The effect of commercial orientations on the success of technology innovation projects

Technology resulting in external exploitation
- a spin-out perspective

by
Jules Witte

BSc Industrial Engineering and Innovation Science
Student identity number 0571166

in partial fulfilment of the requirements for the degree of

Master of Science
in Innovation Management

Eindhoven University of Technology (TU/e)
First supervisor: dr. A. de Jong
Second supervisor: prof. dr. E. J. Nijssen

Holst Centre
Supervisor: dr. ir. E. R. Meinders
~ Nothing is permanent except change ~

Heraclitus c. 535 BC - 475 BC
**THESIS SPECIFICS**

<table>
<thead>
<tr>
<th>Title</th>
<th>The effect of commercial orientations on the success of technology innovation projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>J. (Jules) Witte</td>
</tr>
</tbody>
</table>

*Eindhoven University of Technology supervisors*

<table>
<thead>
<tr>
<th>Primary supervisor</th>
<th>dr. A. (Ad) de Jong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secundary supervisor</td>
<td>prof. dr. E. (Ed) Nijssen</td>
</tr>
</tbody>
</table>

*Company (Holst) supervisor*

| Company supervisor | dr. ir. E. (Erwin) Meinders |

<table>
<thead>
<tr>
<th>Version specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version number</td>
</tr>
<tr>
<td>Date of submission</td>
</tr>
</tbody>
</table>

*Subject headings*

Marketing, sales, orientation, capabilities, innovation performance, open innovation, spin-out, success factor, mixed method
MANAGEMENT SUMMARY
This master thesis reports research conducted on the performance of technology open innovation projects from a commercial perspective, originating from a query of the Holst Centre, “How to externally commercialize technology developed with several stakeholders within a research program”. Because the eventual goal of an innovation project is to capture value by (external) exploitation of the technology and the initial potential of exploitation is depicted by the technology characteristics and the value created, drivers of value creation were included to predict the innovation performance through external exploitation. Empiric research shows that the integration of commercial capabilities with strong market and customer orientations is key in building valuable customer solutions and applying suited exploitation strategies, eventually driving innovation performance. Therefore, the role of marketing and sales as commercial drivers of innovation performance in external exploitation is researched, for which the following general research question has been deduced:

“How can commercial orientation increase the success of technology innovation projects in external exploitation?”

Commercial orientation is the organizational culture that stimulates conjoint marketing and sales behaviors to generate and disseminate customer and market information. Sales and marketing compose the commercial aspect of the firm and are distinct in their departmental orientation regarding goals and thought worlds as sales is more customer and short-term oriented, while marketing has a product and long-term orientation, leading to different information generation. Their distinct influence on eventual performance is assessed on capability and orientation level, as is illustrated in figure 1. A mixed method approach utilizing both regression analysis and interviews was used to test the conceptual model and the hypothesis. Furthermore, an explorative assessment was carried out by in-depth interviews regarding contemporary implementation of external exploitation. The main goal of this
additional research was to construct a framework for the Holst Centre for decision making regarding the external exploitation.

Before the regression analysis was carried out a factor analysis was conducted to empirically identify the conceptualized constructs, resulting in one commercial capabilities construct because based on the data no distinction between sales and marketing capabilities could be made. This could be due to starting firms not yet having specialized functions, resulting in all commercial activities carried out by one or a few employees. However, to be able to test all hypotheses the models were tested with a distinction between marketing and sales capabilities and capabilities under one commercial capability construct.

The results of the regression analysis show the relative importance of the capabilities compared to orientations in realizing a satisfying innovation performance. While the positive effect of capabilities on innovation performance is significant in every model tested, both market and sales orientations do not show any significant effects, and moreover, the interaction effects between capabilities and orientations are not found significant in any tested model. This result is believed to be a product of the technology push nature of the spin-outs involved, because relevant commercial activities are harder to execute in these type of projects and the few innovation projects that adequately and timely incorporated commercial personnel were better able to execute relevant marketing and sales activities. Moreover, because capabilities are more concrete compared to orientation this directly helps them to deal with market and customer information gaps. However, taking into account the correlations between the orientations and the capabilities and between the capabilities and business performance, a different mechanism than interactions might be in place. The lack of predictive power of the orientations might be due to: 1) the subjective performance measure utilized here, and 2) the direct assessment of the orientation effect on business performance, which might need a clausal mechanism.

Overall analysis of literature, interviews and additional survey data regarding the external exploitation issue, lead to the conclusion that explicit organization of external exploitation is a pivotal aspect in leading up to be successful at external exploitation as an organization and implementation of this requires going to a learning curve and takes time and effort. Furthermore, organization type plays a role for firms are more likely to externalize more mature technologies compared to universities and R&D. Regarding spin-outs, early spin-out from the principal
company hampers them in achieving (intermediate) success, however, if the nature is a strong technology push success is likely to be achieved. Furthermore, cash-flow generation by offering service and product seems to be a fruitful strategy. Finally, early customer involvement and going to market sooner were indicated as important aspects.

For organizations that commence in external exploitation lacking the internal exploitation option, the evaluation of spin-out or out-license is relevant, while the opportunity of a patent sale is a result of doing none of previous options. The evaluation of spin-out and out-license is initially based on the characteristics of the technology and only if it is suited for spin-out team criteria are relevant for evaluation. This sequence is an evaluation of the options, not a go/no-go decision for the actual spinning out. For this decision more criteria are important, which specifics can be found in appendix D
When I started my master I still had no idea to what I am truly interested in on both academic and professional field. To that extent I had not changed since I began my life as a student. Though several subjects slightly touched my interest, not one could truly captivate me. Even the course of technology entrepreneurship could initially not fully trigger me and it took a semester in Winnipeg, Canada for entrepreneurship to get my true interest. The course of New Venture Analysis is fully to blame for this. The practical approach of the lectures and the development of a business plan judged on actual criteria from practice and business plan competitions with the goal to eventually get a delegation in to the Venture Lab Investment Competition really appealed to my imagination. The subsequent teaming up with graduate students to participate in the Georgia Bowl and the Cardinal Challenge in Louisville strengthened this interest. As such, I was triggered to inquire into opportunities to make it the subject for my master thesis. Although entrepreneurship is a broad field and my prime interest was on technological valorization opportunities by start-ups and spin-outs, together with Ad de Jong and Erwin Meinders we were able to define a specific research topic that all could benefit from. Nevertheless, the eventual result here before you took several iterations of selection and focusing on the subject’s specifics, resulting in the final subject of technology spin-outs from a commercial perspective.

I am indebted to several people who have helped me get through the challenging time in finishing my master thesis. Therefore, I would hereby like to thank Ad de Jong for the opportunity to pursue the subject of my own choice and keeping me focused on the university demands of a master thesis. Furthermore, I have to thank Erwin Meinders for giving me the opportunity to conduct the research partly on behalf of the Holst Centre and for always being positive and constructive. I would also like to thank Ed Nijssen for his direct, practical and useful feedback. Of course, a word of thanks goes out to all the people who participated in the interviews and surveys, thank you for the time and effort. Finally, I thank my parents and my girlfriend for their moral support and especially their patience during my thesis and university education.
# Table of Contents

Thesis specifics ................................................................................................................................ i
Management Summary ................................................................................................................... ii
Preface ............................................................................................................................................. v
Table of Contents ........................................................................................................................... vi
List of Tables ................................................................................................................................ vii
List of Figures ................................................................................................................................ vii
1. Introduction .................................................................................................................................. 1
   1.1 Innovation .............................................................................................................................. 1
   1.2 The Holst Centre ................................................................................................................... 4
   1.3 Research questions ................................................................................................................ 5
   1.3 Outline ................................................................................................................................... 6
2. Commercial orientation in open innovation projects .............................................................. 7
   2.1 Marketing and sales in innovation projects ........................................................................... 7
   2.2 Open innovation at the project level ................................................................................... 15
   2.3 Performance ........................................................................................................................ 21
3. Conceptual model and Hypotheses ........................................................................................ 22
   3.1 Hypothesis ........................................................................................................................... 22
   3.2 Conceptual model ................................................................................................................ 24
4. Research methodology .......................................................................................................... 25
   4.1 Research setting and approach ............................................................................................ 25
   4.2 Mixed-method research: Commercial orientation and capabilities on innovation performance ............................................................................................................................... 26
   4.3 In-depth interviews: External exploitation innovation projects .......................................... 28
   4.4. Quality of research ............................................................................................................. 29
5. Analysis of Results ................................................................................................................ 31
   5.1 Analysis of mixed-method results ........................................................................................ 31
      5.1.1 Survey analysis ............................................................................................................. 31
      5.1.2 Interviews spin-outs ...................................................................................................... 40
   5.2 Analysis of in-depth interviews results ............................................................................... 42
6. Conclusion and discussion ..................................................................................................... 45
   6.1 Overview of the main findings ............................................................................................ 46

VI
6.4 Research contributions and implications ............................................................... 53
6.5 Limitations .............................................................................................................. 54
6.6 Directions of future research .................................................................................. 55
Bibliography .................................................................................................................. 56
Appendices .................................................................................................................... 62
   Appendix A: Measurement items .................................................................................. 62
   Appendix B: Format semi-structured interview .............................................................. 64
   Appendix C: In-depth interview and additional survey questions .................................. 65
   Appendix D: spin-out criteria ....................................................................................... 66

LIST OF TABLES
Table 1 Research divide .................................................................................................. 25
Table 2 factor analysis orientations ................................................................................. 34
Table 3 factor analysis capabilities .................................................................................. 35
Table 4 Final constructs and reliabilities ......................................................................... 35
Table 5 Descriptives and correlations .............................................................................. 36
Table 6 Regression analyses ............................................................................................. 38
Table 7 Technology characteristics more suited for spin-out versus those more suited for out-licensing (Gisling et al., 2010) and interviews ......................................................... 50
Table 8 Team criteria ........................................................................................................ 51

LIST OF FIGURES
Figure 1 Basic conceptual model .................................................................................... ii
Figure 2. Holst business model ......................................................................................... 4
Figure 3. Generic project organization .............................................................................. 4
Figure 4 Open innovation NPD funnel, Kirschbaum 2005 ................................................... 16
Figure 5. Commercialization definition by PDMA, Lehtimäki (2008) ................................. 18
Figure 6. Ordinal Governance Mode choice categorization (Lichtenthaler, 2005) ............... 20
Figure 7 Conceptual model ............................................................................................... 24
Figure 9 Technology phase spin-out ............................................................................... 32
Figure 10 Market........................................................................................................................... 32
Figure 11 Product or service .......................................................................................................... 32
Figure 12 Organization type .......................................................................................................... 33
Figure 13 Use of incubator ........................................................................................................... 33
1. INTRODUCTION
This master thesis reports research conducted on the performance of technology open innovation projects from a commercial perspective. The research was carried out in cooperation with the Holst Centre to address the issue of how to externally commercialize technology from innovation projects.

1.1 INNOVATION
Technological innovation is one of the main drivers of modern economies and influencing examples include e.g. LED lighting, hybrid cars and 3D-tv. Firms nowadays generate over one-third of their sales and profits by products introduced in the last five years (Schilling, 2008). However, firms propelling technological innovation are confronted by rapid technical changes and increasing customer demands, requiring businesses to keep their level of technological innovation in pace to protect their margins, market share and to lower their costs to not fall behind and die (Chesbrough, 2003a; Dodgson et al., 2008; Teece, 1986). Moreover, product life cycles still decrease and the cost of innovation projects are rising (Chesbrough, 2003a, Schilling, 2008). As a result, profiting from newly commercialized products is hard, with a failure rate 40%-50% (Chiesa and Frattini, 2011). The resulting situation as such, is a paradoxical one, on the one hand firms need to innovate to stay competitive but on the other hand it is harder to innovate and yield satisfactory returns on investment, making innovation management a complex and multi-disciplined field with high risk and uncertainty (Chiesa and Frattini, 2011).

To be commercially successful in innovation, firms need not only to excel at product innovation, but also at business model design, understanding the design options as well as customer needs and technological trajectories (Teece, 2006). Product innovation is the creation of value for certain customers through new product development (NPD) as part of a firm’s exploration process (March, 1991; Teece, 2006) and the appliance of a certain business model refers to the capture of value of developed innovations as a part of the exploitation process of a firm (March, 1991; Teece, 2006). However, both processes cannot be cleanly separated (Teece, 2006) and for a firm to be successful both processes need to be executed profoundly (e.g. Benner and Tushman, 2003). Furthermore, empiric research shows that the integration of commercial

---

1 The focus in this thesis is on technological innovation making the addition of technological redundant.
capabilities with strong market and customer orientations is key in building valuable customer solutions (e.g. Day, 1994; Ernst et al., 2009) and suited exploitation strategies (e.g. Langerak et al., 2004, Lichtenthaler et al., 2009). Essential in exploration and exploitation are market and customer related activities (e.g. Griffin et al., 1996; Langerak et al., 2004; Ernst et al., 2010), which should be driven by the marketing and sales cooperation (Guenzi an Troilo, 2007). Though, recently the distinct contribution of sales over marketing to product innovation has empirically been shown (Ernst et al., 2009; Pitkänen et al., WP2011), historically research has a strong marketing orientation and sales has received minimal attention (Biemans et al., 2009; Ernst et al., 2009; Guenzi and Troilo, 2007). Sales and marketing are distinct in their departmental orientation regarding goals and thought worlds, while sales is more short-term and customer oriented, marketing has a long-term and product orientation (Homburg and Jenssen, 2007). Therefore, the role of sales should not be disregarded because integrating sales leads to a higher level of customer need knowledge and ideation (Ernst et al., 2009; Homburg et al., 2009).

Academic literature mainly focuses on market orientation deployment implicitly by both sales and marketing or solely by marketing, ignoring a necessary explicit separation between the responsibilities of marketing and sales (Guenzi et al., 2009; Ernst et al., 2009). Therefore, research on the distinctive role of sales in product development is needed. This thesis aims at assessing the effect of the conjoint marketing-sales responsibilities to the market and customers as the commercial aspect in innovation projects, because market orientation is more than just market activities done by marketing, rather they are commercial activities focused at the market and the customer and are the joint responsibility of marketing and sales (Biemans et al., 2009; Dewsnap et al and Jobber, 2009). Therefore, commercial orientation here is defined as an extension of market orientation and is the organizational culture that stimulates conjoint marketing and sales behaviors to generate and disseminate customer and market information in the innovation process. Moreover, instead of researching if the sole possession of an orientation leads to innovation performance (e.g. Narver and Slater, 1990), coherent capabilities are included as to explain how this market-based asset of market orientation is deployed to achieve competitive advantage (Morgan et al., 2009).
**OPEN INNOVATION PROJECTS**

Next to orchestrating the innovation process in such a way that a maximum of value is created by technical advancement as well as customer need fit, firms are replacing their closed innovation paradigm (Chesbrough, 2003) to address the competitive environment. By organizing corporate structure beyond their traditional boundaries, organizations utilize and profit from technology by external exploration and exploitation of necessary resources and activities (Teece, 1998), a paradigm known as *open innovation* (Chesbrough, 2003). This thesis evaluates innovation projects which result are subject of external exploitation, a aspect that has been underutilized and under-researched (Lichtenthaler, 2009). External exploitation refers to actively pursuing commercialization of technological knowledge exclusively or in addition to its internal application (Lichtenthaler and Ernst, 2006). While external exploitation can lead to a decrease in time-to-market, R&D costs and provide additional revenue streams for organizations, it poses difficulties additional to the inherent degree of complexity of innovation projects (e.g. Arora et al., 2001), including the identification of potential technology customers (Lichtenthaler, 2009). Moreover, the decision to externally exploit technology has always been seen as a last resort rather than valued option (e.g. Lichtenthaler et al., 2008; Tidd et al., 1997). Therefore, external exploitation options should be formalized and integrated in the development process of technologies and product marketing, thereby avoiding poor ad-hoc decision making (Lichtenthaler et al., 2009). External knowledge exploitation can be practiced through a variety of types and contract set-ups, however each type can be classified as a form of 1) spin-out, 2) patent sale, 3) alliance/joint-venture, or 4) out-license (Anokhin et al., 2011; Lichtenthaler, 2005). This research mainly focuses on spin-outs projects. Spin-outs are directly limited by the capabilities and backgrounds of the founding team as well as the principal organization’s culture, which extent over time, remaining present to a certain extent after the spinning-out. Moreover, the choice to focus on spin-outs was prompted by 1) being the most viable option for quantitative and qualitative research because of a substantial population in the Eindhoven area, and 2) being a scientific extension of current and contemporary research (e.g. van Burg et al., 2008; Clarysse et al., 2011; Lockett et al., 2005). As such, this research will also touch on the subjects of entrepreneurship and new technology ventures.
1.2 THE HOLST CENTRE
Initially, the idea for this research originated from a question of the Holst Centre: “How to externally commercialize technology developed with several stakeholders within a research program?” This question addresses the issues of external commercialization and a multi-owned knowledge base. After initial exploration this graduation project was delineated to focus on the external commercialization issue, with a focus on the spin-out option.

**ORGANIZATION AND BUSINESS MODEL**
The Holst Centre is an independent open-innovation R&D centre aimed at developing generic technologies and was set up in 2005 by IMEC and TNO, with support from the Dutch and Flanders governments. Due to, among others, the increased complexity and globalization in contemporary business the cost of R&D is growing faster than company revenues. The goal of open innovation is to share ideas, efforts, costs and risks of R&D, to reduce time to market and achieve higher quality of new product generations as well as higher profit margins. The open innovation concept is implemented by the Holst Centre through involving and partnering with organizations that can contribute and add value at different phases of the value chain. At Holst Centre, partners complement their own exclusive R&D with shared R&D, leveraging each other’s talents and know-how in structured and corporate R&D like setting. Typically, Holst Centre results are shared on a non-exclusive basis between the program partners.

![Business model](image1)

**Figure 2. Holst business model**
In order to develop the generic technologies Holst brings partner organizations together along the value chain of the programs in operation as well as academics in the different fields related to the generic technologies. As such, a project organization of Holst can be viewed from a value chain perspective in which in every part of the value chain partner organizations contribute to and
profit from the joint contribution along the entire value chain to develop a generic technology. Through collaboration with both industry and academia, Holst Centre provides market insight and focus to universities and keeps its partner companies informed of the breakthroughs that are expected along its roadmaps. Typically, results obtained within Holst Centre aim for products that appear on the market within three to ten years. Holst Centre is located on High Tech Campus in Eindhoven, has over 150 employees and a commitment from close to 30 industrial partners.

**Issue**

At the Holst in-house competences and market demands once and while lead to an internally developed technology without a partner interested to market or implement it. However, as a R&D centre the Holst Centre is tailored to (co-) develop technology for partners who are interested and capable of commercializing the technology. Therefore, the Holst Centre lacks the knowledge and capabilities to commence (external) commercialization of developed technologies by themselves. Providing a grounded selection of decision criteria for the different external exploitation options can substantially enhance the propensity for making the right decisions while also providing a base for further organizational learning. Therefore in colloquy with the Holst Centre, based on the research described in this thesis a decision criteria tool is developed for Holst Centre to improve decision making and to provide complementary insights and backgrounds in their open innovation context. This part will build on the whole research and actually extends the managerial implications to more specific recommendations.

**1.3 Research questions**

By assessing the conjoint marketing-sales effort in NPD and external exploitation a gap in literature is addressed regarding the lack of sales integration in innovation projects. By assessing the conjoint marketing-sales effort both on the orientation level as well as on the capabilities level, recent research of Morgan et al. (2009) is extended by the inclusion of sales as a complementary resource and capability to marketing. Moreover, assessing external exploitation on project level adds to the existing knowledge base. To support the research the following research questions and supporting sub-questions have been defined:
1. How can commercial orientation increase the success of technology innovation projects in external exploitation?

1 a) What is commercial orientation and are its aspects?
   b) How does commercial orientation impact innovation performance?

2 a) What are commercial capabilities?
   b) How do commercial capabilities impact innovation performance?

3 What is the role of external exploitation in innovation projects?

4 What are relevant criteria and considerations for Holst Centre to organize external exploitation?

1.3 Outline

To research this multifaceted issue a mixed methods research is conducted to fully address the explorative nature of the issue at hand. First, scholarly literature on the marketing-sales interface and their conjoint responsibilities as well as literature on market orientation is used to assess the theoretical frameworks and to construct a conceptual model for the integration of sales and marketing in NPD, after which the project context of open innovation and external exploitation is further explored. Subsequently, a quantitative part will empirically test the proposed model, after which a quantitative part will assess the underlying aspects of the model for triangulation. As introduced, the quantitative part will specifically focus on spin-outs as a form of external exploitation in open innovation.

The remainder of this report is structured as follows: First, contemporary literature will be synthesized regarding the open innovation aspect after which commercial orientation and capabilities will be assessed in chapter 2. Next, in chapter 3 a conceptual model and interesting research questions will be identified based on the previous theoretical assessment. Third, chapter 4 elaborates on the research design and methodological aspects of the empirical study. Hereafter, chapter 5 presents the analysis of the data collected, both quantitative and qualitative and finally in chapter 6 the main findings are presented along with the conclusion and a discussion.
2. COMMERCIAL ORIENTATION IN OPEN INNOVATION PROJECTS

Initial delineation from the Holst Centre question resulted in focusing on the external exploitation issue, while including commercial drivers for value creation in the NPD process as to how innovation performance is achieved. This results in the inclusion of exploration and exploitation, which refer to the two basic parts of a business model: the creation and capture of value, which are mutually intertwined in eventually the same process leading up to innovation performance (Teece, 2006). In the first customer value is created through the research and development phase, while the latter delineates the delivery of value in some sort by the process of commercialization or implementation (March, 1991, Dodgson et al., 2008; Tidd et al., 2009).

In this chapter the theoretical context underpinning the research will be described, which will form the basis for the subsequent conceptual model. It therefore sets out to explore the commercial drivers of innovation performance along with the open innovation context and their relations from academic literature. First, commercial drivers of value creation and innovation performance will be identified and assessed. The commercial perspective is utilized by the overall responsibilities for market and customer activities by marketing-sales forming the firm’s commercial aspect (Guenzi et al., 2007; Dewsnap et al., 2009). Second, the open innovation context of external exploitation will be further assessed top down from the holistic open innovation framework.

2.1 MARKETING AND SALES IN INNOVATION PROJECTS

Innovation projects or New Product Development (NPD) have been of interest of academic scholars for over decades (e.g. Utterback et al., 1975; Teece, 1986; Cooper, 1990). For it is known that up to 40%-75% of innovation projects are subject to failure or insufficient yields (Christensen, 1997; Chesbrough, 2003; Ernst et al., 2010) directly influencing organizational performance (Langerak et al., 2004; Ledwith et al., 2009). Traditionally, NPD is strongly colored by the R&D department, exhibiting a strong technical and research orientation but lacking the proper proactive orientation and capabilities needed to identify potential customers along with their needs and wants, necessary for customer value creation (e.g. Narver and Slater 1990). Facilitating this process and as an antecedent of innovation performance the role of marketing has received extensive attention (e.g. Moorman et al., 1999; De Luca et al., 2010). The marketing
concept prescribes that to achieve sustainable success, firms should identify customer needs more effectively than their competitors (Kirca et al., 2005). However, the role of sales in these aspects has wrongfully been ignored (e.g. Guenzi and Troilo, 2007; Ernst et al, 2010; Pitkänen et al., 2011). On an operational level sales has responsibilities regarding including customer information in the innovation project, which can be through a variety of processes like the Voice of Customer (Von Hippel, 1986), customer selection and development (Bonner and Walker, 2004) and moreover sales has a pivotal role in new product adoption (Hultink and Athuahene-Gima, 2000). As such, sales generates specific market and customer information as a result of a different goal and thought world than marketing (Homburg et al., 2007) and because sales has direct customer contact through the commercial interface with the market and customer different (Homburg et al., 2009). Therefore, the role of sales next to marketing’s role is assessed because of its responsibilities in the relevant activities for generating market and customer information. Moreover, this integrating of marketing and sales, will take the form of joint commercial responsibilities and activities (Dewsnap and Jobber, 2009). Next, the role of marketing and sales in innovation projects is assessed. This is done by assessing the role of marketing first, after which the role of sales is evaluated. The rationale for this sequence is because of the established role of marketing in innovation management literature and because the role of sales possess an extension to the conceptual role of marketing in innovation projects.

THE MARKETING AND SALES CONCEPT IN NPD

As a result of contemporary business fostering customer value creation in innovation projects and the inherent multidimensional nature depicting this customer value creation, the marketing concept has received mounting attention since the development of the cross-functional integration (e.g. Gupta et al., 1986) and market orientation (Kohli et al., 1990; Narver et al., 1990). Though both concepts appear to have little in common by name, they both relate to the integration of marketing, but one at a behavioral level and the other on a cultural level (Homburg et al., 2000). However, both being distinct areas of innovation management literature, they minimally refer and recognize one another (e.g. Ledwith an O’Dwyer, 2000; Ernst et al., 2010) and they therefore do not provide an encompassing picture. The need for integrating marketing

---

2 Much research is aimed at understanding the different interfaces in cross-functional integration, analogously also known under terms like cooperation, interdepartmental integration, interaction, communication and coordination (e.g. Song et al., 1997).
in a certain form can be seen as result of the Chandlerian firm, firms with high functional specialization in which departments hold specific sets of capabilities and information, resulting in low organizational understanding of the technology-market interface (e.g. Troy et al., 2008). This has led to the need of frameworks for effective cooperation and communication between departments, because of their increased interdependence in the variety of multi-dimensional business processes, like NPD. Moreover, like indicated the specific sales aspect in this “role of marketing”, with the goal of integrating specific customer and markets information in innovation projects, has been ignored although in the cross-functional aspect a first attempt is made (Ernst et al., 2010).

**CROSS-FUNCTIONAL INTEGRATION**

Cross-functional integration on the marketing-R&D interface can be viewed as an effective “unity of effort” by different departments in NPD to bring together a firm’s capabilities (Kahn, 2001). Moreover, successful cross-functional integration typically involves active communication between the different functions, formal or informal (Troy et al., 2008). In short, it represents interdepartmental activities and initiatives undertaken between departments to enhance customer value creation (Troy et al., 2008). As such, the extent of the “unity of effort” can be seen as “the magnitude of interaction and communication, the level of information sharing, the degree of coordination, and the extent of joint involvement across functions in specific new product development tasks” (Troy et al., 2008). Moreover, this extent of “unity of effort” can differ throughout the innovation funnel, as the ideas pass through the innovation funnel and the different phases, the effect of integration on performance varies across the stages (Ernst et al., 2010). Cross-functional integration on the marketing-R&D interface brings together capabilities for developing products that meet customer needs, has technical feasibility and can be delivered by the company (Kahn, 2001), a practice which positively affects firm performance and innovation performance (Gupta et al., 1986; Griffin and Hauser, 1996; Song and Xie, 2000). Moreover, cross-functional integration closely relates to the behavioral market orientation definition of Kohli and Jaworski (1990) depicting a set of activities for the generation and dissemination of market and customer information (e.g. Kirca et al., 2005). As such, cross-functional integration on the sales-R&D interface depends on the same principle of the “unity of effort” and the interdepartmental activities and initiatives to enhance customer value creation,
but it is based on the distinct information generated by the sales function because of the previously identified difference to marketing (Ernst et al., 2010).

**MARKET AND SALES ORIENTATION**

The integration of company functions, like marketing, in the innovation process can be achieved on several organizational levels (Homburg et al., 2000). In the case of cross-functional integration the integration results in the bringing together of company capabilities based on formally integrating business functions in the innovation process (Kahn, 2001; Olsen et al., 2001). On the other hand, the integration is conceptualized through an orientation (company culture) underlying the manifestation of market related and inter-departmental activities and initiatives that most efficiently stimulates resources sharing and willingness to work together (e.g. Narver et al., 1990; Kirca et al., 2005). The market orientation approach advocates the presence of a company culture, orientation, for stimulating required relevant behaviors (Narver and Slater, 1990). Previous extensive research has shown that market orientation has a positive relationship with product development performance (e.g. Atuahene-Gima, 1995; Grinstein, 2007) as well as general business performance (e.g. Narver and Slater, 1990; De Luca et al., 2010). This cultural market orientation perspective focuses on organizational values and norms that stimulate market and customer oriented behaviors (Deshpandé et al., 1993; Narver et al., 1990) and is defined as “the organizational culture that most effectively and efficiently creates the necessary behavior for the creation of superior value for buyers and, thus, continuous superior performance for the business”. Hereby a cultural approach is advocated opposed to the behavioral perspective because “If a market orientation were simply a set of activities completely disassociated from the underlying belief system of a organization, then whatever an organization’s culture, a market orientation could easily be copied by the organization at any time” (Narver et al., 1998). This perspective coincides with the resource-based view that for a firm to get a sustainable advantage from market orientation it should be firm characteristic and as such among others in-imitable (Wernerfelt, 1984; Morgan et al., 2009). More specifically, market orientation is characterized by specific norms and values that encourage behaviors existing of customer orientation, competitor orientation and inter-functional coordination components (Narver et al., 1990). These are the necessary behavioral components by which a

---

3 For a literature overview of market-orientation and innovation performance see De Luca et al., 2010
market orientation manifests, including the necessary activities to acquire broad target market information and a dissemination mechanism (Narver et al., 1990; Grinstein, 2008). Historically, the implementation of a market orientation was mainly seen as the responsibility of the marketing department, which however is incorrect (Narver and Slater, 1990; Narver and Slater, 1999). Deducing from the definition, market orientation is the culture for creating customer value, which is a multi-disciplined field that does not restrict itself to integrating marketing in the innovation process. Rather, market orientation stimulates all relevant functions to cooperate for the creation of customer value and is not marketing orientation. Therefore, also in this cultural vein the role of sales with its more specific customer knowledge, necessary for the customer value creation, should be integrated explicitly.

**SALES ORIENTATION**

Clearly, research on the marketing concept in innovation is well positioned to study how organizations could enhance innovative efforts and to increase customer satisfaction because marketing research is intrinsically customer and competitor oriented (Griffin et al., 1996; Hauser et al., 2006). Although, one of the main functions of marketing is bringing in customer knowledge on expressed, latent and future needs (Narver et al., 2004; Blocker et al., 2010) the role of sales with its direct customer contact function has largely been ignored in NPD literature (e.g. Guenzi et al, 2007; Ernst et al, 2010; Pitkänen et al., 2011). Direct contact to customers gives sales employees access to concrete customer experiences enabling them to generate specific customer need knowledge (Homburg et al., 2009). Therefore, recently the role of sales has been proposed as essential in the innovation process (e.g. Guenzi et al., 2006; Pitkänen et al., WP) and, moreover, the added value of sales in different stages of the innovation performance has empirically been demonstrated (Ernst et al., 2010). Compared to marketing, sales has a different thought-world resulting in a different orientation to and relationship with markets and customers, allowing it to generate different but complementary information valuable to the development phase (Homburg et al., 2007). While marketing is rather abstract and analytically based, sales is characterized by specific and anecdotic information. In general, marketing and sales are the functions generally responsible for the customers and markets and therefore form the commercial aspect of an organization (Desnap and Jobber, 2009).
While initial research empirically proves the possible valuable role of sales next to marketing in the innovation process in large established firms (Ernst et al., 2010), it is assessed in a cross-functional vein focused on specific activities on the operational level, in the innovation process and thus on an lower organizational level than an orientation level. Assessing marketing and sales in the advocated orientation vein leads to the identification of a sales orientation next to market orientation. Despite the frequent linking of market orientation with performance the coupling with sales or sales orientation and accompanying empirical research is minimal (Pitkänen et al., 2011). The cultural perspective of market orientation leading to behavior and stimulating activities is in line with Pitkänen et al. (2011) who conceptualize a sales orientation as the required orientation for developing and organizing sales activities in situations where expertise is lacking. In an entrepreneurial situation, the founding team rarely has formal sales processes or practices in place from the beginning; rather they evolve from scratch from the interplay between doing and organizing. While this interplay of doing and organizing takes up a lot of time and effort for inexperienced employees, an orientation or stimulating culture must be in place to encourage this behavior. Therefore, parallel to the cultural definition of Narver et al. (1990) and based on Pitkänen et al. (2011) the relevant sales orientation is defined as that it “…most effectively and efficiently creates the necessary behavior for the creation of superior value for buyers…” from its respective sales function incorporating direct unique customer information and therefore creating “…continuous superior performance for the business”. A sales orientation by which companies can gain a competitive advantage is composed by sales innovativeness and proactive sales orientation (Pitkänen et al., 2011). Sales innovativeness reflects the extent to which an organization demonstrates flexibility and willingness to accept new ways of problem solving with regard to sales (Strutton et al., 1993). Furthermore, proactivity reflects the willingness of organizations to use new approaches and selling methods in order to achieve sales (Van der Borgh et al., 2011). Moreover, this sales pro-activity should lead to “specific” customer orientation leading to superior customer need knowledge (Homburg et al., 2009). In short, the innovative and proactive behaviors will enable the organization to bring more and better customers early on with the ability to lever on them in terms of building a thorough customer need knowledge (Homburg et al., 2009), achieving and creating significant first sales, reference customer(s) (Wouters and Nijssen, 2009; Gomez-Arias and Montermoso, 2007) and sales learning curve (Leslie and Holloway, 2006) all increasing innovation performance.
MARKETING AND SALES CAPABILITIES
Previous research has shown that though market orientation can directly affect organizational performance (Kirca et al., 2005) it needs to be deployed through a mechanism, because while cultural elements are vital they do not shape performance directly. Customers do not purchase products because a firm has a specific culture, rather market orientation stimulates employees to act on the generated market and customer knowledge in order to better serve customers (Hult et al., 2005). Therefore, a variety of mechanisms are proposed through which increased market orientation can improve organizational performance. Innovation performance, among others, has frequently been proposed as mediator between market orientation and firm performance (Atuahene-Gima, 1995; Langerak et al., 2004; Kirca et al., 2005; Ledwith et al., 2009). Other mechanisms, among others, include R&D effectiveness (De Luca et al., 2010) and innovativeness (Hurley et al., 1998; Kirca et al., 2005). Clearly, a market orientation, but also a sales orientation (Pitkänen et al., 2011), needs to manifest itself through professionals executing a wide variety of activities, not necessarily restricted to straightforward customer or market activities. Despite propositions on several mechanisms, no univocal perspective exists in how exactly market orientation is deployed. Instead of assessing through which innovation project activities or aspect market and sales orientation influences eventual firm or innovation performance, recent research proposes that an (market) orientation needs to be deployed by relevant capabilities (Morgan et al., 2009). This capabilities view has not received the same amount of attention in scholarly research, though recently found to be complementary assets for superior firm performance (Morgan et al., 2009). The Resource-Based View (RBV) and the dynamic capabilities suggests that the mere possession of orientation is a necessary resource but not sufficient to achieve superior performance. Rather, organizations that have the capabilities to put its resources to best use, and that invests in capabilities that complement the existing capability base, will be best able to exploit its distinctive competencies (Song et al., 2007).

Capabilities are complex bundles of skills and collective learning enabling routines to ensure superior coordination of functional activities and use of assets (Day, 1994). As such, capabilities are the result of experience and education in their relative field (King and Tucci, 2002). In literature, capabilities are viewed as important mechanisms by which superior knowledge may be deployed by firms to generate economic rents (Madhavan and Grover, 1998). Therefore, the sales and marketing capabilities makes them particularly complementary with firms’ market and
customer based knowledge assets such as sales and market orientation (Day, 1994). Moreover, it is deemed that, especially in turbulent organizational climates, like in commercializing high-tech innovation (Chiesa and Frattini, 2011), capabilities evolve and provide the firm with a sustainable source of competitive advantage (Day, 1994; Wernerfelt, 1984). This is in line with the proposition of “market orientation and the learning organization” (Narver et al., 1995), that learning or evolving of knowledge and insights, and thus capabilities, is necessary in dynamic and turbulent environments in order to facilitate behavioral change leading to performance improvement and eventually competitive advantage (Narver et al., 1995; Sharma and Vredenburg, 1998). However, for capabilities to evolve, market and sales orientation, in its information generating and disseminating role, requires pro-active attitudes for stimulating boundary spanning activities enabling higher-order learning (Narver and Slater, 1995; Sharma and Vredenburg, 1998). Pro-activeness stimulates the learning from exploration and experimentation necessary for knowledge acquisition and generating new behaviors (Narver et al., 1995). While pro-activeness is included in the embraced sales orientation (Pitkänen et al., 2011), the original market orientation construct needs to be adjusted with pro-active customer orientation (Narver et al., 2004; Blocker et al., 2010). In short, organizations that have a strong market and sales orientation, have a pro-active customer attitude and deploy their capabilities accordingly are expected to achieve to create superior customer value and higher innovation performance (Guenzi et al., 2006). Moreover, in line with Morgan et al. (2009) it is expected that market orientation and its relating marketing capabilities complement each other and interact.

In the context of this research, in which innovation project teams are confronted by the possibility of taking their knowledge outside the principal firm by matter of a spin-out explicit integration of the marketing concepts by cross-functional integration often is not possible due to a lack of a marketing function or personnel. Therefore, as well as in small firms lacking explicit functions the integration of marketing and sales will be part of their business philosophy (Ledwith et al., 2009). Moreover, the actual integration of capabilities or market oriented behaviors often is a result of the adoption of a market and sales orientation (Homburg et al., 2000). This is especially applicable to spin-outs, because in a young and aspiring firm lacking a large resource base founders rarely know exactly what to do right away, especially from a technology background, and depend on orientation and pro-active behaviors to use and develop their means to achieve competitive advantage and performance (e.g. Read et al., 2009).
Moreover, it was found that, like their large counterparts, small profit-oriented firms are more likely to adopt an orientation which positively affects their performance (Ledwith et al., 2009). Therefore, assessing the deployment of a market and sales orientation through capabilities is better suited to assess performance in current context than by the behavioral and cross-functional perspective.

**CONCLUSION**
In serving the purpose of bringing in customer and market information into the innovation process, as well as developing a value proposition and future customer and market activities, the influence of the marketing-sales responsibilities as the commercial aspect of the firm is assessed as important performance driver. Moreover, the commercial performance driver is composed of an orientation and capabilities part. Commercial capabilities and commercial orientation become increasingly important in later stage development, because technology exploitation requires entrepreneurial (Narver and Slater, 1995) and market focused attitudes (e.g. Langerak et al., 2004). The commercial orientation is the organizational culture that most efficiently stimulates the required commercial behaviors to create and capture value by the accompanying activities (Narver and Slater, 1990) and hence, in this case the commercial culture. Required commercial capabilities, on the other hand, are complex bundles of skills and collective learning enabling routines to ensure superior coordination of functional commercial activities (Day, 1994); capabilities thus are more concrete than an orientation. Therefore, in their own profound manner both orientation and capabilities lead to required or to a propensity of required commercial activities for successful value creation and value capture.

**2.2 OPEN INNOVATION AT THE PROJECT LEVEL**
Open innovation is a paradigm for organizing innovation beyond traditional borders of organizations to overcome some of the inertia imbedded in what Chesbrough (2003) depicts as Closed Innovation (Chesbrough, 2003a). Closed innovation is a practice applied by large vertical integrated firms known as Chandlerian firms, meaning that firms should employ the best people, internal R&D is the main source of competitive advantage, they should control the entire or a large part of the value chain, actively protect their IPR and that they should come up with ideas better and faster than competitors (Dodgson et al., 2008). Basically, the paradigm is based on the control and possession of assets and resources to achieve a competitive advantage. Recent trends
of globalization and increased flexibility of professionals, advances in information technology creating abundant sources of information, new flexible manufacturing technologies decreasing cost of production and the availability of additional sources of finance outside firms (e.g. Chesbrough, 2003; Schilling, 2006) have led to firms revising their business models, embracing deverticalization, modularization, outsourcing and networking to help them adopt to these changes (Christensen, 2006). This results in firms actively bringing in and divesting out assets based on the full prospect of investment and return (figure 3). This business paradigm is known as open innovation and defined as the “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively” (Chesbrough, 2003).

This definition makes a distinction between the inflow and outflow of knowledge, also referred to as inbound open innovation and outbound innovation (Gassman et al., 2006), relating to exploration and exploitation processes respectively (March, 1991; Lichtenhaler, 2009). On the one hand, external exploration, or inbound open innovation, refers to the internal use of external knowledge e.g. by buying or in-licensing knowledge. External exploration for instance, is the acquiring of new technology start-ups which posses and develops promising new technologies. While on the other hand, external exploitation, or outbound open innovation, depicts internal knowledge being utilized outside the organization e.g. by selling or out-licensing knowledge (Lichtenhaler, 2005). Successful integration of open innovation in a firm should not be seen as radical adoption of both processes, one or both processes can be adopted with varying degrees of freedom and openness (Gassman et al., 2006), and therefore the adoption of open innovation should be seen on a continuum of the adoption of certain open innovation practices instead of a strict dichotomy (Dahlander et al., 2010; Huizingh, 2011) and capabilities in bringing in and out
knowledge should be seen as complements to internal development instead of substitutes (Dahlander et al., 2010). With the concept of open innovation examined and the difference between exploration and exploitation herein established, the remainder of this section is focused on innovation projects, which results are subject of external exploitation.

**EXTERNAL EXPLOITATION**

Within the field of open innovation, external exploitation is the lesser researched and applied part (Lichtentaler et al., 2008), implying that firms have problems in capturing value from outbound activities (Huizingh, 2011). Specifically, it is defined as *outward technology transfer to external organizations pointing to actively pursuing external exploitation, referring to the commercialization of the technology externally or external technology commercialization* (Lichtenthaler, 2009). As such, it depicts the whole process of bringing knowledge in what form or whatsoever to an external party, including the mere basic forms of knowledge transfer, like exchange of employees. More specific, external exploitation can be seen as a value realization effort by externally transferring owned IPR for third party use e.g. commercialization or implementation. Despite a recent increase in interest on external exploitation (e.g. Lichtenthaler, 2011; Van de Vrande et al., 2009) a lack of understanding remains, mainly because academic research’s focus remains on firm level (Vanhaverbeke et al., 2006) and environmental and strategic factors (Lichtenthaler, 2005). This is quite remarkable, because external exploitation can have a significant role in eventual firm performance, especially in R&D institutes. Moreover, the eventual return a firm is able to generate from its technological innovation is determined by the effectiveness and quality of the commercialization process, internally or externally (Dodgson et al., 2008). As such, a lack of understanding exists regarding external exploitation and the issues arising with the commercialization of innovation through external exploitation (e.g. Enkel et al., 2009). For further elaboration, first literature on commercialization will be assessed after which it will be synthesized with external exploitation leading to the conception of commercialization by external exploitation. Finally, external exploitation business practices will be described.

**COMMERCIALIZATION**

Ultimately, the aim of every technological innovation is the delivery of value in some sort by the process of commercialization (Dodgson et al., 2008; Tidd et al., 2009). To establish the act
commercialization in external exploitation first, the concept of commercialization is defined and elaborated. *Commercialization is a set of decisions and activities which define how the new product is positioned and introduced into the market* (Hultink et al., 1997; Kahn, 2005). Basically, commercialization can be depicted as a value realization effort, encompassing the whole final phase in NPD from development to market penetration (Lehtimäki, 2008). The capture of value from the innovation can be in the form of commercial success, market share, setting standards and cost reduction or, as in social innovation, changing the world (Tidd et al., 2009). Because the ability of generating return on technological innovation is a result of the effectiveness and quality of the commercialization process and it generates the necessary funds for reinvestment in R&D and thereby supporting the ongoing innovation, the commercialization process is elementary in building value and sustaining competitive advantage.

![Figure 5. Commercialization definition by PDMA, Lehtimäki (2008)](image)

Commercialization of technological innovation is an uncertain and competitive activity in which the rents from innovative efforts often quickly dissolve, especially in high-tech innovations (Chiesa and Frattini, 2011). Consequently, innovators and incumbents often fail to reap the returns from their innovative efforts (e.g. Teece, 1986; Christensen, 1997). Activities in the commercialization differ significantly from activities earlier in the NPD funnel and therefore they require a different mindset, approach and capabilities than for developing innovations. Therefore, successful commercialization is dependent on people or organizations that usually possess different skills than the original inventors or developers, like skills in marketing and sales (Dodgson et al., 2008). Combining different functions early on during the innovation process has shown to be very fruitful both for the development of new products and successful commercialization (e.g. Troy et al.; Di Benedetto; Ernst et al., 2009).
COMMERCIALIZATION AND EXTERNAL EXPLOITATION

While there is a burgeoning literature on different aspects of external exploitation, commercialization in this aspect, remains ill defined (Markman et al., 2008; Thorburn, 2000; Aggarwal et al., 2009 and Lichtenthaler, 2005). Commercialization in external exploitation basically is a form of external knowledge commercialization or knowledge marketing and therefore can be defined as “the commercialization of technological knowledge exclusively or in addition to its application inside the firm” (Lichtenthaler 2005; Gassman 2006).

Commercialization in this vein means that all or at least the bigger part of the commercialization activities are being conducted by an external party after technology transfer. In addition to these usual commercialization activities, external exploitation encompasses activities like customer identification, process of technology transfer management, continuous (financial) management (Lichtenthaler, 2005), which will be refered to as external exploitation activities. Basically, the externalization process is a form of knowledge transfer or knowledge marketing, which is hampered by the higher complexity of markets for knowledge than those for most products and services (Arora et al., 2001; Guilhon 2001). Besides the challenges of transferring knowledge, imperfections inherent in knowledge markets lead to issues of appropriability and high transaction costs (Brockhoff 1992; Guilhon 2001; Teece 1981).While all external exploitation activities need to be carried out in order to commence external exploitation, the amount of commercialization activities that need to be carried out by the principal company depends on the desired amount of control on the final commercialization. Moreover, the desired control results in a governance mode choice. While literature frequently implies that out-licensing is the sole external exploitation mode, the concept entails a variety of modes of which the main ones are alliances (e.g. joint-venture), spin-out, out-licensing and patentsale (Lichtenthaler, 2005). The modes are illustrated in figure 5, categorized along the extent of organizational integration, or control. Moreover, the mode choice of externalization is a consequence of certain environmental and organizational variables constituting innovation project characteristics (Van de Vrande et al., 2009; Anokhin et al., 2011).
Historically, external exploitation practices have always been more of an ad-hoc activity without a clear roadmap or strategy and seen as a last resort instead of really valued (e.g. Tidd and Trewhella, 1997; Lichtenthaler and Ernst, 2008). However, with the framework of open innovation, in which any intermediate product of the innovation process is considered an economic good that can be exploited internally and/or externally, external exploitation is increasingly being considered and valued in NPD projects (Kirschbaum, 2005; Huizingh, 2011). By integrating external exploitation in NPD, the preliminary value of an innovation during the stages in NPD should be considered not only to the extent of internal implementation, but also to external exploitation. To commence in successful external exploitation incorporating strategy, culture and organization are pivotal elements as well as the extent of formalization and integration of external exploitation in NPD combined with pro-active attitudes (Lichtenthaler and Ernst, 2009; Lichtenthaler, 2011). Moreover, to successfully exploit technological knowledge, deal with knowledge markets and identify external possibilities requires a different set of capabilities and orientation than for research and product development (Arora et al., 2001). However, external exploitation is an extension of product marketing and should be integrated with and driven by the sales-marketing effort (Kotabe et al., 1996). To fully reap its possibilities the establishment of a dedicated technological intelligence department, staffed with marketing, technology and legal competencies and experience is recommended (Lichtenthaler, 2004).

**CONCLUSION**

In technological innovation knowledge assets result from (customer) value creation efforts in innovation projects. As such, the knowledge assets resulting from this development process typically are technologies that can be externalized and commercialized along the entire development process, from seed to mature technology. Organizations that aspire successful external exploitation and to avoid ad-hoc decisions, formal planning constitutes a first step.
However, to successfully employ external exploitation strategic activities firms need to integrate it into their corporate strategy (Chesbrough, 2007), consider external exploitation options early in the innovation process (Lichtenthaler et al., 2009) and align it with their product marketing (Kotabe et al., 1996). As such, the marketing and sales functions are deemed to play a pivotal role in identifying strategic and suited partners for the external exploitation (Kotabe et al., 1996; Lichtenthaler et al., 2009). Furthermore, integrating external exploitation in NPD in this way is especially beneficial for a firm’s future financial performance in markets for technologies characterized by effective patent protection, large number of transactions, high turbulence and competition (Lichtenthaler et al., 2009).

2.3 PERFORMANCE
Traditionally, performance is assessed at company level. However, the last decade this straightforward linking in innovation management has been found an imperfect reflection of contemporary business (e.g. Grinstein, 2007) and innovation performance has frequently replaced business performance. Innovation management literature indicates that market-driven organizations create products aligned to market needs (e.g. Lukas and Ferrel, 2000) and the final performance of organizations result from the portfolio of products it commercializes over time and across product lines (Hauser, 2006). Therefore, using innovation performance instead of overall business performance captures if an organization is successful in creating and capturing value and gives a better understanding of contemporary business (Grinstein, 2007). However, in the context of spin-outs, those that were approached for participation in the survey vary in maturity between just spun-out and mature with at least one fully commercialized innovation, making it hard to adequately assess innovation performance in some cases. Moreover, in essence the spin-outs are based on one generic technology and therefore in this case business performance actually is innovation performance. Therefore, in assessing innovation performance in spin-outs, overall business performance is assessed (Moorman, 1995).
3. CONCEPTUAL MODEL AND HYPOTHESES

As stated this research is based on the notion that a commercial orientation and commercial capabilities can have a significant influence on innovation performance through the value creation and value capture process in spin-outs. As such, this research takes up the task to fill the gap in literature regarding the lack of simultaneous assessment of marketing and sales in both culture and capabilities in NPD and thereby dilate on research questions 1a and 2a. Therefore, based on the previous theoretical framework, more specific relationships and their directions are deduced to form a conceptual model and derive its hypothesis.

3.1 HYPOTHESIS

First, drawing on previous academic literature it is suggested that firms with superior MO achieve superior innovation performance because a market orientated culture embodies organizational values and norms that guide activities, including NPD activities, leading to superior organizational performance (Narver et al., 1990). This organizational culture eventually leads an organization having a more thorough understanding of customers’ needs, competitor capabilities and strategies and a broader market environment than their rivals (e.g., Hult and Ketchen, 2001; Kirca et al., 2005; Ledwith and O’Dwyer, 2009). Therefore it is hypothesized that

Hypothesis 1: A firm’s market orientation has a positive impact on innovation performance.

Second, the innovative and proactive behaviors composing sales orientation will enable the organization to bring more and better customers early on with the ability to lever on them in terms of achieving and creating significant first sales, reference customer(s) (Wouters and Nijssen, 2009) and sales learning curve (Leslie et al, 2006) all increasing innovation performance. It is therefore hypothesized that

Hypothesis 2: A firm’s sales orientation has a positive impact on innovation performance.

Third, capabilities ensure the coordination of relevant activities and to make use of the assets at hand. Especially in turbulent organizational climates, like commercializing high-tech innovation (Chiesa and Frattini, 2011), capabilities evolve and provide the firm with a sustainable source of competitive advantage (Day, 1994; Sharma and Vredenburg, 1998). In spin-outs or independent research teams little or no commercial capabilities might be present, for no individuals in the
team have any experience or education in this field. Nevertheless, some of the activities related
to marketing and sales are viewed essential drivers of innovation performance (Langerak et al.,
2004), and need to be executed in a profound manner to achieve success. Therefore, it is deduced
that the marketing and sales capabilities are those that ensure the execution coordination of their
relevant activities increasing performance (Day, 1994, Song et al., 2007).

**Hypothesis 3**: Firm's marketing capabilities have a positive impact on innovation performance.

**Hypothesis 4**: Firm's sales capabilities have a positive impact on innovation performance.

The Resource-Based View (RBV) and the dynamic capabilities extension suggest that the mere
possession of a resource like capabilities or orientation not sufficient to achieve superior
performance (Morgan et al., 2009). Rather, organizations that have the resources and abilities to
put its capabilities to use through an orientation, and that invests in capabilities that complement
the existing capability base, will be best able to exploit its distinctive competencies (Song et al.,
2007). Previous research has shown that though market orientation can directly affect
organizational performance (Kirca et al., 2005) it needs to be deployed, because while cultural
elements are vital they do not shape performance directly. Customers do not purchase products
because a firm has a specific culture, rather market orientation stimulates employees to act on the
generated market and customer knowledge in order to better serve customers (Hult et al., 2005).
Therefore, organizations that have a strong commercial orientation and deploy their capabilities
accordingly are expected to achieve higher innovation performance. Moreover, in line with
Morgan et al. (2009) it is expected that commercial-based assets like commercial orientation and
their relating commercial capabilities complement each other in an important fashion to explain
innovation performance.

**Hypothesis 5**: The interaction effect between a firm's commercial orientation and commercial
capabilities positively influences innovation performance.
3.2 CONCEPTUAL MODEL

Figure 7 Conceptual model
4. RESEARCH METHODOLOGY

In this chapter, the setting of the research with the focus, the objectives and the academic issues in research is described. Furthermore, the specifics of the methods used to gather and analyze the data to assess the remaining research questions are discussed (1b, 2b, 3, 4).

4.1 RESEARCH SETTING AND APPROACH

Basically, this research aims to cover two objectives, (1) assess the influence of commercial capabilities and commercial orientation on innovation performance in spin-outs and (2) assess the role of external exploitation and mode choice (figure 5) in this setting. To investigate this multi-faceted issue, initially an encompassing explorative research was proposed, because of the lack of clear ideas with the issue at hand, aiming to construct a framework for the integration of sales and marketing in innovation projects. However, also a confirmatory part is added to not only construct a framework but also to test it quantitatively and qualitatively, combining induction and deduction and reaching managerial relevance. Because of feasibility issues however, this approach could not be applied to both objectives and the research was split in two, resulting in the use of different methods. In the first part a mixed-method approach is used while the second part solely exists of a qualitative assessment. Moreover, as previously indicated the first objective will be limited to spin-outs as a form of innovation project. In Table 2 the divide is illustrated.

Table 1 Research divide

| (1) THE INFLUENCE OF COMMERCIAL ORIENTATION AND CAPABILITIES ON INNOVATION PERFORMANCE, RQ 1-2 |
|---|---|
| **Goal** | Assess the influence of the identified predictors on innovation performance |
| **Focus** | Technology spin-outs |
| **Type of research** | Mixed-method, online survey and interviews |
| **Sample size** | 36 surveys, 15 interviews |

| (2) THE ROLE OF EXTERNAL EXPLOITATION AND MODE CHOICE IN INNOVATION PROJECTS, RQ 3-4 |
|---|---|
| **Goal** | Exploration of external exploitation in organizations |
| **Focus** | Companies applying open innovation practices |
| **Type of research** | In-depth interviews, moreover data from the previous part is included |
| **Sample size** | 6 |

Next, the different parts and their methods will be elaborated and issues of reliability and validity will be discussed.
4.2 **MIXED-METHOD RESEARCH: COMMERCIAL ORIENTATION AND CAPABILITIES ON INNOVATION PERFORMANCE**

After identifying relevant aspects of commercial orientation, commercial capabilities possibly influencing business performance in chapter three, the following goal is to measure the constructs to subsequently assess the influence of the former two on the latter. However, the goal of this part of the research is not only to confirm theory; it is also aims to identify the process and the underlying drivers particular to innovation projects. The main reason to also conduct an explorative assessment on the innovation projects is to yield greater insights and deduce managerial results which are more relevant. Combining these goals extends this part from not only being a causal study but also being a descriptive one (Cooper et al., 2003).

**TYPE OF RESEARCH**

Research methodology generally distinguishes between quantitative and qualitative research methods (Onwuegbuzie and Leech, 2005). Quantitative research is the systematic scientific investigation of quantitative properties and phenomena and their relationships. The main objective of quantitative research is to develop and employ mathematical models, theories, or hypotheses pertaining to natural phenomena. Generally, quantitative research leads to the development of instruments and methods for measurements or the collection of empirical data of finally the modeling, collection, and results of data (Muijs, 2004, Muijs, D. (2004), “Doing quantitative research in education”, Sage Publications Ltd). On the other hand, qualitative research methods involve the systematic collection, organization, and interpretation of textual material derived from talk or observation. It is used in the exploration of meanings of social phenomena as experienced by individuals themselves, in their natural context (Malterud, 2001). Because both have their advantages and disadvantages, it has given rise to the paradigm of mixed-methods, which advocates a pragmatic approach and combines both which leads to using the strengths of both (Onwuegbuzie and Leech, 2005).

For this research a mixed-method approach will be applied to not only test the results quantitatively but also qualitatively to identify possible underlying causes. By collecting qualitative and quantitative data, a high degree of generalizability is achieved, moreover, the combination increases the reliability of the results. The quantitative part will be executed through an online survey and will measure the previously identified constructs, while for the quantitative
part semi-structured interviews will be used to get meaningful insights in the particulars and performance drivers from the spin-outs.

**OPERATIONALIZATION OF CONSTRUCTS**

All the latent constructs in the conceptual model were measured using multi-item scales based on contemporary literature. Respondents were asked to indicate their (dis)agreement with a set of statements using a five-point Likert scale which ranged from completely disagree to completely agree, except for the construct business performance, for this construct the respondents were asked to indicate the level of objectives achieved on a set of performance objectives which ranged from much lower than objectives to much higher than objectives.

*Market orientation* was measured based on the conceptualization of Narver and Slater (1990), was updated by adapting *pro-active customer orientation* (Blocker et al., 2011; Narver et al., 2004), *competitor orientation* (Narver and Slater, 1990) and *shared interpretation* (Hult et al., 2005). Furthermore, the measurement of *sales orientation* (Pitkanen et al., WP) includes *sales innovativeness* (Evans et al., 2007) and *pro-active sales orientation* (van der Borgh et al., 2010). The measurement of *sales capabilities* as well as *marketing capabilities* were applied from Pitkanen et al. (WP) based on previous research of Song et al. (2007). Finally, a subjective *business performance* measure was adapted from Moorman (1995) and adjusted on an open interview. In addition to the questions to measure the latent constructs the survey was extended by several general questions in order to characterize the sample.

**DATA COLLECTION PROCEDURE**

The first goal of this research is to measure the constructs of commercial orientation, commercial capabilities and business performance. An online survey was used to gather this information for several reasons; it has the benefits of being able to target unique populations, time-saving and cheap (Wright, 2005). Moreover, lower respondent errors occur through less unanswered questions (McDonald and Adam, 2003). Finally, it is assumed that professionals to be approached are frequent internet users, for they are for a large part dependent on it for several purposes, like information gathering. Next, to collect the qualitative data on spin-outs, professionals within the sample where approached for a meeting to conduct semi-structured interviews and to hold the survey. The professionals approached where first identified through internet research to ensure they possessed the required knowledge and involvement resulting in
them mainly being the CEO, CTO or principal scientist. Hereafter, spin-outs were contacted by phone or email to inquire their willingness to cooperate. They were globally informed of the content of the interview and time frame, which was about 60 minutes.

The survey itself consists of 52 questions measuring eight constructs and related background information. All constructs measurements are based on existing literature, where needed they were adapted to the situation and the answers have a five point likert-scale. Furthermore, the questionnaire was pre-tested by four insiders, after which several improvements were made to guarantee suitable questions for the spin-out situation. The construct measurements of the survey can be found in Appendix A.

The semi structured interview’s goal is to get a better insight in the process of spinning-out and the background of possible success of the spin-outs. Therefore, the interviews loosely focus on the process as well as the identified possible predictors of innovation performance. The semi-structured interview can be found in Appendix B.

4.3 **In-depth Interviews: External Exploitation Innovation Projects**

Next, innovation projects and their results, in terms of open innovation, are assessed from a different organizational perspective by focusing on open innovation parameters and organization of companies engaging in external exploitation. The objective is to explore the manner in which companies deal with the open innovation aspect in their innovation funnel. Moreover, it assesses issues of spin-outs which initially could have been addressed better by the principal organization. Therefore, insights at the externalization process, criteria and the organization of the open innovation aspect will be gathered through interviews with a university, commercial firm, R&D organization and spin-outs.

**Type of research and data collection procedures**

Though some literature is available on governance mode choice (Van Vrande et al., 2009; Anahokin et al., 2011), the process of externalization within large organizations (Lichtenthaler, 2009) and on the strategy aspects of profiting of externalizing innovations (Teece, 2006; Lichtenthaler et al., 2009), a tested framework for addressing the issue of governance mode choice practice is not available yet. Therefore, many of the questions remain on governance
mode choice and its antecedents. As such, an explorative study is conducted on the basis of the externalization practices of these organizations. Therefore a qualitative method is deployed to gather an in-depth understanding of the reasons that govern the decision making process. Loosely focused in-depth interviews will be used to gather the relevant data. Interviews are set up in a way that all relevant topics will be treated, to promote discussion and elaboration by the participant. Interviews with identified organizations were partly set-up through the Holst Centre and partly by approaching pre-identified organizations by phone. Additionally, some explorative questions were added to the spin-out survey to get additional insights on the project level and a level of triangulation to the interviews. The list of topics considered in the in-depth interviews and the survey questions can be found in Appendix C.

4.4. Quality of Research
To ensure and assess the quality of research, criteria on several levels are available for the researcher, knowing: controllability, reliability, construct validity, internal validity and external validity (van Aken et al., 2007; Yin, 2009). Therefore, an elaboration on how this research scores against these criteria follows next. First, the level of controllability is assessed. Controllability is defined as the ability to control academic research as to the level verifiability of the results by others and it is a perquisite for determining the level of reliability and validity (van Aken et al., 2007). In order to achieve a high level of controllability, the research design should contain a high level of detail, such that it is reproducible by others. Therefore, the sources of information, the manner of data collection and the underlying choices are structurally reported. Interviews generally pose a hurdle for this criterion, as they are more difficult to control and reproduce. Therefore, the interview structure is reported and written transcripts are made, tough not included in this report, but like the quantitative data set they are turned in to the supervisors. Second, reliability is assessed by demonstrating that the operations of this study can be repeated, resulting in the same results. A structured approached and the maintaining of the chain of evidence by documenting stepwise procedures increases reliability of the study by preventing error and bias (Yin, 2009). Moreover, adequate measures were taken to minimize the level of bias from the researcher, the research instrument and the respondents. Frequent consultation toke place to minimize the first source; multiple research instruments and data sources were used to reduce the bias from the method; and finally bias from respondents was reduced by selecting those with thorough knowledge regarding the matter, moreover all respondents involved are
active on the same organizational level. Third, validity is the manner in which the researcher is measuring what he wants to measure correctly and adequately (van Aken et al., 2007). According to van Aken et al. (2007), there are three types of validity, hereafter discussed: construct validity, internal validity and external validity. Construct validity refers to establishing correct operational measures for the concepts under study. One manner of achieving high validity is to use multiple sources; therefore this study not only uses qualitative data sources but also quantitative sources. Moreover, the research model was deduced from literature and was consulted with the supervisors and an investment manager of a research institute. Internal validity refers to the establishment of causal relationships whereby certain conditions are shown to lead to other conditions to retain the research from illicit relationships. This aspect counts especially for the explanatory aspect of this study not for the exploratory part, for this part has is not concerned with causal claims (Yin, 2009). By dividing the commercial predictor in several different aspects the specific effect of these aspects can be measured. Therefore, the effect of each aspect will be tested on eventual performance, controlling for spurious conditions. A high level of external validity is achieved if the findings of research can be generalized to other contexts and situations (Yin, 2009). Qualitative methods inherently yield low external validity levels for their limited sample restrains their generalizability. Therefore, this research is extended with quantitative methods to reach a degree of generalizability. Unfortunately, the eventual minor sample size poses generalizability restrains.
5. **Analysis of Results**

Based on the research questions presented in chapter one and the conceptual model in chapter three, research has been conducted as presented in chapter four. The first part of the research has been conducted by the survey shown in Appendix A and the semi-structured interview shown in Appendix B, moreover the in-depth discussion points are presented in Appendix C. The results and the analysis will be presented in this chapter. First, some descriptive information on the gathered cases will be presented after which the model along with the hypothesis is tested. Hereafter, results of the interviews with part of the qualitative sample will be presented, after which the results of both will be analyzed. Finally, the results of the explorative study regarding the role of open innovation and governance mode will be presented and analyzed. This chapter will conclude with the most important findings from the analysis.

5.1 **Analysis of Mixed-Method Results**

The goal here is to test the conceptual validity along with the hypotheses. In order to test them, a regression analysis on the survey results was conducted with SPSS 19 after which the results and the results of the semi-structured interviews are analyzed. First, this chapter starts with assessing some sample characteristics.

5.1.1 **Survey Analysis**

**Sample Characteristics**

Due to the lack of a pre-identified contact list, spin-outs had to be identified through internet research and contacts of interviewed professionals. First, spin-outs were identified by the internet after which the founders were identified by subsequent internet research to ensure a response of the right stakeholders, resulting in a response mainly by the CEO, CTO or principal scientist. This approach eventually yielded a grand total of contacted spin-outs of 74, of which 39 replied and 36 completed the survey, yielding a response rate of 48.6 percent.
The maturity of the technology during the moment of spinning-out of these 36 companies is illustrated in figure 9 illustrates the phase of development in which the technology was situated when it was eventually spun-out. It is possible to initiate a spin-out anywhere on the continuum between an idea and having a fully developed technology. As such, the phases between concept idea and fully developed technology are neither fixed nor rigid; rather they are an approximation of the development phase of the technology on this continuum. As a divide between the phases an accepted taxonomy has been used (e.g. Cooper, 1990). It is remarkable to see more than half of the spin-outs were initiated early in the technology’s life cycle, 61.1%. Generally, this would mean that those companies still need to execute the R&D and engineering activities, which require a lot of resources, financially and technically. This could pose a significant hurdle to overcome for such small companies taking their limiting resources into consideration. Furthermore, only 8.3% of spin-outs started with a fully developed technology ready for market introduction.

Regarding the market spin-outs serve, the larger part (86.1%) of them serves the B2B market, indicating that they serve a specialized high-tech market, as illustrated in figure 10. This image is
confirmed by reviewing the sectors the respondents replied, like e.g. imaging and space industry. Five spin-outs also focus on consumers of which four serve both the B2B and B2C market and only one solely serves consumers. Furthermore, the larger part of the spin-outs (63.9%) focuses on products to generate returns while just 5.6% provides services (see figure 11). However, almost a third of the spin-outs (30.6%) utilize their related knowledge to offer service as well as products.

![Figure 11 Organization type](image1.png)

![Figure 12 Use of incubator](image2.png)

In figure 12 the origin of the spin-outs is illustrated. Of the responded spin-outs little more than half (55.9%) originated from a university and 38.2% are the result of a commercial firm, leaving a small percentage (5.8%) of spin-outs a result of an institute. Finally, figure 13 illustrates the percentage of spin-outs that use or used an incubator for starting their business.

**VALIDATION OF CONSTRUCTS**

Though all constructs and measures are deduced from theory and have been used in academic literature before, the latent structure in all variables (measurement items) was tested by factor analysis and subsequent reliability analysis to empirically prove the structure. As a result of the low sample size, the factor analysis was split in two separate analyses conducted with the same sample size. One factor analysis was executed including market and sales orientation and business performance, while another analysis was carried out on marketing and sales capabilities and business performance. By this division an acceptable variable to item ratio was achieved and both the orientations and the capabilities were tested for significant difference against the dependent variable, business performance. The rationale to execute a factor analysis in-between the 1) orientations and 2) the capabilities is that the items of both orientations and the items of both capabilities have a larger conceptual overlap and thus a larger expected empirical overlap. Executing factor analysis as such ensures sufficient discriminant validity between the concepts where most overlap is expected. Regarding the criteria of the factor analysis, a threshold for the
communality or indicator reliability was set at minimum level of .50 and factor loadings at a minimum of .50 following Hair et al. (2006). The final results of the factor analysis can be found in table 3 and 4. In the first factor analysis three items still remain weakly factored, however, they are left in because they still exceed the minimum threshold and deletion would lead to a significant loss of information, hence two constructs would be left with two items each. Eventually, the analysis resulted in the dropping of the construct Competitor Orientation as part of Marketing Orientation, because item-to-construct correlations were incoherent leaving the items grouped with unrelated theoretical concepts and the dropping of three items due to threshold criteria.

Table 2 factor analysis orientations

<table>
<thead>
<tr>
<th></th>
<th>Sales Innovativeness</th>
<th>Business Performance</th>
<th>Shared Interpretation</th>
<th>Customer Orientation</th>
<th>Sales Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI_1</td>
<td>.898</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI_4</td>
<td>.878</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI_2</td>
<td>.816</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI_3</td>
<td>.653</td>
<td></td>
<td></td>
<td></td>
<td>-.307</td>
</tr>
<tr>
<td>BP_2</td>
<td></td>
<td>.896</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP_1</td>
<td></td>
<td>.863</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BP_3</td>
<td></td>
<td>.849</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ShI_1</td>
<td></td>
<td></td>
<td>.826</td>
<td>.408</td>
<td></td>
</tr>
<tr>
<td>ShI_4</td>
<td></td>
<td></td>
<td>.717</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ShI_3</td>
<td></td>
<td></td>
<td>.587</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CuO_5</td>
<td></td>
<td></td>
<td></td>
<td>.797</td>
<td></td>
</tr>
<tr>
<td>CuO_2</td>
<td></td>
<td></td>
<td></td>
<td>.711</td>
<td></td>
</tr>
<tr>
<td>CuO_4</td>
<td></td>
<td></td>
<td></td>
<td>.638</td>
<td>.419</td>
</tr>
<tr>
<td>SO_4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.845</td>
</tr>
<tr>
<td>SO_3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.758</td>
</tr>
<tr>
<td>SO_1</td>
<td></td>
<td></td>
<td></td>
<td>-.503</td>
<td>.728</td>
</tr>
</tbody>
</table>

Component loadings > |.3|

In the subsequent analysis, no empirical difference could be derived between marketing and sales capabilities; instead all items were found significantly loading on one factor. Therefore, in subsequent analyses a commercial capabilities construct, combining sales and marketing capabilities, is also used next to a singular marketing and sales capabilities construct, replacing them in them in the relevant models. Marketing and sales capabilities are maintained to be able to test for the hypothesis.
Table 3 factor analysis capabilities

<table>
<thead>
<tr>
<th>COMMERCIAL CAPABILITIES</th>
<th>BUSINESS PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC_2</td>
<td>.925</td>
</tr>
<tr>
<td>SC_3</td>
<td>.838</td>
</tr>
<tr>
<td>MC_3</td>
<td>.833</td>
</tr>
<tr>
<td>SC_2</td>
<td>.779</td>
</tr>
<tr>
<td>MC_1</td>
<td>.735</td>
</tr>
<tr>
<td>SC_1</td>
<td>.722</td>
</tr>
<tr>
<td>BP_3</td>
<td>.944</td>
</tr>
<tr>
<td>BP_2</td>
<td>.879</td>
</tr>
<tr>
<td>BP_1</td>
<td>.813</td>
</tr>
</tbody>
</table>

Component loadings > .3

Both parts of factor analyses lead to the same item construct of business performance, thus indicating a strong consistency. For the evaluation of the reliability a threshold of .60 for Cronbach’s alpha in line with Hair et al., (2006) was chosen due to the explorative nature of the research and the low sample size. The remaining constructs and their reliability can be found in table 5.

Table 4 Final constructs and reliabilities

<table>
<thead>
<tr>
<th>CONSTRUCT</th>
<th>SUB-CONSTRUCT</th>
<th># ITEMS INCLUDED</th>
<th>CRONITACH'S ALPHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Orientation</td>
<td>Customer orientation</td>
<td>3</td>
<td>.671</td>
</tr>
<tr>
<td></td>
<td>Shared Interpretation</td>
<td>3</td>
<td>.671</td>
</tr>
<tr>
<td>Sales Orientation</td>
<td>Sales Orientation</td>
<td>3</td>
<td>.714</td>
</tr>
<tr>
<td></td>
<td>Sales Innovativeness</td>
<td>4</td>
<td>.863</td>
</tr>
<tr>
<td>Commercial capabilities</td>
<td>Marketing Capabilities</td>
<td>3</td>
<td>.819</td>
</tr>
<tr>
<td></td>
<td>Sales Capabilities</td>
<td>3</td>
<td>.795</td>
</tr>
<tr>
<td></td>
<td>Commercial Capabilities, one construct</td>
<td>6</td>
<td>.893</td>
</tr>
<tr>
<td>Business performance</td>
<td></td>
<td>3</td>
<td>.859</td>
</tr>
</tbody>
</table>

Finally, the constructs were tested for kurtosis and skewness in order to assess the normality assumption. Testing for normality is done in this fashion because traditional measures are found too inflating and sensitive. None of the constructs was found to violate the threshold of 1.96 (Field, 2005), so no additional measures were needed for conducting analyses.
**REGRESSION ANALYSIS**

In order to conduct a regression analysis, first, the bivariate relationships between the individual constructs are examined through a correlation. Subsequently, a regression analyses will be conducted to test the hypotheses. The correlation analysis is presented in table 6. Because the commercial capabilities construct is composed of the same items as sales and marketing capabilities their mutual correlations are removed from the table.

Table 5 Descriptives and correlations

<table>
<thead>
<tr>
<th></th>
<th>MEAN (S.D.)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Market Orientation</td>
<td>4.15 (.54)</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Sales Orientation</td>
<td>3.87 (.69)</td>
<td>.428**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Commercial Capabilities</td>
<td>3.08 (1.07)</td>
<td>.474**</td>
<td>.414**</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Business Performance</td>
<td>2.81 (.92)</td>
<td>.253</td>
<td>.130</td>
<td>.446**</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Marketing Capabilities</td>
<td>2.99 (1.10)</td>
<td>.466**</td>
<td>.443**</td>
<td>-</td>
<td>.405**</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>6. Sales Capabilities</td>
<td>3.17 (1.57)</td>
<td>.435**</td>
<td>.346*</td>
<td>-</td>
<td>.442**</td>
<td>.806**</td>
<td>1</td>
</tr>
</tbody>
</table>

*p<.05;**p<.01 (1-tailed)

The correlation reveals some interesting points and gives some insight in the expected relationships in the model. First, no significant relationship exists between market orientation and business performance; and sales orientation and business performance, indicating orientations in general to be a bad predictor of business performance. Furthermore, the finding from the factor analysis that underlying aspects of commercial capabilities do not differ significantly from each other is confirmed by their high related mutual correlation. Consequently, the capabilities are all found to be significantly correlated to business performance. Finally, all capability constructs significantly correlate with sales and market orientation, while the latter is not correlated with business performance, possibly indicating that the link between orientation and business performance is not this straightforward (e.g. Langerak et al., 2004; Kirca et al., 2005).

Next, to determine the degree to which business performance, as dependent variable, is predicted by commercial orientation and commercial capabilities several regression analyses were performed. First, the models according to the hypothesis are tested, thus only the individual constructs and the interaction between commercial orientation and commercial capabilities were taken into account, after which the complete model was tested. To control for specific possible
influencing factors, several control variables were included in the model. Instead of controlling for organization related factors, over which the results frequently can be generalized (e.g. Morgan et al., 2009), here factors possibly influencing the status of the related technology are included, 1) the appropriability regime (e.g. Teece, 2007), 2) the extent of technology push, and 3) the maturity of technology at externalization. The results of the regression analysis can be found in table 7, reporting the standardized beta’s on the dependent variable business performance. The first model is used to assess the influence of the control variables, appropriability, technology push and technological maturity. Subsequently, model 2 tests the unique influence of the marketing aspects on business performance by including marketing capabilities and market orientation on business performance. Subsequently, model 3 incorporates the interaction effect between both by testing the effect of marketing capabilities, market orientation and the market orientation * marketing capabilities interaction effect. The same sequence is applied to the sales aspect, resulting in model 4 testing the unique effect of sales capabilities and sales orientation on business performance and model 5 also incorporating the effect of sales capabilities * sales orientation interaction. Hereafter, model 6 and model 7 test the interaction models with commercial capabilities as one construct. Model 6 thus includes market orientation, commercial capabilities and commercial capabilities * market orientation interaction, while model 7 includes sales orientation, commercial capabilities and commercial capabilities * sales orientation interaction. Finally, model 8 and model 9 test the overall model with market orientation and sales orientation but without interactions, model 6 with the division between marketing capabilities and sales capabilities and model 7 with commercial capabilities as one construct.
Table 6 Regression analyses

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MODEL 1</th>
<th>MODEL 2</th>
<th>MODEL 3</th>
<th>MODEL 4</th>
<th>MODEL 5</th>
<th>MODEL 6</th>
<th>MODEL 7</th>
<th>MODEL 8</th>
<th>MODEL 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriability</td>
<td>.015</td>
<td>-.029</td>
<td>-.031</td>
<td>-.009</td>
<td>-.007</td>
<td>-.027</td>
<td>-.015</td>
<td>-.045</td>
<td>-.044</td>
</tr>
<tr>
<td>Technological maturity</td>
<td>-.208</td>
<td>-.338**</td>
<td>-.338*</td>
<td>-.300*</td>
<td>-.300*</td>
<td>-.330</td>
<td>-.335*</td>
<td>-.337*</td>
<td>-.325*</td>
</tr>
<tr>
<td>Technology push</td>
<td>.647**</td>
<td>.657**</td>
<td>.660**</td>
<td>.596**</td>
<td>.621**</td>
<td>.618**</td>
<td>.628**</td>
<td>.660**</td>
<td>.634**</td>
</tr>
<tr>
<td>Market Orientation</td>
<td>.060</td>
<td>.058</td>
<td></td>
<td>.063</td>
<td></td>
<td>.102</td>
<td>.103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing Capability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.420**</td>
<td></td>
<td></td>
<td>.404*</td>
</tr>
<tr>
<td>Market orientation * marketing capabilities</td>
<td></td>
<td></td>
<td></td>
<td>-.010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Orientation</td>
<td>-.042</td>
<td>-.038</td>
<td>-.100</td>
<td>-.151</td>
<td>-.130</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Capability</td>
<td></td>
<td></td>
<td>.410**</td>
<td>.383**</td>
<td></td>
<td>.079</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales orientation * sales capabilities</td>
<td></td>
<td></td>
<td></td>
<td>-.076</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial capabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.418**</td>
<td>.485**</td>
<td>.450**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market orientation * Commercial capabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales orientation * Commercial capabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.376</td>
<td>.559</td>
<td>.559</td>
<td>.518</td>
<td>.522</td>
<td>.556</td>
<td>.562</td>
<td>.578</td>
<td>.568</td>
</tr>
</tbody>
</table>

Dependent variable: Business performance

*p<.05;** p<.01 (1-tailed)
The results of the regression analysis show that the effects of market orientation (model 2, 3, 6, 8 and 9) and sales orientation (model 4, 5, 7, 8 and 9) on business performance are not significant, thereby rejecting hypothesis H1 (p>.05) and hypothesis H2 (p>.05), respectively. Moreover, as a result of both orientations not being significant predictors in all relevant tested models it can be stated that the results are robust. On the contrary, the individual models testing the influence of the capabilities show a significant positive effect of sales (model 4) and marketing (model 2) capabilities on business performance and thus giving initial support for hypotheses H3 (p<.01) and H4 (p<.01). Of the two capabilities, marketing capabilities has a slightly stronger effect. The test of the full model (model 8) shows only a significant effect of the marketing capabilities. This is a result of the fact that marketing and sales capabilities do not differ empirically here and therefore confirms the finding of the factor analysis. This is a result of the high inter-construct correlation, resulting in a limited added portion of variance explained by sales capabilities.

Furthermore, neither the interaction effect between market orientation and marketing capabilities nor the interaction effect of sales orientation and sales capabilities proves to be a significant predictor, respectively model 3 and model 5. Also interaction effects between on the one hand commercial capabilities and on the other hand market orientation (model 6) or sales orientation (model 7) show non-significant effects. Therefore, hypothesis H5 (both interactions p>.05) is rejected. Moreover, the inclusion of the interaction effects dampens the effect of the capabilities. Subsequently, two analyses were executed with the full models, one with a distinction between marketing and sales capabilities (model 8), and one with commercial capabilities constituting construct (model 9). These models again show the importance of capabilities in this setting; commercial capabilities in general indicate a significant positive effect, but on the other hand as already indicated model 6 shows only a significant effect for marketing capabilities. Therefore, the analyses pose that marketing capabilities are more relevant than sales capabilities.

The regression analyses here show the relative importance of capabilities compared to orientations in realizing a satisfying business performance. All models including capabilities (models 2-9) prove the significant influence of capabilities in the process of achieving business performance. Though, these results as such should be taken in to account with precaution because of the absence to empirically distinction between marketing and sales capabilities. While marketing capabilities compared to sales capabilities show significant effect in model 8, this is mainly the effect of low discriminant validity between the two together with marketing
capabilities being slightly the better predictor. On the other hand, marketing and sales orientation lack a significant effect on business performance. Taking into account the correlations between the orientations and the capabilities and between the capabilities and business performance, it might be possible that the orientations not directly influence business performance but rather through a mechanism like product advantage (Langerak et al., 2004), innovativeness (Kirca et al., 2005) or R&D effectiveness (De Luca et al., 2010). The value of interactions additionally to capabilities and orientation (model 3 and 5) is not proven and therefore the RBV theory as deployed by Morgan et al (2009) cannot be confirmed in the same vein.

5.1.2 INTERVIEWS SPIN-OUTS
Next, for further analysis interviews were also conducted. With part of the professionals approached for filling in the survey a semi-structured interview was held for about an hour. Eventually 15 professionals were interviewed with the main goal to assess marketing and sales integration in the process of starting up and spinning out the initial technology innovation more profoundly. Moreover, the results are used for triangulation of the regression analysis results. The outline of the semi-structured interviews can be found in Appendix B. In this paragraph, the results of the interviews will be discussed with a focus on the subjects of the sales and marketing component in the process.

First, the available commercial experience and personnel in the initial team were, as expected and discussed in the theoretical framework, minimally available mainly because the spin-outs are the result of technological innovations with a concentration of personnel with a technological background. For some spin-outs this resulted in not bringing in customers and generating customer feedback by keeping a too tight focus on product and technology development. Though, one entrepreneur with a commercial background indicated that it was vital for their current success to put their products and services to market as quick as possible to generate valuable feedback. He stipulated that the goal is to create a technology that is applicable to customer needs instead of directly aiming for developing and launching a mature technology. Nevertheless, the larger part of the interviewed spin-outs had trouble connecting to the market and possible customers, especially those who started their venture from basic research with merely a proof of concept. They had a hard time in fostering a culture change from being solely technology or engineering oriented to a commercial and entrepreneurial mindset. In overcoming
the lack of commercial attitude and expertise, spin-outs focus on bringing in commercial employees. However, it was pointed out that finding and convincing senior commercial professionals to join them is very hard. First, senior commercial professionals with experience in a particular technical field are hard to find in the Netherlands. This was illustrated by one spin-out that, though being Eindhoven based, has a UK CEO with commercial background as well as a UK sales office. Second, convincing these professionals to join is hard in terms of rewards, financially and stock. Regarding the identification and approach of customers, they are mainly approached through exhibitions and fairs and network of the professionals. However, frequently when possible customers were identified, it was indicated that it was very hard to actually realize subsequent sales. Possible customers often put off actual buying for as long as possible postponing the financial investment. In the case of possible implementation of technology by a customer, customers frequently exhibited features of the not-invented-here syndrome. As such, one entrepreneur mentioned that realizing sales leads is a job of lots of effort and little return. To overcome this many spin-outs tried to construct partnerships with possible customers, in terms of co-financing, development or as reference customer. The buy-in of possible customers or creating partnerships with focus on a few parties or leading organizations in the market is valued. This is especially the case when products were not fully developed. As such, spin-outs were likely to put in a lot of effort in realizing a significant first sale. However, a major issue of realizing initial sales is the securing of financial assets to finish product development or for market introduction. This was frequently mentioned by the metaphor of the chicken and egg. To generate sales an initial investment was needed for realization, but parties providing finance required high levels certainty or already see sales ramping-up before providing finance. Therefore, where and if possible co-financing with customers proved very useful. Moreover, this provided the spin-outs with undilated source of funds in ramping up their business. When asked for what the hardest part was to overcome in getting were they are now two bottlenecks appeared. First, it was pointed out that there are three major steps to be made, knowing: getting the technology to work, realizing a first significant sale and last, gaining independence in the case of spin-outs still in an incubator or becoming financially independent those still financially dependent of certain parties in helping them to cross the valley of death. While the point of getting the technology to work was mentioned several times, the biggest bottleneck experienced by the spin-outs is the realization of a substantial sale. Therefore, when asked what to do
different with the current knowledge many an entrepreneur responded to put the innovation to market sooner and to include possible customers earlier on in the process. Finally, in crossing the valley of death, or just to get the cash flow going, spin-outs not only focused on launching a product but also on offering services in form of consulting based on knowledge in their field.

Implementing a market and customer orientation and identifying and executing relevant activities is largely part of the learning process of the initial team. Most of the spin-outs clearly go through a sales learning curve (Leslie et al., 2006) as they need time to connect to the market and customers, develop their proposition and make inevitable change to their offering. Moreover, the taking of certain actions of the initial team congruent with the effectual approach of marketing (Read et al., 2009). Entrepreneurs frequently emphasized the need to put their means to work achieve the best results possible and fitting. As such, they try to shape their environment and lever their resources, instead of just reacting on events or information. Furthermore, spin-outs put in a lot of effort to realize their first sale. Usually, this sale effort focuses on a strategic possible customer with lead user characteristics, which also is part due the initial technological niche spin-outs usually focus on. Furthermore, spin-outs often are aware of their sales learning curve and invest in the relationship with a first possible customer to adjust or fine tune their offering. Finally, entrepreneurs frequently set out to find customers to co-finance the final development. These findings on exploring of markets and customers are in line with proposed theory of significant first sale (Pitkanen et al., WP) and the reference customer (Wouters and Nijssen, 2009). The general response from the interviews strengthens the results of the regression analysis findings, among others, the result that spinning-out early in the NPD process has a negative effect on performance. Moreover, the spin-outs in which certain commercial capabilities were present early on, showed more profoundness in dealing with markets and customer uncertainty.

5.2 ANALYSIS OF IN-DEPTH INTERVIEWS RESULTS

Next, the context of innovation teams spinning out and the broader perspective of external exploitation is further explored by additional information gathered through the former parts of research as well as several in-depth interviews with professionals dealing with externalizing issues in their organization. As such, the issue of externalization will from a higher
organizational perspective with the objective to explore the manner in which companies deal with the open innovation aspect in their innovation funnel.

Organizations were asked after their externalization practices and experiences. Though the organizations significantly differed on their resource availability regarding product development, engineering and commercial capabilities, they all exhibited a view as to how they could best externalize their technologies. Moreover, it was indicated that despite the formalization of decision structure emotional decisions still occurred once and a while. Several issues where addressed. First, an organizational separation appeared between on the one hand the commercial firm and at the other hand R&D institutes and universities, which is a result of their basic purpose and business model and clearly manifests itself in technology and the commercial approach. Universities and R&D institutes are limited in the previously mentioned resources and their focus on basic research, which generally results in less mature technologies frequently with just a proof of principle or at the most a proof of concept. However, it was indicated that issues of (external) exploitation become relevant around the point when a proof of principal was produced, because it is this point when a single technology can be integrated or further extended by others to compose a possible product. Moreover, before the proof of concept too many technological uncertainties remain making it hard to find financial and other necessary parties.

Second, while all organizations have formalized and standardized their activities to some extent, the commercial firm appears to be more skilful in executing relevant activities and has a clear vision of how technologies are being developed and when and how they will be deployed to the market place in one way or another. Furthermore, the commercial firm and university are not dependent on partners joining the development process whereas the R&D institute severely is. All organizations indicate they go through a learning curve and their practices have evolved significantly the past few years.

Third, though all organizations value the option of bringing in possible customers or partners early in the development, they actually vary in degree of being dependent on bringing in a partner. Moreover, it was pointed out that finding possible customers and generating relevant information early in the development is real hard. One organization indicated that instead of stimulating the project team to conduct market and customer activities they bring in consultants. Though, market and customer information is valued, the generation hereof mainly is the
responsibility of the project team, independent of its composure. As project teams often lack seasoned commercial personnel, it is dependent on the commercial orientation of the project team and the organization for the execution of relevant activities.

Fourth, the eventual decision of external exploitation is based on several criteria and several factors have a play. The evaluation if and how to externalize a technology is mainly based on the nature of the technology and its status, the project team, the potential market, the overall strategy and compatibility with principal organization and the cost and revenues. The strategy aspect refers to the technological alignment the technology has with the future goals and ambitions of the organization and largely depends on the defensive or offensive market vision it has. Moreover, it was indicated that if a certain technology is well protected by patents it offers the possibility to shape the market, because this monopoly gives the opportunity to select preferred commercial partners as well as to maintain certain price levels. Regarding spin-outs it was indicated that it is essential that initiative needs to come from the project team. However, at the university sometimes a team is formed for a technology if the university feels a particular technology has potential or is interesting for initiating a spin-out. Moreover, support from the principal organization is a prerequisite in spinning-out a technology, an aspect which became clear from a case in which this was not present. Furthermore, spin-outs usually are the result of the discontinuing of the technology research the by principal company.

Finally, regarding the issue of the multi-owned knowledge base, although being out of scope, the question was posed to an organization dealing with issue as well. They state that the issue can be resolved in two ways, one being that partners are being bought off or given a share, and second that a new partner is found that is able to implement the technology and willing to take a stake in the project.
6. **CONCLUSION AND DISCUSSION**

In this section, after the recapitulation of the research questions, the conclusions from the results are presented. First, the results and hypothesis testing will be elaborated and mirrored against academic literature. Subsequently, the recommendations for the Holst Centre are discussed as well as the research contributions, limitations and directions for future research.

This research set out to increase the knowledge on two subjects, 1) the influence of commercial orientation and capabilities on innovation performance in spin-outs, and 2) assess the role open innovation in the previous context. The following main research question and sub-questions were defined to guide and structure the research:

<table>
<thead>
<tr>
<th>HOW CAN COMMERCIAL ORIENTATION INCREASE THE SUCCESS OF TECHNOLOGY INNOVATION PROJECTS IN EXTERNAL EXPLOITATION?</th>
</tr>
</thead>
</table>
| 1  a) What is commercial orientation and are its aspects  
    b) How does commercial orientation impact innovation performance? |
| 2  a) What are commercial capabilities?  
    b) How do commercial capabilities impact innovation performance? |
| 3  What is the role of external exploitation in innovation projects? |
| 4  What are relevant criteria and considerations for Holst Centre to organize external exploitation? |

In setting out to expand knowledge on the commercial effort in open innovation projects research a conjoint marketing and sales responsibilities perspective was utilized to assess drivers of innovation performance. A framework was constructed by expanding the conventional view on market orientation by including sales (Guenzi and Troilo, 2007; Biemans et al., 2009; Pitkänen et al., WP2011), taking a pro-active view (Narver et al., 2004; Blocker et al., 2011; Pitkänen et al., WP2011) and including capabilities as deployment mechanism for market-based assets (Morgan et al., 2009). As such, this research applies a holistic approach to integrate sales with market orientation research and is largely explorative in nature. Furthermore, issues and practices of external exploitation were addressed to assess the role of open innovation. Before the interpretation of the results it needs to be stated that while some conceptual drivers are not significant in the analyses, it does not necessarily mean that they are not important in daily business practices. Rather they have their value but lack a substantial direct impact on performance, or the lack of effect is due to research limitations.
6.1 OVERVIEW OF THE MAIN FINDINGS

First, the sub research questions regarding the commercial drivers will be addressed and answered after which guided by the main research question the general conclusion will be drawn. Finally, implications for the Holst Centre will be presented and discussed.

COMMERCIAL ORIENTATION AND INNOVATION PERFORMANCE

RESEARCH QUESTION 1A: WHAT IS COMMERCIAL ORIENTATION AND ARE ITS ASPECTS?

Here commercial orientation here is proposed and assessed as an extension of market orientation by including sales on the same levels (Morgan et al., 2009), orientation and capabilities (Pitkanen et al., WP). As such, commercial orientation is the organizational culture that stimulates conjoint marketing and sales behaviors to generate and disseminate customer and market information. As shown, the role of sales in varies processes and responsibilities regarding the customer and market activities have wrongly been ignored (e.g. Ernst et al., 2009). Moreover, it is deduced from literature that the marketing-sale capabilities are responsible for the relating activities market and customer activities (Homburg and Jensen, 2007; Guenzi et al., 2006; Guenzi and Troilo, 2007). These functions are responsible for the commercial aspect in the firm and therefore, their integrative effort in eventually generating and disseminating relevant information will be depicted as commercial. Therefore, commercial orientation is the organizational culture that stimulates behaviors on the customer-market interface, is being driven by sales and marketing and is pro-active in nature (Narver et al., 1990; Guenzi and Troilo, 2007; Pitkänen et al., WP2011; Blocker et al., 2010).

RESEARCH QUESTION 1B: HOW DOES COMMERCIAL ORIENTATION IMPACT INNOVATION PERFORMANCE?

The results from the regression do not yield significant effects for both market orientation and sales orientation. The non-significant effect of the orientations is consistent across all tested models. Both market orientation and sales orientation lack a predictive power for business performance. This result contradicts most previous studies (e.g. Kirca et al., 2005). One explanation might be the subjective performance measure used here because recently the testing of market orientation on a subjective and objective (ROA) measure on performance also resulted in the insignificant effect the subjective measure whilst the ROA measure was found significantly predicting performance. Furthermore, the effect of market orientation on business performance is directly assessed; however this might be a too straight forward conceptualization (e.g. Langerak et al., 2004; Kirca et al., 2005). Market orientation is likely not to affect business
performance in a direct fashion but rather to value creation mechanisms like R&D effectiveness (De Luca et al., 2010) or innovativeness leading to quality and customer loyalty (Kirca et al., 2005). The same goes for sales orientation; a mechanism which is could to moderate the sales orientation and business performance is the significance of the first sale (Pitkänen et al., WP).

Moreover, the hypothesized orientations are abstract and as a high order organizational cultural aspect, but perhaps this should be more utilized as a multi-stage cultural concept (Homburg et al., 2009).

**Research Question 2A: What are commercial capabilities?**

Day (1994) defines capabilities as “complex bundles of skills and collective learning enabling routines to ensure superior coordination of functional activities and use of assets”. Therefore in line with the previous proposition, commercial capabilities are these marketing and sales capabilities required for the execution of the commercial activities. Capabilities are a result of experience and education in their relative field (King and Tucci, 2002).

**Research Question 2B: How do commercial capabilities impact innovation performance?**

Commercial capabilities, in line with the orientation view and utilizing the dynamic capabilities view (Morgan et al., 2009) are split in a marketing aspect and a sales aspect. Contrary to the orientations, capabilities portray significant positive effects on business performance in all models. This result likely is a consequence of the strong technology project context with a strong technology push nature, in which the process is driven by technological oriented personnel (Herstatt and Lettl, 2004). The technology push context of the project strengthens the result because these relevant activities are harder to execute in these type of projects (Herstatt and Lettl, 2004; Chiesa and Frattini, 2011). Therefore, the few innovation projects that adequately and timely incorporated commercial personnel were better able to execute relevant marketing and sales activities. Moreover, because capabilities are more concrete compared to orientation this directly helps them to deal with market and customer information gaps and thus capabilities have a more direct influence on eventual performance. Furthermore, it is interesting that marketing capabilities have a stronger effect than sales capabilities in the individual sales and marketing models. However, because of the lack of empiric division between the two here, no conclusions can be drawn from this specific result of marketing versus sales capabilities. An explanation of the lack of discriminant validity between sales and marketing capabilities could be that starting firms do not yet have specialized functions and the all commercial activities are
carried out by on or a few employees, resulting in a lack distinction (Biemans et al., 2009). The results indicating that capabilities are a better predictor than orientation is line with the research of Morgan et al. (2009), who found a higher impact of capabilities on subjective performance measures.

**THE ROLE OF OPEN INNOVATION**

**Research question 3: What is the role of external exploitation in innovation projects?**

Within the framework of open innovation any intermediate product of the innovation process is considered an economic good that can be exploited internally and/or externally (Chesbrough, 2003; Huizingh, 2011). Commercial companies, R&D institutes and universities apply this paradigm motivated by varying reasons. Moreover, while some are dependent on the deployment of open innovation for generating revenues or it is their purpose, others are able to lever the exploration and exploitation aspects freely. As a result, the approach of the different organizations varies strongly as well as their mastering of the accompanying process. Clearly, R&D institutes and universities are limited by their options for they at least miss the internal exploitation option and moreover they are limited by their engineering and production capabilities (Lockett et al., 2005). Commercial firms have the possibility to externalize technology anywhere in the innovation funnel, whereas both others are limited by their resources resulting in the need to externalize early on in the innovation funnel. Moreover, the interviewed commercial firm shows more profoundness in the organization and execution of relevant activities. As such, the type of organization partly depicts how an organization actually engages in external exploitation. However, testing the effect of organization type as dummy variable yields no significant effect for one another. However, taking into consideration that universities and R&D institutes engage in external exploitation earlier in the development phase they should be less successful in it because of the negative effect of externalized phase in the regression analysis. Historically, out-licensing has long been the dominant manner for commercialization for universities and R&D institutes, however spin-outs are increasingly gain more popularity (Lockett et al., 2005). Therefore, the origin of an innovation is an important antecedent and driver of external exploitation in innovation projects. Moreover, for successful implementation of external exploitation organizations needs incorporate a strategy regarding their external exploitation activities and procedures need to be standardized (e.g. Lichtenthaler, 2009). Though quickly stated, a clear example arises from the IMEC practices of past decade and half (Moray et
al., 2005). This is in line with Lichtenthaler (2009) and arises from interviews that becoming efficient and coordinated in external exploitation is an evolving and learning process which does not happen overnight. Second, an entrepreneurial climate is necessary to stimulate initiative of the project team or principal scientist, especially in universities and R&D institutes for they often lack commercial attitudes (Gilsing et al., 2010).

**Research Question 4: What are main criteria for the Holst Centre to consider to employ external exploitation?**

Regarding organizations employing external exploitation Lockett et al. (2005) identify three key process issues at the pre-commercialization phase: opportunity recognition, the decision to commercialize and due diligence, and the choice between externalization modes. Here, the focus will be at the process after the decision to commercialize, thus on the due diligence and focuses on the choice between externalization modes. Moreover, the choice between externalization modes was boiled down to 1) alliance, 2) out-license, 3) spin-out, and 4) technology sale (figure 5).

Within the open innovation paradigm organizations have the option to not only internally implement or commercialize their developed technologies, but also to do this externally. Developed or intermediate technologies will be weighed and measured as to utilize it through their business model and if for any reason whatsoever the technology is not found a direct value to contemporary or future business other, hence external, options are being valued. For commercial firms this means internal implementation or commercialization initially is their main goal and if that their initial plan is revised external options can be evaluated. In the Holst context this means that initially, partnerships are their way for commercialization or implementation and when not applicable other (less integrated, figure 5) options can or will be valued. Furthermore, technology sale to an uninvolved party is often seen as a last resort, when technology is not internally applicable, no project team commits itself for spin-out and no advantages over sale can be gained trough out-licensing, sale is an option. As such, regarding the initial four options of 1) spin-out, 2) patent sale, 3) alliance/joint-venture, or 4) out-license, the only two relevant for further evaluation are out-license or spin-out, because alliance is a passed station for reasons mentioned and sale would be a consequence of the decision not to apply spin-out or out-license.
Therefore, on the options and criteria of out-licensing for the Holst Centre will be further elaborated. Gilsing et al. (2010) distil the same choice between spin-out and out-license in the given situation based on Shane (2002, 2004), table 8. In making the distinction between technologies that should be spun-out or out-licensed they base their assessment on the nature of the technology. The nature of the technology, in its broadest form, depicts the eventual potential in exploitation, for it is this asset that will be exploited (Clarysse et al., 2011). The most important criteria as exhibited in table 8 are the purpose (general vs. specific), customer value (significant vs. moderate) and the appropriability regime (strong vs. weak ip protection). First, the purpose or the generic nature of the technology depicts the applicability of the technology, whether it can only be applied to one product or solution, or it is more an enabling technology with a variety of applications. Second, a high level of customer value, though a consequence of many factors including the previous, is vital when an entire company is formed around it, in the case of out-licensing it will be more a cost-benefit decision. Finally, strong appropriability is indispensable to avoid undesirable spillovers and imitation highly unwanted especially in the spin-out case (Teece, 2006; Gilsing et al., 2010).

Table 7 Technology characteristics more suited for spin-out versus those more suited for out-licensing (Gisling et al., 2010) and interviews

<table>
<thead>
<tr>
<th>SPIN-OUT FIRM</th>
<th>LICENSING TO ESTABLISHED FIRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radical</td>
<td>Incremental</td>
</tr>
<tr>
<td>Tacit and codified knowledge</td>
<td>Codified knowledge</td>
</tr>
<tr>
<td>Early stage</td>
<td>Late stage</td>
</tr>
<tr>
<td>General purpose (generic technology)</td>
<td>Specific purpose</td>
</tr>
<tr>
<td>Significant customer value</td>
<td>Moderate customer value</td>
</tr>
<tr>
<td>Major technical advance</td>
<td>Minor technical advance</td>
</tr>
<tr>
<td>Many differentiators</td>
<td>Few differentiators</td>
</tr>
<tr>
<td>Strong IP protection (high appropriability)</td>
<td>Weak IP protection (low appropriability)</td>
</tr>
<tr>
<td>Science-based technological field</td>
<td>Development-based technological field</td>
</tr>
</tbody>
</table>

The set of criteria in table shows significant overlap with criteria indicated by one of the interviewed organization. Although the comparison based on technology characteristics already gives a suited evaluation tool for commencing external exploitation, additional criteria should be assessed, especially when considering spin-out. While the nature of the technology can lead to a decision to out-license, a decision for spin-out based hereon is premature. For a spin-out at least as important is the availability of a team as well as its characteristics as illustrated in table 9.
From the interviews and the data it is clear that a committed team is a straight prerequisite, though the additional data gathered by the surveys indicate is not a success factor because all spin-outs reveal a high level of initial team commitment. Moreover, team characteristics like the capabilities of the members need to be evaluated. If these aspects are to a large extent present or positive the decision can be made a spin-out is suitable. However, several other criteria remain like market, strategy, financial criteria (exhibited in Appendix D). These, however, are a consequence of the combination of the team with a particular technology, because the team decides what specific market to focus on and through which business model to utilize the technology. Therefore, these are not as much criteria to evaluate options of external exploitation, but rather threshold criteria a team sufficiently needs to address, leading to a sound business plan and model as well as the securing of complementary assets (Teece, 2006) before actually venturing out. Finally, the downsides of external exploitation are noteworthy. A downside of a spin-out can be knowledge drain because of skilled and experienced personnel leaves the principal company. Although, especially in commercials firm a spin-out frequently is the result of the principal firm discontinuing research on technology resulting in surplus personnel. Furthermore, if a firm engages in continues external exploitation the IP and the contacts need to be protected and managed respectively, requiring additional company resources.

To summarize, starting from the decision to externally exploit a technology, first the nature of the technology should be evaluated. The technology characteristics need to be evaluated, is it suited for spinning-out or for out-license (table 8)? The result is one of two possible conclusions, first the technology is in early stage and has broad has potential for spinning-out, or second, the application of the technology is limited as well as the possible customer value etc. While the first conclusion does not yet depict the choice, the latter does limited the option to out-licensing. If
the technology has been found to have potential for spinning-out, two options are possible for it is still an immature technology. First, it can be decided to commence in spinning-out for technology perquisites are met or second, it can be decided that the strategic value is greater to further develop the technology to maturity and license it. Finally, if the decision is made to opt for spinning-out, the decision to further ramp up a venture is dependent on the founding team and its characteristics (table 9). Finally, after the team has specified its future business it should be tested against criteria of market, strategy, financial and uniqueness (Appendix D), for the final investment and knowledge transfer.

**GENERAL CONCLUSION – ANSWER TO THE GENERAL RESEARCH QUESTION**

*How can commercial orientation increase the success of technology innovation projects?*

It is remarkable that 1) commercial capabilities have a significant positive effect on business performance, 2) commercial orientations do not have that effect and 3) that commercial capabilities are mutually correlated with commercial orientations. This could be an indication that the presence of certain capabilities leads to strong orientation in executing these tasks, meaning that the hiring of experienced commercial personnel directly leads to performance and an overall commercial orientation. However, it is possible that the effect of orientation on performance is not properly assessed because of the subjective measure of performance (Morgan et al., 2009). The subjective measure was an explicit choice because of the initial reluctance to provide objective financial response.

Therefore, enhancing eventual performance of the innovation projects mainly is dependent on the presence of commercial capabilities. Mirroring this finding to the findings of the interviews provides some understanding hereof. From the interviews it was deduced that spin-outs that started out with commercial personnel showed more propensity in effectual marketing and sales activities, whereas those lacking commercial employees showed less drive to actively engage in sales and marketing activities though they were aware of its value. As such, in all there was a certain amount of commercial orientation present, but those distinguished by commercial personnel more actively engaged in these activities and probably with a higher propensity in the right activities.

---

4 This can have advantages of being able to shape a market, influence the technological progress and the return
Thus, while commercial orientation leads to executing commercial activities, based on the interviews, this does not actually lead to a higher performance. However, the inclusion of commercial capabilities by commercial personnel does lead to eventual innovation performance in spin-outs.

6.4 RESEARCH CONTRIBUTIONS AND IMPLICATIONS

LITERATURE
This research extends the literature in several directions. First, in line with future directions of research by Morgan et al. (2009) other resources beyond MO and marketing capabilities are incorporated, which is done by integrating sales on the same levels. Moreover, this research shows that with regard to orientation research, capabilities cannot be overlooked as an important asset. However, no evidence for the interaction effect between capabilities has been found (Morgan et al., 2009). Second, in line with Pitkänen et al. (2011) it builds on the new concept of integrating selling into NPD. Therefore, the integration as proposed here is novel and has not been tested in this manner. From the explorative assessment of the role of open innovation it becomes clear the type of organization plays a role in manner of external exploitation, largely in line with Gilsing et al. (2010), however innovation performance in this context of external exploitation with several differentiators has not been assessed previously.

MANAGERIAL
The value of capabilities over culture has been proven as a success factor and along with the results of the interviews, it is suggested that the inclusion of senior or experienced commercial professionals in a spin-out is very valuable. Moreover, the lack of empirical separation between sales and marketing in capabilities is an indication that spin-outs view both activities as highly overlapping. Incorporating a more distinct conjoint sales-marketing effort with articulated sales and marketing responsibilities and cooperation could therefore lead to a better applied organizational interface with market and customers. Furthermore, regarding external exploitation the value of formalization and standardization is shown, as well as issues and possibilities regarding spin-outs are identified thereby offering organizations a handle to better suit spin-outs needs.
**HOLST CENTRE IMPLICATIONS**

This thesis offers several implications for the Holst Centre. First, it provides a theoretical background into external exploitation and thereby offers organizational success factors already identified in literature like the identification of strategy and formalizing and standardizing of open innovation practices. Second, regarding spin-outs the importance of commercial personnel is shown. This is an implication not to be overlooked quickly, for especially the Holst Centre being a young R&D institute with high a technological orientation, such aspects are often disregarded and are only incorporated after trial and error, possibly wasting valuable technologies and assets. Finally, an initial evaluation guideline or tool is provided for the assessment of possibly applying external exploitation in a given situation. Though, this provides criteria from practice and literature and therefore has a grounded base, further specification is needed as well as prioritization of the criteria for more thorough evaluation. Furthermore, spin-outs show to have a great dependency on facilities and resources for technology development and on the integration of customer and market information in which eco-systems like the Holst Centre can play a pivotal role for spin-outs. In this eco-system different parties along the value chain are brought together to not only develop a specific innovation possibly restrained by the environmental possibilities, but to develop the entire value chain needed for scalable innovations.

**6.5 LIMITATIONS**

This study is subject to several limitations. First, regarding the quantitative analyses this study is subject to a low sample size making the observation-to-predictor ratio low. Generally it has been advised to have an observation-to-predictor ratio of twenty for regression analysis (Hair et al., 2006); however, here the minimum threshold of five was just passed. Second, only a limited amount of experts could be approached for the in-depth interviews. Though, insights were given mainly consistent with contemporary literature, here also generalizability remains low. Moreover, though thoroughly prepared the semi-structured and in-depth interviews the questions were not validated with experts. Pre-testing of these interviews could lead to the identification of ambiguous or unclear questions and statements, as to making them more comprehensible. Fourth, the results are based on spin-outs so no it is not with certainty that the same results count for the other type of (open) innovation projects. Third, in common with almost every market orientation study, this research relies on a survey to for the main independent variables, which could lead to the self-serving bias. Finally, in the sample only Dutch spin-outs are included and
as such the research is limited by the geographical location and its characteristics, lacking a geographic generalizability.

6.6 Directions of Future Research

This thesis offers several opportunities for directions of future research. Regarding the aspects of commercial orientation and capabilities, causality between capabilities and orientation should be incorporated. Moreover, applying the model to a larger sample with established firms should lead to more generalizable results. Furthermore, the results on spin-outs are interesting for benchmarking or comparing against other successful regions or countries in spinning-out technology like Israel and the US. Finally, including mechanisms through which orientation affects innovation performance, like first sale and innovativeness or R&D effectiveness, should be included.

Regarding the role of open innovation several aspects could be researched more thoroughly through quantitative research, like the effect of principal organization type or support in setting up a spin-out. Moreover, future research should be aimed more at project level than past research which is mainly on principal organizations.
BIBLIOGRAPHY


## APPENDICES

### APPENDIX A: MEASUREMENT ITEMS

<table>
<thead>
<tr>
<th>Source(s)</th>
<th>Construct</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Narver, Slater and MacLachlan (2004); Blocker Flint, Myers and Slater (2011)</strong></td>
<td>1. Pro active Customer Orientation</td>
<td>CuO1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CuO2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CuO3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CuO4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CuO5</td>
</tr>
<tr>
<td><strong>Narver and Slater (1990)</strong></td>
<td>2. Competitor Orientation</td>
<td>CoO1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CoO2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CoO3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CoO4</td>
</tr>
<tr>
<td><strong>Narver and Slater (1990); Hult and Ketchen (2005)</strong></td>
<td>3. Shared Interpretation</td>
<td>ShI1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ShI2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ShI3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ShI4</td>
</tr>
<tr>
<td><strong>Van der Borg, de Jong, Nijssen and Wieseke (2010);</strong></td>
<td>4. Sales Innovativeness</td>
<td>SI1</td>
</tr>
<tr>
<td><strong>Pitkänen, Parvinen, Töytäri and de Jong, WP2011</strong></td>
<td>SI2</td>
<td>New ways to do business were explored.</td>
</tr>
<tr>
<td><strong>Pitkänen, Parvinen, Töytäri and de Jong, WP2011</strong></td>
<td>SI3</td>
<td>New approaches in selling were explored</td>
</tr>
<tr>
<td><strong>Pitkänen, Parvinen, Töytäri and de Jong, WP2011</strong></td>
<td>SI4</td>
<td>Innovation and creativity in selling were stimulated</td>
</tr>
</tbody>
</table>

| **Van der Borg, de Jong, Nijssen and Wieseke (2010); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | 5. Proactive Sales Orientation | SO1 | Into actual sales work of products/services to the potential customers. |
| **Van der Borg, de Jong, Nijssen and Wieseke (2010); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | | SO2 | The development of sales arguments for the product/service. |
| **Van der Borg, de Jong, Nijssen and Wieseke (2010); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | | SO3 | Experimenting with selling tactics with the potential customers. |
| **Van der Borg, de Jong, Nijssen and Wieseke (2010); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | | SO4 | Creating and identifying sales opportunities in the market. |

| **Song, Benedetto and Nason (2007); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | 6. Marketing Capabilities | MC1 | Work experience in advertising and promotion. |
| **Song, Benedetto and Nason (2007); Pitkänen, Parvinen, Töytäri and de Jong, WP2011** | | MC1 | Experience in dividing the market into customer segments. |
| **Song, Benedetto and Nason, (2007); Pitkänen, Parvinen, Töytäri and de Jong WP2011** | | MC1 | Academic studies in marketing. |

| **Open interview; Moorman and Rust** | 7. Sales Capabilities | SC1 | Work experience in selling at the customer interface. |
| **Open interview; Moorman and Rust** | | SC2 | Experience in managing sales team/function. |
| **Open interview; Moorman and Rust** | | SC3 | Academic studies in selling. |

| **Open interview; Moorman and Rust** | 8. Business Performance | BP1 | Return on investment objectives |
| **Open interview; Moorman and Rust** | | BP2 | Sales and customer growth objectives |
| **Open interview; Moorman and Rust** | | BP3 | Market share objectives |
| **Open interview; Moorman and Rust** | | BP4 | Innovation reputation objectives |
| **Open interview; Moorman and Rust** | | BP5 | Planned value creation objectives |
APPENDIX B: FORMAT SEMI-STRUCTURED INTERVIEW

1. Organizational background of the spin-out (technology, team, parent company etc.)
2. Decision driver for starting a spin-out (why?)
3. Realization of the spin-out, the underlying process and hurdles
4. The use of an incubator
5. The approach and involvement customers from the start
6. Flexibility of the business plan and flexibility of execution
7. Process of 1) realizing a market ready technology, 2) realizing a significant first sale, and 3) realize full independence (a state in which the spin-out is independent of external finance)
8. Financing the operation
9. The use of Subsidies
10. More stakeholders/parties involved in the process
11. Board of advisors
12. Strategy for exit
13. Perceived success factor of current business
14. Biggest challenge till now
15. What to do different with current knowledge
APPENDIX C: IN-DEPTH INTERVIEW AND ADDITIONAL SURVEY QUESTIONS

IN-DEPTH INTERVIEW SUBJECTS
1. Innovation process organization
2. Antecedences of external exploitation
3. Drivers for external exploitation
4. Criteria for governance mode
5. Sales and marketing responsibilities/activities in innovation process
6. Technology push influence
7. Governance modes
8. Performance drivers of external exploitation projects

ADDITIONAL SURVEY QUESTIONS

| The project team was extremely committed to the project [1-5] |
| Technological possibilities provided the driving force for the development of the project [1-5] |
| The projects background was completely in line with the firm’s [1-5] |
| The innovation was easy to replicate by others [1-5] |
| The innovation could entirely be protected by your patents [1-5] |
| Where third parties involved in the development process? (Y/N) |
| In which phase of development was the technology/innovation when spun-off; concept idea [1-5] full developed and market ready |
| What was the main decision driver for starting the spin-out [stage of development-market opportunities-team commitment-strategic considerations-cost and benefits-nature of technology] |
| Was the innovation supported by an incubator? (Y/N) |
| Did you have previous entrepreneurial experience? (Y/N) |
### Appendix D: Spin-out Criteria

<table>
<thead>
<tr>
<th>Technology</th>
<th>Market</th>
<th>Team</th>
<th>Strategy</th>
<th>Financial</th>
<th>Uniqueness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry trends?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Criteria