**Number of occurences**
Sales & Marketing does not prioritize new products to the same degree as R&D	11
Stakeholder resistance	2
Structural deficiencies	14
Insufficient access to the end-user	5
Cultural differencies	4
Insufficient strategic focus on innovation	3
Internal resistance to change	2
Open innovation and external partnerships	1
Lack og skilled personnel	1
Governmental & institutional rules & regulations	9
Lack of information	1
Insufficient communication between R&D & other colleagues	1
Buyers' bargaining power	9
The costumer does not demand the new product	12
The market has changed during the project period	7
Sub-category to The market has changed during the project period: Industry-specific barriers	3
	85