PIONEERING START-UPS’ FIRST MOVER ADVANTAGES AND SUCCESS FACTORS IN B2B SERVICE MARKETS

The development of a tool to assess start-up success through grounded theory and examination of empirical data with Rough Set Analysis
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Executive summary

Much research has been performed on market entry, a lot of which has dealt with timing and order of entry. A key issue has been the existence of first mover (or pioneer) advantages (FMA): the notion that the first firm to offer a certain type of product on the market gains advantages that cannot be obtained by later entrants. This phenomenon has been well-researched for physical products, but less so for services. Services, however, constitute a major part of today's economy. Besides, the specifics of FMA in business-to-business (versus the “standard” business-to-customer) markets have received even less attention.

The goal of this research is to develop a tool to assess the performance of start-ups that offer pioneering B2B services. Such a tool can be used by a number of actors (i.e. entrepreneurs, investors, consultants) involved in such start-ups. The research will focus on university spin-offs. Their performance and growth is currently a much-researched topic, and they have an important role in providing employment, realizing income for universities and aiding in the knowledge and technology transfer from universities to the corporate sector.

Although FMA can help, being the first mover is no guarantee for success. Other factors such as sound management and product quality are just as, if not more, important. Whether different FMA mechanisms apply in individual cases depends on a number of contingencies, such as product and market characteristics. Additionally, advantages from FMA are considered to gradually diminish over time in the face of competition.

There are 15 mechanisms of advantage divided over 3 categories: learning curve advantages, asset preemption advantages and customer switching costs. A complete overview of all mechanisms and their contingencies was composed from multiple academic sources. However, first mover disadvantages can also occur; these are free-rider effects, resolution of technological uncertainty, shift in technology or customer needs and incumbent inertia.

The differences between physical products and services and B2C and B2B marketing were also identified. The effects of these differences on the individual FMA mechanisms were deduced using a grounded theory approach. This knowledge allowed a model of FMA specifically applicable to B2B services to be made. Due to the nature of B2B marketing, the strongest FMA mechanisms are considered to be the preemption of market space, investment by customers, supplier-specific learning and buyer choice under uncertainty.

The Resource-Based View (RBV) was applied to further reduce the model. The RBV considers that competitive advantage is derived from firm-specific combinations of resources that are inimitable by other firms. Intellectual capital (IC) is the overarching term for those resources that are intangible. They do not show up on the balance sheet, but do contribute to competitive advantage. IC consists of human, social and organizational capital. Different FMA mechanisms can be linked to different forms of capital.

In order to empirically test the influence of these forms of capital and other factors on start-up performance, a database of 52 pioneering academic start-ups was made. Fourteen condition attributes (independent variables) and one decision attribute (dependent variable) were measured for each start-up. The decision attribute, performance, is a compound variable derived from three performance indicators. Not all indicators could be gathered for all start-ups. In such cases, performance was estimated based on other available relevant information.

Each condition attribute was tested for whether it had a statistically significant \( p<0.05 \) impact on firm performance by and of itself. Two such condition attributes were found: the attraction of external capital and the time between foundation and market introduction. The data suggested that start-ups that do not attract external capital are more often moderately successful, while start-ups that do attract external capital either fail or are very successful, but are rarely in the “middle ground”. Also, a short time to market was linked to higher
performance, and conversely a long time to market to lower performance. No statistically significant difference in performance was found between start-ups that offered services, start-ups that offered physical products and start-ups that offered a combination of both.

Start-ups that offered only physical products and that offered both physical products and services attracted external capital more often than start-ups that offered only services (p<0.05). Also, start-ups that offer both products and services had a longer time to market than expected, while service-offering start-ups had a shorter time to market than expected (p<0.05). This is possibly due to project complexity, as start-ups that had relatively complex projects took longer to market introduction than those that had relatively simple projects, and vice versa (p<0.05). In addition, more start-ups than expected attracted external capital if they had a more complex project, and vice versa (p<0.10).

As a next step in the empirical analysis, Rough Set Analysis (RSA) was applied. RSA is a data mining technique that was applied to discover patterns in the data regarding combinations of conditions attributes. RSA is a bottom-up approach that induces decision rules of the form "if [conditions] then [class]", with the class being the start-up’s decision attribute; a performance category. Rules of such form are simple to understand and use. Other advantages of RSA are that it requires no preliminary information about data, does not assume normal distribution and works with small sample sizes. The best decision rules from a number of runs with different parameters were gathered. The induced decision rules led to the same conclusions as the statistical significance tests.

The strongest and most relevant decision rules were selected and transformed into a tool. Using information on the condition attributes of a start-up, an assessment of that start-up’s performance can be obtained. If the start-up in question corresponds to a decision rule, the likelihood that the object falls into a certain performance category is given. The tool is quick and easy to understand and use, as per its requirements. The tool is presented on page 73 and the managerial implications of the research on page 74.

However, the strength and accuracy of the tool could only be tested on the sample itself, so little is known about its generalizability. Furthermore, no support was found for the correlation between human and social capital and firm performance, a correlation that is generally recognized in other academic literature. This may be due to the fact that the use of as much publicly available data as possible was necessary, which has possibly resulted in a less accurate dataset than could be realized with in-depth interviews.

The current study also required the assumptions of sound strategic, operational and financial management, sufficient product quality and the availability of a sufficient market to be made, but these factors could not be tested. Additionally, even though several defunct and unsuccessful start-ups were included in the sample, the possibility of survivor bias must be considered. Thus, the greatest limitation of this study is the limited sample size and difficulty in accurate data collection. Further research with a statistically representative sample is required before claims about generalization can be made.

Despite such limitations and the complexity of the field, the patterns regarding the attraction of external capital and time to market are empirically supported and can be valuable knowledge to any actor involved in university spin-offs that pioneer B2B products or services. Furthermore, this study was (one of the) first on this particular topic and therefore also exploratory in nature. In that regard, the study was successful in uncovering some interesting starting points for future research.
Preface

What feels like a lifetime ago I completed my secondary education (VWO) which was meant to prepare me for university. Even then, though I had chosen a beta-minded track, my grades reflected a more jack-of-all-trades-but-master-of-none personality. In the end, I went to a university of applied sciences (HBO) instead. After receiving my engineer’s degree, I felt that maybe the road should not stop there. But rather than battle with more equations, I wished to build upon my jack-of-all-trades character.

I chose the Master Management of Technology, where a bit of a culture shock regarding the learning environment and the difference between social and exact sciences, but also so many insights and interesting courses awaited me.

Now before you lies the thesis that concludes my path of learning at the Delft University of Technology. Of course, it would not be here if it were not for the help of the graduation committee. I would like to thank ms. Van Geenhuizen, ms. Roosenboom-Kwee and mr. Enserink for agreeing to take place in the committee, their interest in my research, constructive feedback, helpful insights and challenging me to critical thought. Ms Van Geenhuizen especially has invested much more time than I believe is the norm for a chair.

Although the finish line ended up somewhere besides the originally planned track, I would also like to thank ADSE B.V. and mr. Kneepkens for providing the basis of what would eventually be my research topic.

Finally, I would like to thank my parents for their incredible patience with my study career and my sister for setting such a good example, even though I do not always follow.
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1 Introduction

This first chapter familiarizes the reader with the research topic. At the end of this chapter, it will be clear what this research aims to address and why this is relevant. The three paragraphs of this chapter provide background information, the problem definition and the demarcation respectively.

1.1 Background

A lot of research has been performed on market entry, either a new market with an existing product or an existing market with a new product, or both. Much of this research has dealt with timing and order of entry (Miller, Gartner, & Wilson, 1989) (Gerosky, 1995) (Song, di Benedetto, & Zhao, 1999) (Helfat & Lieberman, 2002) (King & Tucci, 2002) (Zhao, Luo, & Suh, 2004) (Bayus & Agarwal, 2007) (Freeman & Sandwell, 2008). A key issue has been the existence of first mover advantages (FMA): will the first firm to offer a product be the most successful and profitable? The first important paper on FMA was written by Lieberman and Montgomery (1988). Even though extensive research has been performed on the subject since then, there seem to be few definitive answers. In any case, a simplistic view of FMA (i.e. just being the first in the market will automatically lead to success) is broadly refuted by many authors (Zachary, Gianiodis, Payne, & Markman, 2015).

1.1.1 Product and service differences

Services and physical products have some very different characteristics. In marketing literature, the most important of these are often cited as intangibility, inseparability, heterogeneity and perishability (Jobber, 1995) (Hoffman, 2000) (Baron & Harris, 2003).

- Intangibility: services cannot be touched, seen, handled. The practical implication of this is that customers cannot fully evaluate the service before purchasing it. For the decision of buying a service, one must rely on previous experience, advice from others, etc.
- Inseparability: Services are produced and consumed simultaneously. The service provider and the customer often have to cooperate to achieve maximum value. Quality control is harder: it must be done ad hoc.
- Heterogeneity: Physical products from a production line are all similar. The nature of services is thus that they are never exactly the same, it depends on individuals and circumstances.
- Perishability: Services cannot be stored. An empty seat on an airplane or in a movie theatre cannot be reclaimed. Careful planning is required to counterbalance supply and demand throughout time.

Given the differences between goods and services, it stands to reason that several factors of influence in the timing of entry in goods markets have different characteristics in the timing of entry in service markets. More detailed information on the difference between products and services is discussed further in the thesis.

1.1.2 Changing to a service economy

The majority of the research on FMA has focused on product markets (as in goods, physical products). However, over the last decades, the economies of many developed countries have transformed from manufacturing-driven to service-driven economies (Bitran & Lojo, 1993) (Akehurst, 2008). Services contribute to over 70% of GDP in many of the world's leading economies, and even in upcoming economies such as China.
and India services already constitute a sizable portion of GDP. To illustrate how important services are, some figures are given in Table 1 and Table 2.

Table 1: The percentage of GDP that is realized by services (The World Factbook, 2015). All figures from 2014 unless stated otherwise.

<table>
<thead>
<tr>
<th>Country</th>
<th>% of GDP</th>
<th>Country</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>77.7</td>
<td>Israel</td>
<td>71.9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>74.8</td>
<td>Germany</td>
<td>68.4</td>
</tr>
<tr>
<td>Japan</td>
<td>74.3 (2013)</td>
<td>South Korea</td>
<td>59.4</td>
</tr>
<tr>
<td>EU average</td>
<td>73</td>
<td>India</td>
<td>57.9</td>
</tr>
<tr>
<td>Brazil</td>
<td>70.4</td>
<td>China</td>
<td>48.2</td>
</tr>
</tbody>
</table>

Table 2: Employment in high- and medium-high technology manufacturing sectors and knowledge-intensive service sectors as a share of total employment in the EU28 countries. Source: (Eurostat, 2016).

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU28 manufacturing</td>
<td>5.5</td>
<td>5.6</td>
<td>5.6</td>
<td>5.6</td>
<td>5.7</td>
<td>5.7</td>
</tr>
<tr>
<td>EU28 services</td>
<td>38.7</td>
<td>39.0</td>
<td>39.3</td>
<td>39.4</td>
<td>39.7</td>
<td>39.9</td>
</tr>
</tbody>
</table>

How come that services nowadays constitute such a large part of the global economy? Gallouj (2002) states that services and innovation are the two main characteristics of modern societies, therefore manufacturing cannot be considered the only engine of growth. Aside from the rise of new services, some activities that were traditionally purely manufacturing activities are transformed into service activities. Vargo & Lush (2004) call this a change from “goods-dominant” to “service-dominant” logic of marketing, others call it “servicizing” or “servitization” (Reiskin, White, Johnson, & Votta, 1999) (Baines, Lightfoot, Benedettini, & Kay, 2009) (Plepys, Heiskanen, & Mont, 2015) but the concept is the same: that of selling a product’s functions instead of the product itself.

A real-world example of this shift is that of the “Power by the Hour” model: instead of selling jet engines in a traditional way, General Electric and Rolls-Royce charge customers for an engine’s operating hours (Chesbrough, 2012) (Smith, 2013). If the engine requires repairs, the manufacturer sends a repair crew to manage the repairs. Thus the aircraft operators do not pay for nor take ownership of the machine itself (the engine), but pay for the service that machine provides (thrust).

As a result of changing to a service-driven economy, many authors consider services as the main drivers of economic growth (Metcalfe & Miles, 2000) (Andersen, Howells, Hull, Miles, & Roberts, 2000) (Weissenberger-Eibl & Koch, 2007) (Spohrer & Maglio, 2008).

### 1.1.3 Trends in the business-to-business sector

The business-to-business (B2B) sector has seen an increase in private equity investments in contrast to the B2C (business-to-customer) sector in the years 2011 to 2013 (Figure 1). The overall value of B2B private equity deals has risen over the last years (Figure 2), and investments in B2B start-ups have risen while investments in B2C start-ups have dropped from 2015 to 2016 (Figure 3). Also, slow growth is forecast for most European countries’ B2B sectors (PWC, 2016).
1.1.4 Concerning start-ups

The empirical part of this thesis will focus on start-ups. The Dutch government recognizes the importance of start-ups on economic growth, and it has planned to support start-up companies by allocating funds and adjusting its regulations (rijksoverheid.nl, 2016). Also, venture capital as a percentage of GDP in the Netherlands grew from 0.024 to 0.032 from 2013 to 2015 (although after dropping from 2007 values) (Eurostat, 2016). Invested capital in B2B start-ups has grown globally by around 40% in the last 2 years while invested capital in B2C start-ups has declined by around 10% (Figure 3).

There is an increasing number of start-ups that are university spin-offs. They are considered to achieve the transfer and commercialization of technologies that are developed in universities, as well as to provide employment, realize income for universities and link universities with the corporate sector (Van Geenhuizen & Soetanto, 2009). However, such start-ups face many obstacles and their growth is often small (Degroof & Roberts, 2004) (Mustar, Wright, & Clarysse, 2008) (Van Geenhuizen & Soetanto, 2009).
1.2 Problem definition

As explained earlier, the majority of the research on first mover advantages has focused on manufacturing and mass consumer goods (Song, di Benedetto, & Zhao, 1999) (López & Roberts, 2002) (Posselt & Berger, 2007) (Freeman & Sandwell, 2008) (Magnusson, Westjohn, & Boggs, 2009). A number of articles have addressed the situation and begun to close the gap. But given the huge importance of services in the current economy, it is surprising that no more effort has been made to investigate FMA for service products. B2B services are an important part of the economy. Michel et al. (2003) state that intellectual services such as consultancy, market research and technical developments can reach up to 40% of firm purchases, versus 10-15% in the early 90’s. This paper is already 13 years old at the time of writing, so that percentage may have risen still further since.

So far, scholars looking into FMA for services have addressed individual pieces of the puzzle. This makes the literature on FMA for services diffuse and fragmented. To this author’s knowledge, no-one so far has tried to create an all-encompassing overview of all the aspects of FMA for B2B services. Also, as a result, for firms considering to pioneer new services onto the market there is currently no easy method to evaluate how first mover advantages (or disadvantages) can affect that process. Finally, there is little empirical research on the growth of academic spin-off start-ups (Walter, Auer, & Ritter, 2006) (Hayter, 2013), even though they are seen as important vehicles for knowledge transfer and economic growth.
1.3 Demarcation

The occurrence of FMA (or the likelihood thereof) is but one of the aspects that affect the success of firm entry, alongside factors such as dynamic capabilities, previous entry experience, entry strategy and more. To investigate all such factors here would make the coverage level too broad, which is detrimental for the depth of the work. It would also detract from the focus of the to be developed tool (see Chapter 2), possibly making it too large and unwieldy.

Innovation and being a first mover are, by their definitions, closely related. The emergence of services and the process of servitization has sparked much research in how the service innovation process differs from the technology innovation process (Nijssen, Hillebrand, Vermeulen, & Kemp, 2006) (Bitner, Ostrom, & Morgan, 2008) (Kindström, Kowalkowski, & Sandberg, 2013). However, the subject area of FMA and therefore of this research as well focuses on the marketing side of new services. Specifically how innovation occurs in services is not part of this project.

The Technical University Delft has close ties to a number of start-ups through its YES!Delft incubator, which should facilitate data collection. Start-ups will be limited to the Netherlands and in three industry sectors: greentech, medical and business support. These sectors are chosen based on the availability of cases.

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**Chapter summary**

- Products and services have different characteristics, which changes the way they should be marketed and how they are used, perceived and evaluated by customers. The four key differences are intangibility, inseparability, heterogeneity and perishability.

- Services have become a, possibly the, backbone of the economy in developed countries. The process of “servizicing” or “servitization” is the shift of firms from offering a product, to offering the utility that that product enables instead.

- The majority of academic work on first mover advantages has focused on goods.

- The Dutch government aims to support entrepreneurial activities by adjusting regulations for start-ups. Start-ups that are university spin-offs often exhibit slow growth.

- Research on success factors and first mover advantages for start-ups in B2B service markets addresses a niche that so far has received little attention. Nevertheless, it has:
  - Scientific relevance as it adds to the existing knowledge on first mover advantages, as well as start-up formation and growth which is a topic currently receiving much interest.
  - Practical relevance as it allows policy makers, entrepreneurs, investors and universities to make better informed decisions concerning start-ups in general and university spin-offs in particular.
2 Research design

The previous chapter has identified the opportunity for additional research. This chapter will make clear what research will be carried out in order to address the problems evident from Chapter 1, as well as how. It is akin to a project plan. The first paragraph describes the research objective and questions. In the second paragraph several requirements are discussed. The third paragraph presents the research structure.

2.1 Research objective and questions

First off, we will distinguish between the external and internal objectives of the research. The external objective of a research is defined as the goal for which the produced knowledge will eventually be used, not the produced knowledge itself (Verschuren & Doorewaard, 2010). The external objective of this research is to add to the available knowledge on first mover advantages and success factors for start-ups in B2B service markets, and to aid involved actors (entrepreneurs, investors, consultants, policy makers) in making better informed decisions regarding the subject.

The internal objective is to obtain the knowledge that, in turn, will fulfil the external objective (Verschuren & Doorewaard, 2010). The core internal objective is to develop a tool that assesses first mover advantages and success factors for B2B service start-ups. The following steps are taken to complete this objective:

1) to gather all information on FMA mechanisms with all relevant moderating factors
2) to assess how the characteristics of B2B and service marketing influence the various FMA mechanisms
3) to apply the Resource-Based View (RBV) perspective
4) to develop a conceptual model based on all gathered information that indicates how firm success as a dependent variable is influenced by independent variables
5) to gather empirical data on start-ups, from which decision rules for classification are induced using Rough Set Analysis
6) to make the tool based on the analysis of empirical data and the deduced decision rules

Table 3: Short description of the to be developed tool

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who is the tool intended for?</td>
<td>Any person who wishes to assess a start-up’s performance.</td>
</tr>
<tr>
<td>What will the tool do?</td>
<td>Predict performance for start-ups that offer pioneering B2B service products.</td>
</tr>
<tr>
<td>When should this tool be applied?</td>
<td>In the early stages of the start-up.</td>
</tr>
<tr>
<td>Why would this tool be applied?</td>
<td>To obtain an indication whether a start-up will be successful or not. This may aid entrepreneurs or investors in: - deciding whether to continue to invest resources in the start-up or not - possibly adjusting the start-ups’ characteristics that influence the likelihood of success</td>
</tr>
<tr>
<td>How does the tool work?</td>
<td>By evaluating a number of characteristics of the start-up, the founders, and the perceived product, the tool can give a performance estimation.</td>
</tr>
</tbody>
</table>

It must be noted that the tool assumes the presence of several important factors that are not specifically covered in this study, including but not limited to sound strategic and financial management, sufficient product quality, reasonable pricing and a sufficient market size for the product or service.
The following research question is formulated:

*What tool can be developed, and what will its contents be, to assess the expected success of start-ups that offer pioneering B2B service products?*

Which requires the following sub-questions to be answered:

- What FMA mechanisms exist? How do FMA fit within the general process of entry and performance?
- How do FMA differ between goods and services?
- How are FMA affected by B2B versus B2C marketing?
- What factors influence a start-ups’ success when pioneering B2B services?
- What decision rules can be deduced from empirical data using Rough Set Analysis?

### 2.2 Tool requirements

The purpose of the tool is to aid interested actors in assessing a start-up’s performance. This is especially useful in the earliest stages of a start-up. The earliest stages are also the most dynamic; therefore the tool should be quick and easy to apply. This ensures the application of the tool does not take up too much time that may be needed for other work, and encourages the possibility of re-applying the tool when circumstances have changed. Furthermore, the tool should be widely applicable: it should be able to assess any B2B service start-up. Finally, and perhaps most importantly, the tool should be accurate.

- Easy to understand and use: the structure should be simple and clear, self-explanatory and require little to no previous knowledge of market introduction dynamics, strategic or innovation management, etc.
- Quick to use: the tool should take no more than a few minutes to apply.
- Applicable to a wide variety of cases: the tool should be able to assess any B2B service start-up regardless of their specific characteristics.
- Accurate: the tool should have high accuracy or (following the maxim that knowing that you do not know is better than *not* knowing that you do not know) the tool should indicate when accuracy is less high.
2.3 Thesis structure

The project concerns the development of a new tool based on current academic knowledge and knowledge gathered from quantitative empirical data analysis. A block diagram of the process is shown in Figure 4.

- **FMA theory**
  - **Complete model of FMA mechanisms**
  - **Model of FMA mechanisms in B2B services**
  - **Resource-Based View**
  - **Conceptual model**
  - **Empirical data**
  - **Rough Set Analysis**
  - **Decision rules**
  - **Results, evaluation, and recommendations**

![Figure 4: Visualisation of the process structure](image)

First, a literature review is performed on the subject of first mover advantages. The results of this review comprise Chapter 3. It results in a general overview of all possible FMA mechanisms for any product, regardless of characteristics. Then, literature reviews are performed regarding the differences between product and service marketing, and B2C and B2B marketing. Chapter 4 describes these findings.

When this knowledge is applied to FMA theory, a more distinct model for FMA mechanisms specifically for B2B service products can be made. This is achieved in Chapter 5. In order to break down the model even further and make it manageable to perform quantitative data analysis, the Resource-Based View is then applied in Chapter 6. The RBV is a well-documented and often-used perspective on firm competitiveness. This leads to a concise conceptual model which indicates what sorts of empirical data should be collected.

The operationalisation of the concepts and the collection of data is described in Chapter 7. In Chapter 8, the theory of Rough Set Analysis is explained and its application is discussed. RSA is a method of knowledge discovery in databases, applicable to the current research. The induced decision rules and other findings are used to make the proposed tool in Chapter 9. Finally, the evaluation, discussion and recommendations for further research conclude the thesis in Chapter 10.
Chapter summary

- The goal of this thesis is to make a tool that makes a predictive performance assessment for start-ups in B2B services, making use of FMA theory and empirical data. In order to do so:
  - Existing knowledge on FMA, service marketing and B2B marketing will be linked.
  - The Resource-Based View will be used to identify key resources and make a concise conceptual model.
  - Rough Set Analysis will be used to analyze empirical data and induce decision rules for categorization.
- The tool will assume the presence of several important factors that are not specifically covered in this study, including but not limited to sound strategic and financial management, sufficient product quality, reasonable pricing and a sufficient market size for the product or service.
3 Theory on first mover advantages

This chapter will provide an overview of the existing academic knowledge regarding first mover advantages. First, the methodology of the performed literature review is presented. Then, some important concepts of socio-technical theory, necessary for a complete understanding of some FMA mechanisms, are explained for readers new to the subject in paragraph 3.2. Following that is the main body of the chapter, consisting of paragraphs 3.3 to 3.6, wherein all theory on FMA is presented.

3.1 Literature review methodology

This paragraph only deals with the methodology. The paper trail and actual results can be seen in Appendix I. The overarching goal of the literature review is to provide academic background information, to reveal what has already been researched on the topic (Webster & Watson, 2002) (van de Wijngaert, Bouwman, & Contractor, 2014). Dissecting this overarching goal into smaller pieces, the literature review can (Randolph, 2009):

- place the research in historical context
- provide support for grounded theory
- identify the main methodologies and research techniques used
- identify important variables within the topic
- establish the context of the problem
- familiarize the researcher with the topic vocabulary

The importance of literature reviews is frequently stressed, in addition to the fact that it is often not performed as well as it could be (Hart, 1998) (Randolph, 2009). A proper literature review has breadth, depth, clarity, consistency and rigour (Hart, 1998). This literature review aims to meet those goals through thorough documentation of the search process and its results.

In order to start finding relevant literature, several key words were identified from the background, problem definition and previous experience of the author regarding the field. These key words are used to find literature using multiple search engines: Scopus, Web of Science and Google Scholar. The use of multiple search engines ensures a broader coverage. Apart from finding relevant papers through keyword searches, a second approach is finding papers through referencing. With referencing, one can either go “forward” or “backward” (Webster & Watson, 2002). Going backward is achieved by looking at the sources that are cited by the current article. Conversely, going forward is achieved by looking at what other literature cites the current article as a reference. A combination of the three approaches provides the means necessary to find all relevant articles in the target domain. The paper trail, necessary for transparency, is included in Appendix I.

This literature review is of a qualitative nature. The outcome of the literature review is textual and constitutes the large majority of Chapter 3 and parts of Chapter 4. Based on the concept matrix of Webber & Watson (2002), a second table is included in Appendix II that identifies the subject area of each article, in order to show in what area most research has taken place.

The selection of found papers is not considered to be an exhaustive, but a purposive sample. This means that central or pivotal articles in the field have been examined (Cooper H. M., 1988). For example, several older papers (around the 1980’s) dealing solely with FMA for consumer goods were found but have intentionally not been included. Whether every single important paper has been included cannot be guaranteed. Nevertheless, the paper trail in Appendix I shows how heavily forward and backward referencing was used in the search.
process. Most articles were found this way. It is unlikely that important papers on the subject of FMA would not have been referenced or cited by any of the papers that have been included. Therefore, it can be concluded with reasonable certainty that a complete overview of relevant papers has been made.

### 3.2 Important concepts

Before the basics of first mover advantages are explained, the reader will be quickly introduced to some socio-technical theories that will help in the understanding of some FMA concepts. One of the most important concepts is that of creative destruction (Schumpeter, 1942). According to this concept, innovations constantly replace older technologies, which is the driver of technological progress. This continuous replacement of the old with the new incessantly redefines the economy, technology and society; as old technologies disappear and firms go bankrupt, and they are replaced with new technologies and other firms.

Another key concept is that of the technological regime, which is a very broad term. It is the existing, embedded system surrounding a technology from a socio-technical perspective. Within the technological regime are included the technology itself, how it is produced, used, viewed, supported, financed, regulated, interacts with other technologies, etc. (Geels, 2002). If any of these factors change, so does the technological regime. The introduction of a new technology can lead to the creation of a whole new technological regime from scratch.

In innovation literature, innovation is often categorized either as incremental, or as radical, disruptive, really new, or discontinuous. Although there are some semantic differences between radical, disruptive, really new or discontinuous innovations (Garcia & Calantone, 2002), it goes beyond the scope of this text to address this issue in detail. Suffice to say that incremental innovations are small improvements of existing processes or technologies, sold in existing markets. The technological regime changes, but the changes are relatively mild. Radical, disruptive, really new or discontinuous innovations are those innovations that have the potential to replace existing technologies or processes or open up totally new markets. As a result, technological regimes are hugely changed, fully replaced, or newly created. Some examples of radical innovations are the telephone, the jet engine, the refrigerator and digital photography.

### 3.3 Basics of first mover advantages

The notion of first mover advantages has its roots in the 1950’s and 60’s from empirical observations that first movers’ performances appeared to better than that of later entrants (Suarez & Lanzolla, 2007). This led to researchers looking for theoretical explanations of why this would be the case, and many papers have since been written on the topic. Early empirical papers have mostly studied nonservice consumer and industrial goods (Robinson & Fornell, 1985) (Urban, Carter, Gaskin, & Mucha, 1986) (Robinson, 1988) (Lambkin, 1988) (Miller, Gartner, & Wilson, 1989). Later, and not yet to the same extent, attention has also been given to FMA for services (Song, di Benedetto, & Zhao, 1999) (López & Roberts, 2002) (Magnusson, Westjohn, & Boggs, 2009).

The definition of “pioneer” and “first mover” is not fully consistent in literature. One can distinguish between the first to have an idea, the first to produce a working prototype, or the first to enter the market. The majority of authors, though, have used the definition that the first to enter the market is the pioneer or first mover (Lieberman & Montgomery, 1988). This is also the definition that will be used here.

First mover or pioneer advantage is generally also not very distinctly defined by researchers. The most often quoted definition states that the first mover advantage is the degree to which a pioneering firm is able to earn
above average profits (Lieberman & Montgomery, 1988). This would be the simple version, given that this definition does not include other performance measures such as market share and profit margin, long-term advantages, or competitors. For this thesis, first mover advantage will be defined as:

- the degree to which a pioneering firm and/or early mover(s) can outperform other firms that enter the same market with a similar product at a later time, from the time of market entry by the pioneer to the onset of market maturity. Outperforming can be meant to achieve higher market shares, higher profit margins, or better survivability chances.

Note that this definition speaks of a pioneer and early mover(s). And while “pioneer” and “first mover” are interchangeable, “early movers” are by definition not pioneers but later entrants, albeit only shortly after the true pioneer. Why was the definition chosen to be in this form? Because FMA do not strictly apply to the true pioneer only (Suarez & Lanzolla, 2007). Imagine a case as in Figure 5 where a pioneer and an early follower enter a market shortly after one another, and later entrants follow five years later. The time elapsed between the first and second entrant is insignificant compared to the time lapse to later entrants, and (assuming all else equal) both the pioneer and the early mover would equally benefit from FMA mechanisms versus the later entrants.

![Figure 5: FMA can be obtained by multiple actors.](image)

### 3.3.1 Arguments against FMA

Some researchers have argued and found evidence against FMA. Lilien and Yoon (1990) investigated manufacturing firms. Their data showed that third and fourth entrants had higher likelihoods of success than did first and second entrants. Golder & Tellis’ (1993) results show a much lower market share for pioneers than other studies, and show that 11% of pioneers are market leaders compared to almost half in the PIMS data (for more information on the PIMS database, see paragraph 3.3.2). The survivor bias was removed by including non-survivors in the sample: it was found that 47% of market pioneers fail.

Boulding & Christen (2003), performing a study into the long-term profit implications of pioneering, found that there is a profit (and market share) advantage for pioneers that lasts for 12 to 14 years, which afterwards becomes a cost disadvantage versus competitors. As a result they have been cited as providing counterevidence against FMA (Suarez & Lanzolla, 2007). However, their results are probably better interpreted as showing that FMA do not automatically result in long-term advantages, rather than denouncing short- and medium-term advantages. More on this can be found in paragraph 3.3.3.

One of the arguments against FMA is that it is not pioneering that causes firms that move first to perform better. Instead, pioneering firms pioneer because have the best resources and managerial skills, and therefore gain the largest market shares. However, Murthi et al. (1996) have shown that even though managerial skills have a positive effect on firm performance, a positive association between pioneering and market share remains even if controlling for managerial skills, thus supporting the existence of FMA.

Min et al. (2006) empirically studied the difference between incremental and really new innovations. Their results indicate that pioneers of radical innovations have much higher failure rates than pioneers of incremental innovations. They measured a 12-year survival rate of 23% for pioneers of radical innovations.
versus a 61% 12-year survival rate for pioneers of incremental innovations. Interestingly, the 12-year survival rate for followers was hardly affected by the level of innovativeness (38% versus 39%). Thus, they conclude that pioneering a really new innovation may not always be worth the effort.

Despite some claims to the contrary, the majority of researchers do believe that FMA exist. This is the same conclusion drawn by several meta-analyses of FMA (Szymanski, Troy, & Bharadwaj, 1995) (Kalyanaram, Robinson, & Urban, 1995) (Gómez-Villanueva & Ramírez-Solís, 2013) (Zachary, Gianiodis, Payne, & Markman, 2015). Nevertheless all authors agree almost exclusively that even though they support the existence of FMA, whether pioneering actually results in FMA or not is still heavily dependent per case on the conditions of the market, the characteristics of the product, the capabilities of the firm and other factors (see paragraph 3.6).

### 3.3.2 Notes on the measurement of FMA

Many early studies use the PIMS database (Robinson & Fornell, 1985) (Lambkin, 1988) (Miller, Gartner, & Wilson, 1989) (Parry & Bass, 1990). There are several drawbacks to this database (Kerin, Varadarajan, & Peterson, 1992). First, the data on who is a pioneer is self-reported and thus may be historically incorrect. Secondly, the units of observation range from divisions to product lines to single brands within product lines. Thirdly, the database groups data from different products and markets, whereas FMA may be more or less pronounced between different products and markets.

Also, the timing of entry is measured imprecisely. The PIMS database relies on self-reporting of whether a firm was a pioneer or not and thus may be incorrect (Kerin, Varadarajan, & Peterson, 1992). Self-reported data may be inconsistent with reality for two reasons: firm managers may believe their firm was the first but are hampered by bounded rationality, or they may state their firm was a pioneer even if they know it was not due to the social identity advantage attributed to pioneering (Barnett, Feng, & Luo, 2013).

Some studies use rank order of entry while others use time lag. A rank order cannot give information of the effects of lead time, which has been shown to affect FMA in studies that do account for time lag in entry. Also, many studies treat pioneer-follower as a binary measure (a firm is either a pioneer or not), whereas other studies have shown that early followers have advantages over late followers as well (Jakopin & Klein, 2012).

Survivor bias is the problem of (also involuntarily) restricting samples to include only firms that have survived to a particular point in time (VanderWerf & Mahon, 1997). If early-moving firms that failed are not incorporated in the data only the surviving firms remain (i.e. the firms with the best performance). Due to survivor bias it will be more likely that support for FMA is found. Nevertheless the meta-analysis of VanderWerf & Mahon (1997) found no evidence that the impact of survivor bias is significant.

Market share is most often used to find evidence for FMA (VanderWerf & Mahon, 1997). There are some limitations to the use of market share as a performance measure. For one, the use of market share is disputed by some authors because market share is not a direct measure of profit. Most researchers use market share because figures are more easily available, and it does not require a firm-by-firm analysis of the income-expense structure.

Also, consider the hypothetical case of two firms entering the same market, the second entering one year after the first. If they exhibit identical sales growth relative to their time in the market, the firm that entered first will always have a higher market share even if their performance is essentially the same (Lieberman & Montgomery, 1988).
3.3.3 FMA in the long run: sustainability

Several studies have concluded that the effects of FMA are moderated by lead time (Lieberman & Montgomery, 1998) (Min, Kalwani, & Robinson, 2006) (Suarez & Lanzolla, 2007). The longer the first entrant enjoys a monopoly position, the stronger the FMA will be (Brown & Lattin, 1994). It is also widely believed FMA do eventually erode over time if competition is present (Kalyanaram, Robinson, & Urban, 1995) (Boulding & Christen, 2003) (Bijwaard, Janssen, & Maasland, 2008). This can happen gradually over a period of years or decades, or abruptly, as a discontinuous innovation comes along and redefines the technological regime.

Suarez and Lanzolla (2007) argue that FMA isolating mechanisms should only be investigated in the time period from first market entry by the pioneer, to the onset of market maturity. They define the onset of maturity as the time at which sales over time peak, which would the steepest point (the inflection point) on a cumulative sales versus time S-curve (Figure 6).

![Figure 6: The inflection point on the cumulative sales curve](image)

Important moderating factors in the sustainability of FMA are the pace of technological and market evolution (Suarez & Lanzolla, 2007) (Finney, Lueg, & Campbell, 2008) (Magnusson, Westjohn, & Boggs, 2009). According to Suarez & Lanzolla (2007), pioneers can more easily benefit from FMA if both the technology and the market evolve smoothly. From a technological perspective, it will be harder for followers to “leapfrog” the pioneer’s product with a clearly superior offering. Thus, with a slower pace of technological development, it is easier to compete on product variety rather than quality. It was shown that pioneers perform better in markets where variety is more important than quality (Bohlmann, Golder, & Mitra, 2002). From a market perspective, slow evolution provides followers little room to gain a foothold, especially for products where network externalities play a role (for more information on network externalities, see paragraph 3.4.3).

Conversely, FMA are more difficult to sustain if the pace of technological and market change is high (Suarez & Lanzolla, 2007) (Finney, Lueg, & Campbell, 2008). It increases the risk of knowledge inertia, technology obsolescence, uncertainty leads to higher risks, patenting is less effective, there is more reluctance to negotiate long-term contracts, and later entrants will be more likely to find market space where the incumbent is not yet present.

A first-mover advantage does not last indefinitely. Depending on several factors, it can be months, one year or ten years. Where exactly is the transition from FMA to long-term, sustainable competitive advantage? The answer to this question is complex and falls outside the scope of this research.
3.3.4 The position of FMA within the market entry process

The majority of researchers point out that entry timing alone does not guarantee higher market shares or higher profitability. Rather, it is one part of a wider set of considerations to be taken into account. Being the first to the market can help, but it never guarantees success. Rather, “the observed market share pattern is explained as much by other factors as by entry order” (Kerin, Varadarajan, & Peterson, 1992, p. 38). The view is shared by Lieberman & Montgomery (1998) who state that entry order effects are weaker than marketing mix effects. Urban et al. (1986) found that market positioning and advertising expenditures were more closely related to market share than entry order. Also, while de novo entry attempts are more frequent, de alio entry attempts are more often successful (Morris, 2009). Thus, FMA should be examined in the context of company strategy and marketplace variables.

Figure 7 shows a preliminary model by Zachary et al. (2015). The model, as the authors themselves acknowledge, is very general. There is no indication of whether the five questions must be answered in parallel or can be answered sequentially, or if there are differences in relative importance. Nonetheless the model is a good graphical representation of FMA being just one chapter of the whole book that is the entry process.

![Figure 7: Five contingencies of entry (Zachary, Gianiodis, Payne, & Markman, 2015)](image)

3.4 First mover advantage mechanisms

Three categories of first mover advantages were put forward by Lieberman and Montgomery (1988). This classification has since been used in many other papers on the subject (Suarez & Lanzolla, 2007). The categories are leadership in product and process technology, preemption of (scarce) assets, and development of buyer switching costs.

3.4.1 Learning curve advantages

Organizational learning is considered to be important in many industries (Spence, 1981). Innovations can be divided into two categories (Damanpour & Gopalakrishnan, 1998). Technical innovations involve products, services and production processes; they are directly related to the core activities of the firm. The second category, administrative innovations, involves the organizational structure and administrative processes; they are not directly related to the core activities but to the management of the firm.
Technological learning curve

The first-mover has a head start and can keep ahead on the technological learning curve versus competitors.

The standard learning curve models (Figure 8) specifies an increase in proficiency/efficiency over time. The economic learning curve model theorizes that per-unit production costs are reduced as output increases (Lieberman & Montgomery, 1988). Pioneering firms are further on the learning curves than later entrants and if they can keep ahead of competitors, they will continue to experience efficiency and cost advantages versus their competitors.

![Figure 8: The standard learning curve (left) and the economic learning curve (right)](image)

However, it is generally acknowledged that learning-based advantages are not always easily maintained as information spreads rapidly within most industries (Lieberman & Montgomery, 1988). This is especially true for codified knowledge. Tacit knowledge is much harder to define and imitate and is therefore considered to contribute to FMA more effectively (Kerin, Varadarajan, & Peterson, 1992). On the downside, tacitness can restrict the flow of information within a company. Martin & Salomon (2003) found that high levels of tacitness actually impede a firm’s ability to expand abroad. Even so, corporations were found to rely more on secrecy and lead time than patent protection for their competitive advantage (Cohen, Nelson, & Walsh, 2000).

Organizational innovation

The first-mover has a head start and can keep ahead on the organizational learning curve versus competitors.

Innovation in organizational and management structures, i.e. through investments in human capital, can increase efficiency, productivity, and creativity. Administrative innovation increases organisational efficiency and facilitates organizational learning (Subramanian & Nilakanta, 1996). Organizational innovation leads to better firm performance (Camisón & Villar-López, 2014). The pioneer can obtain a head start in incorporating new processes, organising dedicated teams or departments, forming strategic alliances, aiming for vertical integration, etc. Such changes in organizational structure, workforce or even company culture and capabilities can result in inimitable advantages and can therefore be more robust (sustainable) than advantages through physical resources (Kerin, Varadarajan, & Peterson, 1992).
Intellectual property rights and appropriability mechanisms

The first mover can use intellectual property rights to appropriate the returns on their innovation.

Another way in which technological leadership may be maintained is through forms of IPR (intellectual property rights). If the first mover can successfully patent key innovations it may deter new entrants. Other advantages of patenting are that patents can signal expertise (Arundel, 2001) and they can enhance the patent-holder’s negotiation position (Harabi, 1995). Between the patenting, copyright and trademark forms of IPR, patents are recognized as the strongest form (Tuppura et al, 2010).

However, patents do not always offer strong protection, they can be invented around (Harabi, 1995), or the rate of technological change is such that the patent becomes obsolete before it runs out. For these reasons, some researchers dismiss patents as one of the least important factors for FMA (Harabi, 1995) (Cohen et al, 2000). Empirical research found that a higher percentage of firms rated secrecy as more valuable than patenting (Arundel, 2001).

3.4.2 Preemption of (scarce) assets

Assets, or resources, come in many shapes and forms, i.e: financial, physical, legal, human, organizational, informational and relational (Magnusson, Westjohn, & Boggs, 2009). Many of them can be subject to contributing to FMA. A list of various assets as they appear in FMA literature and how they may be applicable to FMA is given here.

Preemptive investments

The first mover can deter competitor entry by being the first to organise its production capacity.

This FMA deals with factor inputs: land, labour and capital goods. Investments in production facilities strengthen a first mover’s position by enabling increased production and showing commitment to competitors. In addition the increased production may lead to reduced market prices of the product, which may be sustainable for the pioneer with a relative cost advantage but not for later entrants. In practice, however, these preemptive investments in equipment were not found to be very useful in deterring entry (Lieberman & Montgomery, 1988). Even so, through scale economies and moving further along the learning curve (streamlining production while competitors are still setting up production) the first mover can indeed attain cost advantages (Kerin, Varadarajan, & Peterson, 1992).

Physical resources

The first mover can pre-empt physical resources (i.e. raw materials, subcomponents).

If a firm creates an innovation, the resulting knowledge asymmetry can enable it to gather resources at a reduced cost. Certain material resources may be bought before competitors (imitators) require the same resource and the increased demand drives up the price. Additionally, the first mover may sign exclusive contracts with component or subsystem suppliers.

Note that this FMA deals with so-called secondary inputs: resources that are required to create a product that are converted in production. The primary inputs land, labour and capital goods enable the making of products (the conversion of secondary inputs to output) but are not consumed during the process like secondary inputs are.
Human resources

The first mover can pre-empt human resources (i.e. specifically trained personnel).

As for physical resources, a firm can preempt human resources to a certain extent. Employing quality personnel or attracting specifically schooled employees can prevent competitors from capturing human capital. However this advantage is more difficult to maintain given the fact that employees are not property and can move between firms (Lieberman & Montgomery, 1998).

Political resources

The first mover can get involved in political processes and initiate business-government relations sooner than later entrants.

Relationships with the government can be seen as a resource if it enables a firm to benefit from them (Shaffer, 1995) (Hillman, Keim, & Schuler, 2004) (Griffith & Harvey, 2004). Political resources can be used to operate corporate social responsibility and corporate political action (Mellahi, Frynas, Sun, & Siegel, 2016). Since access to key government officials and experience with the political process are rare and hard to imitate, they can be sources of competitive advantage (Boddewyn & Brewer, 1994).

Traditionally, rulemaking was a task of the government (or other regulating bodies) alone. In recent years, regulatory negotiations have been used to create new legislation. In regulatory negotiation an advisory committee of representatives from the government, companies, industry associations, interest groups, etc. cooperates to draft new legislation (Siegler, 1997) (Langbein & Kerwin, 2000). The body of work of drafting the regulations is performed by this advisory committee, while the regulating body steers the process, assesses the proposed regulation and retains the final word. In such a case of rulemaking, firms with high political resources and experience in the political game can better influence the process to their benefit than firms that lack these attributes.

The role of political resources within FMA has been empirically studied by Frynas et al. (2006). They state that firm performance is influenced by business-government relations and legislation. This is in large degree due to the fact that the capabilities of different firms to adhere to new legislation are very different; new legislation can alter the competitive positions of firms in the market. Firms may even support legislation that is detrimental to their own performance if competitors are even more adversely affected.

One way through which political resources can contribute to FMA is through reciprocity. Rather than a one-off quid pro quo, reciprocity is the building of a long-term, stable, cooperative relationship in which the involved parties both benefit. These relationships become stronger over time in a self-reinforcing loop as more investments, agreements, information sharing etc. occur (Ring & Van de Ven, 1994). Political resources were empirically shown to aid greatly in establishing entry barriers for followers, but another case showed that political resources can also be effectively used by late entrants to overcome other firms’ FMA (Frynas, Mellahi, & Pigman, 2006).

Spatial preemption

The first mover can be the first to occupy prime locations.

Depending on the product or service delivered, firms can benefit from being located in certain locations. Think of city centres for restaurants, shopping streets for clothes stores, airports and train stations for food vendors.
An often cited example is that of ATM machines (Dos Santos & Peffers, 1995) (Song, di Benedetto, & Zhao, 1999) (Varadajaran, Yadav, & Shankar, 2008). A pioneering firm can acquire such locations before their competitors.

The geographic coverage of a location determines how far customers are willing to travel to obtain the service. If the utility and cost of a service are low, customers are not likely to travel far to obtain it (e.g. hair dressers, pharmacists, gyms). On the other hand, a high-utility high-cost service (higher education, business consulting, a high-end store where race bikes are adjusted to individual riders) is more likely to draw customers from further away. Aside from distance, legislative or cultural barriers can also limit a location’s geographic coverage (Bitran & Lojo, 1993). The greater the geographic coverage of a location, the less important spatial preemption is as a mechanism for FMA.

**Market space**

*The first mover is free to define its own product differentiation and positioning in the market, and influences customer perceptions of the product.*

The products of various firms are characterized by their different attributes and characteristics. Customers perceive these differences, which results in firms’ positioning (differentiation) in the market. The most important product attributes as perceived by customers are termed key buying criteria. A positive net balance of positive and negative differentiations, especially in terms of key buying criteria, results in a competitive advantage (Kerin, Varadarajan, & Peterson, 1992). Pioneers can obtain a competitive advantage if they obtain a positive differentiation, and the attributes resulting in this positive differentiation are the result of capability gaps that cannot be imitated by competitors (Coyne, 1986).

Product (in)imitability depends on tacitness, complexity, specificity and the interconnectedness with the firm’s resources and skills (Bharadwaj, Varadarajan, & Fahy, 1993). The more complex a product and its accompanying processes, the harder it will be to imitate. Specificity refers to how specific the skills are that are needed for the new service. If they are general skills, applicable to this service offering but also to many others, it stands to reason other firms will possess these skills as well or can quickly gain them. If the skills required to provide a service are very specific to that service, it increases the inimitability of that service. Interconnectedness means how much the skills and resources required to offer the new service match those of the other existing, products of the firm. Interconnectedness increases inimitability if possible competitors lack complementary skills or resources that are possessed by the innovating firm.

Additionally, the first mover may to some extent influence which product attributes become key buying criteria. This is because the first mover can evolve to be recognized as the industry standard. If the first product on the market is satisfactory, it becomes the yardstick against which other entrants are measured (Schmalensee, 1982) (Carpenter & Nakamoto, 1989). In other words, the first successful product shapes consumer expectations and preferences.

Not all customers want or require the exact same product. As such, product differentiation is used by many firms to service as many customers as possible (within the boundaries of effectiveness and profitability of market segments). Pioneering firms can deter new entrants by preempting many market niches. The pioneering firm is free to focus on the most promising market segments first, leaving less attractive segments for competitors (Kerin, Varadarajan, & Peterson, 1992). In growing markets, incumbents can even enter new market niches before they become profitable (Lieberman & Montgomery, 1988).
Marketing cost asymmetries

The first mover can market its product without competition and can focus on customer retention. Originality is valued by customers.

The first mover, in the initial period of monopoly, can market its products without interference by competitors, whereas later entrants must market their products in a “cluttered” field. Later entrants that wish to overcome this asymmetry must invest more in their marketing effort. Later entrants must have a superior product, or invest more in advertising, in order to overcome the existing perceptions. The first mover can focus on customer retention, whereas the later entrant must try to create brand awareness and try to alter the existing consumer buying pattern (Kerin, Varadarajan, & Peterson, 1992). Kardes et al. (1993) found that, of all brands in a market, pioneer brands are more likely to be remembered and selected by clients. In addition, Tufano (1989, p. 235) states that “bankers [as the study covers financial products] believe that innovating signals their intangible and unique abilities better than advertising”, thereby making pioneering a good marketing tool in itself.

Barnett et al. (2013) argue that first movers have an advantage by being the first in a market through the social mechanism of market memory. Customers value originality and authenticity, and thus pioneering is beneficial for a firm’s social identity. A firm’s social identity and its claims of authenticity in a market are stronger if the firm focuses on that particular market as opposed to firms simultaneously operating in a variety of different markets and industries (Barnett, Feng, & Luo, 2013). In the same manner, a de novo entrant that is established within the market, and matures with the market, is more strongly associated with that market than a de alio entrant would be.

3.4.3 Customer switching costs

Just as technology developers experience sunk costs when developing a new product, so can the buyers of a new product experience similar sunk costs. These costs can be both monetary and non-monetary, as will be explained later. High customer switching costs can make customers reluctant to switch to alternative products, resulting in increased customer retention. While this also causes customer retention to be easier for followers, the first mover can bind customers before competitors enter the market whereas later entrants must compete for customers.

Contractual switching cost

The first mover has the greatest chance of contractually binding customers while there are no alternatives on the market.

The most direct form how first movers can bind customers is through contractual switching costs. This can include, as the name suggests, signed contracts between customer and supplier. But also less strict (and more often used) mechanisms such as bonus point systems for every purchase amount (airline frequent flyer programs, supermarket actions with savings stamps, repeat-purchase discounts (Klemperer, 1987)) can be counted as contractual switching costs.
Investment cost by customers

Customers may be reluctant to switch from a first mover’s product due to sunk costs.

Some products and services require effort by the customer before they can be effectively consumed. Examples are employee training, qualifying new suppliers, costs of supplementary required products or other preparations. If such preparations are specific to a product, it forms a barrier for switching to alternative products. This mechanism is highly similar to the sunk cost concept: the human tendency to take into account previous investments when making decisions about future investments (Haller & Schwabe, 2014).

Supplier-specific learning

Customers become familiar with the product they are using, which may deter them from switching to alternatives.

Customers that own a product or have experienced a service of a certain supplier learn to effectively use it. The efficiency with which they use the product may improve with extended use. For example, employees may become more proficient with software programs, managing the settings on a manufacturing robot, the turning circle and driving characteristics of a forklift, etc. As the buyer familiarizes itself with the product of a certain supplier, the increased proficiency with the product can be seen as a sunk cost (Åstebro, 2004). This may deter the buyer from switching to the product of another supplier, where such proficiencies have to be learned anew. The pioneer has the highest chance to ensnare customers this way.

Buyer choice under uncertainty

When faced with a buying decision, customers may stick to the product they already know or copy the decision of other users.

Since buyers only fully experience the products they own or the services they have used, there is an information asymmetry between the products they have and have not used. If the first product that consumers use works satisfactory, consumers may stick with that product even in the presence of similar competing products (Schmalensee, 1982). Moreover, new customers that have not yet experienced a brand may free-ride on the experience of other customers (in other words, trust in their judgment) and select the leading brand (Rumelt, Theory, strategy, and entrepreneurship, 2005). These mechanisms are mainly true for low-cost products; high-cost products justify search and selection costs.

Network externalities

Certain products increase in value as the number of adopters increases. A self-reinforcing spiral is strongest for the first mover.

There are products that increase in value as the number of users increases (Katz & Shapiro, 1985). This occurs through the mechanisms of interaction and complementary goods and services. For the interaction mechanism, the telephone is the classic example. The more people have a telephone, the more utility is gained from owning one’s own telephone. Other communication products such as Facebook, LinkedIn also increase in value as more people use it. People that enjoy playing online multiplayer games may opt for the gaming console that has the largest community. A CAD software programs may also offer increased value to a company
if many other companies use it: information and file exchange between suppliers and customers is easier if all use the same software or the files are compatible.

Complementary products are products that provide extra value for the core product (Katz & Shapiro, 1994). There are many examples of products that are intimately related to each other: VHS players and tapes, music players and earphones, bicycles and tire pumps, chargers for electrical products, etc. The value of the core product increases with additional complementary products, and in return complementary products get produced for those products with large market shares.

Network externalities increase the value of the base product. Since network externalities can lead to self-reinforcing cycles, this can be a source of first mover advantage. Later entrants must choose to either make their product compatible with the existing complementary products, or compete with not only the product but the product-complementary products system that is in place.

3.5 First mover disadvantages

Being a first mover has certain disadvantages as well: Lieberman and Montgomery (1988) already mentioned first mover disadvantages in their first paper. As it is important for pioneering firms to realize the mechanisms through which these disadvantages can occur, they will be explained here. First mover disadvantages can be seen, by definition, as advantages for fast followers and late movers.

3.5.1 Free-rider effects

Innovating is costly, and these costs are necessarily borne by the pioneer. However, as information spreads quickly within most industries, later entrants can imitate a pioneer’s product at much lower cost. Mansfield et al. (1981) state that firms can imitate an innovation at 65% of the costs of the innovator. Banks reports that 50% to 75% less investment is needed to imitate an innovation (Tufano, 1989).

It is argued that follower firms can benefit most from free-rider effects if the innovation is close to their area of expertise (Teece, 1986). For example, a car manufacturer that generates an innovation that allows bicycle components to be made lighter could bring a racing bike featuring that innovation to the market. But once traditional racing bike firms copy the innovation, they will have the benefit of previous experience in the market, established brand name, existing distribution channels, etc. As such, it will be exceedingly hard for the new entrant to defend his initial advantage against followers.

3.5.2 Resolution of technological or market uncertainty

The pioneer firm usually faces great uncertainty about customer needs and preferences. It was explained previously that the first mover can, to some extent, shape these needs and preferences. But in markets where this mechanism is not efficient, the first mover faces a greater risk of misalignment between its product characteristics and customer needs and preferences. If such a situation occurs, later entrants can easily capitalize on that mismatch and offer superior products.
3.5.3 Shift in technology or customer needs

Innovation is an ongoing process. New technologies continue to be developed and replace older technologies. This concept of the new continuously replacing the old is called creative destruction (Schumpeter, 1942). It is one of the reasons that a first mover advantage cannot last: the first mover must always be aware that new technologies will come about that replace the existing technologies. This is generally called the vintage effect: firms that enter a market later can use the latest (better, cheaper) technologies than pioneers (Bohlmann, Golder, & Mitra, 2002). Likewise, a firm can achieve an initial successful alignment with the industry environment. But in dynamic industries, this alignment is increasingly reduced over time (Bayus & Agarwal, 2007). Finally, the needs of the customer also change over time. Unless the first mover is able to respond adequately to these changes, followers may capitalize on these changes and fill the newly formed market niches (Lieberman & Montgomery, 1988). The inability of dominant or first mover firms to accommodate technological or market changes is called incumbent inertia (see next paragraph).

3.5.4 Incumbent inertia

Lieberman & Montgomery (1988) identify incumbent inertia as a first mover disadvantage, and multiple authors (Golder & Tellis, 1993) (Finney, Lueg, & Campbell, 2008) (Gómez-Villanueva & Ramírez-Solís, 2013) follow their example. Yet it is debatable whether incumbent inertia is actually specifically a first mover disadvantage. Incumbent inertia is a detractor to firm innovativeness and flexibility for any firm at any time; the development of incumbent inertia is not exclusively related to pioneers. Nevertheless, incumbent inertia is one of the mechanisms that can turn a pioneers’ initial advantage into a later disadvantage. So even though incumbent inertia may not be specifically more relevant for first movers than for later entrants, it is not less relevant either.

The stronger the incumbent inertia, the harder it is for the incumbent to adapt to change. Often, inertia is the result of the quest for efficiency (Lieberman & Montgomery, 1988). Once a product is introduced to the market and sales are growing, firms will seek to optimize their income through cost reductions. This is often achieved through efficient large-scale production, structured processes, and a rigid organization, which leads to reduced flexibility. While cost optimization through these mechanisms is rational behaviour, if a firm focuses too strongly on exploitation it may become incapable of adequately responding to change when change occurs. This balance of optimizing the firm’s activities that provides its incomes today, versus innovating and looking for new sources of income for the future, is called the exploitation-exploration paradox (Leonard-Barton, 1992). Indeed, Mueller et al. (2012) found an inverted U-shape relation for firm performance versus pioneering orientation (i.e. exploration orientation). Firms at medium/medium-high levels of pioneering orientation performed better than firms with a very high pioneering orientation.

It was also found that strategic learning negatively moderates the relation between pioneering orientation and performance (Mueller, Titus, Covin, & Slevin, 2012). This can be explained by competency traps, also known as core rigidities (Siggelkow & Levinthal, 2005), which lead to inertia. Three types of competency traps are described by Ahuja & Lampert (2001). The familiarity trap is the tendency for firms to stick to the familiar versus the unfamiliar. The maturity trap is the tendency to stick to mature (and therefore usually better-performing) versus new technologies. The propinquity trap is to look for solutions close to existing solutions (i.e. adaptations, variations), rather than finding truly new solutions. As technological progress occurs and markets change, it can be understood that the same strategic actions may result in different outcomes in different points in time: this is when a firm’s reliance on past experience and strategic learning can inhibit performance. Higher levels of strategic learning increase the likelihood that firms rely on previously gathered knowledge and are caught in competency traps.
It is also possible that incumbent firms underestimate the viability of new technologies. This was shown in empirical several cases (Cooper & Schendel, 1976). But even if managers of incumbent firms recognize the threat of new innovations, sunk costs in the present technology, fixed assets, and reluctance to cannibalize on the sales of present technology can lead to inadequate response.

Such theories seem to suggest that firms are better off not learning at all. However, as explained in paragraph 3.4.1, learning is also one the mechanisms through which FMA are obtained and can be extended. Learning enables cost optimization, increased fit with customer preferences, product improvement, etc. Learning is valuable for as long as that which is learned is applicable. That is, for as long as the circumstances under which the learning has occurred are the same or sufficiently similar. When changes occur that make the previously learned knowledge incompatible with reality, reliance on that previously learned knowledge becomes a detrimental factor. Given all these considerations the following conclusion can be reached: firms should learn and use that learned knowledge to optimize their operations, but also reflect on the legitimacy of the learned knowledge over time, and be prepared to discard old knowledge and start learning anew within a different paradigm if the situation requires it.

### 3.6 Contingencies and moderating factors

In paragraph 3.3.4 it was explained that first-mover advantage is not as straightforward as “being the first in the market will lead to success”. This is reflected in FMA literature. Zachary et al. (2015) found that 50 out of the 105 studies they analysed find support for so-called contingency effects.

A contingency, according to the dictionary, is “the dependence on chance or on the fulfilment of a condition”. In FMA literature, contingencies are conditions or characteristics that influence the entry timing-profitability relationship. In other words, contingencies act as moderating factors on relationships (Kerin, Varadarajan, & Peterson, 1992) and the two terms are used interchangeably. The different contingencies can make the overall first-mover advantage stronger or weaker.

For example, how well a firm can capitalize on first mover advantages depends on the fit between the necessary and possessed resources of a firm to capitalize on a market opportunity and the fit between the necessary and possessed resources of a firm to capitalize on mechanisms that create FMA (Kerin, Varadarajan, & Peterson, 1992). In simpler words: a firm must have both a good product and the means to put FMA into effect. The same idea is put forward, in different words, by Finney et al. (2008): they propose that firms that combine high skills in 1) acquiring resources, 2) bundling the resources into products, 3) positioning the products on the market, and 4) maintaining and protecting those resources, are more likely to obtain and defend FMA.

The above contingency was considered to act on FMA as a whole, i.e. on the general, all-encompassing advantage of being first, the total effect. This is the approach taken by some other authors as well (Murthi, Srinivasan, & Kalyanaram, 1996) (Min, Kalwani, & Robinson, 2006) (Suarez & Lanzolla, 2007) and is shown in Figure 9. However, it shows little in the way of how these different contingencies influence the FMA advantage.

![Figure 9: Moderating factors acting on the overall effect](image-url)
A different approach is shown in the conceptual model of Kerin et al. (1992). In their paper, they introduce an alternative, four-way categorization of the FMA mechanisms to the three-way categorization of Lieberman & Montgomery (1988). Kerin et al. (1992) divide the FMA mechanisms in economic, pre-emption, technological and behavioural factors. Their model depicts a number of contingencies that act upon the different categories of FMA (the individual FMA mechanisms are not pictured). Together, the different subcomponents make up the totality of the FMA advantage.

While more detailed than the previous example, and complex at first glance, their model is still somewhat general. For example, “product characteristics” are depicted to influence the pre-emption factors, but “product characteristics” is still a broad term. In addition, it is not clear specifically which FMA mechanisms that are categorized in pre-emption factors are affected by product characteristics. And if it does affect all of the mechanisms categorized there, does it affect all of them equally strongly?

FMA is a highly complex phenomenon (Lee, Song, & Yang, 2015). In an attempt to capture all its facets, an even more detailed conceptual model will be in this study. The individual FMA mechanisms will be treated separately (Figure 10). This approach is the most accurate, but it does pose the question of which contingencies affect which FMA mechanisms, specifically for B2B service products. This is a question that requires an extensive answer, which will be the content of Chapter 5.

Figure 10: Moderating factors acting on individual FMA mechanisms. This example is simplified: multiple contingencies can act on one mechanism, and one contingency can act on multiple mechanisms.
Chapter summary

- FMA are generally considered to exist, can apply to both true pioneers and fast followers versus later entrants depending on circumstances, and are considered to gradually diminish over time.

- FMA are not guaranteed to early movers. Nor is it the only factor that influences the entry process; advertising expenditures and the marketing mix are just as important in determining market shares.

- There are 15 FMA mechanisms in 3 categories:
  - Learning curve advantages: technological learning curve, organizational innovation, IPR and appropriability mechanisms.
  - Preemption of assets: preemptive investments, physical resources, human resources, political resources, spatial preemption, market space, marketing cost asymmetries.
  - Customer switching costs: contractual switching cost, investment cost by customers, supplier-specific learning, buyer choice under uncertainty, network externalities.

- First mover disadvantages (and conversely late mover advantages) are free-rider effects, resolution of technological uncertainty, shift in technology or customer needs and incumbent inertia.

- FMA mechanisms are influenced by contingencies: these moderating factors influence the strength and applicability of the various FMA mechanisms. The most precise way of modelling FMA is to identify which contingencies act on which individual FMA mechanisms.
4 Marketing of B2B services

This chapter serves to establish the differences between goods and service products, and the differences between business-to-consumer (B2C) and business-to-business (B2B) marketing. It is necessary to understand these differences in order to see how FMA may change between these environments. The first paragraph will contrast services against goods. The second paragraph discusses what academic research has been done on the subject. The third paragraph contrasts B2B against B2C marketing, with the fourth paragraph again discussing what academic research has been performed.

4.1 Characteristics of services

First let us clearly define what is meant by service products and what is meant by goods/physical products. Throughout this paper, by the term service will be meant a service as an end product unless stated otherwise. In other words, what is not meant is “customer service”. This distinction is important as customer service is not an end product in itself; it is only an additional means to achieve the sale of an end product, be it a physical or a service end product.

Often services are necessarily accompanied by goods or vice versa. This can cause distinguishing between services and goods to be somewhat of a grey area. Having a new kitchen installed by professionals, or attending a training course with supplementary training manuals, are both examples of this. Many end products contain both service and goods elements (Akehurst, 2008), and as a result there is a continuum with “pure goods” at one end and “pure services” at the other (Jobber, 1995). For a product to be qualified as a service in this research, it should be clear that the main element of the end product consists of services (identifiable by, amongst other things, the later described characteristics of intangibility, perishability, inseparability and heterogeneity). Of the examples, the kitchen would be classified as a product. One buys the kitchen itself, the installation is only a temporary service that is required for the exploitation of the physical product. A training course would be classified as a service, as the physical training manuals are only supportive tools for lectures or workshops, not the end products. Figure 11 shows some examples. Note that some services, such as a restaurant dinner, are even more difficult to pin down than others. In this case, it would really depend on the type of restaurant. In a fine-dining restaurant the host, the waiters and the atmosphere are central to the customer experience, whereas in a self-order fast-food restaurant customers will be more alert to having a good food/price ratio. As the main value proposition is different, the first example would lean towards the services side and the second toward the goods side of the spectrum.

Figure 11: The goods-services continuum with several examples.

A number of marketing principles apply for both physical and service products (i.e. the four P’s of product, price, place and promotion, having a unique selling proposition, market segmentation). Some services rely on repeat purchases (Libai, Muller, & Peres, 2009) (Peres, Muller, & Mahajan, 2010), just as some consumable products do. But services and physical products also have some very different characteristics. Therefore, not all marketing principles should be expected to be applicable in exactly the same way between the two categories.
Likewise, the differences between physical products and service products can have an impact on the applicability of some FMA mechanisms. To identify how marketing and FMA principles and mechanisms are affected, the differences between physical and service products will be explored. In marketing literature, the most important of these differences are often cited as intangibility, inseparability, heterogeneity and perishability (Jobber, 1995) (Hoffman, 2000) (Baron & Harris, 2003).

4.1.1 Intangibility

Intangibility implies that services cannot be touched, seen, and handled. The practical implication of this is that customers cannot fully evaluate the service before purchasing it. Physical products are often evaluated before purchase: there can be factual, technical specifications which can be measured against requirements and competitive products; this is objective evaluation. On the other hand products may be seen, handled, tested (i.e. fitting clothes, test driving a car) to get a “feel” for a product; which is subjective evaluation. The latter is more important for consumer products.

In contrast, services cannot be easily compared to competitive or alternate offerings, nor measured in advance (Sowter, 2000). One strategy for removing customer uncertainty due to intangibility is to “materialize” the service: to give tangible clues about the service. Examples are a ticked-off checklist of performed tasks and neatly folded towels in a hotel room to show they have been washed. Another strategy to remove customer uncertainty is to inform potential new customers of the (positive) experiences of prior customers. This can be done by asking prior customers to write testimonials or to offer descriptive case studies of past projects (Jobber, 1995).

Intangibility often causes services to be easily imitable (Bitran & Lojo, 1993). Remember that the cost of imitation can be as low as half the cost of innovation (paragraph 3.5.1) and the time of imitation was less than a year for a number of financial products (Tufano, 1989). Services are harder to imitate if they are highly dependent on the infrastructure of the company (Bitran & Lojo, 1993) or a firm’s inimitable resources (Finney, Lueg, & Campbell, 2008).

Another implication of intangibility is that there is no transfer of ownership. There may be some supplementary physical goods involved in the consumption of the service, some physical goods may even do transfer to a different owner. But, remembering the goods-services continuum, the main value creating propositions of services remain intangible and cause services to be consumed, not possessed (Lovelock, 1984).

4.1.2 Inseparability

Inseparability refers to the fact that services are often produced and consumed simultaneously. Depending on the nature of the service, this means that the service provider and the customer are both present at the same time to operate the service, and that the service provider and the customer have to cooperate to achieve maximum value. Those services where face-to-face contact is a requirement for the operation can face some issues as explained here.

Travel time and cost for customers and service providers means that service providers can be geographically limited (Bitran & Lojo, 1993). Likewise, in regions with a higher density of different cultures and legislation such as in Western Europe, service providers may be bounded by those constraints (Bitran & Lojo, 1993). The inclination for service providers or customers to travel in order to establish face-to-face contact arguably increases if the value of the service increases; people rarely go to the hairdresser ten kilometres away, but are more likely to travel thirty kilometres to follow a language course.
The customer evaluation of the process is strongly dependent on the conduct of the service provider employees (Lovelock, 1984) (Jobber, 1995). An identical service, but provided through different employees, may earn different levels of customer satisfaction. Therefore the selection, training and rewarding of front-line staff is deemed very important (Jobber, 1995).

This cooperation between service provider and customer also makes quality control more difficult. Faulty physical goods from a production line can be intercepted before they reach customers. Even though some faulty products can slip through, the customer is not aware of most of the quality issues that occur within the manufacturing plant. In contrast, a lot of the quality control of services has to be performed ad hoc during the process. And when a quality control issue does occur, customers are likely to notice as they are part of the process themselves (Baron & Harris, 2003).

4.1.3 Heterogeneity

Inseparability results in interactive provider-customer relations. Another consequence of these interactive relations is a high variability in service processes. In many services, a large human component introduces inconsistency and irregularity to a higher degree than computers or machines would. As with inseparability, heterogeneity means that quality control is harder to achieve (Bitran & Lojo, 1993) (Jobber, 1995).

Baron & Harris (2003, p. 20) go so far as to state “no two service provisions are exactly the same, whatever the attempts to standardize them”. This, however, is a bit too strong an argument. The consistency of services depends on how much the service is people-based versus equipment-based. For example, all ATM’s service each customer uniformly, whereas human tellers not only treat each customer differently, but also differ among themselves (i.e. personality and skill set) (Lovelock, 1984).

Standardisation of services, then, can be achieved to a certain extent by reducing or eliminating the human component through automation. Of course, this cannot be done for all services. For those services where human interaction cannot be eliminated, efforts for standardisation must be made through the quality of the employees and standardizing their work processes. Just as for the matter of inseparability mentioned in the previous paragraph, the matter of heterogeneity can be addressed through careful selection, training and rewarding of front-line staff (Jobber, 1995).

4.1.4 Perishability

Physical products can be stored, and fluctuations in demand can be accommodated through stockpiling. The stockpile can act as a buffer between the regular output and irregular demand, so products can (temporarily) be sold at a lower or at a higher rate than they are produced. A service cannot be stored, and consequently when the rate of sale is lower than the rate of possible production, the excess production capacity implies a loss for the firm (i.e. an empty seat on an aircraft). Neither can a higher rate of sale than rate of production be realized (two passengers in one aircraft seat). Careful planning is required to counterbalance supply and demand throughout time (Lovelock, 1984). Depending on the service, some providers have the option of smoothing supply by offering price incentives in off-peak periods (Bitran & Lojo, 1993).

Another strategy for firms to deal with perishability is to assemble a portfolio of larger projects and smaller projects, where the smaller projects can be used to fill gaps in the schedules of the larger projects (Sowter, 2000). Whether this strategy is applicable depends on the nature of the services provided. Another strategy may be to increase the flexibility of the available work force and production through temporary contracts and outsourcing.
4.2 Research on FMA for service products

Theoretical reasoning may lead one to believe that FMA cannot occur for services, or at least not as strong as they do for manufactured products (easy imitability, short lead times, limited/no patenting possible). Even so, empirical evidence shows that service firms do innovate and that they do enjoy first mover advantages (Posselt & Berger, 2007). Therefore, many authors have argued that FMA for service products do indeed exist, contrary to what might have been expected at first glance (Tufano, 1989) (Makadok, 1998) (López & Roberts, 2002) (Varadajaran, Yadav, & Shankar, 2008) (Usero & Fernández, 2009).

Song et al. (1999) investigated the perceptions of managers in manufacturing and service firms. They conclude that managers in manufacturing firms do perceive FMA to have a much stronger effect on performance than service managers. Service managers mainly perceive the effect of FMA to be higher market shares, not necessarily higher profits. Since this study does not directly measure the effects of FMA but the managerial perceptions of it, there may be a difference between the outcomes of this study and reality. However, Song et al. state that their results are “likely to reflect reality, since managers form perceptions based on what they observe or experience” (Song, di Benedetto, & Zhao, 1999, p. 832).

Usero & Fernández (2009), studying the mobile telephony market, found that followers were not able to overcome pioneers through market actions. On the other hand, non-market actions of followers (lawsuits, filing complaints, public accusations against rivals) were successful in eroding first mover advantages. Another study in the mobile telephony market also found support for FMA (Jakopin & Klein, 2012). Additionally, they state that firms that operated in the traditional telephone market had more market share and better financial operating margins.

Makadok (1998) studied the money market mutual fund industry (MMMF). This industry was specifically selected due to the ease of entry and product imitation. Even so, the results supported the existence of FMA. Profits were eroded the more entrants entered the market, but it was found that “market share advantages are moderately sustainable and price advantages are highly sustainable” (Makadok, 1998, p. 692). Thus, FMA can occur even in those industries where the product can be easily imitated. One of the possible reasons mentioned to support this, is that there are key resources that are not easily imitated. In the case of the MMMF, the inimitable key resource was the existing customer base.

Likewise, Tufano (1989) and López & Roberts (2002) also find empirical evidence for FMA in financial services. Tufano concluded that pioneers do not necessarily enjoy quality (and profit margin) advantages, but they do enjoy distinct quantity (market share) advantages. This appears to be consistent with the managerial perceptions on FMA in service firms (Song, di Benedetto, & Zhao, 1999). Pioneering banks do not enjoy a monopoly period where they can charge higher prices, as most innovations were copied by competitors within one year. Rather, innovators reduce profit margins or underprice their new products to amass market share.

The profit margin of innovators was expected to be maintained through a lower cost structure. This was consistent with the data but not directly tested (Tufano, 1989). López & Roberts (2002) noted that their data did not support advantages for the pioneer per se, but for early movers. In other words, they support the time lag mechanism over the rank order mechanism (paragraph 3.3.2). Their data also shows how an early entrant, who offered only the studied product, was overcome by a late entrant, a bank, offering the studied product amongst a variety of other services (López & Roberts, 2002). This is a good example of the notion that FMA in and of themselves are not capable of sustaining a competitive advantage, but are part of a bigger picture. In this case, it was the superior product portfolio of the late entrant that allowed it to overcome the FMA of the early entrant.

Varadajaran et al. (2008) studied the difference of FMA in internet market environment (IME) versus the physical market environment (PME). They proposed that network externalities are more important in the IME,
and even more so for information products than physical products. Also, the IME enables firms to gather much data on their customers. This can be used to personalize and customize the product offering and the interactive experience, thereby creating buyer switching costs. Additionally, such data can be used to gather first-hand feedback on customer behaviour and preferences, thus helping the firm to improve and diversify the product offering. To keep ahead of the competition through diversification and quality improvements is one of the most effective strategies for pioneering firms (De Brentani, 1989).

In services, the formal appropriability measures (patenting, copyrights and trademarks) can be more difficult to use (Djellal & Gallouj, 2001) (Chang, Linton, & Chen, 2012). The best way of defending pioneer advantage in the service industry is brand image, followed by secrecy and integration with clients (Djellal & Gallouj, 2001), the latter pointing to the switching cost category of FMA. Even so, according to the data by Djellal & Gallouj (2001) only brand image was viewed as an effective FMA mechanism by more firms than those who saw it as ineffective, and then only by 2%. Generally, the data was not very optimistic on the capabilities of service firms to protect their innovations.

Nevertheless many authors have done research into brand image/brand equity, and the amount of research done does imply that brand equity can be of significant importance (Aaker, 1996) (Keller & Lehmann, 2006). For example, a search in Scopus using the terms “brand image” OR “brand equity”, listing hits from 2005 onwards in social sciences and humanities, produced over 2200 search results. Overall, it is argued that service quality leads to increased customer satisfaction (Brady, Cronin, & Brand, 2002), which in turn leads to customer loyalty (Caruana, 2002). Likewise, increasing brand equity results in increasing brand loyalty (Lassar, Mittal, & Sharma, 1995), and lends credibility to a firm’s products (Erdem & Swait, 1998). While for physical goods the product is the primary brand, for services the company is the primary brand (Berry, 2000), and branding is as important for service organisations as it is for manufacturing organisations (Berry, 2000) (Brodie, Whittome, & Brush, 2009).

4.3 Characteristics of B2B marketing

Firms can sell products either to consumers (business-to-consumer, B2C), or to other firms (business to-business, B2B). Given the different characteristics of individuals and firms, business-to-business marketing has some differences with consumers marketing. Additionally, B2B services tend to be more specialized and technology driven than consumer services (Gounaris, 2005). The following paragraphs will address several important ways in which B2B marketing was found to differ from B2C marketing.

4.3.1 Demand market structure

The structure of the demand market is an important factor in B2B marketing (Michel, Naudé, Salle, & Valla, 2003). It is described as the individual size and number of customers that a supplier is serving. When there are many potential customers (dispersed customer base), the marketing strategy is the most, but not completely, like consumer goods marketing. Such a market can be segmented, and different product offerings for each segment can be developed. The firm may choose to direct more attention to certain market segments.

On the other hand, if there are few potential customers (concentrated customer base), the firm has little possibility of choosing between customers. Here, it is important to establish and maintain more extensive relationships with customers. The product offering can be tailored more to each customers’ situation. Another form is that of one-off, single projects. Often, these are very large projects in which the supplier and customer (and maybe more actors besides) cooperate in order to set the details of each actor’s role in the project, the deliverables, responsibilities, deadlines etc.
Demand in B2B markets is often a derived demand (Hutt & Speh, 2000): the demand for a product depends on the demand for other products that are linked to the first product. The demand for dishwasher tablets increases the more people use dishwashers, for example, and a financial consultant can gain more work if its client company grows over time.

4.3.2 Supplier-customer relations

In B2C marketing, the contact between the firm and the consumer is often restricted to the moment of purchase. In B2B marketing, there are durable links (ongoing relationships) between the supplier and the customer. In more concentrated customer bases, there will be a higher degree of interaction. It was found that satisfaction with the process was just as important as satisfaction with the product for business customers (Tanner, 1996). Securing repeat purchases from existing customers yields more profits than securing new customers (Doney, Barry, & Abratt, 2007).

The supplier-customer relations in B2B marketing can be characterized by active participation of both partners, reciprocal investments and stability of the relationship through interdependence (Michel, Naudé, Salle, & Valla, 2003). Regarding services in B2B environments, the notion of co-creation has emerged (Ordanini & Pasini, 2008) (Zhang & Chen, 2008), where value is not so much created within firm A and sold to firm B, but rather is created by firm A and B jointly.

Other characteristics of these inter-firm relations are complexity, symmetry and informality (Snehota & Håkansson, 1995). Complexity refers to the fact that multiple employees on each side are involved, and the scope of established relationships is often not constrained to a single product or service. Symmetry refers to the fact that both partners, being firms, have technical, human, financial and information resources. In some cases, the buyer has more knowledge or resources than the supplier. This is different from businesses selling to consumers, where the firm will always have more resources than the individual. Lastly, informality refers to the fact that informal bonding is more often relied upon than writing contracts.

Apart from the dyadic supplier-customer relations, the network concept is also important (Håkansson & Snehota, 1989). It states that, within an industry, actors are all interconnected through a complex network and "relationships develop that link the resources and activities of one party with those of another" (Håkansson & Snehota, 1989, p. 260). If the relation between two actors changes, it will affect other relations within the network (Håkansson & Ford, 2002).

Figure 12: In any form of network, if the relation between A and B changes, it will affect the other relations as well.
The main propositions of the network model are summarized as follows (Håkansson & Snehota, 1989, p. 192):

1) **Business organizations often operate in a context in which their behaviour is conditioned by a limited number of counterparts, each of which is unique and engaged in pursuing its own goals.**

2) **In relation to these entities, an organization engages in continuous interactions that constitute a framework for exchange processes. Relationships make it possible to access and exploit the resources of other parties and to link the parties’ activities together.**

3) **The distinctive capabilities of an organization are developed through its interactions in the relationships that it maintains with other parties. The identity of the organization is thus created through relations with others.**

4) **Since the other parties to the interaction also operate under similar conditions, an organization’s performance is conditioned by the totality of the network as a context, i.e. even by interdependencies among third parties.**

### 4.3.3 Purchasing decision

The purchase decisions of customers are often based on rational considerations as well as emotions (Scotter, 2016). Firms generally aim to base their purchase decisions as much as possible on objective information and knowledge. In fact, exactly how firms purchase is of such importance that it is quite a large area of research: that of organizational buying behaviour (Johnston & Lewin, 1996) (Sheth, 1996). The structure of consumer and organizational buying behaviour is similar in broad terms, i.e. need identification, finding and weighing alternatives, choice, use/implementation. But in organizational buying, the amounts of people involved and information processed are much greater. Organizational buying behaviour is complex; it is a multi-phase, multi-person, multi-department, multi-objective process (Johnston & Lewin, 1996). The fact that businesses aim to make their decisions as objectively as possible has led to the belief that brand equity in B2B marketing is not as important as it is for B2C marketing. However, research has shown that brand equity can indeed be of significant importance in B2B marketing (Lynch & de Chernatony, 2004) (Webster & Keller, 2004) (Kotler & Pfoertsch, 2004) (Leek & Christodoulides, 2011). For organizational buyers, the emphasis lies more on the selling organization as a whole rather than on its individual brands (Kuhn, Alpert, & Pope, 2008).

### 4.3.4 Knowledge management

Firms have access to large amounts of information (Michel, Naudé, Salle, & Valla, 2003). Knowledge has been viewed as a major resource for companies and a principle source of value creation and sustainable competitive advantage (Maryam & Leidner, 2001), and much research has been performed on knowledge management and knowledge management systems (Easterby-Smith & Lyles, 2011). Marketing information is one form of knowledge. It can be, for example, information on market and customer dynamics, market structure, competition, competitive position of the company and sales, distribution and promotion monitoring (Michel, Naudé, Salle, & Valla, 2003).

Recall the previously discussed extensive use of information in organizational purchasing and the network model of Håkansson & Snehota (1989); these substantiate the importance of marketing information. In the network model, changes in the operations of one actor can influence the relations and operations of other actors upstream, downstream and parallel of that actor, and thus may influence the whole dynamic of the market. In such cases, anticipating the effects of one’s own actions and being informed of the actions of others can be a useful advantage.
4.4 Research on FMA in B2B environments

Some early studies using the PIMS database differentiate between consumer goods and industrial goods markets, and have found evidence for FMA in industrial goods markets (Robinson, 1988) (Miller, Gartner, & Wilson, 1989) (Parry & Bass, 1990). Aside from these few studies, the effects of B2B marketing on the existence of FMA appears to be a very scarcely researched topic.

A Scopus search on “B2B OR business-to-business” AND “first mover* OR early OR pioneer* (both in Title, Abstract, Keywords) gave 39 hits. Most of the search results were focused specifically on e-commerce, e.g. (Legner, 2008) (Rosenzweig, Laseter, & Roth, 2011) (Hertwig, 2012). No support was found for FMA in B2B e-commerce (Rosenbloom, 2002) (Hidding & Williams, 2003). However, based on the conclusions of many other articles cited in this thesis, this is more likely attributed to the “e-commerce” than to the “B2B” characteristic.

The only paper to touch upon first mover advantages in B2B markets not related to e-commerce focused on internationalization activities. Cassia & Magno (2015) reported they found empirical evidence for FMA when B2B firms enter emerging economies, but they do need to create their own sales networks. This corresponds with the network concept of paragraph 4.3.2.

Recall that the organizational purchasing process is extensive, and aimed to be as objective as possible. This might suggest that the “buyer choice under uncertainty” mechanism holds up for consumer products but not for B2B products. However, there is speculation that “the extreme levels of heterogeneity that characterize high technology markets may actually discourage buyers from engaging in search activity” (Weiss & Heide, 1993, p. 229), and it may actually be homogeneity that stimulates search effort, as it is harder to distinguish between the different products.

Al-Kwifti, Ahmed, & Yammout (2014) examined brand switching in high-tech B2B markets. While not directly focused on FMA, their results may be of interest here. They state that high-technology products have an increased switching cost for users, due to the information intensity, ambiguity and complexity. Additionally, buyers put less effort into the search process in the face of high switching costs (Weiss & Heide, 1993). The higher switching cost and accompanying discouragement for buyers to search for alternatives suggest an increased possibility for FMA.

Chapter summary

- Physical and service products are placed in a spectrum; services may require support by physical elements, and physical products may be accompanied by connected services.

- The key characteristics of services are intangibility, inseparability, heterogeneity and perishability. These influence how services are used, perceived and evaluated by customers.

- Evidence from academic research shows that FMA can occur for services just as for physical products.

- B2B marketing differs from B2C marketing in market structure, supplier-customer relations, the purchasing decision and the clients’ knowledge management.

- Little research has been done on FMA in B2B environments, but theory suggests some FMA mechanisms may be stronger in B2B markets.
5 First mover advantages for B2B service products

Chapter 3 provided the overview of all possible FMA mechanisms from academic literature. Chapter 4 discussed the differences between goods and services, and the specific characteristics of B2B marketing. This chapter will combine the three clusters of information. It is discussed how each FMA mechanism applies specifically to B2B services using grounded theory. Grounded theory is a bottom-up approach; an analysis of systematically gathered data and information in order to develop new theory (Strauss & Corbin, 1994) (Della Porta & Keating, 2008). In addition, all moderating factors for the individual mechanisms are discussed. The chapter will conclude with an overview of which FMA mechanisms are important in B2B services, while all moderating factors can be found in Appendix III.

5.1 Learning curve advantages

Technological learning curve
De Brentani (1989) argues that success for new services depends on the focus on quality, the need to be innovative and the reduction of costs. Extending these arguments from point-in-time success to continued success implies that firms need to continuously improve quality, innovate, and seek to reduce costs to keep ahead of competitors. Also, Ofek & Sarvary (2001, p. 1441) argue that professional service firms can “leverage the cumulative experience gained from serving their customer base to either reduce their variable costs or increase the quality of their products/services”. In other words, the more customers they serve, the more they can learn and improve their offerings. Thus, the first mover advantage of being further along the learning curve than competitors is just as important for B2B services as it is for goods.

Recall that tacit knowledge is much harder to define and imitate and is therefore considered to contribute to FMA more effectively (Kerin et al., 1992). Service products often have larger reliance on the quality and experience (which is tacit knowledge) of personnel than goods do. How much the service depends on tacit knowledge is an important moderating factor for the effectiveness of being ahead on the learning curve.

A well-connected firm has more access to knowledge and learning, and can benefit from the capabilities and resources of other firms. Network connectivity increases innovativeness and knowledge flow (Granovetter, 1981) (Hausman, 2005) (Zaheer et al., 2010). For this reason, firms with good network access may find it easier to stay ahead on the learning curve (García-Villaverde et al., 2012).

Intellectual property rights and appropriability mechanisms
Due to their intangibility, services are harder to protect through patenting (Song et al., 2000) (Magnusson et al., 2009). In fact, the relation between the appropriability regime and FMA is considered inconclusive by Tuppura et al. (2010) based on their review of Makadok (1998) and López & Roberts (2002). Szymanski et al. (1995) even pose that filing for patents is detrimental to first movers, as they can be ineffective and require the submission of a lot of information that could otherwise remain secret. They argue that late movers could benefit more from patenting. After the market and technology are more mature and uncertainty is reduced, late movers can develop a differentiating product that better fits customer needs and protect it with patents. Thus, patenting is not considered to effectively contribute to FMA in services.

Secrecy is often mentioned alongside patenting as an appropriation mechanism. The notion that secrecy positively contributes to FMA is supported by multiple authors (Levin, et al., 1987) (Bharadwaj et al., 1993) (Tuppura et al., 2010). However, appropriation through secrecy relies on inimitability of the product, which is covered in elsewhere in the model and does not need to be included again here.
Organizational innovation
Organizational inertia can counteract innovativeness. Formalisation and centralisation are considered to negatively influence innovativeness, while specialisation is a positive moderator (Damanpour, 1991). Managerial skills are also considered to positively influence organizational effectiveness and innovation (Finney, Lueg, & Campbell, 2008) (Murthi, Srinivasan, & Kalyanaram, 1996). No evidence was found to suggest organizational innovation is significantly more or less important in B2B service marketing.

5.2 Preemption of (scarce) assets

Preemptive investments
In manufactured goods, having a larger installed production capacity (primary inputs) than competitors can be an important FMA. For services, it strongly depends on the nature of the service. For services that are equipment or labour intensive, preemptive investments can provide an FMA. But considering, for example, internet-driven services where the acquisition of a domain name and servers might be the bulk of necessary factor inputs, it will be easy for late entrants to match the production capacity of first movers in a short time. In these cases, preemptive investments do not significantly contribute to FMA.

Note that labour and equipment intensity are not mutually exclusive: a service can depend on both people and equipment, either of the two, or neither such as in the case of some internet-driven services. In general, this mechanism will not be as strong in B2B services.

Physical resources
Whether the preemption of physical resources is important for new service products is influenced by the resource dependency (Tuppura, Hurmelinna-Laukkanen, Puumalainen, & Jantunen, 2010) on secondary inputs. These inputs can range from raw materials to components and subsystems. If not only the secondary inputs themselves but also the suppliers of them are scarce, this can also create an opportunity for an FMA. Pioneers can pre-empt the supplier base by setting delivery quota or signing exclusivity contracts to prevent competitors from accessing the same resources.

As mentioned previously, some services are indeed centred around or require support by physical goods. But even if this is the case, the pre-emption of physical resources will not be as important for B2B services as it is for goods.

Human resources
It was established that the quality of front-line service personnel, i.e. those that come in contact with the customer, is important for the perception of the quality of the service (§4.1), and in turn quality is important for the success of services (De Brentani, 1989). Likewise, the quality of personnel is important in B2B services.

Whether pre-emption of human resources can be used to create an effective FMA in services depends on the required level of employee training and the labour intensity of the service. If the required level of employee training is low, firms will be able to recruit new or retrain current personnel more easily than if the required level of employee training is high. If the service is labour intensive, i.e. if it cannot be easily automated, requires face-to-face contact, or requires high levels of customization, the importance of employee pre-emption also rises.
Spatial preemption
Services that require face-to-face communication can obtain an FMA by pre-empting convenient geographic locations. On the other hand, an increasing amount of services today require no such communication as they are offered through the internet such as internet banking, travel agency websites, information intermediaries for and between consumers (i.e. eBay) and more.

Whether spatial pre-emption is an effective mechanism for FMA depends on the benefit derived from a good location, which is product-dependent. The geographic coverage is another moderating factor: the larger the geographic coverage of a location, the more customers are willing to travel and thus the less important the eventual location is. How far customers are willing to travel is in turn related to the utility offered by a product.

B2B services may well depend on face-to-face interaction, especially considering the intricate and ongoing relationships. But given the fact that B2B products are often more costly and more deeply rooted with the client firm’s practices, clients are likely more willing to travel as well. Geographical proximity may still influence a buyer’s decision, but the FMA mechanism discussed here is geographical pre-emption, and that is unlikely to occur in B2B service markets. Therefore, it will not be included in the model.

Market space
The same mechanisms that allow a pioneer to obtain FMA through product differentiation in goods occur in services. In theory, a pioneering service firm can also obtain a product differentiation advantage. However, it was established that services are more easily imitated than physical products. Only services that depend on inimitable key resources, surrounding and supporting systems, processes, infrastructures etc. cannot be imitated by competitors.

Product customization is increasingly important (Ramani & Kumar, 2008). Especially with ICT technology, firms can obtain information on individual customers through successive interactions. This information can be used to achieve profitable customer relationships (Ramani & Kumar, 2008). The first firm to enter a market has the longest time to optimize their customer information, and subsequently optimize their product offerings. B2B firms generally serve fewer customers and cooperate more closely with them, thus strengthening this FMA mechanism.

Combining the notion of pre-empting product characteristic space with the notions of co-creation and the network view of Håkansson & Snehota (1989) in B2B marketing also suggests that this FMA mechanism is more important in B2B markets than it is in consumer markets. If firms upstream and downstream adapt to accommodate the product of a pioneering firm, the new product becomes embedded in the network and it becomes more difficult to switch to competing products when they arise.

Marketing cost asymmetries
It was established that the intangible nature of services causes some difficulty for customers to objectively measure service quality. Rather, it is previous experience, communicated experience of others and brand equity that offer customers a way of evaluating services. The more intangible a product, the stronger this effect will be. Assuming sufficient product quality, a pioneer can build positive experiences and brand equity and can focus its efforts on customer retention. Late entrant service providers who wish to overcome the pioneer’s lead by definition cannot use the two most important marketing mechanisms for services: experience and brand equity. Therefore it is proposed that this FMA is stronger for services than it is for products.
On the other hand, the purchasing decision of firms is aimed to be as objective as possible. Furthermore, firms looking for solutions perform their own market searches for possible solutions. Therefore, in B2B markets in general, marketing cost asymmetry does not seem be as important a mechanism for FMA than it does in consumer markets. This balances the overall importance of this mechanism in B2B service markets.

**Political resources**

No argumentation was encountered that suggests this type of FMA is more effective or less effective for services. There are, however, several moderating factors that influence how effective political resources can be.

The level of government interference in an industry dictates how important political ties are in that industry, as well as how far the industry has formed. As with individual technologies, industries early in the development process can be influenced and steered more easily than those in later stages of development, where path-dependency and lock-in impede change.

Firm size is related to the resources controlled, the ability to get politically engaged and economic power (Hillman, Keim, & Schuler, 2004). Thus firm size influences the political impact of a firm. The experience and expertise of a firm with politics affects how well it can play the political game. These measures also help to determine the political impact of the firm. Of course, the greater the political impact of a firm, the better it can use its political resources to obtain FMAs.

Finally, the stability and consistency of the political environment also has an effect on the strength of this FMA. In the Netherlands, "inconsistent and changing policy measures have increased the level of uncertainty" (Jacobsson & Bergek, 2004, p. 830) which eventually resulted in a weaker wind energy industry compared to other countries. In the case of cross-border expansion, the level of inter-government cooperation was found to be of importance to FMA (Frynas, Mellahi, & Pigman, 2006).

### 5.3 Customer switching costs

**Contractual switching cost**

This is one of the most straightforward FMA’s. Whether customers can be retained through signing long-term contracts largely depends on the type of service provided. It does not appear to be more or less important for B2B services than other commercial offerings.

**Investment by customers**

Whether investment costs are an effective source of FMA depends on the height of the investments. Three types of investments are considered. Equipment and employee training are monetary costs. If the operation of the service requires adaptation of existing processes, a cost of time and effort must be spent.

The investment costs by customers are often high in B2B environments, due to the co-creation of products and the linkages as explained in the network model of Håkansson & Snehota (1989).
Supplier-specific learning

The strength of this FMA is affected by how much learning is required to achieve maximum levels of efficiency. Another moderating factor is how often the product or service is used or consumed per time period: products that are used daily are more likely to benefit from supplier-specific learning than products that are used once every few weeks. Single-use services do not benefit from this FMA at all.

Lastly, a pioneering firm can bind customers by customization of the product offering to individual customers. Examples are personalized accounts on a website, or airline frequent flyer programs where customers get personalized offers based on previous travel itineraries. A first mover has the longest time to build a customer database and acquire necessary data, which can lead to increased customer retention (Varadajaran, Yadav, & Shankar, 2008). As for investment cost, this mechanism is considered more important in B2B services.

Buyer choice under uncertainty

Since service products are more intangible, customers must rely more heavily on past experience in their product choice than they would for physical goods, which leads to more repeat purchases. The buying decision of firms is a more objective process. Intuitively, one might think that the organizational buying process reduces the uncertainty and thus the strength of this FMA. However, buyers put less effort into the search process in the face of higher switching costs (Weiss & Heide, 1993) (paragraph 4.4), which is the case in B2B markets. Thus, this mechanism is considered more important in B2B services.

Since frequency of consumption influences how quickly and deeply customers obtain experience with a product, it is a (positively) moderating factor for this FMA. The track record of a firm with its existing customers influences the likelihood that customers remain loyal: the more positive the previous experience, the stronger customer loyalty will be.

Network externalities

Two categories of network externalities were identified. Direct (interaction) effects occur when the product increases in utility the more people use it. Complementary products that are linked to the core product can also increase its utility. When social group accessibility benefits and the number of complementary products available increase, so does the utility from network externalities.

Interaction effects are considered to increase if the social network of the product users is dense (Lee, Song, & Yang, 2015). Conversely, if the social network is weak so are the interaction effects. The logic behind this argument seems sound: if the customers have frequent and strong connections between themselves, there will be more reason for them to use the same products than if they operate more individually. The social distance is a negatively moderating factor for interaction effects. No evidence was found to suggest this mechanism is stronger or weaker in B2B service markets.

5.4 Resulting overview of moderating factors

The previous paragraphs have listed all first-mover mechanisms that are applicable for B2B service products. These are listed in Table 4. A multitude of moderating factors was identified. They are listed in Appendix III. Some of these can be actively influenced by the firm, others are dependent on the nature of the product or external factors. They have been grouped into four categories: internal factors (strategic), internal factors (resources & capabilities), product characteristics and external factors. The first two categories are controllable by the firm, although some factors may require time and effort to change. Product characteristics can be
controlled by the firm to some extent. The nature of the product may constrain the freedom of choice of its characteristics, and the final shape and form of a product is a trade-off of many considerations between different apartments (technological feasibility, financial return, the firm’s vision and values, etc.). Thus, the product characteristics may not always be optimally attuned to induce FMA. The last category, external factors, cannot be controlled by the firm in any significant way. Still, these factors cannot be discounted when evaluating the likelihood of FMA.

Table 4: Categorization of the FMA mechanisms by importance in B2B services

<table>
<thead>
<tr>
<th>Most important</th>
<th>Moderately important</th>
<th>Least important/not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market space</td>
<td>Tech. learning curve</td>
<td>Intellectual property rights</td>
</tr>
<tr>
<td>Investment by customers</td>
<td>Organizational innovation</td>
<td>Preemptive investment</td>
</tr>
<tr>
<td>Supplier-specific learning</td>
<td>Human resources</td>
<td>Spatial preemption</td>
</tr>
<tr>
<td>Buyer choice under uncertainty</td>
<td>Political resources</td>
<td>Physical resources</td>
</tr>
<tr>
<td></td>
<td>Marketing cost asymmetry</td>
<td></td>
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<td></td>
<td>Contractual switching cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Network externalities</td>
<td></td>
</tr>
</tbody>
</table>

Chapter summary

- Many contingencies were identified that influence the effectiveness of FMA mechanisms. Some contingencies are internal to the firm (strategic or capability-based), others external, still others are characteristics of that particular product (or service) under investigation.

- Due to the difference in characteristics of B2C/B2B and product/service marketing, the various FMA mechanisms are either more or less effective for B2B services.
  - The most important B2B service FMA mechanisms are: the preemption of market space, investment by customers, supplier-specific learning and buyer choice under uncertainty.
  - Roughly equally effective mechanisms are: advantages on the technological learning curve and organizational innovation, preemption of human resources and political resources, marketing cost asymmetry, contractual switching cost and network externalities.
  - Less important or inapplicable mechanisms are: intellectual property rights, preemptive investments, spatial preemption and preemption of physical resources.
6 Model reduction with the Resource-Based View

The full model of FMA deduced from theory, even with the identification of important and less important mechanisms in B2B services, is too extensive to test in this thesis. In this chapter, the resource-based view (RBV) is used to reduce the model further. By their nature start-ups are constrained in resources, and university spin-offs especially so (Van Geenhuizen, Ye, & Au-Yong-Oliviera, 2014). Applying the resource-based view will result in a concise conceptual model.

The earliest papers on the resource-based view had already made connections between the RBV and FMA theory (e.g. Dierickx & Cool (1989) and Barney (1991)). A further integration of the RBV and FMA theory was proposed by Lieberman & Montgomery (1998). Whether researchers followed their advice or acted on their own insights, the first-mover advantage theory and the resource-based view have often been combined in academics, a range of examples being (Doh, 2000) (Li, Lam, Karakowsky, & Qian, 2003) (Cui & Lui, 2005) (Finney, Lueg, & Campbell, 2008) (Rodríguez-Pinto, Rodríguez-Escudero, & Gutiérrez-Cillán, 2012).

The RBV is introduced and explained in paragraph 6.1. Paragraph 6.2 identifies various forms of capital, which are connected to the various FMA mechanisms in the following paragraph. Paragraph 6.4 concludes the chapter with the resulting conceptual model.

6.1 Introduction to the RBV

Finding and understanding sources of (sustained) competitive advantage has been an important subject in management research. One of the most well-known models (Grundy, 2006) is that of Porter’s Five Forces of the threat of new entrants, rivals, and substitutes and the bargaining power of buyers and suppliers (Porter, 1979).

Porter’s model is externally focused, and it assumes that all firms in an industry have homogenous resources and strategies, and that those resources can be freely exchanged (i.e. are perfectly mobile) (Barney, 1991). In contrast, the RBV works under the assumption that each individual firm has its own unique set of tangible and intangible resources, and not all of these resources can be moved or copied across firms (Barney, 1991) (Peteraf, 1993). The different resources of each firm allow them to conceive of and implement different strategies (Barney & Arikan, 2001), and capabilities (organizational routines) arise from the combination and coordination of different resources (Amit & Schoemaker, 1993) (Martín-de-Castro, Navas-López, López-Sáez, & Alama-Salazar, 2006). It is the unique set of resources controlled by a firm that determines that firm’s competitive position. The RBV has grown to be one of the most well-known theories in management science (Srivastava, Liam, & Christensen, 2001) (Newbert, 2007) (Kraaijenbrink, Spender, & Groen, 2010).

The RBV has a broad definition of resources. To illustrate; “assets, capabilities, organizational processes, firm attributes, information, knowledge, etc.” (Barney, 1991, p. 101) and “brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital, etc.” (Wernerfelt, 1984, p. 172) are all considered resources. In fact, the lack of a clear definition and delineation of “resource” in the RBV is one of its strongest critiques (Kraaijenbrink, Spender, & Groen, 2010).
6.1.1 Conditions for (sustained) competitive advantage on the firm level

Peteraf (1993) identified four conditions which are required for competitive advantage to be maintained:

- Resource heterogeneity: firms have different resources which allows them to produce at different levels of efficiency (i.e. different cost structures), allowing some firms to earn supernormal profits
- Ex post limits to competition: subsequent to a firm gaining a superior position, there must be mechanisms that limit the competition for that superior position (sustainability). These mechanisms are called entry barriers or isolating mechanisms (Rumelt, 1984)
- Imperfect mobility: the resources that allowed a firm to earn supernormal profits must be non-tradeable. Also, some resources may be tradeable, but at excessive cost or they are less valuable in the new environment than the old. Apart from immobile, such resources are often also inimitable.
- Ex ante limits to competition: there must be limits to the competition for superior positions prior to their occupation, i.e. even before any firm has obtained such a position in the first place. Otherwise, the competition for superior positions would be such that all expected supernormal profits are eroded away. There “could only be a source of above normal returns if some firm had the foresight or good fortune to acquire it in the absence of competition” (Peteraf, 1993, p. 185)

The heterogeneity assumption is critical to the existence of limits to competition and imperfect mobility. These other factors are all derivatives of resource heterogeneity (much in the same way, actually, that the intangibility of services is the core difference from which the other distinguishing properties of services versus physical goods are derived).

6.1.2 Conditions for (sustained) competitive advantage on the resource level

Peteraf’s four conditions operate at the firm level. On the resource level, Barney (1991) developed the VRIN model. These are four conditions that determine if a resource can be a source of sustainable competitive advantage:

- Valuable: a resource is valuable to a firm if it allows a firm to improve its efficiency or effectiveness, and the benefits outweigh the costs.
- Rare: resources controlled by a large number of firms cannot, by definition, be sources of competitive advantage. When the number of companies that owns a particular resource is smaller than the number required for approaching perfect competition conditions, the resource can still be considered rare enough to be a source of competitive advantage.
- Inimitable: only if resources are inimitable can they be sources of sustainable competitive advantage. Inimitability can be the result of four factors (Dierickx & Cool, 1989) which will be explained below.
- Non-substitutable: substitutability comes in two forms: either the resource itself may be substituted with an equivalent, or a very different resource may result in the same strategic effect. An example based on the one given by Barney (1991) is that of a charismatic, visionary leader, which causes all managers in a firm to have a clear view of the future. Even though the visionary leader is valuable, rare and inimitable (as he is a unique individual), he can be substituted by an individual with similar traits (1st form, equivalent resource) or by a systematic, companywide planning process (2nd form, different resource but with the same strategic effect).

The VRIN model was later updated to the VRIO model (Figure 13), where the “non-substitutability” condition was changed to the “organization” condition, referring to the extent to which the organization is actually exploiting the valuable, rare and inimitable resource (Barney, 1997).
6.1.3 Inimitability of resources

Dierickx & Cool (1989) are oft-cited scholars regarding resource inimitability in RBV literature. The following factors that can influence resource (in)imitability were identified from their work.

**Time compression diseconomies**

Time compression diseconomies occur when resources require time to build, and the speed with which they are built up can only be influenced to some extent. For example, a certain level of input for R&D over a period of one year yields more results than having twice that level of input for R&D for a half-year period (Dierickx & Cool, 1989). Additionally, the value of resources such as reputation and relations are also time-dependent, in that they take a long time to acquire and therefore cannot be easily copied by competitors.

**Asset mass efficiencies**

This refers to the fact that having high levels of a stock can facilitate further growth of that stock. Such positive feedback loops can occur in R&D. When the existing customer base is a valuable resource, and product network externalities and/or the bandwagon effect (Abrahamson & Rosenkopf, 1993) apply, the existing customer base will grow faster the larger it is.

**Causal ambiguity**

In some cases, there can be a “dispersion in the results obtained by different firms even when initial endowments are equivalent” (Lippman & Rumelt, 1982, p. 418). In other words, differences in firm positions occur even when it is not clear what causes them. Likewise, the development of asset stock (valuable resources) may also be influenced by factors that are beyond our ability to control or even identify, and thus the development of resources is not always deterministic and continuous (Dierickx & Cool, 1989). Imitability becomes impossible in the face of causal ambiguity: that which cannot be seen or understood cannot be imitated.

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**Figure 13: The VRIO model. Source: (managementmania.com, 2015).**
Interconnectedness of asset stocks

The value of one resource in a firm may be influenced by the availability of other, connected resources or capabilities in the firm. In such cases, not only the one resource but a set of interacting resources ought to be imitated in order for competitors to homogenize firm resource positions. Thus, this factor does not inhibit the imitation of the single resource per se, but it inhibits the imitation through the complexity and required effort of imitating a whole set of resources.

This touches on the notion of RBV theory that firms have, or exist of, a set or bundle of resources (Wernerfelt, 1984), and it is this set of combined resources that determines the makeup, opportunities, set of possible strategies and competitiveness of the firm (Amit & Schoemaker, 1993) (Morgan, Vorhies, & Schlegelmilch, 2006) (Sirmon, Hitt, & Ireland, 2007) (Lockett, Thompson, & Morgenstern, 2009).

6.1.4 Moving from a static RBV to the inclusion of dynamic capabilities

One of the criticisms of the RBV was that it was static (Sirmon, Hitt, & Ireland, 2007): it looks at a firm’s resources at one point in time. This is an incomplete view of reality, since the value of resources not only changes over time (Armstrong & Shimizu, 2007) but also erodes over time (Dierickx & Cool, 1989). At some point, firms will have to re-construct their resource base to stay competitive.

A different and complementary approach to the RBV that addresses this problem is the dynamic capabilities (DC) perspective (Figure 14). Dynamic capabilities are a firm’s organizational and strategic processes that underlie “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece, Pisano, & Shuen, 1997, p. 516). Dynamic capabilities do not affect a firm’s production directly but build, integrate, or reconfigure the operational capabilities that enable production (Helfat & Peteraf, 2003). The dynamic capabilities perspective has served as an extension to the RBV (Eisenhardt & Martin, 2000) (Griffith & Harvey, 2001) (Helfat & Peteraf, 2003) (Ambrosini & Bowman, 2009).

![Dynamic capabilities diagram](image)

Figure 14: Resources build capabilities, and both resources and capabilities are used in production. Dynamic capabilities influence how well a firm can adapt its resources and capabilities in order to react to change.

Interestingly, while the RBV assumes heterogeneity in resources, DC theory states that the dynamic capabilities of different firms are more homogenous in nature and that “best practices” exist (Eisenhardt & Martin, 2000). In other words; the processes through which firms develop and organise their resources are more alike than the outcomes of those processes. Furthermore, in moderately dynamic markets, these routines are quite detailed, linear and analytic. In highly dynamic markets, dynamic capabilities are simpler, more experiential and situation-specific (Eisenhardt & Martin, 2000).
6.2 Forms of capital in the RBV

In summary, it is the bundle or mix of resources that gives firms their competitive advantage in the RBV. Resources are all tangible or intangible inputs or assets that a firm can use or has access to. Resources facilitate capabilities (Amit & Schoemaker, 1993); a capability is the ability of a firm to use or organise its resources in order to achieve an end result. Grant (1996) poses that superior profitability results from resource- and capability-based advantages rather than market positional advantages.

Assets, resources and capabilities used by a firm in the creation of products or services are called capital (Chisholm & Nielsen, 2009). One important form of capital in all situations is financial capital. For start-ups, the attraction of sufficient financial capital may be critical for success (Lee, Lee, & Pennings, 2001) (Rosenbusch, Brinckmann, & Müller, 2013). This is equally true for university spin-offs (Van Geenhuizen & Soetanto, 2009) (Soetanto & Van Geenhuizen, 2015). However, the attraction of sufficient financial capital is not any easier for a pioneering firm (it may even be harder, especially for radical innovations) than for others. Since this study focuses on first mover advantages, attention will be given here to those forms of capital through which first movers can gain those advantages.

It was noticed that some firms were valued higher on the stock market than can be accounted for when looking at their physical and financial assets. It is now understood that such value comes from intellectual capital: “the talents and skills of individuals and groups; technological and social networks and the software and culture that connect them; and intellectual property such as patents, copyrights, methods, procedures, archives, etc” (Stewart, 2010, p. 1). Simply put, intellectual capital is everything that adds value to the firm but cannot be directly accounted on a balance sheet. Intellectual capital is VRIN/VRIO from an RBV perspective, and therefore eligible to contribute to competitive advantage. Indeed, since the 1990’s, much focus has been placed on intellectual capital and it is considered the main competitive advantage for firms. A small selection of papers on intellectual capital being (Hall, 1993) (Henderson & Cockburn, 1994) (Glunk & Wilderom, 1998) (Lorenzoni & Lipparini, 1999) (Hitt, Bierman, Shimizu, & Kochhar, 2001) (Bontis, 2001) (Adler & Kwon, 2002) (Peña, 2002) (Hatch & Dyer, 2004) (Youndt, Subramaniam, & Snell, 2004) (Martín‐de‐Castro, Navas‐López, López‐Sáez, & Alama-Salazar, 2006) (Sydler, Haefliger, & Pruksa, 2014) (Wang, Wang, & Liang, 2014) (Inkinen, 2015).

There are various differing models of intellectual capital (see Bontis (1998) and Marr, Schiuma, & Neely (2004) for examples). They differ in building blocks and their interrelations, and depending on the mapping, some aspects or resources may be in one category or the other. Generally though, it is acknowledged that human, organizational and social capital are the basic components of intellectual capital (Guthrie & Petty, 2000) (Stewart, 2010) (Ferenhof, Durst, Bialecki, & Selig, 2015).

6.2.1 Human capital

In the RBV, human resources are certainly considered a source of competitive advantage (Hitt, Bierman, Shimizu, & Kochhar, 2001) (Wright, Dunford, & Snell, 2001) (Colbert, 2004) (Hatch & Dyer, 2004) (Wright, Hmielewski, Siegel, & Ensley, 2007). Human resources lead to human capital through individual employees’ skills and capabilities. Even though the organisation (e.g. acquisition processes, training programs) of HR can be similar, the outcomes of those processes are unique to each firm because each employee is a unique individual. Therefore, human capital cannot be imitated across firms. Human capital on the individual level is described as the genetic inheritance, education, experience, and attitudes about life and business (Bontis, 1998) or KSAO; knowledge, skills, abilities and other characteristics (Ployhart & Moliterno, 2011).

These individual (micro-level) characteristics lead to human capital on macro-level through the dynamics of group and team work (Ployhart & Moliterno, 2011). Thus the link between micro- and macro-level human capital is shaped by interdependence and coordination between employees, workflow structure, dynamism of
the environmental context, behavioural processes, cognitive mechanisms and psychological states of individual employees (Ployhart & Moliterno, 2011).

Human capital is a function of employee selection, development and use (Hatch & Dyer, 2004). That means in part human capital depends on the pre-existing characteristics of all individual employees, in part it is shaped by the firm through personal development, employee interactions and organization structure. Furthermore, human capital is specific to the originating firm and requires adjustment costs if transferred (Hatch & Dyer, 2004). For example, the switching of two employees between organizations, even if they have the same qualifications on paper, can result in increased or decreased effectiveness in the organization due to the difficult-to-predict effects of group dynamics.

Knowledge falls under the RBV definition of a resource (Wernerfelt, 1984). In fact, knowledge is considered an highly important resource in RBV literature (Spender & Grant, 1996) (Barney & Arikan, 2001) and has even generated a whole field of research; that of knowledge management and knowledge management systems (Nonaka & Takeuchi, 1995) (Alavi & Leidner, 2001) (Serenko, Bontis, Booker, Sadeddin, & Hardie, 2010). Tacit knowledge such as experience and skills are especially important. The inimitability of tacit knowledge was already discussed in FMA literature (Kerin, Varadarajan, & Peterson, 1992). Tacit knowledge is embedded in human capital.

When certain knowledge is VRIO, it can contribute to sustainable advantage. From an RBV standpoint, it can also be seen that (tacit) knowledge and the capabilities derived therefrom are considered inimitable through time compression diseconomies, asset mass efficiency and causal ambiguity. Helfat (1994) posed, in line with the resource heterogeneity view, that R&D is firm-specific: a firm’s unique set of knowledge and path dependencies cause R&D to be inimitable, which leads to increased appropriability.

Technological capabilities depend on the knowledge and tacit knowledge available to a firm, and thus on human capital. Technological capabilities are associated with a start-up’s performance (Lee, Lee, & Pennings, 2001) and firm performance (Wiklund & Shepherd, 2003) (Tsai, 2004) (Ortega, 2010). Not only capabilities related to the core product or service of a firm can increase performance, the same is also true for “supporting” capabilities. For example, higher IT capabilities are also shown to lead to higher firm performance (Bharadwaj A. S., 2000) (Aral & Weill, 2007). It must be noted though, that empirical evidence that technological capabilities increase firm performance is not uniformly supportive (Coombs & Bierly, 2006); the relation may be more complex than it appears at first sight. It is likely that other interactions with the others forms of capital moderate the relationship between technological capabilities and firm performance.

Marketing knowledge is another important aspect embedded in human capital. It results in marketing orientation, which can be defined as “the organizationwide generalization of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organizationwide responsiveness to it” (Kohli & Jaworski, 1990, p. 6). Such market knowledge can increase firm performance (Wiklund & Shepherd, 2003) (Chang & Tseng, 2005) (Chorev & Anderson, 2006).

6.2.2 Organizational capital

Organizational capital, also referred to as structural capital, is the combination of operating philosophy, culture, routines, processes, organizational structure and HRM policies of a firm (Youndt & Snell, 2004) (Galbreath, 2005). Strong organizational capital facilitates the use of the available social capital, allows the most to be made of the available human capital (Bontis, 1998); e.g. educative, supporting, with the right people in the right positions, and enables available knowledge to actually contribute to performance (Kalling, 2003). Simply put, in terms of Barney’s framework, the organizational capital refers to how well “O” is managed for VRI resources.
A more detailed definition of organizational capital is the “combination of explicit and implicit, formal and informal knowledge which in an effective and efficient way structure and develop the organizational activity of the firm, that includes culture – implicit and informal knowledge; structure – explicit and formal knowledge; and organizational learning – implicit and explicit, formal and informal renewal knowledge processes” (Martín-de-Castro, Navas-López, López-Sáez, & Alama-Salazar, 2006, p. 328). The notion that organizational culture can be a source of competitive advantage is supported by Barney (1986) and Grant (1991). The table below shows the different aspects of organizational capital and their characteristics.

Table 5: Organizational capital assessment matrix by Martín-de-Castro et al. (2006)

<table>
<thead>
<tr>
<th>Characteristics of strategic resources and capabilities</th>
<th>Culture</th>
<th>Structure</th>
<th>Org. learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Inimitability</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-substitutability</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Non-transferability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Appropriability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Durability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Effects**

<table>
<thead>
<tr>
<th></th>
<th>Culture</th>
<th>Structure</th>
<th>Org. learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive parity</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Sustained competitive advantage</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

6.2.3 Social capital

Social capital (also called relational capital) is the sum of benefits and costs that result from a firm’s social ties and relationships. “Social capital is the goodwill available to individuals or groups. Its source lies in the structure and content of the actor’s social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor” (Adler & Kwon, 2002, p. 23). It is considered part of the resource base of the firm (Chisholm & Nielsen, 2009), as it is both appropriable and convertible: it can be used to attain other economic advantages (Adler & Kwon, 2002). Social capital was empirically found to be an important factor in firm performance (Youndt & Snell, 2004) (Newbert, 2007).

Two types are often defined; internal and external social capital (Adler & Kwon, 2002) (Chisholm & Nielsen, 2009). They correspond to strong and weak ties (Granovetter, 1981) and bonding and bridging ties (Patulny & Svendsen, 2007), also shown in Figure 15. Both internal and external social capital improve an organization’s performance (Carrie & Pil, 2006).

Internal social capital refers to the relations of actors within a system (Carrie & Pil, 2006), or the relations of the individual members within a single organization (Chisholm & Nielsen, 2009), depending on the level of analysis. Internal social capital facilitates knowledge flow between actors and enables the development of common goals (Carrie & Pil, 2006).

External social capital is comprised of an organization’s relations to other actors that are outside the organization. It facilitates the transfer of tacit knowledge between cooperating organizations (Collins & Hitt, 2006) and allows firms to obtain resources by providing access to external providers of resources, and reduces uncertainty in interactions with the environment (Lavie, 2006). Another form of external social capital is the relationships with customers (Bontis, 1998), which includes concepts such as brand equity and customer loyalty (Stewart, 2010). Its value lies in relations external to the organization and is therefore hard to codify (Bontis, 1998), but customer capital has been empirically found to contribute to firm performance (Chang & Tseng, 2005) (Chorev & Anderson, 2006).
In some cases, firms can use their network to gain access to resources not directly under control by the firm by cooperating in partnerships (Lavie, 2006). In the same manner that the bundle of resources and capabilities of single firms determine their competitive position, firms can enter into a partnership to achieve a unique combination of resources and capabilities together (Figure 16). Profits thus collected are called relational rent: “supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners” (Dyer & Singh, 1998, p. 662).

6.3 Assessing the first mover advantages with the RBV perspective

In this paragraph the developed FMA model (Appendix IV) will be assessed from an RBV perspective, in order to find room for further simplification. Grounded theory will be used to determine where both streams of literature use different terms for similar concepts, where concepts can be combined and what concepts cannot be captured when using the RBV. Recall that resources in the RBV are defined as all tangible and intangible assets and capabilities that are owned or controlled by the firm, which enable it to conceive of and implement strategies that improve firm performance (Wernerfelt, 1984) (Barney, 1991) (Amit & Schoemaker, 1993).
The danger of having such an all-inclusive definition has the drawback of making the RBV so vague as to be of little value through logical tautology (having a statement that is always true on any valuation or interpretation of its terms) (Kraaijenbrink, Spender, & Groen, 2010). Therefore, the following section aim to keep more closely to the core of the definition of a resource, and discard those items that flirt with the boundaries of the concept of resources.

A second point is that the original focus of the RBV is to assess sustainable competitive advantage (SCA), which was concluded in §3.3.3 to be outside the focus of FMA theory. Nevertheless, with a small difference in perspective the RBV can be used to examine which resources, or types of resources, are more important for pioneering firms.

The technological learning curve advantage of FMA theory is closely tied to human capital. It was found that technological knowledge of employees is one form of human capital; thus this FMA mechanism is strongly linked to human capital. In the same way, the learning curve advantage in organizational innovation is closely tied to the organizational capital concept of the RBV. Where FMA theory looks at the process of continuous improvement and thereby keeping ahead, the RBV focus is on increasing a “level of stock” (Figure 17). These views can complement each other neatly: moving ahead on the learning curve is synonymous with increasing the level of stock.

Figure 17: Increasing the level of stock of capital sources increases firm performance.

In FMA theory, human resources are mentioned as a possible pre-emption advantage and, as the name implies, are also considered a resource. There is a semantic difference between human resources and human capital though: Hatch & Dyer (2004) consider human resources to be employees and human capital to be their knowledge and skills. Human capital can be increased though attracting new or training current employees. Up to this point, the two theories are still very much aligned. The pre-emption of workers leads to the pre-emption of their human capital by definition. But, while having human capital certainly is a resource, the action of pre-emption cannot be called a resource. Under the broader definition of resource, the possibility for action might be considered a resource, but that risks coming close to the logical tautology discussed earlier. The only way a first mover can take advantage on the human capital side from an RBV perspective is through having developed more human capital than competitors, which is similar to the “staying ahead on the learning curve” advantages discussed above.

Marketing cost asymmetry considered the difference in effort required to make the product or service known to the market for first and later entrants. This in itself does not appear to be an asset or resource that is controllable by the firm, and therefore falls outside the RBV perspective. On the other hand, brand equity and reputation are connected to this FMA, and these are considered resources (Stewart, 2010). These concepts fall under social capital in the RBV. De novo entrants cannot have these resources by definition, de alio entrants can “borrow” reputation and brand equity from the parent company. The first entrant in a market is best suited to develop these resources more quickly than later entrants due to time compression diseconomies and asset mass efficiencies.

The preemption of market space concerned the ability of a first mover to take market segments without competition. At first sight this cannot be considered a resource: a “possibility for action” is not a firm-owned or controlled asset. But if we look at a later point in time, the existing occupation of market segments does lead to
a resource: access to the existing customer base (Makadok, 1998). This falls under (external) social capital. Pioneering firms do not yet have an existing customer base for their new product or service, but they do have the ability to build one without competition.

Political resources are another aspect of external social capital. In contrast to an existing customer base, pioneering firms can have this form of external social capital. A founder can have pre-developed personal, political ties and leverage these as resources for his or her start-up. A de alio entrant can leverage political ties from the parent company. But even if they are not existent at first, the first mover has the opportunity to develop better relations than later entrants due to time compression diseconomies.

Contractual switching cost and customer choice under uncertainty can both be linked to external social capital, as they depend on the customer-firm relations, having an existing customer base, brand equity and customer loyalty.

Investment by customers, supplier-specific learning and network externalities depend on the characteristics of the product. The effects of these mechanisms fully lie with the customers: they are beyond the control or ownership of the firm. Therefore, they do not fit within the stricter RBV perspective employed here.

### 6.4 Resulting conceptual model

The previous chapters discussed all necessary theory on FMA mechanisms and how it applies to B2B service markets and within the RBV. This knowledge can now be used to make a concise conceptual model that can be empirically tested.

The first mover advantages from an RBV perspective, in essence, boil down to the better development of all forms of intellectual capital for the pioneer. The three forms of intellectual capital are human, organizational and social capital. These three forms of intellectual capital are considered to positively influence firm performance. The resulting conceptual model is straightforward (Figure 18).

![Diagram](Image)

**Figure 18:** The three forms of intellectual capital influence firm performance.

A first mover advantage can be gained through the better development of intellectual capital versus later entrants. There are, however, some factors that influence firm performance that are not related to first/late mover dynamics. One of these was financial capital (discussed in paragraph 6.2), others are the sector the firm operates in (i.e. medical, agriculture, transport), the company portfolio (offering a single or multiple products), firm size and firm age. The inclusion of these measurements in the empirical analysis increases its accuracy and allows their use as control variables. Precisely how all such concepts are measured is discussed in the next chapter.
## Chapter summary

- The RBV and FMA theory have often been connected in literature, and there is overlap in both theories.
- Intellectual capital is often seen as a main driver for firm competitive advantage, which in turn leads to increased firm performance. Intellectual capital consists of human, organizational and social capital.
- The FMA mechanisms of advantage on the technological learning curve and in human resources can be linked to human capital in the RBV.
- The FMA mechanisms of organizational innovation and marketing cost asymmetry can be linked to organizational capital in the RBV.
- The FMA mechanisms of preemption of market space, political resources, contractual switching cost and customer choice under uncertainty can be linked to social capital in the RBV.
- The FMA mechanisms of investment by customers, supplier-specific learning and network externalities cannot be seen as firm resources, and therefore do not fit within the framework of the RBV.
- The three forms of intellectual capital are all considered to be affected by FMA. Additionally, there are several other factors that cannot be counted as resources nor are affected by FMA, but are expected to influence start-up performance.
7 Operationalization and data collection

This chapter first discusses the operationalization in paragraph 7.1: how the theoretical notions that comprise the conceptual model can be measured in practice. The selection of the start-ups in the sample is explained in paragraph 7.2. Subsequently, it is described how the data was gathered in paragraph 7.3. The last paragraph describes the process used for the handling of missing data.

7.1 Operationalization of concepts

Given the time constraints of both the researcher and the start-ups’ managers, the majority of data will be collected from publicly available sources. This includes company websites, social media (e.g. LinkedIn, Facebook), newspaper articles, technology websites, newsletters, radio interviews, etc. This is a necessity, but does limit the possibilities for data collection. On the upside, start-ups are often managed by young, pro-active people that already have an affinity with such ICT methods for corporate communication. The operationalisations are established based on the fact that, for the most part, publicly available sources of information must be used. The operationalisation of the forms of capital is described in the following paragraphs.

All data is measured as ordinal data (with exception of industry sector, which is categorical). Ordinal data is a type of categorical data, the difference being that ordinal data has a rank order (e.g. one category can be considered as “better”, “higher” or “more” than another). Rough Set Analysis is well suited to deal with such categorical data

7.1.1 Human capital

The level of education of the founders is used as a proxy for the level of technical skill. It will be measured as the highest diploma achieved, information on which is expected to be available on LinkedIn in nearly all cases.

Previous work experience in corporate and academic settings is measured. Note that time spent obtaining a PhD is not included in university work experience, since the earning of a PhD degree is already measured in level of education. Appointments such as postdoc or professor are included, as well as appointments in research institutes that are not strictly universities (such as the Max Planck Institute and the CWI). As only three objects would fall in the middle class in a three-class system, HC3 was made a binary attribute.

As the final indicator for human capital it is recorded whether or not the start-up’s founders have previous entrepreneurial experience, either in setting up one other start-up or multiple.

Table 6: Operationalization of human capital.

<table>
<thead>
<tr>
<th>Measurement:</th>
<th>Coded as 0</th>
<th>Coded as 1</th>
<th>Coded as 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC1: Level of education</td>
<td>MSc (WO)</td>
<td>PhD</td>
<td>-</td>
</tr>
<tr>
<td>HC2: Previous corporate work experience</td>
<td>No experience</td>
<td>&lt;10 years work experience</td>
<td>&gt;= 10 years work experience</td>
</tr>
<tr>
<td>HC3: Previous academic work experience</td>
<td>No experience</td>
<td>Work experience</td>
<td>-</td>
</tr>
<tr>
<td>HC4: Previous entrepreneurship experience</td>
<td>No experience</td>
<td>Has set up 1 other start-up</td>
<td>Has set up multiple start-ups</td>
</tr>
</tbody>
</table>
7.1.2 Organizational capital

Organizational capital cannot be externally measured from publicly available sources of information. However, since the sample is a selected sample of start-ups, organizational capital is not expected to play an important role in any case. After all, there is little “organization” to speak of. It may even be the case that what constitutes as positive contributors to organizational capital in larger firms (clear task descriptions, documented processes, routines etc.) are in fact not beneficial for start-ups: they need a high amount of flexibility instead. Thus, the exclusion of organizational capital is argued not to be detrimental to the results.

7.1.3 Social capital

The social capital of the start-ups is measured by the size of its network. For the same reasons as for organizational capital, internal social capital will not be possible to measure. External social capital (relational capital) is divided in business and academic networks. The business network can be measured by evaluating collaborations, partnerships, joint projects etc. Such information is often provided by start-ups as it builds their reputation and status. Customers are not counted as network contacts, unless it is stated they were engaged in such activities as co-development or pilot testing.

Table 7: Operationalization of social capital.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Coded as 0</th>
<th>Coded as 1</th>
<th>Coded as 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1: University network size</td>
<td>No network</td>
<td>Ties to a single university</td>
<td>Ties to more than one university</td>
</tr>
<tr>
<td>SC2: Business network size</td>
<td>No network</td>
<td>Small network (5 or less)</td>
<td>Large network (&gt;5)</td>
</tr>
</tbody>
</table>

7.1.4 Additional factors

Several additional variables are measured that are not part of the resource base of the firm, but are factors that may influence its performance. The categorization of these variables is as follows and shown in Table 8.

Firm size at foundation is measured by how many employees there were at the time of founding. A large number of start-ups are founded by either one or two persons, which has the advantages of easy oversight and swift decision making. Other firms are founded by three or more persons. This adds more human capital to the team, but it may be harder to reach unanimous decisions.

There is a multitude of prizes that can be won, examples of which are the Philips Innovation Award (phia.nl, 2016) and the Shell LiveWIRE Award (livewire.nl, 2016). Winning such an award signals confidence from outsiders in the product or the start-up.

The availability of sufficient capital is a necessary condition for start-up success. A start-up has to overcome an initial period with little or no incoming cash flow from product sales. To distinguish between getting some sort of funding or grant, which almost all start-ups do, and attracting larger amounts of capital, a threshold of €100,000 is used.

Overall start-up performance may be different in different industry sectors. In this research, three industry sectors are represented in the sample.
Product and service firms are also distinguished from each other. Recall that the product-service spectrum is a continuum, and the difference is not always clearly evident. For example, a number of start-ups of physical products are not capable of surviving on the sale of their intended product alone, if only because they have no strong production capabilities. In such cases, they often work to realize cash flows by offering their specialized knowledge as consultants or partners in other projects. In such cases, the start-up is designated as a hybrid.

The start-ups’ focus is measured by the fact whether start-ups have one or multiple products in their portfolio. The definition of different products is taken as “products that tap into different core capabilities, fields of knowledge, or require different skills to create”. To illustrate: one medical start-up offers surgery simulation equipment (both hardware and software) and accompanying training courses. There are multiple versions of the equipment for different forms of surgery. However, this start-up has been codified as focused since the different versions of their product all use the same knowledge and capabilities to produce.

The readiness of the product at the time of founding is the last additional factor. Some start-ups are founded based on an idea, and require some years to fully develop their product. Other start-ups are founded in order to market a product that had already been developed previously. The readiness of the product is measured by the time difference between the founding of the company and the introduction of the product on the market or the first sale, depending on availability of information.

Table 8: Operationalization of additional factors.

<table>
<thead>
<tr>
<th>Measurement:</th>
<th>Coded as 0</th>
<th>Coded as 1</th>
<th>Coded as 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF1: Firm size at foundation</td>
<td>Less than 3</td>
<td>More than 3</td>
<td>-</td>
</tr>
<tr>
<td>AF2: Prize(s)</td>
<td>No mention of prizes</td>
<td>Prize(s) won</td>
<td>-</td>
</tr>
<tr>
<td>AF3: Attraction of external capital</td>
<td>None or less than €100.000</td>
<td>More than €100.000</td>
<td>-</td>
</tr>
<tr>
<td>AF4: Industry sector</td>
<td>Greentech</td>
<td>Medical</td>
<td>Business support</td>
</tr>
<tr>
<td>AF5: Product-service orientation</td>
<td>Core business is a physical product</td>
<td>Hybrid</td>
<td>Core business is a service</td>
</tr>
<tr>
<td>AF6: Focus</td>
<td>Start-up also offers other products</td>
<td>Investigated product is the only offering</td>
<td>-</td>
</tr>
<tr>
<td>AF7: Time to market</td>
<td>3 or more years of development needed</td>
<td>&lt;3 years of development needed</td>
<td>&lt;1 year of development needed</td>
</tr>
</tbody>
</table>

7.1.5 Firm performance

Measuring firm performance is difficult, and many papers have been written on the subject, e.g. Wiklund & Shepherd (2005), Landajo et al. (2008), Delen et al. (2013), Miller et al. (2013) and Harrison & Wicks (2013). The combination of different measures of firm success gives the best results (Wiklund & Shepherd, 2005). Therefore, three different indicators for firm success were recorded and later combined into a single measure for firm success.

The first is the growth in FTE’s. The addition of new employees is often mentioned on a start-up’s website’s news page or on other social media sources. The acquisition of new employees signals increased investment, work capacity and capabilities and as such is an indicator of firm growth. Furthermore, since firms are not expected to hire new employees if they cannot be supported, it is an indicator of positive future expectations within the firm.
The first international sale is an important milestone for start-ups. How soon the first international sale is made after market entry is a measure of success: the shorter the time, the more successful the start-up is considered to be.

The final indicator for firm performance is turnover. Turnover does not necessarily specify productivity, efficiency or profit margin, but it is an often-used indicator for the financial size of a firm. Due to the sensitive nature of financial information, and with the aim to solicit maximum response rates of the studied start-ups, turnover was recorded as belonging to different categories.

Table 9: Firm performance indicators used to operationalize firm performance.

<table>
<thead>
<tr>
<th>Measurement:</th>
<th>Coded as 0</th>
<th>Coded as 1</th>
<th>Coded as 2</th>
<th>Coded as 3</th>
<th>Coded as 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPI1: Growth in FTE’s</td>
<td>No growth</td>
<td>Between 1 and 5</td>
<td>More than 5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FPI2: Time to first international sale</td>
<td>No international sales or &gt;3 years</td>
<td>International sale within 3 years</td>
<td>International sale within 1 year</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FPI3: Turnover in 2015 (€)</td>
<td>0 – 100,000</td>
<td>100,000 – 250,000</td>
<td>250,000 – 500,000</td>
<td>500,000 – 1,000,000</td>
<td>&gt; 1,000,000</td>
</tr>
</tbody>
</table>

Based on these criteria, firm performance is codified as belonging to one of four categories. Some start-ups have been taken over by larger companies. In these cases, the performance is measured according to the situation as it was at the moment of take-over. The following rules were used to determine each start-up’s performance.

- If the start-up is known to have ceased operations: category 0
- If the start-up has not yet introduced its product on the market, appears to be a sleeping firm (no news in the last 12 months) or has a low turnover (0 or 1): category 1
- If the start-up has introduced its product to the market and showed activity in the last 12 months (e.g. news posts): category 2
- If the start-up has grown in FTE and achieved a high turnover (3 or 4): category 3

The categories of firm performance have the following textual interpretations.

Table 10: Firm performance categories and their textual descriptions.

<table>
<thead>
<tr>
<th>Category</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The start-up has ceased operations</td>
</tr>
<tr>
<td>1</td>
<td>The start-up appears to be a sleeper or has not yet introduced its product to the market</td>
</tr>
<tr>
<td>2</td>
<td>The start-up is active, and may show signs of moderate growth</td>
</tr>
<tr>
<td>3</td>
<td>The start-up is very successful; it grows fast in FTE and turnover</td>
</tr>
</tbody>
</table>
7.2 Sample selection

The sample is restricted to university spin-offs, as was explained in Chapter 1. Also, data on these start-ups is more easily accessible, which helps with time and resource constraints of this master thesis. The majority of the sample companies that were used in this research are start-ups that are connected to the TU Delft. Of these, most were or still are in the YES!Delft incubator. University spin-offs are often highly innovative and therefore provide a good sample of pioneering firms. Aside from start-ups connected to the TU Delft, some information on additional innovative start-ups was available from the section ETI at the faculty of TPM and by internet searches. The sample includes both providers of services and providers of physical products. These were intentionally selected, as it allows for comparison between the two types of firms.

7.2.1 Selection criteria

As per the research goals, a selection was made for university spin-offs that are first movers. Some start-ups could be disregarded by the researcher as not being pioneering with its product. However, for most start-ups it was not known by the researcher whether they are pioneers, and time and resource constraints required the use of self-reporting of pioneering.

The definition of a first mover is the first firm to enter the market with a specific product (paragraph 3.3). But this definition may still cause confusion. Consider the following case: A firm in the Americas offers a new product, but does not operate and has no intention of operating in Europe. Somewhat later, a European firm offers a similar product in the European market and similarly keeps to its geographical location. Does the European firm count as a pioneer? Very strictly speaking not, but when there no mixed interests, no interactions, no competition etc. between the two firms, all pioneering advantages will still be applicable for the European firm versus later European entries. Therefore, in this study, a market entrant is also considered a pioneer if it is the first to offer a product in a certain geographical area that is unaffected by the actions of a “true” pioneer from a global viewpoint.

Also in line with the research goals, the selection was limited to those start-ups that offer B2B services. What constitutes a service was described in Chapter 4. One useful indicator is transfer of ownership; for many services, there is no clear transfer of ownership. Rather, there is information exchange, the use of a product that remains property of the service supplier, or the service firm performs some task(s) for the customer. Still, the categorization of “service” or “physical product” must occur along the spectrum, and is clearer for some cases than it is for others.

Start-ups from three industry sectors will be investigated: medical, greentech and business support. Greentech refers to start-ups whose products are renewable and sustainable. These are often in the energy sector. Start-ups in the category business support offer products that enhance the operations of other firms, mostly on an organizational level. Looking at multiple sectors allows for increased generalization of results, or it may provide information regarding differences between the sectors.

Firm age was the last selection criteria. A minimum amount of time must have passed before any conclusions can be made with reasonable certainty. Start-ups founded between 2000 up to and including 2012 were selected. At the time of writing, these start-ups will have operated at least 2 full years.
7.2.2 Resulting sample

The total resulting sample size is 52 start-ups. The sample population can be seen in Appendix V. The population was manually selected, and it was the goal of the researcher to distribute the sample over the three sectors (medical, greentech, business support) and three different natures of activities (offering services, products, or a mixture of both). The exception is the business support category, which by its definition only features service providers. For privacy reasons, the data in the information table is not available in this thesis.

The diversity of the sample is important. The more diverse the objects in the sample, the more information there is available in the sample and the more generalizable are the results. In fact, as will be explained in Chapter 8, retaining just one from a set of objects that are fully similar to each other is one of the methods of data reduction in Rough Set Analysis.

7.3 Data collection

Most inputs can be found by the researcher in online information sources (i.e. company web site, newspapers, blogs, LinkedIn). Whenever possible, such data will be taken from multiple sources to increase its validity; a process called triangulation (Hammersly, 2008) (Jonsen & Jehn, 2009). Information that cannot be gathered by the researcher will be requested from the corresponding start-up. Such self-reporting is necessary due to the nature of the measured concepts and the existing time and resource constraints, but may introduce some errors.

Social desirability bias is the result of respondents’ tendencies to give socially desirable answers, which often implies they exaggerate positive points and understate negative ones (Chung & Monroe, 2003) (Gonyea, 2005). Not all biases are intentional though: bounded rationality (limited human cognitive capabilities), self-serving bias (positive outcomes are attributed to internal factors, negative outcomes are attributed to external factors) and memory distortions (past events are evaluated more positively than they were, positive events are more often recalled than negative ones) can also serve to diminish self-reporting validity (Gramzow & Willard, 2006) (Robbins & Judge, 2012). Interestingly, one study found that self-reporting leads to underreporting of human capital (Massingham, Nguyen, & Massingham, 2011). On the positive side, this study deals with relatively short time spans which should decrease the memory distortions of self-reporting.

7.4 Missing data

Rough set analysis does not handle missing data effectively (Greco, Matarazzo, & Slowinski, 2000). Apart from simply disregarding all objects with incomplete data, several different methods for dealing with missing data have been developed (Grzymala-Busse, 2009) with different results. However, the ROSE2 software only allows for a single solution: it can fill the missing data with the most common value for that attribute (ROSE2 User's Guide, 1999). This approach is far from ideal, and it was therefore decided not to use this method. Instead, if no specific, definitive data could be found, related data and the insight of the researcher was used to make an informed estimation. This was done for no more than two missing variables per object to maintain sample strength. Two objects that had at first been selected in the sample were discarded due to this limit.
Turnover could unfortunately not be collected for all start-ups. It was necessary to estimate the performance of 18 start-ups based on other indicators than the method described in paragraph 7.1.5. In these cases additional information that does not fit the operationalization, but is useful in categorizing firm performance, was used.

The additional information that was used in the estimations included but was not limited to:

- information on sales figures (serving as an indicator for turnover)
- turnover of earlier years
- prognoses for 2014-2015 turnover from earlier years
- recent acquisition of more financing
- website/news activity

### Chapter summary

- The independent and dependent variables have been operationalized so they can be measured objectively. Organizational capital was excluded due to its reduced applicability to start-ups and its difficulty to measure.

- There are four measures for human capital, two measures for social capital, and seven additional (non-intellectual capital) measures, making a total of thirteen independent variables. Firm performance is the single dependent variable.

- The dependent variable, firm performance, is based on three indicators for performance. Estimations based on additional information were made where the originally intended information was not available.

- 52 pioneering university spin-off start-ups have been selected, spread over the different industry sectors and product-service categories.
8 Empirical data analysis

The gathered data is stored in an information table, structured as in the example in Table 19 (page 65). A small selection of the information table for this study can be seen in Appendix VI. Access to the full table can be requested from the chair of the examination committee. The investigated firm attributes are called the condition attributes; these are the independent variables. The decision attribute is firm performance; this is the dependent variable. The information table allows one to look for cause-effect dependencies between the independent and dependent variables.

This chapter describes how the gathered empirical data is analysed. In paragraph 8.1, some statistical tests are performed to see if the individual attributes have an impact on firm performance, and to find patterns between condition attributes. For small amounts of data, it may be possible for the researcher to scan for these relations manually. But the limitations of the human mind prevent this approach if complexity increases (Arthur, 1994).

Rough Set Analysis is the approach used to find such patterns. It is introduced paragraphs 8.2 and 8.3. Paragraph 8.4 contains the application of Rough Set Analysis. The final paragraph discusses similarities and differences between product- and service-oriented start-ups.

8.1 Statistical significance tests on condition attributes

In order to test if there are statistically relevant connections between individual condition attributes and firm performance, Fisher’s exact (and the Fisher-Freeman-Halton extension) and chi-square tests were carried out. These tests are used to check whether the difference between observed and expected frequencies is due to chance, or if there are patterns in the data to a certain statistical probability (usually 5% or p < 0.05).

Expected firm performance values for each category are calculated from the dataset itself using the totals of the observed values. For example, we know that 13 out of 52 firms exhibit FP=3, or 25%. We also know that 21 firms offer physical products. Taking 25% of 21 firms equals 5.25 firms. Thus, we expect 5.25 firms to offer physical products and have a performance of FP=3. This method is repeated for all combinations. While it is impossible to have “5.25” firms in real life, we are dealing with expected values used for calculations, and as such having numbers with fractional components in the expected group does not matter.

Both tests have the same goal, but chi-square tests cannot be accurately used if there are cells with a value under five (Gravetter & Wallnau, 2008), which is the case for most attributes here. In fact, in order to increase the numbers in each category and thereby increase the statistical tests’ accuracy, the attribute firm performance was reduced from 4 to 2 categories for these tests (see Table 12 on the next page for an example). All the cross-tables for the statistical tests can be found in Appendix VIII.
8.1.1 Condition attributes tested against performance

All Fisher exact tests were performed using an online calculator (vassarstats.net, 2016), which gave the results shown in Table 11. Chi-square tests in Microsoft Excel were only performed for all attributes that had no more than 1 cell with n<5, due to the mentioned reduced accuracy.

Table 11: The p-values for each condition attribute, tested against firm performance.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Fisher’s exact test p-value</th>
<th>chi-square p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC1: Level of education</td>
<td>0.569</td>
<td>0.879</td>
</tr>
<tr>
<td>HC2: Corporate work experience</td>
<td>0.369</td>
<td>-</td>
</tr>
<tr>
<td>HC3: Academic work experience</td>
<td>1.0</td>
<td>0.737</td>
</tr>
<tr>
<td>HC4: Entrepreneurship experience</td>
<td>0.619</td>
<td>-</td>
</tr>
<tr>
<td>SC1: University network</td>
<td>0.362</td>
<td>-</td>
</tr>
<tr>
<td>SC2: Business network</td>
<td>0.672</td>
<td>-</td>
</tr>
<tr>
<td>AF1: Number of founders</td>
<td>0.409</td>
<td>0.568</td>
</tr>
<tr>
<td>AF2: Prize(s)</td>
<td>0.315</td>
<td>0.417</td>
</tr>
<tr>
<td>AF3: External capital</td>
<td>0.0094</td>
<td>0.0085</td>
</tr>
<tr>
<td>AF4: Industry sector</td>
<td>0.581</td>
<td>0.462</td>
</tr>
<tr>
<td>AF5: Product-service orientation</td>
<td>0.448</td>
<td>-</td>
</tr>
<tr>
<td>AF6: Focus</td>
<td>0.365</td>
<td>0.447</td>
</tr>
<tr>
<td>AF7: Time to market</td>
<td>0.0095</td>
<td>0.0183</td>
</tr>
</tbody>
</table>

Only AF3 and AF7, the acquisition of external capital and the time to market, have observed frequencies that are distinct enough from the expected frequencies that it is said it cannot be due to chance at a p=0.05 significance level, or even at the p=0.01 level. Only the chi-square test for AF7 does not imply significance at the p=0.01 level, but the Fisher’s exact test result should be weighed more heavily due to the n<5 limitation of the chi-square test.

Taking a closer look at AF3 (Table 12) reveals an interesting result. For start-ups that received no external capital, fewer firms than expected had low performance, and more firms than expected had a higher performance. The exact opposite is true for start-ups that did receive external capital. This is a counterintuitive result. To investigate further, a second test was performed with different setup, grouping FP=0,1,2 and FP=3 (Table 13).

Table 12: The observed and expected values of attribute AF3, the attraction of external capital.

<table>
<thead>
<tr>
<th>AF3: External capital</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>None or &lt; €100,000</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>More than €100,000</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.0094
P-value (chi-square): 0.0085
Table 13: Second iteration of the Fisher test for attribute AF3.

<table>
<thead>
<tr>
<th>AF3: External capital</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1,2</td>
<td>FP=3</td>
</tr>
<tr>
<td>None or &lt; €100.000</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>More than €100.000</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>13</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.0305
P-value (chi-square): 0.0250

The result is another statistically significant pattern (p<0.05), but now the conclusion would be that the attraction of external capital is correlated to FP=3, and not attracting external capital is correlated to FP=0,1,2. It appears that start-ups that did not receive external capital are more often in the “middle ground”, while start-ups that do receive external capital either fail or become very successful. A theoretical argument for these results may be that start-ups that did not receive external capital also did not need it per se. Their products may have required smaller investments to develop, thereby reducing risk, whereas start-ups that did require external capital worked on larger, more time- and resource-consuming projects that inherently have larger risks.

Attribute AF7 shows that more start-ups than expected had a low performance if the time to market was longer. Conversely, the frequency of start-ups that exhibited a very short time between their foundation and market introduction showed a higher performance than expected. The medium category is very close in expected and observed values. Thus, it seems that a short time to market is a positively moderating factor for firm performance; a result that is theoretically supported by FMA literature.

Table 14: The observed and expected values of attribute AF7, the time between foundation and market introduction.

<table>
<thead>
<tr>
<th>AF7: Time to market</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>More than 3 years</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Between 1 and 3 years</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.0095
P-value (chi-square): 0.0183

8.1.2 Core project complexity

The fact that both AF3 and AF7 exhibit statistically significant patterns may not be arbitrary. They may be related in the fact that the size and resource requirements of start-ups’ projects are both reflected in these measures. Large, challenging projects are more likely to require external capital and to take longer to introduce to the market, and both of these are indicators for low performance. Smaller, “easier” projects may not require external capital, can be introduced to the market quickly and lead to higher firm performance. In order to check for this hypothesized phenomenon, an additional condition attribute was added to the database; core project complexity (AF8).

The term “core project” is used because some start-ups worked on different projects (which is also why attribute AF6, focus, was used). But the core project, on which the foundation of the start-up is based, is the one of interest. Factors taken into account in the evaluation of complexity are size, level of innovativeness,
required effort for market introduction (medical products, for example, require validation, trials, etc. before they can be introduced, while business services do not) and method of distribution (software is easier to distribute than physical products). A three-way categorization was used of projects that were relatively complex, of moderate complexity, and relatively simple (coded as 0, 1 and 2 in the information table respectively).

Conducting a Fisher test to check the individual influence of this attribute on firm performance (likewise grouped as [0,1] and [2,3] as for the other Fisher tests) did not produce a statistically significant result (p=0.216).

8.1.3 Condition attributes tested against each other

To further investigate relations between the attraction of external capital, time to market, core project complexity and product-service orientation, additional statistical tests were performed. First, the attraction of external capital and product-service orientation is investigated (Table 15). Start-ups that offer physical products and start-ups that offer both are grouped together. It can be seen that more start-ups that offered physical products and hybrids attracted external capital than expected, while fewer service-offering start-ups attracted external capital than expected and vice versa. The results are supported at the 5% confidence level.

Table 15: The attraction of external capital tested against product-service orientation.

<table>
<thead>
<tr>
<th>External capital versus product-service orientation</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No capital</td>
<td>Capital</td>
</tr>
<tr>
<td></td>
<td>attracted</td>
<td>attracted</td>
</tr>
<tr>
<td>Physical prod. or hybrid</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Service</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>26</strong></td>
<td><strong>26</strong></td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.044  
P-value (chi-square): 0.048

Support (p<0.05) is also found for the pattern between time to market and product-service orientation (Table 16). More hybrids start-ups had a longer time to market introduction than expected, and more service-offering firms had a shorter time to market introduction than expected. For this calculation, the category time to market was adapted to a binary variable. The data supports the notion that service-offering start-ups generally realize market introduction quicker than start-ups that offer both physical products and services. A theoretical argument for this phenomenon is that hybrids are often start-ups whose core project is a physical product, but the higher difficulty in bringing a physical product to the market forces these start-ups to offer services as a means of generating cash flows for short-term survival.
Table 16: The time to market tested against product-service orientation.

<table>
<thead>
<tr>
<th>Time to market versus product-service orientation</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>10</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.022  
P-value (chi-square): 0.030

To see if the observed patterns of attraction of external capital and time to market to start-up performance are indeed linked to the core project complexity as theorized in paragraph 8.1.2, these attributes were tested against each other. Table 17 indeed shows that more start-ups than expected attracted external capital if they had a more complex project and vice versa, although less strongly supported with a statistical significance at the 10% level.

Table 17: The attraction of external capital tested against core project complexity.

<table>
<thead>
<tr>
<th>External capital versus project complexity</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No capital</td>
<td>Capital</td>
</tr>
<tr>
<td></td>
<td>attracted</td>
<td>attracted</td>
</tr>
<tr>
<td>Relatively complex</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Moderate</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Relatively simple</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.086  
P-value (chi-square): 0.076

The final calculation, statistically significant at the 5% level, shows that more start-ups than expected that had relatively simple projects had a short time to market introduction, while more start-ups than expected that had relatively difficult projects had a longer time to market introduction and vice versa. Note that both variables were adapted to binary variables to strengthen the results.

Table 18: The time to market tested against core project complexity.

<table>
<thead>
<tr>
<th>Time to market versus project complexity</th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relatively</td>
<td>Relatively</td>
</tr>
<tr>
<td></td>
<td>complex</td>
<td>simple</td>
</tr>
<tr>
<td>More than 1 year</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>14</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.027  
P-value (chi-square): 0.023
8.2 Introduction to Rough Set Analysis

That the condition attributes other than the attraction of external capital and time to market did not exhibit statistically significant patterns with firm performance individually does not explicitly mean they do not influence firm performance. Rather, it may be specific combinations of factors that influence performance. Patterns by such combinations of attributes cannot be found with Fisher tests. Rough Set Analysis does have this capability.

In addition, most statistical methods used in academic research (i.e. regression analysis) require a sufficient sample size to be effective, of at least 80 to 100 objects (Blaikie, 2003) (Verschuren & Doorewaard, 2010). Such a sample size is not available in this study. Furthermore, statistical tests are mainly designed to test hypotheses that are predefined by the researcher. In contrast, knowledge discovery in databases (KDD) through data mining is a bottom-up approach to analyse patterns in data (Fayyad, Piatetsky-Shapiro, & Smyth, 1996) (Witten & Frank, 2005). Since this is an exploratory study KDD will be applied to find such patterns. Rough Set Analysis is a suitable technique for this purpose.

Traditional, mathematical models are necessarily very strict, or crisp (Pawlak, 1982). An object either falls into a class, or it does not. But real-world applications are often not so black and white. This research provides excellent examples of such ambiguity and vagueness in real world applications: classifications in the product-service continuum, whether a firm is a first mover or not, and firm performance are inherently vague.

One approach to such vagueness is fuzzy set theory, wherein an object can fall into a class to a certain degree, i.e. it can have partial membership (Pawlak, 1982). Another approach is rough set theory, which works with fuzzy boundary regions of a set. Rough set theory is the background of rough set analysis, wherein decision rules are inductively derived from a set of objects that are characterized by attribute values and decision values (Pawlak, 2002). Decision rules are textual rules of the form “if [conditions] then [decision class]”.

Rough set analysis has several important advantages. First off, it does work with the sample size of this study and does not need preliminary or additional information about data. This is different from regression analysis, which assumes and even depends on normal distribution of values and the absence of multicollinearity. Furthermore, rough set analysis allows for data reduction without sacrificing accuracy, can efficiently find hidden patterns in data and allows the automatic generation of decision rules (Pawlak, 1982) (Suraj, 2004). It is a relatively new technique, but has seen previous use in research including for example Dimitras et al. (1999), Nijkamp et al. (2002), Dai & Xu (2013), Tseng et al. (2016), and in one article currently in print for the journal Technological Forecasting and Social Change (Taheri & Van Geenhuizen, in print for 2017). RSA has been used in medicine, finance, pharmacology, geology, social sciences, and engineering (Pawlak & Slowinski, 1994).

Multiple software applications for RSA have been developed (Komorowski et al, 1999). In this research, the Rough Set Data Explorer version 2.2 (ROSE2) is used (Predki, Słowinski, Stefanowski, Susmaga, & Wilk, 1998) (Predki & Wilk, 1999). It was developed by the Poznan University of Technology and is freely available to researchers (IDSS, 2016).

8.3 Theory of Rough Set Analysis

Consider a set of objects S with attributes A, and with X ⊆ S and Y ⊆ A. The subset X can be approximated by constructing the S-lower and S-upper approximations of X. The S-lower approximation of X is the set of objects that can be classified as certainly falling in X. The S-upper approximation of X is the set of objects that can only possibly be classified as falling in X. Note that the S-lower approximation of X is a subset of the S-upper approximation of S by definition. Finally, the set of objects in S that can be said to certainly not fall in X is called the S-outside region of X (Komorowski, Polkowski, & Skowron, 1999). The region between the S-upper and S-
lower approximations of $X$ is called the boundary region. A graphical representation is given below in Figure 19. If the $S$-lower and $S$-upper approximations of $X$ are identical, the boundary region is empty and the set is said to be crisp. Otherwise, the set is rough (Pawlak, 1982).

One of the mentioned advantages of RSA was data reduction. Data reduction occurs in two ways. The first is the search for equivalence classes (Komorowski et al., 1999), wherein the investigated characteristics of objects are similar (indiscernible). When looking at a single attribute (let us take $c_2$) in the example in Table 19, it is seen that $x_1$, $x_2$, and $x_4$ all have the same value. Therefore, they are said to be in the $c_2$-equivalence class $\{x_1, x_2, x_4\}$, with $\{x_3\}$ and $\{x_5\}$ completing the family of $c_2$-equivalence classes. These are also called the $c_2$-elementary sets. Elementary sets based on all attributes (in this example, the $\{c_1, c_2, c_3, d\}$-elementary set) may also exist, this is called an atom (ROSE2 User's Guide, 1999). In the example, $x_1$ and $x_4$ are similar on all counts and constitute an atom. Data reduction can be achieved because only one object in an equivalence class is needed to represent the entire equivalence class (Komorowski et al., 1999).

The second form of data reduction is the identification of reducts, and subsequently the core. Not all attributes may be necessary to come to the same classification. The least minimal subset of attributes that ensures the same quality of classification as the full set of attributes is called a reduct. Multiple reducts in a single information table are possible. In the example of Table 19, classifications can be made using either reduct $\{c_1, c_2\}$ or $\{c_2, c_3\}$. In other words, either $c_1$ or $c_3$ can be omitted in the analysis without a penalty in classification accuracy (Rissino & Lambert-Torres, 2009). The attribute $c_2$ is present in all reducts and is called the core: it cannot be omitted without losing accuracy (ROSE2 User's Guide, 1999).

There are two important characteristics that determine the usefulness of a decision rule: its strength and its coverage. The strength is the total number of objects that is covered by the rule (i.e. the number of objects that
have the same values for all condition and decision attributes described in the rule). The higher this number, the more objects this rule can be applied to. The coverage is the percentage of the decision class that is covered by the rule. A percentage of 100% means that every single object in that decision class is covered by that rule. For the example information table above, the following rules were found. For such a simple example, all objects are easily classified. The decision rules are shown in Table 20.

Table 20: Decision rules for the example information table.

<table>
<thead>
<tr>
<th>Rule</th>
<th>{objects covered}</th>
<th>Strength (#)</th>
<th>Coverage (%)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If (c1 = 2) then (d = 0)</td>
<td>{5}</td>
<td>1</td>
<td>50.00</td>
<td>100%</td>
</tr>
<tr>
<td>If (c2 = 2) &amp; (c3 = 0) then (d = 0)</td>
<td>{2}</td>
<td>1</td>
<td>50.00</td>
<td>100%</td>
</tr>
<tr>
<td>If (c1 = 0) then (d = 1)</td>
<td>{1, 4}</td>
<td>2</td>
<td>66.67</td>
<td>100%</td>
</tr>
<tr>
<td>If (c2 = 0) then (d = 1)</td>
<td>{3}</td>
<td>1</td>
<td>33.33</td>
<td>100%</td>
</tr>
</tbody>
</table>

8.4 Application of Rough Set Analysis

The data table was entered in ROSE2. The quality of classification with all attributes was 100%, indicating that there is no conflicting data within the dataset. A large number of 145 reducts was found, each consisting of 7, 8 or 9 condition attributes. A list of how often each attribute was included in a reduct is shown in Table 21.

Table 21: The list of attributes and how often they occurred in the reducts.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Frequency</th>
<th>% Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC1: Level of education</td>
<td>83</td>
<td>57.24</td>
</tr>
<tr>
<td>HC2: Corporate work exp.</td>
<td>97</td>
<td>66.90</td>
</tr>
<tr>
<td>HC3: Academic work exp.</td>
<td>60</td>
<td>41.38</td>
</tr>
<tr>
<td>HC4: Entrepreneurship exp.</td>
<td>73</td>
<td>50.34</td>
</tr>
<tr>
<td>SC1: University network</td>
<td>145</td>
<td>100</td>
</tr>
<tr>
<td>SC2: Corporate network</td>
<td>65</td>
<td>44.83</td>
</tr>
<tr>
<td>AF1: Number of founders</td>
<td>65</td>
<td>44.83</td>
</tr>
<tr>
<td>AF2: Prize</td>
<td>64</td>
<td>44.14</td>
</tr>
<tr>
<td>AF3: Attraction of external capital</td>
<td>66</td>
<td>45.52</td>
</tr>
<tr>
<td>AF4: Sector</td>
<td>72</td>
<td>49.66</td>
</tr>
<tr>
<td>AF5: Product-service orientation</td>
<td>88</td>
<td>60.69</td>
</tr>
<tr>
<td>AF6: Focus</td>
<td>80</td>
<td>55.17</td>
</tr>
<tr>
<td>AF7: Time to market</td>
<td>74</td>
<td>51.03</td>
</tr>
<tr>
<td>AF8: Core project complexity</td>
<td>97</td>
<td>66.90</td>
</tr>
</tbody>
</table>

SC1 (university network) is present in all reducts, meaning it forms the core. Since at least 7 attributes are needed to perform a complete classification (the smallest reducts), using only the core will result in imprecise classification rules. Recall that a reduct is no more than a subset of attributes that allows the same level of classification as all attributes; how often a certain attribute is included does not imply anything about that attribute’s classification power. What the results of the search for reducts do show is that quite many attributes are needed to come to the same level of classification as using all reducts, and all attributes are fairly evenly distributed amongst all reducts. A completely accurate classification based on fewer than 7 attributes is not possible.
8.4.1 Rule induction on the full dataset

Of the four different analysis algorithms available in ROSE (basic minimal covering with extended conditions, extended minimal covering with entropy and Laplace evaluation measures, and satisfactory description), satisfactory description was found to produce optimal results. The first three methods find only rules that are 100% accurate, meaning that for each rule no objects are found that have the same condition attribute values but conflicting decision attribute values. These methods resulted in long, difficult rules with low coverage. With the satisfactory description method, rules can be induced with an accuracy threshold defined by the user. To maintain reasonable accuracy, an accuracy threshold of 75% was used. In addition, the rule length was limited to maximum 3 conditions, and a coverage threshold of 30% was used.

It was found that stronger rules were found when the two lower performance categories were grouped together as \([0,1 \rightarrow 1]\). The resulting categorization of performance in three classes consisting of \([1]\), \([2]\) and \([3]\) was found to have a better balance between the coverage of rules while not sacrificing too much accuracy in the decision attribute. Other variations were also tried such as removing objects and variables and regrouping variables. A full list of variations is given in Appendix IX, but none were found to provide stronger rules.

The rules in Table 22 are a selection of the optimal rules (based on strength and accuracy) that were found when rules were induced from the whole database. The numbers in square brackets denote what decision classes the covered objects truly belong to, from high to low. For example, the first rule classifies objects as FP=2 with \([3, 21, 2]\). It covers 26 objects, 21 of which truly belonged to the class FP=2, 3 objects belonged to class FP=3 and 2 objects to FP=1. Thus, the rule’s accuracy is 21/26=80%, with 3/26=12% actually belonging to FP=3 and 2/26=8% actually belonging to FP=1.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Str (#)</th>
<th>Cov (%)</th>
<th>Acc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1 ((AF3 = 0) \Rightarrow (FP = 2)) ([3, 21, 2]) If the start-up does not attract external capital, it is moderately successful.</td>
<td>26</td>
<td>77.78</td>
<td>80.77</td>
</tr>
<tr>
<td>G2 ((HC3 = 0) &amp; (AF1 = 0) &amp; (AF3 = 0) \Rightarrow (FP = 2)) ([1, 12, 0]) If there are less than 3 founders, that have no academic work experience and do not attract external capital, the start-up is moderately successful.</td>
<td>13</td>
<td>44.44</td>
<td>92.31</td>
</tr>
<tr>
<td>G3 ((HC1 = 1) &amp; (AF2 = 1) \Rightarrow (FP = 2)) ([1, 11, 1]) If the founders have a PhD degree and have won a prize with their start-up, the start-up is moderately successful.</td>
<td>13</td>
<td>40.74</td>
<td>84.62</td>
</tr>
<tr>
<td>G4 ((AF3 = 1) &amp; (AF7 = 2) \Rightarrow (FP = 3)) ([5, 1, 0]) If the start-ups attracts external capital and realizes market introduction within 1 year, it is very successful.</td>
<td>6</td>
<td>38.46</td>
<td>83.33</td>
</tr>
<tr>
<td>G5 ((AF2 = 0) &amp; (AF3 = 1) &amp; (AF7 = 0) \Rightarrow (FP = 1)) ([0, 1, 4]) If the start-up won no prize, attracted external capital and took more than 3 years to market introduction, it was unsuccessful.</td>
<td>5</td>
<td>33.33</td>
<td>80.00</td>
</tr>
<tr>
<td>G6 ((SC1 = 2) &amp; (AF5 = 0) \Rightarrow (FP = 3)) ([4, 0, 0]) If the start-up has ties to more than 1 university and offers a physical product, it is very successful.</td>
<td>4</td>
<td>30.77</td>
<td>100</td>
</tr>
</tbody>
</table>

Str is the strength: the number of objects that matches the decision rule’s conditions.
Cov is the coverage: the percentage of objects of the decision class that is identified by this rule.
Acc is the accuracy: the percentage of objects that is correctly classified by this rule.

These rules support the notions gained from the Fisher tests: start-ups that did not attract external capital are much more often relatively successful, whereas start-ups that did attract external capital become either very successful or unsuccessful. When start-ups attracted external capital, and it is coupled with a short time to market introduction, the start-ups were very successful (the fourth rule).
When the start-up attracted external capital, but had a long time to market introduction and no prize was won, the start-ups were unsuccessful (the fifth rule). Furthermore, we see that having a PhD and winning a prize, two conditions that are theoretically considered to contribute to high performance, does not lead to very successful start-ups but rather moderately successful ones.

8.4.2 Testing on split data sets (product vs. service)

The use of the total data set revealed little in terms of different success factors for service- and physical product-oriented start-ups. In order to more directly investigate this, the database was split. The middle category, hybrids, was included by making four selections of start-ups: service-only, product-only, service and hybrid, and product and hybrid. However, the inclusion of hybrids did not improve the results, and it was decided to focus on product- and service-only start-ups. Looking at products and services separately the following distributions of performance is seen.

Table 23: The number of product- and service-oriented start-ups in each performance category.

<table>
<thead>
<tr>
<th>Performance category -&gt;</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products (n=21)</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Services (n=21)</td>
<td>3</td>
<td>13</td>
<td>5</td>
</tr>
</tbody>
</table>

Category 3 is defined as very successful: the start-up is selling its product/service on the market and exhibiting growth in both FTE and turnover. Category 2 is defined as moderate success: the start-up selling its product/service on the market and may show signs of moderate growth in FTE and/or turnover. Category 1 is defined as no success: the start-up ceased operations, has not realized market introduction yet or is otherwise inactive (“sleeper”).

It seems that product-oriented start-ups are more likely to fail or become very successful, while services fail less often but are also less often very successful. It appears that services offer a lower risk but are more difficult to become really successful with, while products are more risky but realize greater returns if successful. However, no values were significantly different from expected values according to statistical calculations.

The attraction of external capital and time to market were re-evaluated using Fisher tests similar to the method described in paragraph 8.1. While statistically significant patterns were found on the complete database, no patterns could be found for both variables when looking at product-oriented or service-oriented start-ups separately. This may be attributed to the fact that the splitting of the database results in too low an object count to prove statistical significance.

8.4.3 Service-oriented start-ups

Table 24 shows the best rules that were found on the subset of the database that includes only start-ups that offer services. Several similarities with the full database can be seen. Rules S1 and G1 are similar, and there is a general tendency in all rules that shorter times to market introduction result in higher performance than longer times to market introduction. Rules S1, S6 and S7 show that the attraction of external capital can lead to either very high or low performance, while not attracting external capital more often leads to moderate performance, which is the same conclusion that could be drawn from the Fisher tests.
Table 24: Selection of decision rules for service-oriented start-ups (n=21)

<table>
<thead>
<tr>
<th>Rule</th>
<th>Str</th>
<th>Cov (%)</th>
<th>Acc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 ((AF3 = 0) \Rightarrow (FP = 2)) &amp; [2, 11, 1]</td>
<td>14</td>
<td>84.62</td>
<td>78.57</td>
</tr>
<tr>
<td>S2 ((AF7 = 2) \Rightarrow (FP = 2)) &amp; [3, 7, 0]</td>
<td>10</td>
<td>53.85</td>
<td>70.00</td>
</tr>
<tr>
<td>S3 ((AF3 = 0) &amp; (AF7 = 2) \Rightarrow (FP = 2)) &amp; [1, 6, 0]</td>
<td>7</td>
<td>46.15</td>
<td>85.71</td>
</tr>
<tr>
<td>S4 ((HC1 = 1) &amp; (AF7 = 2) \Rightarrow (FP = 2)) &amp; [1, 5, 0]</td>
<td>6</td>
<td>38.46</td>
<td>83.33</td>
</tr>
<tr>
<td>S5 ((AF3 = 1) &amp; (AF7 = 0) \Rightarrow (FP = 1)) &amp; [0, 1, 2]</td>
<td>3</td>
<td>66.67</td>
<td>66.67</td>
</tr>
<tr>
<td>S6 ((AF3 = 1) &amp; (AF7 = 2) &amp; (AF8 = 2) \Rightarrow (FP = 3)) &amp; [2, 0, 0]</td>
<td>2</td>
<td>40.00</td>
<td>100</td>
</tr>
</tbody>
</table>

Str is the strength: the number of objects that matches the decision rule’s conditions.
Cov is the coverage: the percentage of objects of the decision class that is identified by this rule.
Acc is the accuracy: the percentage of objects that is correctly classified by this rule.

8.4.4 Product-oriented start-ups

Table 25 shows the selection of optimal decision rules for product-oriented start-ups. Note that rule P2 is similar to S1 and G1 and thus also applies to start-ups that only offer physical products. In further support of the notion that the attraction of external leads to either very successful or unsuccessful start-ups, rule P1 shows no objects that were moderately successful when external capital was attracted.

Rules P5 and P6 have low strength and coverage, but are included as they support the conclusions from the Fisher’s tests and are 100% accurate. Rule P5 shows that the combination of attraction of external capital and quick market introduction leads to high success. P6 shows that, even with a relatively complex project, quick market introduction still leads to high success.

Table 25: Selection of decision rules for product-oriented start-ups (n=21)

<table>
<thead>
<tr>
<th>Rule</th>
<th>Str</th>
<th>Cov (%)</th>
<th>Acc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 ((HC1 = 0) &amp; (AF3 = 1) \Rightarrow (FP = 3)) &amp; [6, 0, 2]</td>
<td>8</td>
<td>75.00</td>
<td>75.00</td>
</tr>
<tr>
<td>P2 ((AF3 = 0) \Rightarrow (FP = 2)) &amp; [1, 5, 1]</td>
<td>7</td>
<td>71.43</td>
<td>71.43</td>
</tr>
<tr>
<td>P3 ((SC1 = 2) \Rightarrow (FP = 3)) &amp; [4, 0, 0]</td>
<td>4</td>
<td>50.00</td>
<td>100</td>
</tr>
<tr>
<td>P4 ((HC1 = 1) &amp; (HC2 = 1) \Rightarrow (FP = 2)) &amp; [0, 3, 0]</td>
<td>3</td>
<td>42.86</td>
<td>100</td>
</tr>
</tbody>
</table>
### 8.5 Comparison between product- and service-oriented start-ups

It appeared from Table 23 that service-oriented start-ups are more often moderately successful, and product-oriented start-ups are more often either very successful or unsuccessful, but the numbers are not statistically significant.

Stronger empirical support is available to support the notions regarding the attraction of external capital and time to market. That is, both for product- and service-oriented start-ups, attracting external capital leads either to failure or to more prominent success. Both product- and service-oriented start-ups that did not attract external capital had a tendency to end up in the middle ground, i.e. being moderately successful. Time to market seems equally important for product- and service-oriented start-ups. These notions are supported by the Fisher tests, RSA on the full dataset and RSA on both subsets of the data. Note that it was also found that product-oriented and hybrid start-ups attracted external capital more often than service-oriented start-ups.

In general, the empirical data seems to indicate the following:

Services are generally less complex to market than products. Service-oriented start-ups exhibit a shorter time to market, which is correlated with higher firm performance. Service-oriented start-ups less often attract external capital than product-oriented start-ups, which is correlated with lower-risk, lower-return performance (the middle ground).

Product-oriented start-ups attract external capital more often. Product-oriented start-ups that attract external capital and realize quick market introduction are more often very successful. Product-oriented start-ups that attract external capital but do not realize market introduction quickly are more often unsuccessful. Again, start-ups that attract no external capital more often end up in the middle ground.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Str</th>
<th>Cov (%)</th>
<th>Acc (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5 <code>(AF3 = 1) &amp; (AF7 = 2) =&gt; (FP = 3)</code></td>
<td>3</td>
<td>37.50</td>
<td>100</td>
</tr>
<tr>
<td>If the start-up attracts external capital and realizes market introduction within 1 year, it is very successful.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P6 <code>(AF7 = 2) &amp; (AF8 = 0) =&gt; (FP = 3)</code></td>
<td>3</td>
<td>37.50</td>
<td>100</td>
</tr>
<tr>
<td>If the start-up realizes market introduction within 1 year with a complex project, it is very successful.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P7 <code>(HC2 = 0) &amp; (AF7 = 0) &amp; (AF8 = 1) =&gt; (FP = 1)</code></td>
<td>3</td>
<td>50.00</td>
<td>100</td>
</tr>
<tr>
<td>If the founders have no work experience and do not realize market introduction within 3 years with a moderately complex project, the start-up is unsuccessful.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Str is the strength: the number of objects that matches the decision rule’s conditions.
Cov is the coverage: the percentage of objects of the decision class that is identified by this rule.
Acc is the accuracy: the percentage of objects that is correctly classified by this rule.
Chapter summary

- Two attributes appeared to have a statistically significant (p<0.05) impact on firm performance by themselves: the attraction of external capital and the time to market. For external capital, it seems that firms that did not attract external capital were more often moderately successful. Firms with a short time to market performed better than those with a long time to market.

- An extra condition attribute, core project complexity, was added. It was found that core project complexity is not significantly connected in and of itself with firm performance.

- Start-ups that offer physical products and those that offer both products and services attracted external capital more often than start-ups that offer only services (p<0.05).

- Start-ups that offer both products and services had a longer time to market than expected, while service-offering start-ups had a shorter time to market (p<0.05).

- More start-ups than expected attracted external capital if they had a more complex project, and vice versa (p<0.10).

- Start-ups that had relatively complex projects took longer to market introduction than those that had relatively simple projects, and vice versa (p<0.05).

- To check for possible impacts of combinations of attributes, Rough Set Analysis is a suitable approach. It searches for patterns in an exploratory (from the ground up) manner, works well with the available data, and the induction of decision rules is useful for classification problems. The advantages of RSA are that it:
  - is a variation of fuzzy set theory, meaning that it is better suited to the ambiguity of real-world applications than traditional mathematical models.
  - does not need preliminary information about data.
  - allows for data reduction without sacrificing accuracy.

- Rule induction was performed on the complete data and two subsets; product- and service-oriented startups. The decision rules with the highest strengths and coverages were collected.

- The empirical data seems to indicate a pattern that service-offering start-ups are more often moderately successful, while product-offering start-ups are either unsuccessful or very successful depending on their time to market introduction.
9 Tool design and application

Let us recall the greater picture and recap the goal of this thesis: to make a tool that makes a predictive performance assessment for start-ups in B2B services, making use of empirical data and rule induction through Rough Set Analysis. Or with a more practical example: A new start-up is formed. Involved actors and stakeholders are interested in its development; they wish to assess in what performance category this start-up will fall. They find data on the firm and its founders, and use this data in a tool to assess firm performance. The tool that can be used for this purpose is presented in paragraph 9.2. Paragraph 9.1 first reflects on the tool’s requirements, and afterwards paragraph 9.3 discusses the managerial implications.

It must be repeated that this tool does assume the presence of several important factors that are not specifically covered in this study. These include, but are not limited to, factors such as sound strategic and financial management, sufficient product quality, reasonable pricing and a sufficient market size for the product or service.

9.1 Meeting requirements

In the chapter on research design, some requirements for the tool were defined (page 7). The tool has to be easy to understand and use, quick to use, applicable to a wide variety of cases and accurate. To address the first two requirements, the tool is made to consist of a single table that is no larger than an A4 page. It is based on decision rules and their outcomes, and these are presented in plain text. All necessary information to use the tool is presented in the tool itself.

The third requirement stated that is must be possible to assess any service-oriented start-up, regardless of its characteristics. 19 out of 21 cases in the sample subset can be identified with the collection of decision rules that the tool is based upon. No decision rules were found for the remaining cases that were supported by multiple objects. In order to make the tool applicable to all cases with certainty, the last row is added which is based on the distribution of start-ups in the sample across the performance categories regardless of the condition attributes. This method is the least precise, which is why it is left for last.

Regarding accuracy, the last requirement stated that the tool should be accurate. The decision rules’ outcomes are presented as percentage chances if they did not feature 100% accuracy. These percentages are correct for all objects within the database, but the generalizability of the tool is not tested in this study.
### 9.2 Outline and content of the tool

The tool is made based on the decision rules that were found on the subset of service-oriented start-ups. They are rewritten and organized from high start-up performance expected at the top to low performance expected at the bottom. All information required to use the tool is included in the table itself. If a start-up matches all conditions in a row, the chance that the start-up will belong to a certain performance category is known. If no rules match, the bottom rule can be used that is based on the distribution of start-ups in the sample over the different performance categories, regardless of characteristics. This is the least accurate and is therefore saved for last. Also note that it is likely there is an element of survivor bias (for more information see paragraph 10.2), making these probabilities somewhat optimistic.

**Table 26: The tool.**

Applicable to start-ups that offer pioneering B2B services.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Performance Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>All conditions in a row must match for it to apply. If more than 1 row applies, the one with the most matched conditions takes precedence.</td>
<td></td>
</tr>
<tr>
<td>High success is defined as: selling its product/service on the market and exhibiting growth in both FTE and turnover.</td>
<td></td>
</tr>
<tr>
<td>Moderate success is defined as: selling its product/service on the market, may show signs of moderate growth in FTE and/or turnover.</td>
<td></td>
</tr>
<tr>
<td>No success is defined as: ceased operations, no market introduction yet realized or otherwise inactive (“sleeper”).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does the start-up:</th>
<th>High success</th>
</tr>
</thead>
<tbody>
<tr>
<td>- attract external capital</td>
<td>75% chance of high success</td>
</tr>
<tr>
<td>- have a relatively simple project?</td>
<td>25% chance of moderate success</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does the start-up:</th>
<th>Moderate success</th>
</tr>
</thead>
<tbody>
<tr>
<td>- attract external capital?</td>
<td>30% chance of high success</td>
</tr>
<tr>
<td>- have a relatively simple project?</td>
<td>70% chance of moderate success</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does the start-up realize market introduction within 1 year?</th>
<th>Moderate success</th>
</tr>
</thead>
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<tr>
<td>17% chance of high success</td>
<td>83% chance of moderate success</td>
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<th>Does the start-up:</th>
<th>Moderate success</th>
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<tr>
<td>- not attract external capital</td>
<td>14% chance of high success</td>
</tr>
<tr>
<td>- realize market introduction within 1 year?</td>
<td>86% chance of moderate success</td>
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<th>Does the start-up not attract external capital?</th>
<th>Moderate success</th>
</tr>
</thead>
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<tr>
<td>14% chance of high success</td>
<td>79% chance of moderate success</td>
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<td>7% chance of no success</td>
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<th>Does the start-up:</th>
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<td>- attract external capital</td>
<td>33% chance of moderate success</td>
</tr>
<tr>
<td>- not realize market introduction within 3 years?</td>
<td>67% chance of no success</td>
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If none of the above rules apply, the following general indication may be used.

<table>
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<tr>
<th>General Indication</th>
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<td>24% chance of high success</td>
<td>62% chance of moderate success</td>
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</table>
9.3 Managerial implications

Several conclusions have been reached in this thesis. In this paragraph, these are translated into more practical management advice. Recall that the research was carried out under the assumption that several prerequisites were present that were not tested for (i.e. sound strategic and financial management, sufficient product quality, reasonable pricing and a sufficient market size). The developed tool and the implications discussed here are best applied in the early phases of a start-up, when there is most flexibility and the uncertainty is highest.

The most important FMA for B2B services were identified using grounded theory. They are the preemption of product market space, investment cost by customers, supplier-specific learning and customer choice under uncertainty. The preemption of market space may be hard to achieve for start-ups as they have limited resources: they might simply not be able to serve the full potential market. Nevertheless it may be beneficial to start establishing contacts with possible future clients. This would also tie in with the FMA mechanism of customer choice under uncertainty: client firms can reduce their search costs if the start-up is already in their network. Investment cost by customers and supplier-specific learning can be stimulated by embedding the service in the client’s process(es), through co-creation and by providing many customization options.

The empirical data showed a general pattern that relatively complex projects more often attracted external capital, were less successful when they took long to get to the market and more or highly successful when a short time to market was realized. Relatively simple projects less often acquired external capital and more often realized a short time to market introduction, and were moderately successful.

Unfortunately, the level of project complexity partly depends on the product’s inherent characteristics and is therefore generally not very adaptable. It seems that entrepreneurs that establish a start-up focusing on a relatively simple project have a choice: if they can internally finance the project, this is the more secure way to go but it more often leads to moderate growth than to high growth. On the other hand, external capital can be attracted to open the way to higher growth, but this is a higher-risk strategy. The attraction of external capital also raises expectations and introduces responsibilities. Only when the entrepreneur is fairly certain that the service can be introduced to the market relatively quickly and that it will be successful is the optional attraction of external capital advised.

The attraction of external capital can also be a necessity rather than an optional choice. This is often the case if more complex projects are initiated. The attraction of external capital should not be seen as a “necessary evil”, but the entrepreneur should be aware that the effects are similar to the optional attraction of external capital: it raises expectations and introduces additional responsibilities. The entrepreneur may pay more attention to reporting progress and the management of expectations surrounding the start-up in these cases.

In either case, getting to the market quickly was found to be beneficial to a start-up’s performance. A theoretical argument for the correlation between time to market and performance may be that a certain “buzz” is created when a start-up is founded; a positive image with high hopes and expectations. But the more obstacles are encountered and the more time passes before market introduction, the more this optimistic image recedes.

However, overambitious application of the knowledge that a shorter time to market introduction leads to higher success may lead to a “self-destructive prophecy”. Although it is not researched in this study, pushing incomplete or inadequate products or services on the market cannot be expected to lead to higher start-up performance. A quick market introduction should not be pursued as a goal in itself. Rather it should be seen as something to strive to if possible, but not realized at the expense of other necessities.
Chapter summary

- The tool is based on a set of decision rules. Start-ups for which a predictive performance assessment is needed are compared to the decision rules. The decision rule(s) that apply for that start-up leads to an indicated performance category.

- The goal of this thesis was to develop a tool to assess start-ups that offer pioneering B2B services. It should be easy to use, quick to use, applicable to any start-up that offers a pioneering B2B service and be accurate.
  - Ease and quickness of use is realized by making the tool a single table that contains all necessary information. It is applicable to all start-ups that offer a pioneering B2B service.
  - The tool’s chance distributions vary for each decision rule. The percentages are correct for all samples in the dataset, but the generalizability of the tool to samples outside the dataset is not tested.

- FMA mechanisms may be strengthened by early networking, embedding the service in the clients’ process(es), co-creating value and offering customization options.

- If internal financing is possible, it is a lower-return but also lower-risk strategy. The acquisition of external capital (either by choice or necessity) is a higher-risk higher-return strategy.

- A short time to market introduction is correlated with higher firm performance. This is something to strive to, but it should not be a goal in itself at the expense of product readiness or quality.
10 Outcome, results, discussion and recommendations

This final chapter is a review and evaluation of the performed work. The first paragraph recounts the results, matches them to the intended results from the research design and describes how well the research questions are answered. A reflection on the performed work is given in the second paragraph. The third paragraph gives recommendations for further research, while the last paragraph contains a short personal reflection.

10.1 Results

The three outputs as defined in Figure 4 (page 8) were a full model of FMA mechanisms, a reduced model for FMA mechanisms in B2B services, and a tool to assess start-up performance. The first two outputs are given in Appendix IV, the tool is presented on the previous page. The research questions are answered here, starting with the sub-questions. The main research question is answered last.

- What FMA mechanisms exist? How do FMA fit within the general process of entry and performance?
  Fifteen different FMA mechanisms were identified from literature, divided over 3 categories. The workings of each mechanism are described in Chapter 3. The learning curve advantages are technological learning curve, organizational innovation, and IPR and appropriability mechanisms. The preemption of asset advantages are preemptive investments, physical resources, human resources, political resources, spatial preemption, preemption of market space and marketing cost asymmetries. The customer switching cost advantages are contractual switching cost, investment cost by customers, supplier-specific learning, buyer choice under uncertainty and network externalities

  Each mechanism can allow a pioneer to obtain a specific advantage over later entrants. Whether these mechanisms and thus advantages actually apply depends on many factors, such as firm, product and market characteristics. FMA are connected to the timing of entry. This is just one entry factor that determines overall performance, the “when” question alongside the “how, who, where, what” questions. Performance advantages of FMA are considered to gradually diminish over time with competition, until equilibrium is reached or a new innovation in introduced.

- How do FMA differ between goods and services?
  In general, academic papers and empirical data support the existence of FMA in services. The FMA mechanisms of IPR and appropriability mechanisms, preemptive investments, pre-emption of physical resources and spatial pre-emption are considered less important than for physical products. The mechanism of buyer choice under uncertainty was considered more important for services.

- How are FMA affected by B2B versus B2C marketing?
  Academic research focusing on FMA mechanisms in B2B markets was not found. However, comparing the differences in characteristics between B2C and B2B marketing does allow the identification of more important mechanisms through grounded theory. These are the preemption of market space, investment by customers, supplier-specific learning and buyer choice under uncertainty.

- What factors influence a start-ups’ success when pioneering B2B services?
  Intellectual capital is one of the most important aspects of the Resource-Based View. Intellectual capital consists of human, organizational and social capital. These forms of capital are immaterial, cannot be directly accounted on a balance sheet, but do contribute to the value of the firm. Furthermore, they are a strong source of competitive advantage, as their intangibility makes them hard to copy or overcome by competitors. Pioneering firms have more time to build up intellectual capital, which is reflected in some of the FMA mechanisms.
Human and social capital of start-ups have been measured, organizational capital was not measured due to the fact that start-ups inherently have little organizational capital and its difficulty to measure. Seven other factors besides intellectual capital were also measured for the start-ups in the sample: number of founders, the winning of (innovation) prizes, attraction of external capital, industry sector, product/service orientation, focus, and time to market.

Of all the measured attributes, the attraction of external capital and time to market were found to have the most influence. It appeared that attracting external capital acts as a lever; it often makes start-ups either very successful or unsuccessful. Start-ups that did not attract external capital more often ended up as being moderately successful. This behaviour was more pronounced for product oriented start-ups than for service-oriented start-ups. Another important determining factor was the time to market introduction: shorter time to market introduction was associated with higher performance and a longer time to market introduction with lower performance. This was true for both product- and service-oriented start-ups. These conclusions are supported both by Fisher’s tests for statistical significance and Rough Set Analysis.

- What decision rules can be induced from empirical data using Rough Set Analysis?
Using different reducts, sets of objects, and analysis algorithms available in ROSE2, a number of decisions rules were found. Decision rules for the whole dataset, and sub-parts of the dataset containing only product- and service-oriented start-ups were compared. Eventually, the most important condition attributes were collected and used to form the tool.

- What tool can be developed, and what will its contents be, to assess the expected success of start-ups that offer pioneering B2B service products?
The decision rules derived from the subset of data using service-oriented start-ups were used to create the tool. They were rewritten in clearer form and presented in a single table, that also included all necessary data to understand the tool. If a rule applies, the probability that the start-up belongs to a certain performance category is given. The accuracy of the tool is not tested on objects outside of the sample, therefore its generalization is uncertain.

10.2 Discussion

Some interesting results have been obtained. The observations regarding the patterns surrounding the attraction of external capital and time to market introduction are empirically supported by the data gathered in this study. Given that this is the first (or one of the first) studies that focuses on pioneering B2B service start-ups, it is also of an exploratory nature. To find empirically supported patterns is therefore useful and can provide a starting point for future research.

The developed tool is quick and easy to understand and use, thus meeting those requirements that were set beforehand. Any pioneering B2B service start-up can be assessed and its accuracy is good when testing objects within the dataset. However, the accuracy of the tool outside of the data set is uncertain. The number of objects that the decision rules are based on is not very high, especially in the two data sub-sets for products and services. This may have attributed to the inability of finding more strongly supported correlations. Thus, the generalizability of the decision rules is up for discussion due to the low number of objects they are based on.

Furthermore, the study likely suffers from a survivor bias; more surviving start-ups are included in the sample than non-surviving start-ups, simply because information on non-surviving start-ups is hard to collect. Paragraph 3.3.2 (page 13) already discussed survivor bias as an often-occurring shortfall in FMA literature. Unfortunately, the time and resource constraints of this thesis did not permit the exclusion of survivor bias. Several unsuccessful start-ups have been included, but the ratio may not be comparable to real-life figures.
In hindsight, the set goal may have been too ambitious. To develop a strong, universally supported tool from a single study may be a difficult achievement in any case, let alone in the highly complex and multifaceted fields of market entry, pioneering and firm performance. The remainder of this paragraph describes the difficulties that were encountered and how these may have influenced the current research.

The necessity of having to rely for a large part on publicly available data of the start-ups in the sample, although avoiding the self-reporting bias, may not be as accurate as actual interviews with start-up founders. Time and resource constraints also contributed to a relatively small sample size. The distribution of firms in the performance categories is not ideal, especially as this was the decision attribute. The necessary grouping into low (0,1) and high (2,3) performance for the statistical significance tests of individual condition attributes may have skewed the results, as could be seen for the results for attribute AF3 (attraction of external capital). Regarding the RSA analysis, some rules may have been proven wrong or other rules may have had more support in a larger data sample.

Another difficulty was the grey areas in assigning values to the start-ups on several attributes. For example, categorization of start-ups on the product-service continuum was necessary. Where is the boundary? When does a firm classify as offering a service only or being a hybrid? Although care was taken in these classifications and explanations are given with each operationalisation, the fact remains that such grey areas always pose difficulties and remain open to discussion.

The initial literature review on FMA is considered to have included all relevant articles. By extension the researcher believes that all FMA mechanisms currently known in academic circles are included in this thesis. Scientific papers using empirical data and the grounded theoretical analysis of FMA and product-service differences in this thesis support the notion that FMA apply to services as well. Other academic articles focusing on FMA specifically in B2B markets was not found, but grounded theory likewise supports the notion that FMA exist in B2B markets. The methodology and outcomes of the theoretical part, the models in Appendix IV, are considered to accurately reflect FMA theory but have not been empirically tested.

The RBV and the notion of intellectual capital are well-known and often used throughout business sciences. The link between FMA and RBV has already been made by multiple researchers. However, not all FMA mechanisms can be evaluated with the RBV, as not all mechanisms depend on firm-controlled resources. In addition, the RBV itself is not undisputed (Sanchez, 2008) (Kraaijenbrink, Spender, & Groen, 2010) (Arend & Lévesque, 2010).

The difference between bridging and bonding ties was not measured in this thesis. Patulney & Svendsen (2007) argue for their distinction, and Scholten et al. (2015) investigate bridging ties in Dutch university start-ups. Also, this research did not include later entrants in the sample. There are two reasons for this: most of the start-ups have such innovative products that there simply are no later entrants, and the inclusion of later entrants even if they are available, at this sample size, would have diluted the number of start-ups in each individual category even further. The downside is that no comparison can be made between pioneering start-ups and later entrants. A comparison was made between product- and service-oriented start-ups, but no significant difference was found in the performance of each.

Although the founding year of all start-ups was measured, the values for several attributes are not corrected for time. For example, older start-ups have had more time to build up a business network, or to gain a higher turnover. This is also supported by Ortín-Ángel & Vendrell-Herrero (2014), who found that university spin-offs underperform at first, but this underperformance disappears after 2-3 years. But since only firms that have operated at least 2 full years were included in the sample, and some of the youngest firms in the sample fell in the highest turnover category, it seems that not correcting for time has not had a large influence on the data accuracy.
Experience, human capital and social capital are often cited as important factors for start-up success (Shane & Stuart, 2002) (Peña, 2002) (Maurer & Ebers, 2006) (Colombo & Grilli, 2010) (Criaco, Minola, Migliorini, & Serarols-Tarrés, 2014) (Muñoz-Bullon, Sanchez-Bueno, & Vos-Saz, 2015) (deloitte.com, 2016). However, this research did not find strong connections between these forms of intellectual capital and performance. An explanation might be that the difficulties regarding the data described above have influenced the ability of the analytical methods to find such connections. Regarding experience specifically, it may be that no connection was found due to the fact that the sample consists of university start-ups. A large portion of the start-ups in the sample were started by students that just finished their education; they had no work or entrepreneurship experience. The proportion of such start-ups in this sample may not be an accurate reflection of all start-ups.

10.3 Recommendations for further research

The empirical base from which to draw conclusions in this research was limited. Continuation of the research performed here, with larger and perhaps more detailed data samples than were possible here, may yield better results in the form of more strongly decision rules. Additionally, more research can be done to check the generalizability of the induced decision rules, for example by the testing of more objects from outside the current sample. A statistically representative sample is needed to support generalizability. A further benefit of a larger sample is the fact that it enables the use of other forms of statistical analysis, such as regression analysis. Additionally, other KDD techniques such as decision tree or clustering algorithms may be applied.

The accuracy and completeness of the model for FMA in B2B services is currently not empirically tested. It was developed from grounded theory, but empirical research may be performed in the future to support or amend the model.

Research on FMA in services has already been undertaken. It is known that FMA exist for services, although some mechanisms are stronger than others. But does the position of an offering on the product-service continuum act as a scale? Do “service-FMA’s” become stronger and “product-FMA’s” weaker the further a product is on the service-side of the spectrum and vice versa? Based on the insights gathered during the writing of the thesis the author believes that this may indeed be so, but more research on this subject is needed before any conclusions can be drawn.

Very little academic work was found to address FMA in B2B markets versus B2C markets. This thesis used a grounded theory approach to infer the effects of B2B marketing on FMA, but more theoretical and empirical research is needed for a complete coverage of the subject; future studies might provide such coverage.

Perez & Sánchez (2003) propose that the success and contributions of university spin-offs is not limited to their product sales and employment generation, but also in their function of transferring and creating knowledge in innovation networks. Future studies could incorporate measures to capture such activities and come to a broader definition of performance.

10.4 Personal reflection

Personally, I think the results are less conclusive than I had imagined beforehand: the decision rules are necessarily based on small numbers of objects, which is a weakness regarding their generalization. Also, the generally accepted notion that previous experience (in all fields) is beneficial to start-up performance was not really supported by the data.

In hindsight I would have moved more quickly through the theoretical chapters and focused more on the operationalization, sample population, data collection and the analysis of the data. Perhaps more conclusions
could be drawn from the data if more time had been available for “playing around” with categories, operationalizations, parameters, etc. Nevertheless, as mentioned in paragraph 10.2, perhaps I should focus more on the fact that I did find some empirically supported patterns despite the field’s complexity, rather than the fact that I did not manage to find more relations than I did now.

What I am content with is the coverage of the known academic theories of FMA, product-service and B2B-B2C differences, and the combining of these streams of literature. I also think my identification of what FMA mechanisms are stronger in B2B markets is useful for B2B firms’ managers, even though further research and empirical testing is needed.
References


Appendix I: Literature review paper trail

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<tr>
<td>AND</td>
<td>first* OR pioneer* OR early*</td>
<td>Article Title, Abstract, Keywords</td>
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<tr>
<td>AND</td>
<td>advantage*</td>
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Search in social sciences & humanities, no restrictions on date. Sorted by number of citations.

2nd hit: Pioneering advantages in manufacturing and service industries: Empirical evidence from nine countries (Song, Benedetto, Zhao 1999)

Cites:
- Success and failure in new industrial services (Brentani 1989)
- Financial innovation and first-mover advantages (Tufano 1989)
- First-mover (dis)advantages: Retrospective and link with the resource-based view (Lieberman, Montgomery 1998)
- First-mover advantages (Lieberman, Montgomery 1988)
- Sustainable competitive advantage in service industries: A conceptual model and research propositions (Bharadwaj, Varadarajan, Fahy 1993)
- First-mover advantage: A synthesis, conceptual framework, and research propositions (Kerin, Varadarajan, Peterson 1992)
  Is cited by: Entry Timing: Enduring Lessons and Future Directions (Zachary, Gianiodis, Payne 2014)

Cited by:
- First-mover advantage in an Internet-enabled market environment: Conceptual framework and propositions (Varadajaran, Yadav, Shankar 2008)
- Pioneering advantage in new service development: A multi-country study of managerial perceptions (Song, Benedetto, Song 2000)

5th hit: First-mover advantages in regimes of weak appropriability: The case of financial services innovations (Lopez, Roberts 2002)

Cites:
- A framework for analyzing service operations (Bitran, Lojo 1993)
- Can first-mover and early-mover advantages be sustained in an industry with low barriers to entry/imitation? (Madakok, 1998)
- Meta-analysis of the impact of research methods on findings of first-mover advantage (Vanderwerf, Mahon 1997)
- Pioneer advantage: Marketing logic or marketing legend? (Golder, Tellis 1993)

Cited by:
- The influence of appropriability conditions on the firm's entry timing orientation (Tuppura, Hurmelinna-Laukkanen 2010)
- Is there a real pioneer’s advantage? Lessons learned after almost thirty years of research (Gómez-Villanueva, Ramírez-Solís 2013)
  
  Cites: Late Mover Advantage: How Innovative Late Entrants Outsell Pioneers (Shankar, Carpenter, Krishnamurthi 1998)

- Service regime: An empirical analysis of innovation patterns in service firms (Chang, Linton, Chen 2012)

- First come, first served: How market and non-market actions influence pioneer market share (Usero, Fernández, 2009)

8th hit: Order-of-entry effects for service firms in developing markets: An examination of multinational advertising agencies (Magnusson, Westjohn 2009)

Cites:

- The role of environmental dynamics in building a first mover advantage theory (Suarez, Lanzolla 2007)

- First mover advantages in international business and firm-specific political resources (Frynas, Mellahi, Pigman 2006)

Cited by:

- Social identity, market memory, and first-mover advantage (Barnett, Feng, Luo 2013)

9th hit: Entry order, market share, and competitive advantage: A study of their relationships in new corporate ventures (Miller, Gartner, Wilson 1989)

Cited by:

- Pioneering Orientation and Firm Growth: Knowing When and to What Degree Pioneering Makes Sense (Mueller, Titus, Covin, Slevin 2012)

- Towards a comprehensive model of entry timing in the ICT industry: Direct and indirect effects (García-Villaverde, Ruiz-Ortega, Parra-Requena 2012)

29th hit: First-mover and incumbency advantages in mobile telecommunications (Jakopin, Klein 2012)

Cites:

- Order of entry and business performance: An empirical synthesis and re-examination (Szymanski, Troy, Bharadwaj 1995)

- Market pioneer and early follower survival risks: A contingency analysis of really new versus incrementally new product-markets (Min, Kalwani, Robinson 2006)

- Controlling for observed and unobserved managerial skills in determining first-mover market share advantages (Murthi, Srinivasan, Kalyanaram 1996)

- Market pioneers, late movers, and the resource-based view (RBV) A conceptual model (Finney, Lueg, Campbell 2008)

- Early mover advantages: An empirical analysis of European mobile phone markets (Bijwaard, Janssen, Maasland 2008)
58th hit: - Network structure effects on incumbency advantage (Lee, Song, Yang 2015)

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48th hit: - The timing of market entry and firm performance: A perspective of institutional theory (Li, Li, Cai, 2014)

51st hit: - Competition In Mediation Services: Modeling The Role of Expertise, Satisfaction, and Switching Costs (Agrawal, Hariharan, Rao, Kishore 2013)

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10th hit: - Order of Entry and Performance in New Markets (Lambkin 1988)

11th hit: - Order of market entry: Established empirical generalizations, emerging empirical generalizations, and future research (Kalyanaram, Robinson, Urban 1995)
Appendix II: Overview of found literature

<table>
<thead>
<tr>
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<td>Lee, Song &amp; Yang 2015</td>
<td>Network structure effects on incumbency advantage</td>
<td>Strategic Management Journal</td>
<td>0</td>
<td>The social distances in a network moderate the effectiveness of network effects.</td>
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<td>Zachary, Gianiodis &amp; Payne 2015</td>
<td>Entry Timing: Enduring Lessons and Future Directions</td>
<td>Journal of Management</td>
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<td>The existence of FMA is strongly influenced by contingencies. Entry timing is just one of many entry mode decisions.</td>
</tr>
<tr>
<td>Agrawal, Hariharan, Rao &amp; Kishore 2013</td>
<td>Competition In Mediation Services: Modeling the Role of Expertise, Satisfaction, and Switching Costs</td>
<td>Journal of Organizational Computing and Electronic Commerce</td>
<td>0</td>
<td>It is more effective for followers to compete with pioneers on basis of expertise and quality than with lower prices. Pioneers can defend their position through high levels of customer satisfaction.</td>
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<td>Barnett, Feng &amp; Luo 2013</td>
<td>Social identity, market memory, and first-mover advantage</td>
<td>Industrial and Corporate Change</td>
<td>3</td>
<td>Pioneering results in a social, cognitive advantage due to the customers’ positive associations with authenticity and originality. This advantage erodes over time.</td>
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<td>Gómez-Villanueva &amp; Ramírez-Solís 2013</td>
<td>Is there a real pioneer’s advantage? Lessons learned after almost thirty years of research</td>
<td>Academy of Strategic Management Journal</td>
<td>0</td>
<td>Meta-analysis that supports the existence of FMA.</td>
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<td>Chang, Linton &amp; Chen 2012</td>
<td>Service regime: An empirical analysis of innovation patterns in service firms</td>
<td>Technological Forecasting and Social Change</td>
<td>8</td>
<td>Informal appropriability conditions may be better for service innovations than formal appropriability mechanisms (patenting, copyrights and trademarks).</td>
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<td>García-Villaverde, Ruiz-Ortega &amp; Parra-Requena 2012</td>
<td>Towards a comprehensive model of entry timing in the ICT industry: Direct and indirect effects</td>
<td>Journal of World Business</td>
<td>4</td>
<td>Entry timing partially mediates the relationship between firm capabilities and firm performance. Firms are less likely to pioneer if their product is easily imitable.</td>
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<td>Jakopin &amp; Klein 2012</td>
<td>First-mover and incumbency advantages in mobile telecommunications</td>
<td>Journal of Business Research</td>
<td>4</td>
<td>Supports the existence of FMA in the mobile telecommunications market. Supports that the time-in-market is a better measure than rank order.</td>
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## Key finding(s)

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<td>The influence of appropriability conditions on the firm's entry timing orientation</td>
<td>Journal of High Technology Management Research</td>
<td>4</td>
<td>Strong intellectual property rights result in higher pioneering orientation. Tacitness has no effect on pioneering orientation.</td>
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<td>Magnusson &amp; Westjohn 2009</td>
<td>Order-of-entry effects for service firms in developing markets: An examination of multinational advertising agencies</td>
<td>Journal of International Marketing</td>
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<td>Support the existence of FMA in service industries.</td>
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<td>Usero &amp; Fernández 2009</td>
<td>First come, first served: How market and non-market actions influence pioneer market share</td>
<td>Journal of Business Research</td>
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<td>Support the existence of FMA in the mobile telecommunications market. State that non-market actions are the only actions that significantly reduce pioneer market share.</td>
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<td>The role of environmental dynamics in building a first mover advantage theory</td>
<td>Academy of Management Review</td>
<td>105</td>
<td>FMA's are strongest when both the technology and the market evolve gradually. FMA are weakest when both the technology and the market evolve turbulently.</td>
</tr>
<tr>
<td>Frynas, Mellahi &amp; Pigman 2006</td>
<td>First mover advantages in international business and firm-specific political resources</td>
<td>Strategic Management Journal</td>
<td>98</td>
<td>Introduce “political resources” as an additional source of FMA. Non-market actions can benefit early and/or late movers.</td>
</tr>
<tr>
<td>Min, Kalwani &amp; Robinson 2006</td>
<td>Market pioneer and early follower survival risks: A contingency analysis of really new versus incrementally new product-markets</td>
<td>Journal of Marketing</td>
<td>77</td>
<td>Pioneers of radical innovations suffer great risks and higher failure rates. Pioneers of incremental innovations are more likely to benefit from FMA. The risk for followers is the same for radical and incremental innovations.</td>
</tr>
<tr>
<td>Author(s) and year</td>
<td>Title</td>
<td>Journal</td>
<td>Cit.</td>
<td>Key finding(s)</td>
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<tr>
<td>Boulding &amp; Christensen 2003</td>
<td>Sustainable Pioneering Advantage? Profit Implications of Market Entry Order</td>
<td>Marketing Science</td>
<td>83</td>
<td>Pioneers have long-term demand advantage and initial profit advantage, but profit disadvantage after 12-14 years.</td>
</tr>
<tr>
<td>Lopez &amp; Roberts 2002</td>
<td>First-mover advantages in regimes of weak appropriability: The case of financial services innovations</td>
<td>Journal of Business Research</td>
<td>43</td>
<td>FMA do exist for financial services. Longer lead times strengthen the FMA. FMA are higher if complete bundles/platforms are offered, as opposed to single products.</td>
</tr>
<tr>
<td>Song, Benedetto &amp; Zhao 1999</td>
<td>Pioneering advantages in manufacturing and service industries: Empirical evidence from nine countries</td>
<td>Strategic Management Journal</td>
<td>91</td>
<td>Manufacturing firm managers perceive both the risk and the reward (FMA) of pioneering to be higher than do service firm managers. Service firm managers believe that pioneering leads to market share advantages more than advantages in ROI.</td>
</tr>
<tr>
<td>Lieberman &amp; Montgomery 1998</td>
<td>First-mover (dis)advantages: Retrospective and link with the resource-based view</td>
<td>Strategic Management Journal</td>
<td>470</td>
<td>Propose that the resource-based view and FMA can support each other. Provides a concise meta-analysis of various FMA papers.</td>
</tr>
<tr>
<td>Madakok 1998</td>
<td>Can first-mover and early-mover advantages be sustained in an industry with low barriers to entry/imitation?</td>
<td>Strategic Management Journal</td>
<td>135</td>
<td>FMA can be sustained even in regimes with weak appropriability.</td>
</tr>
<tr>
<td>Shankar, Carpenter &amp; Krishnamurthi 1998</td>
<td>Late Mover Advantage: How Innovative Late Entrants Outsell Pioneers</td>
<td>Journal of Marketing Research</td>
<td>141</td>
<td>Pioneers enjoy higher market shares than non-innovative followers. But innovative followers enjoy greater market shares than pioneers and non-innovative followers.</td>
</tr>
<tr>
<td>Vanderwerf &amp; Mahon 1997</td>
<td>Meta-analysis of the impact of research methods on findings of first-mover advantage</td>
<td>Management Science</td>
<td>107</td>
<td>Depending on the research methods they use, researchers are either more or less likely to find FMA. Researchers are more likely to find FMA if: -tests use market share (most tests) instead of other performance measures -firm competitive strengths are not taken into account</td>
</tr>
<tr>
<td>Murthi, Srinivasan &amp; Kalyanaram 1996</td>
<td>Controlling for observed and unobserved managerial skills in determining first-mover market share advantages</td>
<td>Journal of Marketing Research</td>
<td>46</td>
<td>Even when accounting for differences in managerial skills, support for FMA remains positive.</td>
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<tr>
<td>Author(s) and year</td>
<td>Title</td>
<td>Journal</td>
<td>Cit.</td>
<td>Key finding(s)</td>
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<tr>
<td>Kalyanaram, Robinson &amp; Urban 1995</td>
<td>Order of market entry: Established empirical generalizations, emerging empirical generalizations, and future research</td>
<td>Marketing Science</td>
<td>128</td>
<td>There is general support for the existence of FMA. FMA erode over time with competition.</td>
</tr>
<tr>
<td>Bharadwaj, Varadarajan, Fahy 1993</td>
<td>Sustainable competitive advantage in service industries: A conceptual model and research propositions</td>
<td>Journal of Marketing</td>
<td>405</td>
<td>Introduce many propositions regarding how service firms can obtain/sustain competitive advantage.</td>
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<tr>
<td>Bitran &amp; Lojo 1993</td>
<td>A framework for analyzing service operations</td>
<td>European Management Journal</td>
<td>25</td>
<td>Provides a clear overview how services differ from goods.</td>
</tr>
<tr>
<td>Golder &amp; Tellis 1993</td>
<td>Pioneer advantage: Marketing logic or marketing legend?</td>
<td>Journal of Marketing Research</td>
<td>342</td>
<td>47% of pioneers fail. Find lower market share rates than other studies.</td>
</tr>
<tr>
<td>Kerin, Varadarajan &amp; Peterson 1992</td>
<td>First-mover advantage: A synthesis, conceptual framework, and research propositions</td>
<td>Journal of Marketing</td>
<td>389</td>
<td>An overview paper of FMA. Coherently describes many FMA and reflects on numerous moderating factors. Strongly supports the contingency perspective. The four-way categorization of FMA is one of the standards in FMA literature.</td>
</tr>
<tr>
<td>Miller, Gartner &amp; Wilson 1989</td>
<td>Entry order, market share, and competitive advantage: A study of their relationships in new corporate ventures</td>
<td>Journal of Business Venturing</td>
<td>37</td>
<td>Support the existence of FMA. Pioneers enjoy quality and technology advantages. Followers do not have lower cost structures than pioneers.</td>
</tr>
<tr>
<td>Lambkin 1988</td>
<td>Order of Entry and Performance in New Markets</td>
<td>Strategic Management Journal</td>
<td>177</td>
<td>Supports the existence of FMA.</td>
</tr>
<tr>
<td>Lieberman &amp; Montgomery 1988</td>
<td>First-mover advantages</td>
<td>Strategic Management Journal</td>
<td>1228</td>
<td>Introduces many first mover advantages and disadvantages. The three-way categorization of FMA is one of the standards in FMA literature.</td>
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</tbody>
</table>
Appendix II cont: subject matrix

Numerous distinct FMA mechanisms are considered to contribute to an overall first-mover advantage for the pioneering firm. If an article has dealt with multiple mechanisms for FMA or the complete, overarching phenomenon, it is located in columns 1 or 2. If, in contrast, the research has focused on a single FMA mechanism it is located in column 3. Column 4 is reserved for research that does not strictly deal with FMA, but contains useful information on services, service marketing, service characteristics, etc. It becomes clear that most early research dealt with FMA in general for goods, while later research has more often looked at services or specific FMA mechanisms.

There are 12 and 11 papers in the first two columns of the subject matrix respectively, indicating that most papers address FMA as a general phenomenon or look at a combination of mechanisms. It might seem that services have received as much attention as physical goods in FMA research, but remember that several papers that would fit in column 1 have been discarded as superfluous. Five papers have been written focusing on specific FMA mechanisms. Lastly, two papers were included that fall into the last category.

<table>
<thead>
<tr>
<th>Author(s) and year</th>
<th>Title</th>
<th>FMA, general, for goods only</th>
<th>FMA, general, for services/mixed</th>
<th>Specific FMA mechanisms or moderators</th>
<th>Other connected research</th>
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<tr>
<td>Lee, Song &amp; Yang 2015</td>
<td>Network structure effects on incumbency advantage</td>
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<tr>
<td>Zachary, Gianiodis &amp; Payne 2015</td>
<td>Entry Timing: Enduring Lessons and Future Directions</td>
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<tr>
<td>Agrawal, Hariharan, Rao &amp; Kishore 2013</td>
<td>Competition In Mediation Services: Modeling the Role of Expertise, Satisfaction, and Switching Costs</td>
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<td>X</td>
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<td>Barnett, Feng &amp; Luo 2013</td>
<td>Social identity, market memory, and first-mover advantage</td>
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<td>Gómez-Villanueva &amp; Ramírez-Solis 2013</td>
<td>Is there a real pioneer’s advantage? Lessons learned after almost thirty years of research</td>
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<td>Chang, Linton &amp; Chen 2012</td>
<td>Service regime: An empirical analysis of innovation patterns in service firms</td>
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<td>García-Villaverde, Ruiz-Ortega &amp; Parra-Requena 2012</td>
<td>Towards a comprehensive model of entry timing in the ICT industry: Direct and indirect effects</td>
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<td>Author(s)</td>
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<td>Focus or Key Points</td>
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<td>Jakopin &amp; Klein 2012</td>
<td>First-mover and incumbency advantages in mobile telecommunications</td>
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<td>Mueller, Titus, Covin &amp; Slevin 2012</td>
<td>Pioneering Orientation and Firm Growth: Knowing When and to What Degree Pioneering Makes Sense</td>
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<td>Tuppura, Hurmelinna-Laukkanen, Puimalainen &amp; Jantunen 2010</td>
<td>The influence of appropriability conditions on the firm’s entry timing orientation</td>
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<td>Magnusson &amp; Westjohn 2009</td>
<td>Order-of-entry effects for service firms in developing markets: An examination of multinational advertising agencies</td>
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<td>Usero &amp; Fernández 2009</td>
<td>First come, first served: How market and non-market actions influence pioneer market share</td>
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<td>Bijwaard, Janssen &amp; Maasland 2008</td>
<td>Early mover advantages: An empirical analysis of European mobile phone markets</td>
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<td>Finney, Lueg &amp; Campbell 2008</td>
<td>Market pioneers, late movers, and the resource-based view (RBV): A conceptual model</td>
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<td>Varadajaran, Yadav &amp; Shankar 2008</td>
<td>First-mover advantage in an Internet-enabled market environment: Conceptual framework and propositions</td>
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<td>Suarez &amp; Lanzolla 2007</td>
<td>The role of environmental dynamics in building a first mover advantage theory</td>
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<td>Frynas, Mellahi &amp; Pigman 2006</td>
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<tr>
<td>Song, Benedetto &amp; Song 2000</td>
<td>Pioneering advantage in new service development: A multi-country study of managerial perceptions</td>
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<td>Vanderwerf &amp; Mahon</td>
<td>Meta-analysis of the impact of research methods on findings of first-mover advantage</td>
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<td>Murthi, Srinivasan &amp; Kalyanaram</td>
<td>Controlling for observed and unobserved managerial skills in determining first-mover market share advantages</td>
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<td>Kalyanaram, Robinson &amp; Urban</td>
<td>Order of market entry: Established empirical generalizations, emerging empirical generalizations, and future research</td>
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<td>Szymanski, Troy &amp; Bharadwaj</td>
<td>Order of entry and business performance: An empirical synthesis and re-examination</td>
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<td>Bharadwaj, Varadarajan, Fahy</td>
<td>Sustainable competitive advantage in service industries: A conceptual model and research propositions</td>
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<td>Bitran &amp; Lojo</td>
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<td>Kerin, Varadarajan &amp; Peterson</td>
<td>First-mover advantage: A synthesis, conceptual framework, and research propositions</td>
<td>1992</td>
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<td>De Brentani</td>
<td>Success and failure in new industrial services</td>
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<td>Miller, Gartner &amp; Wilson</td>
<td>Entry order, market share, and competitive advantage: A study of their relationships in new corporate ventures</td>
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<td>Tufano</td>
<td>Financial innovation and first-mover advantages</td>
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<td>Lambkin</td>
<td>Order of Entry and Performance in New Markets</td>
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<td>Lieberman &amp; Montgomery</td>
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## Appendix III: Moderating factors of FMA

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<th>Moderating factor</th>
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<td>Preemptive investment</td>
<td>(Jakopin &amp; Klein, 2012) (Zachary, Gianiodis, Payne, &amp; Markman, 2015)</td>
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<td></td>
<td>Marketing cost asymmetry</td>
<td>(Boulding &amp; Christen, 2003)</td>
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<tr>
<td>Centralisation</td>
<td>Organizational innovation</td>
<td>(Damanpour, 1991)</td>
</tr>
<tr>
<td>Formalisation</td>
<td>Organizational innovation</td>
<td>(Damanpour, 1991)</td>
</tr>
<tr>
<td>Specialisation</td>
<td>Organizational innovation</td>
<td>(Damanpour, 1991)</td>
</tr>
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<td><strong>Internal factors (resources &amp; capabilities)</strong></td>
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<td>Firm size</td>
<td>Preemptive investment</td>
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<td>Political resources</td>
<td>(Frynas, Mellahi, &amp; Pigman, 2006) (Hillman, Keim, &amp; Schuler, 2004)</td>
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<td>Access to networks</td>
<td>Tech. learning curve</td>
<td>(García-Villaverde, Ruiz-Ortega, &amp; Parra-Requena, 2012)</td>
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<tr>
<td>Track record</td>
<td>Customer choice under uncertainty</td>
<td>(Song, Di Benedetto, &amp; Song, 2000) (Szymanski, Troy, &amp; Bharadwaj, 1995)</td>
</tr>
<tr>
<td>Managerial skills</td>
<td>Organizational innovation</td>
<td>(Murthi, Srinivasan, &amp; Kalyanaram, 1996)</td>
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<td>Political expertise and experience</td>
<td>Political resources</td>
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<td><strong>Product characteristics</strong></td>
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<td>Level of “newness”</td>
<td>Tech. learning curve</td>
<td>(Min, Kalwani, &amp; Robinson, 2006)</td>
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<td></td>
<td>Product char. space</td>
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<td>Tacitness</td>
<td>Tech. learning curve</td>
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<td>Product char. space</td>
<td>(Tuppurra, Hurmelinna-Laukkanen, Puumalainen, &amp; Jantunen, 2010)</td>
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<td>Labour intensity</td>
<td>Preemptive investment</td>
<td>(Bharadwaj, Varadarajan, &amp; Fahy, 1993)</td>
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<td>Human resources</td>
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<td>Equipment intensity</td>
<td>Preemptive investment</td>
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<td>Delivery mode</td>
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<td>(Varadajaran, Yadav, &amp; Shankar, 2008)</td>
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<td>Benefit from location</td>
<td>Spatial pre-emption</td>
<td>(Dos Santos &amp; Peffers, 1995) (Varadajaran, Yadav, &amp; Shankar, 2008)</td>
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<td>Complexity</td>
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<td>Specificity</td>
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<td>Source</td>
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<td>Interaction externalities (social group accessibility)</td>
<td>Network externalities</td>
<td>(Varadajaran, Yadav, &amp; Shankar, 2008) (Lee, Song, &amp; Yang, 2015)</td>
</tr>
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<td>Complementary products (technology compatibility)</td>
<td>Network externalities</td>
<td>(Min, Kalwani, &amp; Robinson, 2006) (Varadajaran, Yadav, &amp; Shankar, 2008)</td>
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<td>Consumption frequency</td>
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<td>Investment by customers</td>
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<tr>
<td>Learning required for proficiency</td>
<td>Supplier-specific learning</td>
<td>(Boulding &amp; Christen, 2003)</td>
</tr>
<tr>
<td>Possibility for product customization</td>
<td>Supplier-specific learning</td>
<td>(Varadajaran, Yadav, &amp; Shankar, 2008)</td>
</tr>
<tr>
<td>External factors</td>
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<tr>
<td>Scarcity of suppliers</td>
<td>Physical resources</td>
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<tr>
<td>Speed of market growth</td>
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<td>Refuted by (Garcia-Villaverde, Ruiz-Ortega, &amp; Parra-Requena, 2012)</td>
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<tr>
<td></td>
<td>Product char. space</td>
<td>but supported by (Suarez &amp; Lanzolla, 2007) (Magnusson, Westjohn, &amp; Boggs, 2009) (Szymanski, Troy, &amp; Bharadwaj, 1995)</td>
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<tr>
<td>Possibility for non-market actions</td>
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<td>(Usero &amp; Fernández, 2009)</td>
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<td>Lead time in market</td>
<td>Tech. learning curve</td>
<td>(Jakopin &amp; Klein, 2012) (Makadok, 1998)</td>
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<td>Organizational innovation</td>
<td></td>
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<td>Marketing cost asymmetry</td>
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<td></td>
<td>Customer choice under uncertainty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Network externalities</td>
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<tr>
<td>Speed of technology evolution</td>
<td>Tech. learning curve</td>
<td>(Suarez &amp; Lanzolla, 2007)</td>
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<td>Product char. space</td>
<td></td>
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<tr>
<td>Ability to influence the emergence of key attributes</td>
<td>Product char. space</td>
<td>(Carpenter &amp; Nakamoto, 1989)</td>
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<td>Social distance in customer network</td>
<td>Network externalities</td>
<td>(Lee, Song, &amp; Yang, 2015)</td>
</tr>
<tr>
<td>Government interference</td>
<td>Political resources</td>
<td>(Frynas, Mellahi, &amp; Pigman, 2006)</td>
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<td>Level of development of industry</td>
<td>Political resources</td>
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<td>Stability of political environment</td>
<td>Political resources</td>
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<td>Cooperation between home and host government (in case of foreign operations)</td>
<td>Political resources</td>
<td>(Frynas, Mellahi, &amp; Pigman, 2006)</td>
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</table>
Appendix IV: Complete model of FMA mechanisms

CONTINUES ON NEXT PAGE
CONTINUED FROM PREVIOUS PAGE

**Preemption advantage**

- Incumbency
- Intangibility
- Market growth
- Lead time
- Marketing cost asymmetry
- Tacitness
- Immateriality
- Specificity
- Interconnectedness
- Ability to influence key attributes
- Level of newness
- Ability for product customization
- Government interference
- State of industry formation
- Political stability
- Inter-government cooperation
- Foreign operations
- Political experience
- Firm political impact
- Firm size

**Switching cost advantage**

- Equipment required
- Customer training required
- Adaptation to product required
- Contractual switching cost
- Learning required
- Consumption frequency
- Ability for product customization
- Lead time
- Intangibility
- Consumption frequency
- Track record
- Social group accessibility
- Social distance in customer network
- Own firm's complementary products
- Network externalities
- Investment by customers
- Supplier-specific learning
- Customer choice under uncertainty

**Overall FMA advantage**
Model of FMA mechanisms for B2B service products

Preemption of product market space, investment by customers, supplier-specific learning and customer choice under uncertainty are the most important FMA mechanisms.
# Appendix V: Sample population

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Appendix VI: Information table sample

A random selection of 5 objects for illustration.

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<thead>
<tr>
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<th>HC1</th>
<th>HC2</th>
<th>HC3</th>
<th>HC4</th>
<th>SC1</th>
<th>SC2</th>
<th>AF1</th>
<th>AF2</th>
<th>AF3</th>
<th>AF4</th>
<th>AF5</th>
<th>AF6</th>
<th>AF7</th>
<th>AF8</th>
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</table>
Appendix VII: Histograms

**HC1: level of education**
0: Master’s degree
1: PhD degree

**HC2: Corporate work experience**
0: No experience
1: Work experience (<10 years)
2: Significant work experience (>=10 years)

**HC3: Academic work experience**
0: No experience
1: Work experience

**HC4: Entrepreneurship experience**
0: No experience
1: Has set up 1 other start-up
2: Has set up multiple start-ups
SC1: University network
0: No network
1: Ties to a single university
2: Ties to more than one university

SC2: Business network
0: No network
1: Small network (5 or less)
2: Large network (>5)

AF1: Number of founders
0: Less than 3
1: 3 or more

AF2: Prize(s)
0: No mention of prizes
1: One or more prizes won
AF3: Attraction of external capital
0: None or less than €100,000
1: More than €100,000

AF4: Industry sector
0: Greentech
1: Medical
2: Business support

AF5: Product-service orientation
0: Core business is physical product
1: Hybrid
2: Core business is a service

AF6: Focus
0: Start-up also offers other products
1: Investigated product is the only offering
0: 3 or more years of development needed
1: <3 years of development needed
2: <1 year of development needed

0: The start-up has ceased operations
1: The start-up appears to be a sleeper or has not yet introduced its product to the market
2: The start-up is active, and may show signs of moderate growth
3: The start-up is very successful; it grows fast in FTE and turnover
## Appendix VIII: Cross tables

### HC1: Level of education

<table>
<thead>
<tr>
<th></th>
<th>Observed values</th>
<th>Expected values</th>
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<td>25</td>
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**P-value (Fisher): 0.569**  
**P-value (chi-square): 0.879**

### HC2: Corp. work experience

<table>
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<td>13</td>
<td>20</td>
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<td>23</td>
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**P-value (Fisher): 0.369**

### HC3: Aca. work experience

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<td>0: No experience</td>
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<td>15</td>
<td>3.46</td>
</tr>
<tr>
<td>Total</td>
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<td>40</td>
<td>52</td>
<td>12</td>
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**P-value (Fisher): 1.0**  
**P-value (chi-square): 0.737**

### HC4: Entrepreneurship experience

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<td></td>
</tr>
<tr>
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<td>25</td>
<td>33</td>
<td>7.62</td>
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<tr>
<td>1: Has set up 1 other start-up</td>
<td>2</td>
<td>11</td>
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</tr>
<tr>
<td>2: Has set up multiple start-ups</td>
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<td>6</td>
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**P-value (Fisher): 0.619**

### SC1: University network

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<td>5.77</td>
</tr>
<tr>
<td>2: Ties to more than 1 university</td>
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<td>15</td>
<td>3.46</td>
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<tr>
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**P-value (Fisher): 0.362**
### SC2: Corporate network

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<td>0: No network</td>
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</tr>
<tr>
<td>1: Small network (5 or less)</td>
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<td>2: Large network (&gt;5)</td>
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P-value (Fisher): 0.672

### AF1: Number of founders

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<td>0: Less than 3 founders</td>
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</tr>
<tr>
<td>1: 3 or more founders</td>
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<td><strong>Total</strong></td>
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P-value (Fisher): 0.409

P-value (chi-square): 0.568

### AF2: Prize(s)

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P-value (Fisher): 0.315

P-value (chi-square): 0.417

### AF3: External capital

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<td>16</td>
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P-value (Fisher): 0.0094

P-value (chi-square): 0.0085

### AF4: Industry sector

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</tr>
<tr>
<td>1: Medical</td>
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<td>16</td>
</tr>
<tr>
<td>2: Business support</td>
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<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

P-value (Fisher): 0.581

P-value (chi-square): 0.462
### AF5: Product-service orientation

<table>
<thead>
<tr>
<th></th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>0: Core business is a physical prod.</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>1: Hybrid</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2: Core business is a service</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

*P*-value (Fisher): 0.448

### AF6: Focus

<table>
<thead>
<tr>
<th></th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>0: Also offers other products</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>1: Core product is the only offering</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

*P*-value (Fisher): 0.365  
*P*-value (chi-square): 0.447

### AF7: Time to market

<table>
<thead>
<tr>
<th></th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>0: 3 or more years</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>1: Between 1 and 3 years</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2: Less than 1 year</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

*P*-value (Fisher): 0.0095  
*P*-value (chi-square): 0.0183

### AF8: Core project complexity

<table>
<thead>
<tr>
<th></th>
<th>Observed values</th>
<th>Expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FP=0,1</td>
<td>FP=2,3</td>
</tr>
<tr>
<td>0: Relatively complex</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>1: Moderate</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>2: Relatively simple</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>40</td>
</tr>
</tbody>
</table>

*P*-value (Fisher): 0.216  
*P*-value (chi-square): 0.191
Appendix IX: RSA parameter variations

Some variations or adaptations of the database were discussed in the body of the report. In addition, the following variations that were not discussed in the text were also applied with the aim of finding stronger relations and decision rules. They did not sort any significant effect. Note that these variations were tried separately, but several have also been tried in combination with each other.

- Using different analysis methods (basic minimal covering, extended minimal covering with entropy measures, extended minimal covering with Laplace measures).
- Regrouping of dependent variable as [0,1] and [2,3] (same as Fisher’s tests).
- Regrouping of dependent variables in [0,1,2] and [3].
- Removing all objects with FP=1.
- Removing all objects with FP=0.
- Regrouping HC2 as a binary variable, by making both [0,1,2] and [0,12].
- Regrouping HC4 as a binary variable, by making both [0,1,2] and [0,12].
- Combining HC2 and HC4 as a single variable.
- Regrouping SC1 as a binary variable, by making both [0,1,2] and [0,12].
- Regrouping SC2 as a binary variable, by making both [0,1,2] and [0,12].
- Regrouping AF7 as a binary variable, by making both [0,1,2] and [0,12].
- Using only human capital condition variables.
- Using only additional factor condition variables.
- Grouping hybrid start-ups with product-oriented start-ups.
- Grouping hybrid start-ups with service-oriented start-ups.