



UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master Degree Project in Innovation and Industrial Management

Value Creation through Orphan Innovations

A case study of AstraZeneca

Malin Palmqvist and Cecilia Zander

Supervisor: Evangelos Bourellos
Master Degree Project No. 2016:60
Graduate School

Abstract

It can be assumed that within all industries, it does occasionally happen that innovations occur that are not in line with the company's business strategy. This master thesis focuses on these innovations that throughout this paper are called Orphan Innovations, as they do not belong to the company's core business. The concept of orphan innovations is examined through the lens of the pharmaceutical industry, and with focus on the pharmaceutical company AstraZeneca.

To look into what possibilities that could exist related to orphan innovation, the existing management process as well as the potential business value of orphan innovations is examined. It can through this research be concluded that Orphan Innovations are present at AstraZeneca, and that there are four different ways for how orphan innovations could be managed at the company; through a sale of the innovation, through realization through open innovation, through publication of research, or it is dismissed. Additionally, what happens with the orphan innovation depends heavily on local circumstances such as the individuals, hence the employees and the management attitude, but also on whether and how much data that is accessible. It can further be concluded that both tangible and intangible business value can be extracted through orphan innovations. These values are capital, increased employee motivation, improved reputation, as well as access to new knowledge.

Key words: Orphan innovation, open innovation, outbound open innovation, corporate entrepreneurship, value creation, innovation, pharmaceutical industry, AstraZeneca.

Acknowledgement

Throughout the process of this master thesis, there has been several people engaged, that we owe our gratitude to.

First, we especially want to thank Magnus Björsne, the CEO of the BioVenture hub at AstraZeneca, for very appreciated guidance, as well as inspiration and the help with developing the subject of orphan innovations. Also, thank you for very helpful comments and the time you took to help us think one step further, as well as for helping us to get in contact with the interviewees for the empirical study.

Moreover, we would like to thank our supervisor Evangelos Bourellos for the support during the process of developing this master thesis. Also, great thanks to Daniel Ljungberg for additional support and comments in the final stages of writing this thesis.

Additionally, we want to dedicate our appreciation to all of the respondents who brought value to this master thesis through meeting us for interviews, that enabled the empirical material for this research. We are also very grateful for the warm and open reception that we received during our visits at AstraZeneca.

Last, we have much appreciated the support from our friends and families.

Thank you!

Gothenburg 06.07.2016

Cecilia Zander

Malin Palmqvist

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Introduction

This opening chapter starts by giving a broad presentation of the subject and main idea of the master thesis, to later on become narrowed down to present the problem discussion leading to the aim of the thesis as well as the research questions. Furthermore, the delimitations and the outline of the research are presented.

Innovation is in the manual by OECD & Eurostat (2005) defined as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”. Hence, innovations are something that has already been further processed in order to generate new or improved value. Innovation is important for all industries, and the development of new and improvement products and processes are connected to the growth of the company. Furthermore, companies need innovation in order to improve and develop new products as a way to stay ahead of competitors (Baumol, 2002).

Traditionally, companies saw innovation as a strictly internal process, also called closed innovation, and the attitude was that it was important to permit competitors from utilizing from the company’s resources such as competences, ideas and knowledge. However, the attitude towards how innovation should be performed has changed for the boundaries to weaken between the company itself and its surroundings to include external resources in the innovation process, also known as open innovation (Chesbrough, 2003:a). Open innovation includes both the outside-in aspect, where the organization uses external resources in the development process as well as the inside-out aspect, where the organization aims at selling or licensing internal resources such as competences, ideas and knowledge to an external market (Gassman & Enkel, 2004).

Integration of innovation into the corporate strategy is said to be one of the most important success factors for innovation. Additionally, a key success factor for innovation is a strategy that is integrated, focused as well as clearly articulated (McKinsey, 2012). Even if the focus of the company is one of the key success factors it occasionally happens that innovations occur within companies with nowhere to be implemented or useful, because it does not belong to the company’s core business. Innovations that are in line with the company’s core business is easier to implement and to find a strategy for, because of schemes and activities already known rather than for innovations that do not fit with the core business, and that does

not build upon current schemes and activities within that particular organization. Due to lack of the required internal knowledge, competences and infrastructure, there is a risk that innovations outside of the core business are most often ignored since focus and resources are not prioritized towards such innovations. The fundamental question is how companies can turn such innovations into useful valuable innovations with the help of new entrepreneurial opportunities within their network and create the managerial processes needed. Which in turn could generate competitive advantage and a new way of conducting work more efficiently (Coles and Mitchell, 2004). An innovation that becomes or constantly remains outside of the core business will hereafter be defined as “orphan innovation” after inspiration from Aurora et al. (2001) who states that a technology is orphan when the parent company’s market share related to the technology does not exist or is very small.

1.1 Background

The pharmaceutical industry, being the sector with the highest research and development (R&D) investments in the world (European Commission, 2014), has processes that are resource consuming. This can be connected to the high safety and efficacy requirements, the regulations that has become more rigorous (Hartmann & Hassan, 2006) and that it is by far the industry that is most connected to science (Ding et al., 2014). Further supporting this statement is that the general development costs for one single drug has increased from USD 138 million in 1975 to over USD 1.5 billion today (EFPIA, 2014). The increase in development costs can be explained by why many pharmaceutical companies are having a hard time integrating the emerging knowledge and that the diseases that are left with no efficient treatment are more complex and not yet fully understood (Hartmann & Hassan, 2006). These arguments are all giving incentives for a need to examine the value creating process within the industry, and it is in this master thesis made from the perspective of orphan innovations at the pharmaceutical company AstraZeneca.

AstraZeneca is a pharmaceutical company driven by innovation (AstraZeneca, 2016:d), and it is operating in more than 100 countries, however, the company has patients worldwide (AstraZeneca, 2014:a). The company’s core therapeutical areas are cardiovascular and metabolic diseases, oncology, respiratory, inflammation and autoimmunity, neuroscience, infection and vaccines (AstraZeneca, 2016:a), but as within every company, it can be assumed that innovations sometimes emerge that does not fall in any of the core business areas, so called orphan innovations. AstraZeneca is managing everything from the discovery of

possible new medicines to manufacturing and distribution (AstraZeneca, 2016:d). At AstraZeneca the R&D phase is generally between 10-15 years, which can explain why the company is spending approximately one fifth of the revenue on R&D (AstraZeneca, 2014:a). This gives incentives to examine the value creation process and to find ways for the company to capitalize and benefit also on ideas and innovations that lacks the alignment with their activities and capabilities.

1.2 Problem discussion

Innovations and opportunities, such as orphan innovations generated within large companies, for example AstraZeneca, can sometimes be problematic when the knowledge in how to appropriate the innovation value is not visible and exposed, and is not in line with previous knowledge and activities. Such innovations, that might unexpectedly have come forward, can be neglected rather than getting an acceptance through the phases within the R&D process and untapped value might be lost during the process.

In this thesis the focus will be on orphan innovations, which could be seen to appear in two different ways. These two ways for how orphan innovations could appear was developed in discussion with Magnus Björsne, the CEO of the BioVenture hub. The first way an orphan innovation could appear is when an innovation first is in line with the company's business strategy (BS) and has already been invested in suddenly becomes orphan due to changes in the expectations of the innovation. This makes the innovation not in line with the company's core business, and represents the upper line in Figure 1. The upper line will hereafter be referred to as orphan innovations that have emerged at project level. A change in the expectations can for example be if the medicine is not efficient to treat the intended disease, but could be efficient to treat another disease that is outside of the company's therapeutical areas. The second way an orphan innovation could appear is when an individual at the company develops an innovation as a side project, but the innovation is outside of the core business of the company. However, the company itself is not adopting the innovation as it is not in line with the BS, and the innovation continues to be orphan. The second way for orphan innovations to appear can be seen as the lower line in Figure 1. The lower line will hereafter be referred to as orphan innovations that have emerged at individual level.

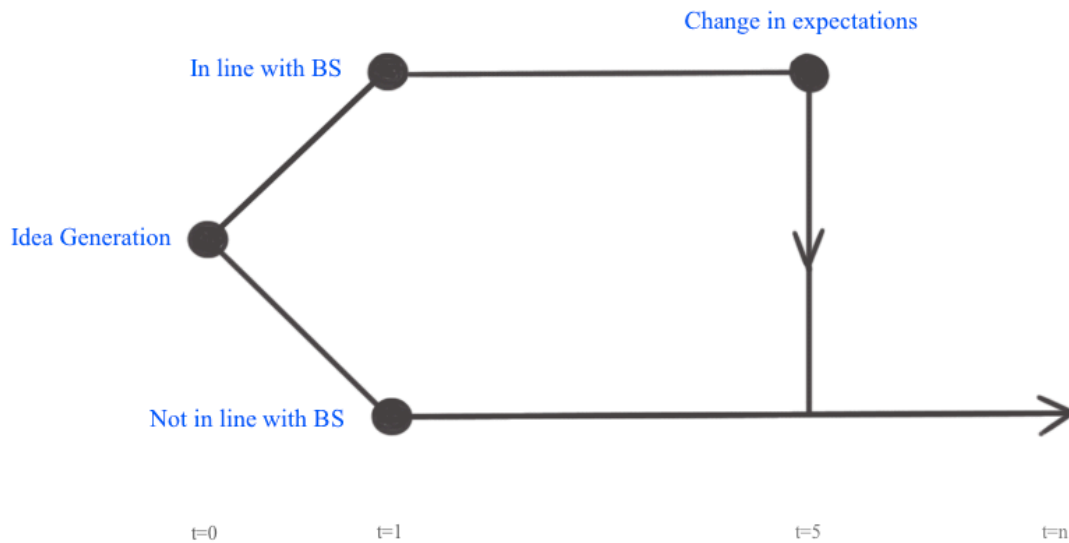


Figure 1: The appearance and path of orphan innovations (developed in discussion with Magnus Björnsne 03-22-2016)

Comparing these two appearances of orphan innovations under the condition that the orphan innovations are dismissed, AstraZeneca is left with a loss in the case where investments have already been made, hence in the upper line in Figure 1. Furthermore, in the case where the innovations have occurred on an individual level, hence in the lower line in Figure 1, AstraZeneca is possibly missing out on opportunities that could have generated both intangible and tangible value. The question is if orphan innovations could for instance be a source of opportunities and perhaps create value for a large company such as AstraZeneca if not completely ignored.

1.3 Purpose and Research Question

The aim of the master thesis is to further investigate how orphan innovations are handled within the company today, to further examine how they, as a part of a knowledge spillover effect can create value for the company throughout the organization and its stakeholders. The focus will be on how the value creation process can be viewed from the aspect of orphan innovations at AstraZeneca, both when orphan innovations occur spontaneously at individual level within the organization without any corporate investments made, but also when they occur in current and invested projects as a result of a change in the innovation's expectations. This leads to the following research research questions and sub questions.

- *How does AstraZeneca manage orphan innovations?*
 - *How does AstraZeneca manage orphan innovations when they emerge in already invested projects?*
 - *How does AstraZeneca manage orphan innovations when they emerge spontaneously at individual level?*
- *What tangible and intangible business values can be extracted from orphan innovations?*

1.4 Delimitations

The concept of orphan innovation can be faced in different ways depending on what angles that are adopted and investigated. In this master thesis, the focus will be on innovation projects that fails to proceed and falls in the category of orphan innovation due to a change in expectations of an innovation within the company, and on innovations that have the characteristics of orphan innovation from the beginning, they have so called occurred spontaneously at an individual level. Innovations that lies in between these two dimensions, hence innovations that are not truly in line with the company's core business but that the company still proceeds with internally are therefore not focused on. Additionally, the thesis will not include the aspect of orphan innovations that quit being orphan as the company chooses to proceed with the innovation, and because of that make amendments to the original business strategy.

Moreover, this thesis will not focus on the idea generation process or on the ideas themselves, but rather on when the idea already has become an innovation, meaning that the idea generation process has already been taking place and has developed into an innovation consisting of expectations of future business value.

Also worth mentioning is the fact that the case study took place at AstraZeneca's R&D site in Mölndal, meaning it will focus mainly on the R&D side of the company, leaving for instance the sales organization out of the picture.

1.5 Research Outline

The opening chapter provides the reader with an introduction, introducing the concept of orphan innovations and why it is an interesting and important subject to investigate. Furthermore, the introduction proceeds to present a brief background of the pharmaceutical

industry as well as the pharmaceutical company AstraZeneca. Additionally, the research questions as well as the delimitations are presented in order to narrow down the subject. The second chapter describes and motivates the research methods used and how the thesis was conducted. The second chapter also state possible alternative methods, and motivates why these were not used. The research method chapter is ended with a description of the quality of this thesis, referring to the concept of authenticity and trustworthiness as well as with some criticism to the chosen research method. The third chapter gives a theoretical framework with suitable theories in order to enhance the understanding of the subject and in order give support to the analysis of the empirical material that is presented in the upcoming chapter, i.e. chapter four. Theories such as open innovation, corporate entrepreneurship as well as value creation are presented. Chapter four presents the important aspects from the empirical data that could help answering the research questions stated previously, hence, the focus lies on the management of orphan innovation and the value creation of orphan innovations. The fifth chapter consists of the analysis made out of the empirical material and the theoretical framework, and it aims at discussing answers for the research questions. Chapter five is followed by the sixth chapter and the conclusions that aims at answering the master thesis' research questions. Additionally, chapter six also provides the reader with suggestions for further research.

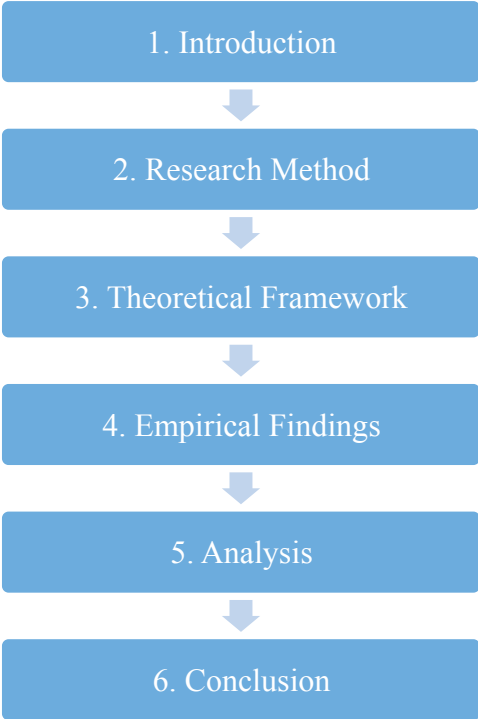


Figure 2: Research Outline

2. Research Method

The Research Method chapter presents the method that is used in order to conduct this master thesis. Arguments are presented for why the chosen methods are the most suitable ones for the particular thesis, but it also includes alternative methods. Additionally, the development process of the thesis, with focus on the important amendments and decisions are presented as well. The chapter is ended by a description of the quality of the thesis as well as some criticism to the chosen approach.

2.1 The emergence of the subject “Orphan innovations”

Before the subject of orphan innovation was created, the intent was to conduct a narrow study of a medical device that had been developed at AstraZeneca, which was not in line with the core business. However, due to patent restrictions it was not possible to examine the specific product and still publish the thesis in time. Instead, the main focus of the research became more generalized on the subject of innovations that do not fit with the core business, meaning the emergence of the subject “orphan innovations” took place. This was deliberated with the help of our supervisor, Evangelos Bourellos, as well as the CEO of the BioVenture hub at AstraZeneca, Magnus Björsne.

After some further interesting discussions with Magnus Björsne, the research questions were also modified to not include all different cases of orphan innovations at AstraZeneca, but to instead focus on when orphan innovations have emerged from a change in innovation expectations at project level as well as when they have emerged at individual level. After the discussion it was also decided that the thesis should not include the idea generation process as well as the emergence process of orphan innovations itself. Therefore, this was put in the research delimitations. The research is aimed to rather focus on the stages after the emergence, as that is of greater interest from a corporate perspective since orphan innovations are not something that the company actively would like to encourage, and because of that, the emergence phase is of less importance at the moment.

2.2 Research Strategy

Research is generally divided into two different approaches; quantitative and qualitative research. The quantitative research is used in research where it is important to emphasize qualification for the data collection as well as for the analysis. In comparison, a qualitative

strategy emphasizes words which makes it possible to gain more depth in the primary data (Bryman & Bell, 2011). Since the aim of this master thesis is to examine the existence of orphan innovation at AstraZeneca, how they manage orphan innovation today as well as how orphan innovation can be valuable, an approach that offers depth in the understanding of the company is required. Therefore, the most suitable research approach for this master thesis and the approach that is used, is the qualitative research. A quantitative strategy is not used since it would generate more superficial data, probably resulting in less depth in the analysis.

As previous research on the subject of orphan innovation is limited, the thesis has an exploratory approach, meaning the conclusions is less based on previous literature and more based on the empirical material. However, related literature will be used in order to discuss the empirical material. Furthermore, the exploratory approach supports the inductive approach, as the inductive approach implies that generalizations are made out of the observations and that they are resulting in theory as an outcome of the research (Bryman, & Bell, 2011). As the previous literature on orphan innovation is limited, and as the observations at AstraZeneca aims to create some generalizations in order to add to the theoretical ground of orphan innovations, this master thesis is built upon the inductive approach. The contrary approach is the deductive approach that aims at examining the relationship between research and theory by testing a hypothesis. The result of the deductive approach is either a confirmation or a rejection of the hypothesis, and if the hypothesis is rejected it can lead to a revision of the theory (Bryman, & Bell, 2011). Since the previous literature on the subject of orphan innovations is limited as stated before, and as there is no clear theory to build a hypothesis regarding orphan innovations on, the deductive approach is not suitable for this thesis. Moreover, a single case study of one organization, which is the research design for this thesis and that will be argued for further down in this chapter, is not suitable for changing a theory which could be the possible outcome of a deductive approach, but to rather create a deeper understanding of an organization.

The paradigm of a research should be interpreted as an explanation of how research is performed, what is examined and how the results of the study are interpreted (Bryman, 1988). There are four paradigms that are based on the assumptions of objectivism and subjectivism as well as assumptions related to the function and purpose of the study; regulatory and radical. An objectivist approach means that the organization and its structures and processes are viewed from an external perspective. A subjectivist approach on the other hand, views the organization as a product that is based on individuals and their social experiences. With

employee interviews as our primary data for this qualitative study the thesis is taking on a subjectivist approach where the internal perspective is at focus. Interpretations and social aspect becomes important with the goal to examine the management of orphan innovations at AstraZeneca as well as the possible value creation.

Continuously, regulatory represents a purpose where the aim is to describe what is happening in an organization but without judging it. Possible changes are allowed for how to improve what is going on in the organization. Lastly, the radical approach, aims to describe how organizations should be, through judging the organization and later on present suggestions about how that can be achieved (Bryman & Bell, 2011). As this thesis aims at describing the situation of the way that orphan innovations are managed today at AstraZeneca as well as to present some tangible and intangible business values connected to orphan innovations, the regulatory approach suits best and is used. The chosen research questions do not require neither judgment of the organization nor suggestions for how to improve the processes or value creation, and because of that the radical approach is not suitable for this master thesis. When the subjective approach and the regulatory approach is used together it results in what is called an interpretative approach. Because of the nature of the research questions for this master thesis, the aspect of interpretivism is of greatest relevance, also meaning a hermeneutic approach where social actions are interpreted subjectively. Therefore, it is also the opposite to the positivistic approach.

2.3 Research Design

This master thesis is based on a single case study of AstraZeneca. The choice of AstraZeneca is made because the company is capital strong, it is global and well established. Furthermore, the company is operating in an interesting industry that is both complex and very resource consuming referring to its R&D cost, as it is the sector that has the highest R&D investments in the world (European Commission, 2014). Additionally, AstraZeneca is a company that is more or less built upon innovation and the company has the aim for science to be at the center of all of the company's activities (AstraZeneca, 2014:a). Because of that it can be assumed that innovations that are not in line with the core business can emerge within the company. With these arguments AstraZeneca is a company where orphan innovations could lead to new opportunities if the value of such innovations could be captured.

The reason for choosing a single case study instead of for instance, a case study of multiple companies, a comparative study or a longitudinal study, is because of the time frame of the master thesis. As a multiple case study examines at least two companies, as a comparative study compares at least two different cases and as a longitudinal study examines change through investigating two different points in time, they all require more resources (Bryman & Bell, 2011). Since the aim is to provide an analysis with depth rather than breadth with a tight time schedule, and as the thesis does not focus on change, the single case study is the most suitable research design. Furthermore, a single case study fits the qualitative research as it offers significant depth to the analysis of the research. However, a multiple case study could have offered room for more generalizations, and it is brought up in the method criticism later on in this chapter.

2.4 Data Collection

2.4.1 Primary Data

The primary data is the data that is collected directly through first-hand contact during the research process, and in this case, the primary data is collected through face to face interviews with employees at AstraZeneca.

2.4.1.1 The interviews

The case study took place at the AstraZeneca R&D site in Mölndal, Gothenburg. Therefore, the interviewees are within the field of the R&D at AstraZeneca. The interviews were conducted with three employees working with line management and four employees working with research/project management. The reason for choosing to interview both people from line management and from research/project management is to give different insights regarding the concept of orphan innovation. It can be believed that depending on the work tasks, as well as the differences in the closeness to research, the perceptions can differ and add additional insight to the study. Also, all interviewees chosen for the case study were senior people within the industry, to give an experienced view of both the industry and orphan innovations. The experience and knowledge of orphan innovation is of great importance for this master thesis and therefore senior people is believed to give more experience and knowledge about it than individuals that have not had equal amount of time in the industry. In total, nine possible candidates for the study was given by Magnus Björsne. However, only seven candidates responded to the interview invitation and were later on booked into seven separate interview meetings that took place at AstraZeneca in Mölndal. Before the

interviewees were booked the interviewees were informed that the interviews would take 20-30 minutes and they were given a brief explanation of orphan innovations in order for them to be a bit more prepared before the interview. All interviews were held in Swedish.

Interviewees from line management

Totally three people from line management were interviewed and the interview questions can be found in Appendix 1. Line Manager 1, that is called LM1 further on, is the president of AstraZeneca Sweden AB. As the president of AstraZeneca Sweden AB, the working tasks involves interaction with politics, policymakers and other businesses, as well as internal coordination. The interview with LM1, that was the second interview, was held in a public, but relatively quiet area at the site in Mölndal the 18th of April 2016. It took approximately 25 minutes.

Line Manager 2, that is called LM2 further on, is the head of the BioVenture Hub. The BioVenture Hub, being a part of AstraZeneca and located in Mölndal, offers academic groups and biotech companies laboratory space, facilities and access to AstraZeneca's competences and infrastructure (AstraZeneca, 2016:c), and it is further explained in chapter four. As the head of the BioVenture Hub, the working tasks concerns different aspects of business development. The interview with LM2, that was the third interview, was held the 18th of April 2016, in a conference room at the site in Mölndal. The interview took approximately 20 minutes.

Line Manager 3, also called LM3, works as Senior Director for Drug Metabolism and Pharmacokinetics. LM3 is the manager for the department, and LM3 is also the project leader for two projects that concerns larger molecules than the company is usually working with, and in that way it is a new area for AstraZeneca. The interview with LM3 was the seventh and last one of the interviews. The interview was held at the 26th of April 2016, and it was held at the Coffee Lab at AstraZeneca's site in Mölndal. The Coffee Lab is a cafeteria with sofas where more casual meetings and conversations can be held. The duration of the interview was about 30 min.

Table 1: Overview of the interviews with employees from line management

Name	Work Title	Work Tasks	Date	Duration
Line Manager 1 (LM1)	President of AstraZeneca Sweden AB	External interaction and internal coordination	04-18-2016	25 min
Line Manager 2 (LM2)	Head of the BioVenture hub	Business development	04-18-2016	20 min
Line Manager 3 (LM3)	Senior Director Drug Metabolism and Pharmacokinetics	Responsible for Metabolism and Pharmacokinetics department and two projects	04-26-2016	30 min

Interviewees from research/project management

Totally four people from research/project management were interviewed and the interview questions can be found in Appendix 2. Research/Project Manager 1, that is called RPM1 further on, works as a clinical research physician, meaning that the working tasks involve medical responsibility to start, design and implement clinical studies. RPM1 works mainly within the area of diabetes and dyslipidemia. The interview with RPM1 was the first one of the interviews, and it was held on the 18th of April 2016. The interview was held at AstraZeneca at a common and quiet area. The duration of the interview was approximately 25 minutes.

Research/Project Manager 2, later on called RPM2, works as a senior director physician with responsibility for early clinical programs first in healthy volunteers and later on, in patients. RPM2's work reaches from the early stages of the clinical programs until phase three of the studies. RPM2's main areas are diabetes, cardiovascular diseases as well as hepatic diseases. Additionally, RPM2 is also writing articles for medical journals. The interview with RPM2, that was the fifth interview, was held at 20th of April 2016 at a conference room, and it took around 30 minutes.

Research/Project Manager 3, later on called RPM3 works as a Project Leader for Intelligent Pharmaceuticals, meaning a project leader for different kinds of support solutions such as

tools and devices to patients, with the aim to improve the treatment efficacy. The interview with RPM3 was the sixth interview and it took place on the 20th of April 2016. Furthermore, it was held at RPM3's office and the interview took approximately 25 minutes.

Research/Project Manager 4, also known as RPM4, works with site lead for Innovation Medicine Operations where the team supports innovative medicines and everything related to project management. The interview was the fourth interview to be held at AstraZeneca, and it was held at the Coffee Lab at the company's site on the 20th of April 2016. As the interviewee did not have a meeting booked immediately after the interview, and since the respondent had interest in the subject orphan innovation, the interview continued after the requested 30 minutes to instead take totally 55 minutes.

Table 2: Overview of the interviews with employees from project/research management

Name	Work Title	Work Tasks	Date	Duration
Research/Project Manager 1 (RPM1)	Clinical Research Physician	Responsible for clinical studies	04-18-2016	25 min
Research/Project Manager 2 (RPM2)	Senior director physician	Responsible for clinical programs	04-20-2016	30 min
Research/Project Manager 3 (RPM3)	Project leader for intelligent pharmaceuticals	Developing supporting medical tools/devices	04-20-2016	25 min
Research/Project Manager 4 (RPM4)	Site lead for innovation medicine operations	Supports the function innovative medicine	04-20-2016	55 min

Interview structure

The interviews followed a semi-structured approach in order to get answers on related questions but to also be able to offer flexibility for viewpoints that the interviewees might find important and would like to bring up. Compared to semi-structured interviews and why not choosing otherwise, a structured interview could result in a lack of collecting important

information as the respondent would not be given any space to add additional information that does not fall within the asked questions. This could make the analysis rather flat and there is a risk that the depth of the analysis could be jeopardized. Moreover, an unstructured interview could result in redundant information from the interviewee under the condition that the interviewee is talkative (Bryman and Bell, 2011). A lot of redundant information would make it complex to shift the information to focus the analysis on the chosen research question. Another risk with the unstructured interview is that the interviewee would not understand the subject of orphan innovations as the term is quite unspoken. The semi-structured approach offers the requested depth and focus, as well as support for the interviewee to talk about a new and maybe unknown subject.

The interviews were recorded after approval from the interviewees. Recording the interviews enable repetition of the interviews and because of that it is possible to refresh and regain other possible connections and outcomes from the interviews.

Interview guideline

In order to make sure that all topics are covered during the interviews, an interview guideline was used (see Appendix 1 and 2). However, the interview guideline was structured differently depending on the role of the interviewee. The line managers were asked questions more related to business strategy and structures for the processes of orphan innovations, and the research/project managers were asked questions related more to the perception of orphan innovations within daily operations. This division was made as it was believed that the data could get higher quality if the questions were changed to suit better with the position and working area of the interviewee.

In order to set up the interviews in the best way possible, two meetings with the CEO of AstraZeneca's BioVenture hub were made regarding the design of the interview guideline, which can be compared to a pilot interview. The meetings were held on the 22nd of Mars 2016 and the 6th of April 2016. The reason for doing pilot interviews was to prepare and improve the interview guideline in order for it to create opportunities to generate better quality in the data gathered in the interviews. After feedback from the pilot interviews the questions were improved in order for them to be more precise regarding definitions, and in order for them to be more focused on the specific research questions and subject of the research.

2.4.2 Secondary Data

Further, the secondary data in this thesis is information that is the output from other researches, i.e. published research, but also published information from and about AstraZeneca that is of interest for the specific topic. The secondary data is of importance to enable the analysis of the collected primary data, and to get a general understanding of the subject as such.

The secondary data is collected through a literature study. A literature study can be made either as a systematic review or as a narrative review. A systematic review is said to be more reliable based on the argument that the understanding of the subject becomes more comprehensive (Tranfield et al., 2003). Additionally, the systematic review is less likely to be biased (Bryman & Bell, 2011) as all hits after a search in a database are evaluated to determine if it is of interest for the research or not. However, the systematic literature review is time consuming since evaluating all hits after a search in a database can mean that thousands of articles must be evaluated and considered. Because time is limited when writing a master thesis, a narrative review, that is not as time consuming as the systematic review is made. The narrative review gives the authors an initial impression of their research area (Bryman & Bell, 2011) and the process is time efficient.

The literature study is made through searches in databases such as Business Source Premier, Web of Science, Emerald, and the school's library's online searching tool GUNDA. Key words that are used both as single words and in combination are: open innovation, pharmaceutical industry, project management, corporate entrepreneurship, orphan innovation, value creation, value capture and outbound open innovation. Furthermore, suitable literature from the courses in the master program Innovation and Industrial management is used. Recommendations on suitable literature were also given by lecturers from the institute of innovation and entrepreneurship at the school of business, economics and law, being a part of the university of Gothenburg. And lastly, information from AstraZeneca's official web page and AstraZeneca's annual report is also used in order to support choices and to give insight to the industry and the company.

2.5 Data Analysis

Concerning the analysis of the empirical data, different tools are used. Some common techniques related to qualitative data analysis can be either analytic induction or grounded

theory. On the one hand, analytic induction generally builds upon the saturation of empirics collected until no abnormal cases are revealed and then the hypothesis can either be dismissed or approved. On the other hand, grounded theory builds upon some general other implications within the process. Some key points or tools used within this theory are for instance theoretical selections, coding, theoretical saturation and continuous comparisons. The outcome from grounded theory can be seen as concepts and categories (Bryman & Bell, 2011). Within the frame of the particular research questions and since the research design relies on one single case study, the latter process is used when analyzing the qualitative data, meaning that grounded theory is used as a guideline. This is due to that analytic induction is lacking in providing useful guidelines when conducting the data collection as well as due to that a hypothesis is difficult to create because of lack of previous research on orphan innovations and one company is not enough to determine if a theory is correct or not.

Some of the grounded theory implications that are used in the process of the analysis concerned the theoretical selection, saturation within the process, the coding process and continuous comparisons that are also brought up by Glaser & Strauss (1967). Theoretical selection refers to the discovery of certain categories within the process of qualitative data collection. Saturation within this process is of great importance to meet the claim of reliability and validity and so forth. The coding process refers to the coding of data being coded before conducted since this can ease the collection of data and the analysis process. Theoretical saturation concerns collection of data and its categories, and the saturation of the coded data. The continuous comparisons are by Glaser & Strauss (1967) pointed out to be one of the key aspects and elements within grounded theory and refers to maintain the connection between empirics and theory and the collection in between.

Before conducting the interviews, the interview guidelines were constructed in a coded way with underlying topics in order to ease the coding of the conducted data as told by Glaser and Strauss (1967) to be an advantage both in the coding process but also in the process of the analysis. After the interviews were done, the first step in the coding process meant transcribing all of the interviews in detail. This was made in order to ease the coding process since patterns and keywords could easier be withdrawn from the transcribed text. Since all the interviews were in Swedish, the transcribed material remained in Swedish as well, in order to not lose any significant language interpretations. The coding process started with differentiating and search for important keywords and key sentences. After this was made,

some comparisons between the material could be made within the interview groups to further find the structure for the analysis process.

2.6 Quality of the research

Validity and reliability are some of the criteria for evaluating quantitative research. Within qualitative research however, the disagreements amongst researchers in how to implement similar criteria for the evaluation of qualitative research exists (Bryman and Bell, 2011). Alternative criteria instead of validity and reliability are further developed by Lincoln and Guba (1985) and Guba and Lincoln (1994). The authors state two similar categories for evaluation of qualitative research as “authenticity” and “trustworthiness”, where trustworthiness could be divided into four subgroups; “credibility”, “transferability”, “dependability” and “confirmability”. These five concepts in total are concepts that are created in order to establish some fundamental criteria in how to measure the quality of a qualitative research. However, within qualitative research, more than one reality might exist and there is no single one explanation of a phenomenon as could be presented by a quantitative research.

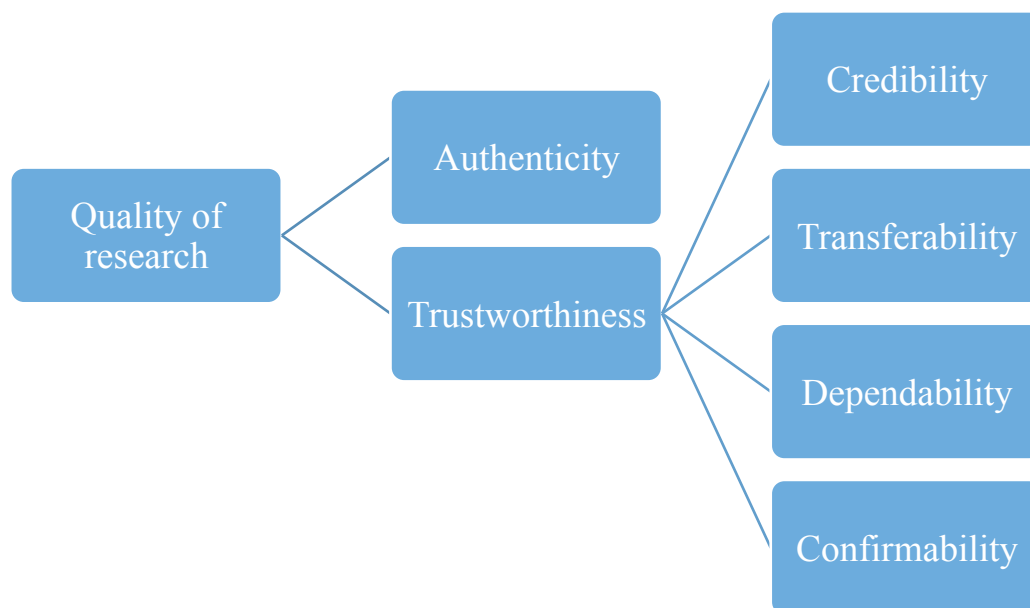


Figure 3: Quality of research - Authenticity and Trustworthiness (based on theories by Lincoln & Guba (1985) and Guba & Lincoln (1994))

2.6.1 Authenticity

Authenticity focuses mainly on fairness and whether the participants’ experiences are faithfully and fairly described as well as if the research is fairly based on different viewpoints.

To minimize the issues related to authenticity, the interviews were divided into two different kinds of interviewees, line management and project/research management, to give a fair picture of the subject orphan innovation and to take different viewpoints into consideration. Furthermore, the interviews were conducted with a semi-structured approach in order to offer the flexibility for the interviewees to add additional thoughts and viewpoints. Hence, the structure enabled the interviewees to mediate their experiences in a faithful way. Moreover, the interviews were recorded, transcribed and thereafter coded immediately after the interview took place, in order to ensure that the data was described as correctly as possible.

2.6.2 Trustworthiness

Credibility

Credibility is how believable the research is. The credibility focuses on the participants in the research and quality of the gathered information rather than on the quantity. To fulfill the credibility criteria, the interview guideline was for instance developed in collaboration with Magnus Björsne, CEO of the BioVenture hub at AstraZeneca, in order to fully understand and validate the correct meaning of orphan innovation to best suit the individuals that were going to be interviewed. To further mitigate the risks concerning credibility, the interviewees were also given a short presentation of the subject “orphan innovation” to introduce the interviewees to the subject and to make the interview responses consistent. This was also shown to give consistency in the empirical material since it can be interpreted as that all of the interviewees got the same impression of the subject, orphan innovation based on the examples that were brought up. Additionally, the interview questions can be interpreted as not asking for very sensitive information, and because of that, it is likely that the interviewees have given answers in a trustfully way, however, only the respondents can make a good validation on the credibility of the research.

Transferability

Transferability is whether the research findings apply to other contexts or not. Qualitative research is generally based on few sources, and the transferability criteria implies whether or not the result based on these few sources can be used in other similar situations and contexts. Since qualitative research has inherent issues with generalization, some comments can be stated in order to mitigate the risk of low transferability. Even if this study is based on a single case study, hence focusing on only one organization, it is also based on one of the largest pharmaceutical companies where much resources are put into R&D. This could increase the

possibility to find orphan innovations and to find out more about the management of it. It could because of that possibly be comparable with a similar company in a similar situation. However, it cannot be ensured that the result of the thesis is transferable as this thesis is aiming at creating some kind of theoretical ground for the subject orphan innovation that is yet quite unexplored. Additionally, to better be able to ensure transferability, it would be preferable if the study included more organizations to get an increased amount of viewpoints and data.

Dependability

The essential concern within dependability is whether or not another researcher would obtain the same results if the research was made a second time in accordance to the process described in the research. This takes into account the consistency and transparency of the findings and how well the processes in the study are accounted for. With the guidance from AstraZeneca to fully understand their situation in the subject of orphan innovation, the dependability criteria could be seen as compiled to, and could for instance be visible in the empirical material and its consistency in the perceived phenomena “orphan innovation”. Moreover, the interviews were conducted with the help of an interview guideline, to increase the dependability. However, follow up questions were occasionally asked depending on the different situations, which can be considered to lower the dependability as they are not included in the interview guideline. After the interviews they were transcribed and coded immediately after they took place to minimize the risk of losing important data. Additionally, the research process and the gradual development process is well explained in the Research Method chapter, which increases the chances of the research to be conducted in the same way and possibly with the same result.

Confirmability

Lastly, Confirmability is related to objectivity and it takes into consideration if the research findings are supported by the collected data or if the researcher’s values or perspective has affected the research findings (Lincoln & Guba, 1985; Guba & Lincoln, 1994; Bryman & Bell, 2011). Throughout the process of this master thesis, the values and beliefs from us as the researchers have not been a perceived issue inflicting the outcome from the study. The appearance of orphan innovation relies completely on the collected data, as no previous knowledge about orphan innovations existed amongst us as authors before the subject was brought up at the first meeting at AstraZeneca on the 22nd of February 2016. However, some

knowledge about supporting theories existed before conducting the research, and that could have slightly inflicted the process, but not neither intentionally nor consciously.

2.7 Method Criticism

All different methods can be criticized in one way or another. In this case, the choice of making a qualitative single case study gives for instance, only the view and depth of one single company, in this case AstraZeneca. In order to create generalizations that can be applicable in more situations, research needs to be done on more than one organization. However, as the existing literature on orphan innovations is very limited, the view of orphan innovations in one single organization still adds to the existing research, and it is argued to be the most suitable method with the regards to the research questions and time limit.

Furthermore, there are potential limitations and restrictions concerning the empirical data collection that was made through interviews with employees at AstraZeneca. It is possible that sensitive data was not shared as an active choice, and it is also possible that the interviewees tried to share a positive view of the company rather than bringing up problems and difficulties. However, the impression was that the interviewees spoke freely and tried to give an honest picture of the reality of AstraZeneca.

Concerning the evaluation of the quality of the research, some criticism could be directed toward the credibility criteria especially. Respondent validation and triangulation that is brought up by Lincoln & Guba (1985) and Guba & Lincoln (1994), could have been done to improve the credibility, but due to the time restriction this was left out and can for that reason be criticized.

3. Theoretical framework

In this chapter the theoretical framework from the literature review is presented. The theoretical framework is mainly focusing on corporate entrepreneurship, value creation, and innovation management culminating into outbound open innovation. The literature review aims at supporting and fortify the analysis and arguments that are put forward, and which could be connected to the concept of orphan innovation.

3.1 Innovation Management

3.1.1 Closed innovation

In the past, closed innovation was more or less seen as the only way to manage innovation. Closed innovation is when the organization works only with internal R&D, meaning that processes like idea generation, development and commercialization are all managed internally within the organization. With this view, organizations need to have all the brightest and best people in the organization to succeed, and intellectual property (IP) is seen like a protection from other organizations to profit from the ideas (Chesbrough, 2003:a). When a market for technology exchange is lacking, i.e. when a closed innovation strategy is used, it is common that organizations need to acquire complementary assets, such as knowledge, equipment, distribution and marketing channels to be able to extract profits from the innovation (Teece, 1986).

3.1.2 Open innovation

Later on, open innovation started to occur, and when it is used, the organization uses both innovations that are developed internally and developed externally as all of the best people are not working within the organization. The boundary between the organization and its surrounding is weaker and the organization can get ideas from the surrounding as well as it can extract own ideas to the surrounding. The open innovation approach views IP as a way for the organization to profit from others using its IPs and as a way to buy competences and knowledge when buying others IPs. With this approach it is believed that the best ideas come if both internal and external sources are used, and that can lead to a better business model than if only internal sources are used (Chesbrough, 2003:a). Compared to closed innovation the developer does not need to directly access the complementary assets to appreciate from the

innovation, however, the transaction costs might increase when acquiring them from external sources (Arora et al., 2001).

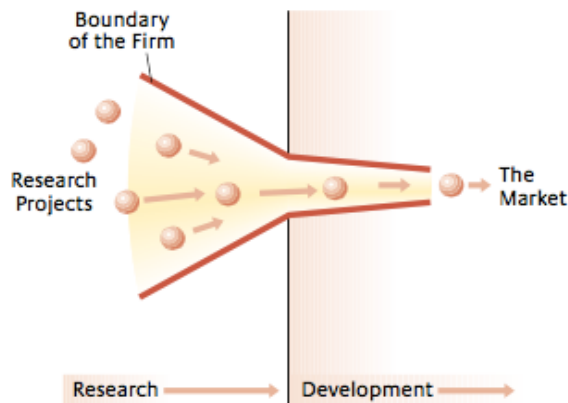


Figure 5: Closed innovation (extracted from Chesbrough, 2003:a)

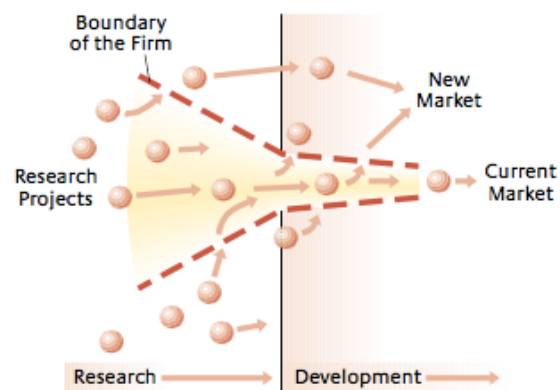


Figure 4: Open innovation (extracted from Chesbrough, 2003:a)

One of the largest difference between these two innovation management methods is that the open innovation has the ability to save “false negatives”. “False negatives” can be explained as innovations that seem to not be worth investing in due to its lack of promise but that in the end turns out to be valuable. For an organization using a closed innovation approach these innovations are likely to be missed out on as they might fall outside the current business of the organization, or because new competences or knowledge is needed in order to understand the potential of the innovation. However, when open innovation is used these kinds of projects can be developed and commercialized with the help of the surrounding environment and create value for the organization (Chesbrough, 2003:a).

3.1.2.1 Inbound and outbound open innovation

Three core processes within open innovation has been identified by Gassman & Enkel (2004); the coupled process strategy, the outside-in process and the inside-out process. The coupled process explains when multiple parties (at least two) merge in order to benefit from external knowledge for a specific project. The outside-in process explains the process when the company brings knowledge from the external environment into the organization. The outside-in process can also be compared to what Chesbrough and Crowther (2006) calls inbound open innovation, and it is generally more present in early phases within the innovation process. Inbound open innovation is further explained as how to leverage external innovations and bringing them inside the company. Within the pharmaceutical industry inbound open innovation can be described as a way to generate innovation, as collaboration is seen as a way

to generate innovation as well as it includes the possibility to purchase scientific services and in-licensing (Chiaroni et al., 2009).

The inside-out process, that is the most important one for this specific thesis, means that the organization's knowledge is shared to external parties through licensing, selling or investments in different collaborations with external actors (Gassman & Enkel, 2004). Chesbrough and Crowther (2006) describes the inside-out process with the expression outbound open innovation. Outbound open innovation is described as how to leverage and bring internal innovations to the outside of the company. Outbound open innovations could for instance mean that other external organizations are useful and have a better suited business model to fit a specific innovation compared to the actual company. Outbound open innovation could also be seen as a way to exploit innovation within pharmaceutical biotech companies, which refers to the exploitation through collaboration, out-licensing, and the possibility to supply scientific services (Chiaroni et al., 2009). Furthermore, Chiaroni et al. (2009) states that outbound open innovation is generally more common in the second phase and later phases in the innovation process in the pharmaceutical biotech companies. However, the concept of outbound open innovation lacks some theoretical ground as the concept has been given less attention compared to inbound open innovation (Mortara & Minshall, 2011; Enkel et al., 2009).

Technologies, i.e. technology IPs, intangibles technologies, technologies in products and technical services are assets, and it can though be traded between companies. Exchange of technologies as a part of open innovation, can for example be made through licensing, cross-licensing agreements, joint ventures, partnerships and contract R&D (Arora et al., 2001). Innovations can through outbound open innovation be commercialized through either selling or out-licensing. This can advantageously be made with innovations that previously have been ignored (Chesbrough, 2003:b; Chesbrough 2003:c; Chesbrough, 2006). It is believed that out-licensing innovations has become more common at the same time as some examples has been seen of companies strategically prioritizing to out-license innovations (Fosfuri, 2006). However, it can be argued that it is most often the success stories of out-licensing and sales that are shown in the literature, and that the many obstacles and difficulties rarely are presented. The obstacles and difficulties can prevent companies from out-licensing and selling the innovation (Rivette & Kline, 2000). Additionally, there are transaction costs associated with both out-licensing and selling that needs to be taken into consideration before deciding whether to leverage through out-licensing or sale, or to not proceed with the innovation at all

(Gambardella et al., 2007). It is also a stated obstacle to estimate the potential value of an innovation before out-licensing or selling the innovation, and that can make the potential revenue difficult to estimate (Chesbrough & Rosenbloom, 2002).

3.1.2.2 Strategic adaptation of outbound open innovation

Kutvonen (2011) has further proceeded with the outbound open innovation concept and developed a model in how external exploitation could lead to different strategic outcomes for an organization. Because outbound open innovation not only could lead to monetary benefits but also to strategic long-term benefits, the author has contributed a model with six different factors that could guide the strategic opportunities for an organization engaging in outbound open innovation, or more precisely “external technology exploitation”.

The first categorization, “gaining access to new knowledge”, where mutual agreements such as within cross-licensing could lead to the access of another company’s knowledge portfolio (Grindley & Teece, 1997; Rivette & Kline, 2000). Also within this categorization, new opportunities to different markets and networks can be an opportunity through outbound open innovation, and it can decrease the entry barriers to those markets significantly (Davis and Harrison, 2001). The second categorization concerns the “learning from knowledge transfer” where the learning curve of the company can be improved and create capabilities (Kutvonen et al., 2010). Also the reputation of a company can be improved in this stage. This means that the reputation can be built on the active choice of the company to join the knowledge transfer and by that attract other partners for collaboration (Kutvonen, 2011). Thirdly, “multiplication of own technology” concerns both setting standards by for instance out-licensing (Kline, 2003) and to widen the network for a specific technology (Kutvonen, 2011). Multiplication of own technology could also mean to gain market shares in different geographical markets or even enter a new market opposite to the current products of the organization (Arora et al., 2001). The fourth group of categories by Kutvonen (2011) is “controlling technological trajectories”, that describes how an organization can benefit from creating outbound flows of technology to use the external environment, that enables further development of their outbound technology. This means that the organization who gave out the technology could reap the benefits of scale by these developments (Von Hippel & von Krogh, 2006). Fifth, “external exploitation as a core business model” shortly states how companies create their business models according to the strategy of external exploitation (Kutvonen, 2011). Lastly, the sixth category is “exerting control over environment”, and it explains the external exploitation process as a way to maintain leadership in the market by licensing (Koruna,

2004), or gain control by complementary production or by creating opportunities for other firms with cross-licensing. This could create lock-in effects with the used technological exploitation (Kutvonen, 2011).

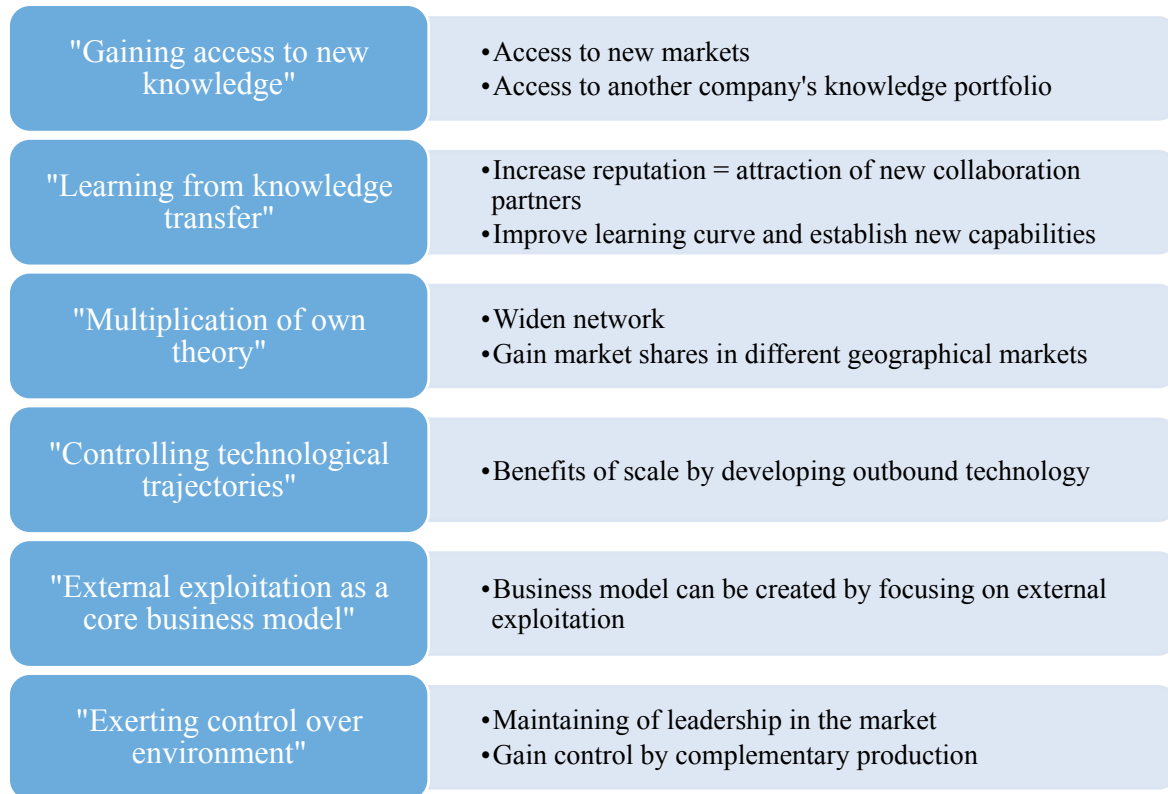


Figure 6: External technology exploitation (based on the theory by Kutvonen, 2011)

3.2 Corporate Entrepreneurship

Corporate entrepreneurship (CE) has been defined by several authors. Rutherford and Holt (2007) interpret the definition as a step or a process in how companies can better adopt and apply their organization's individual entrepreneurial and innovative knowledge, skills and capabilities. The authors further state that CE could play an important part on different levels within the organization. The levels could vary between organizational and individual level. However, the organizational levels of CE depend heavily on the individual level of CE. This is because, as Rutherford and Holt (2007) present it, organizations cannot by their own conduct CE processes without its members, as the organization consists of the individuals. Nevertheless, their model of explaining the interplays between the different categories could be more appropriate when analyzing the organizational construct rather than the actions of individuals. The model that the authors have stated is therefore organized into different categories, in order to understand how different factors are related regarding CE. These

categories are divided into process, context and individual characteristics. Similar to the model by Rutherford and Holt (2007), Ireland et al. (2009) have created a CE strategy that is closely related to these categories. Ireland et al. (2009) describes their model as a CE strategy divided into three different elements; “the entrepreneurial strategic vision”, “the pro-entrepreneurship organizational structure” and “the entrepreneurial process and behavior”. However, Ireland et al. (2009) states the importance of CE strategy. In order for it to work as a strategy properly, it must be a core fundamental vision and be operated at all levels within the organization to not be left out. A CE strategy must be a robust incitement within the organization in order for it not to be vulnerable.

Process

This process category presents the motivational part of CE. Rutherford and Holt (2007) explains it as a powerful human resource management technique to enhance the motivation amongst its organizational members. Factors such as the reward-system and how leaders tend to negotiate CE through the organizations play an important part, and if these parts are lacking, resistance to CE could be present. Also, Ireland et al. (2009) state the top-level managers and reward system as key factors to the promoting of entrepreneurial behavior and the construct of a CE organizational structure. Moreover, the leader and the leadership is of great importance for innovation and it has been given substantial attention in the literature (Mumford et al., 2007; Byrne et al., 2009). The leadership is of importance for the success in creativity (Mumford & Licuanan, 2004). Ireland et al. (2009) include also in the process section the importance and differences in the aspects of culture, resources and capabilities that exist within an organization, which also could affect the CE strategy.

Context

Factors that impacts the context plays an important part when it concerns CE. The definition of context could vary depending on different authors, Rutherford and Holt (2007) have however mainly focused on the factors such as the “perception of co-worker”, “communication climate” and the “perceived organizational support”. What is important to also acknowledge is the fact that Ireland et al. (2009) states, that when changes in competitive capabilities, for instance, are closely related to the organizational structure they could affect and impact the CE strategy. These kind of changes in the organizational context could therefore change the CE strategy indirectly.

Individual characteristics

In order to understand the organization's current status, individual characteristics could be a factor of importance when investigating the implications on CE (Rutherford and Holt, 2007). With individual characteristics, individual's responses and behaviors towards organizational changes and innovation, could differ regarding to certain characteristics. In this way individual characteristics could for instance, affect the way an individual behave entrepreneurially. The concurrence between the entrepreneurial vision, the leaders of the organization driving the organizational pro-entrepreneurial structure, and the individual entrepreneurial knowledge and characteristics are all together required for a CE strategy (Ireland et al., 2009).

3.2.1 The adaptation of Corporate Entrepreneurship

How organizations and companies manage CE differs depending on company specific characteristics and variation can extend from both a resource authority and an organizational ownership spectrum. The organizational ownership means the level of focus related to who has the ownership of the creation of innovations. The resource authority relates to whether projects are funded based on a unit budget, hence ad hoc, or if they are funded based on a dedicated corporate budget. These two variables create the foundation for the "Four models" framework that is presented by Wolcott and Lippitz (2007). These four models are; "The Opportunist Model", "The Enabler Model", "The Advocate Model", and "The Producer Model".

According to the authors Wolcott and Lippitz (2007), all companies are from the beginning within the opportunist model, meaning they have no intentional structure for how to allocate resources or management of CE. The opportunist model is also stated to best fit with companies where managers are more often likely to have a positive attitude with spontaneously generated ideas. However, if such a corporate culture is not present, opportunities from ideas generated within the company are more likely to be dismissed. The Enabler model has a more developed structure for how to allocate resources to CE and new concepts are more likely to get support if being valuable. Within this model, teams are created in order to facilitate CE on an independent basis. When organizational ownership is strongly focused, but resources are not dedicated to CE, the Advocate model is present. This model concerns most organizations that do not have problems with how to fund new concepts and ideas, and the business units of the company are managing the funding. However, the company itself is in favor of promoting CE. The Producer model on the other hand has a more

focused view regarding the organizational ownership to CE as well as a dedicated structure of resource authority. This means for instance, that the company has fundamental established support in order to facilitate CE.

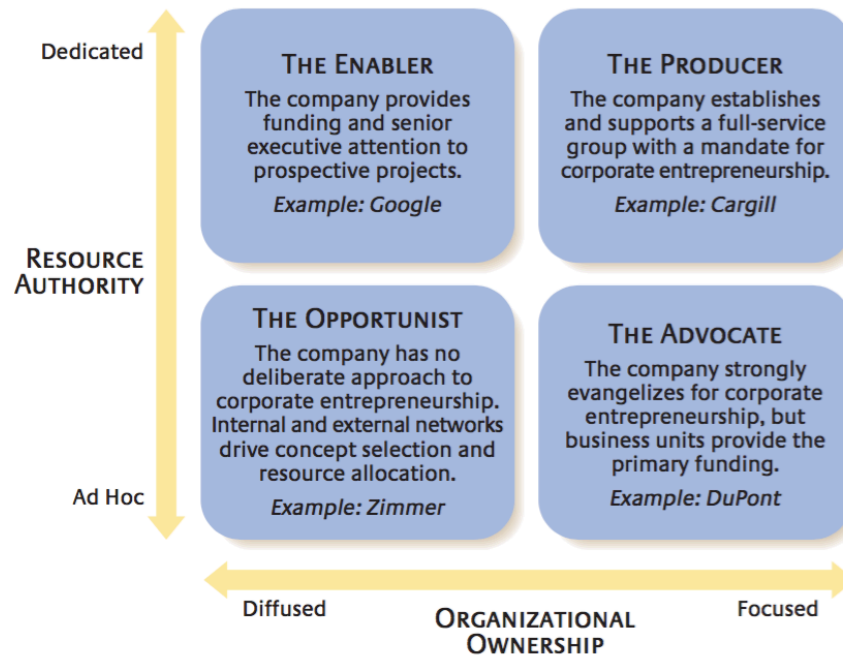


Figure 7: The four models of corporate entrepreneurship (extracted from Wolcott & Lippits, 2007)

3.3 Value creation

The fundamental question in how to bring innovation into value creation is problematic. Corporate and strategic entrepreneurship could also create knowledge spillovers (Agarwal et al., 2007), hence knowledge that needs to be captured in order to reap its value. However, a new innovation can be seen as an entrepreneurial inspiration and an opening for influencing the current architecture of how a company is working today. New opportunities due to innovations could lead to reorganization and increased efficiency and create a new structure in which new innovations fits with new capabilities of an organization. Meaning, a new innovation can also create architectural opportunities (Morris & Ferguson, 1993; Jacobides et al., 2006). Also, profiting from innovation is affected by implications such as the asset structure around the innovator as well as its complementary surroundings. The way the structure is built and invested in concerning the resources to allocate missing regents in the complementary assets is also a factor that could affect the profiting from innovations as well as how and when managerial decisions are made concerning when to enter the market (which in turn could create a dominant design etc.) (Teece, 2006).

However, the decision makers within organizations that have to manage high dynamic projects need to be ruthlessly determined when it comes to cutting projects. Such discipline within an organization could also impact relationships with stakeholders in a negative way if not the collaborating partner are a long term partner, sharing the long term vision with the organization (Meyer et al., 2002). However, as the author Meyer et al., (2002) conclude, the balance between learning and planning could be seen as a challenging problem, no matter what the underlying uncertainties might be.

4. Empirical findings

The empirical study is divided into two distinctive parts. First, a brief description is given of AstraZeneca, the development process at the company as well as the company's different initiatives that could work to support orphan innovation, which have been brought up by the interviewees in the interviews. The second part includes material from the interviews.

4.1. AstraZeneca

AstraZeneca in Sweden has site-facilities located both in Södertälje and in Gothenburg, Mölndal. The main production site is located in Södertälje, and the R&D site is located in Mölndal. The latter site, the R&D site in Mölndal, is one of AstraZeneca's three global research sites which represents almost 22,5% of their R&D operations. The focus of the R&D site in Mölndal is mainly in cardiovascular, respiratory, metabolic, inflammation and autoimmunity diseases (AstraZeneca, 2016:b).

4.1.1. AstraZeneca and orphan innovations

At AstraZeneca, two ways for how orphan innovations can emerge has been found with the help of Magnus Björsne, the CEO of the BioVenture hub in Mölndal. First, they can start up with being an innovation that is in line with the core business and strategy in one of the company's core therapeutical R&D areas. In this case, investments have been made in the innovation and the goal is that such an innovation will bring business value to the company since time and resources has been dedicated. However, due to different reasons the innovation meets a deviation in the R&D process, and the changed expectations of the innovation leads the innovation to become orphan. Therefore, it is no longer in line with the core business.

The second alternative to how an orphan innovation can emerge is when an innovation from the beginning is and continuously remains orphan, meaning that it lacks the connection to the core business already from the beginning. Nevertheless, an orphan innovation, even though it lacks the ability to connect to the core business, does not necessarily mean that it lacks the ability to bring value to the business.

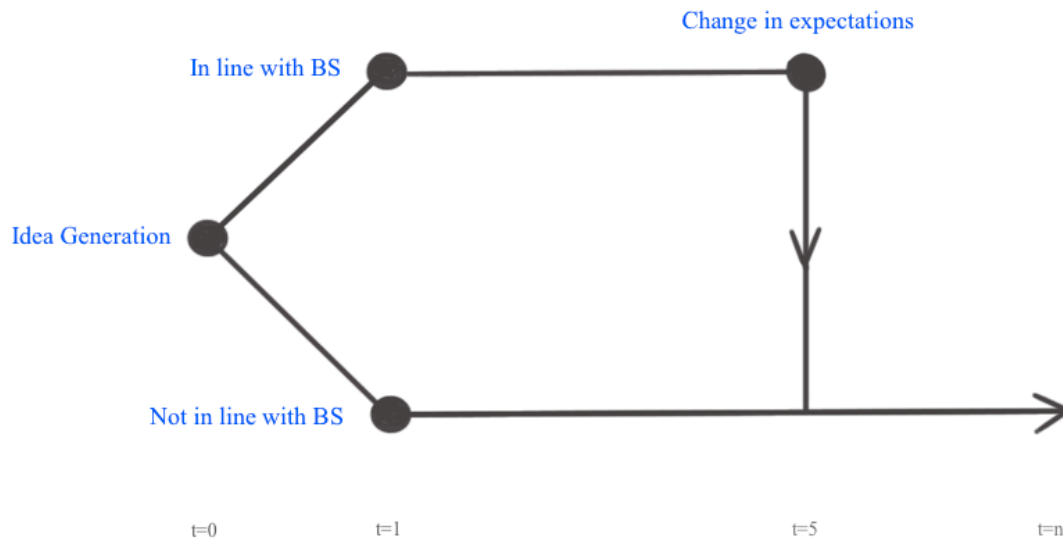


Figure 8: The appearance and path of orphan innovations (developed in discussion with Magnus Björsne 03-22-2016)

4.1.2 Initiatives at AstraZeneca

In the interviews it came forward that the company has some possible initiatives that could be useful for the management of innovations that are not directly connected to the core business. However, these initiatives are often linked to external partners where AstraZeneca benefits from not carrying the whole cost structure and where they get access to external knowledge and vice versa. The Open Innovation center could be seen as such an initiative where AstraZeneca contribute with innovations that they do not want to proceed with but an external partner might do, on behalf of AstraZeneca. The open innovation center can also benefit AstraZeneca by gaining access to new science and develop pharmaceuticals both faster, with reduced risk and with shared costs (AstraZeneca, 2014:b).

The blue sky initiative was brought up by one of the interviewees. It is a voluntary initiative, where employees can spend 10-20% of their time working on an innovation which is not in line with core business.

Lastly, the BioVenture Hub, being a part of AstraZeneca and located in Mölndal, offers academic groups and biotech companies laboratory spaces, facilities and access to AstraZeneca's competences and infrastructure, for recognition only when programs have succeeded. The BioVenture hub was established in 2014, and the initiative today includes several external companies (AstraZeneca, 2016:c).

4.1.3 The development process at AstraZeneca

The R&D process is estimated to be 10-15 years at AstraZeneca. The process begins by identifying unmet medical needs that are in the area of the company's focus. Previous science is explored in order to get the required understanding of the disease in order to enable an identification of potential new medicines. When a new potential medicine is identified, the patent application is filed and the manufacturing requirements are evaluated. The next stage is the pre-clinical studies, where studies are conducted to examine if the medicine meets the intended modification of the disease and if the early safety requirements are fulfilled. After a determination has been made regarding efficacy, possible side effects as well as the level of maximum dosing that can be accepted, the authorities are informed about the trials that are about to begin (AstraZeneca, 2014:a).

In the phase I studies, the medicine is generally tested in a small group of human volunteers to further evaluate the safety, dosing as well as the way the medicine is absorbed, distributed and excreted in the body. The risks are put against the benefits and the planning of the manufacturing process starts, in order for it to be cost-efficient in the future. Continuing to phase II, a small or medium sized group of patients is used in order to further explore the efficacy, the tolerability of the medicine and the optimal dosing. Also in this phase the risk and benefits are compared. Additionally, the economic and therapeutic value is considered to ensure the medicine's value. At the end of phase II studies, a program for phase III is planned, and data is prepared for the regulatory approval. Moreover, the results are validated with regards to safety and benefits, and a possible pricing model is established. In phase III studies, the group of patients increases to a large group, with the aim to confirm the medicine's efficacy as well as to gather additional information related to safety to enable a more precise evaluation of the risk and benefit profile. Furthermore, the work with the branding of the new medicine begins (AstraZeneca, 2014:a).

The last stage of the research and development phase is the regulatory submission and pricing, where the company seeks permission by the regulatory authorities to manufacture, market and sell the new medicine. The company also submits the clinical data package to the regulatory authorities, hence, the data that presents the safety profile as well as the efficacy of the medicine. The regulatory authorities then decide to approve the new medicine or not. An alternative reply is also the request of an additional data collection. When the drug is approved, the launch phase, including the manufacturing can start. The launch phase is estimated to be 5-10 years (AstraZeneca, 2014:a).

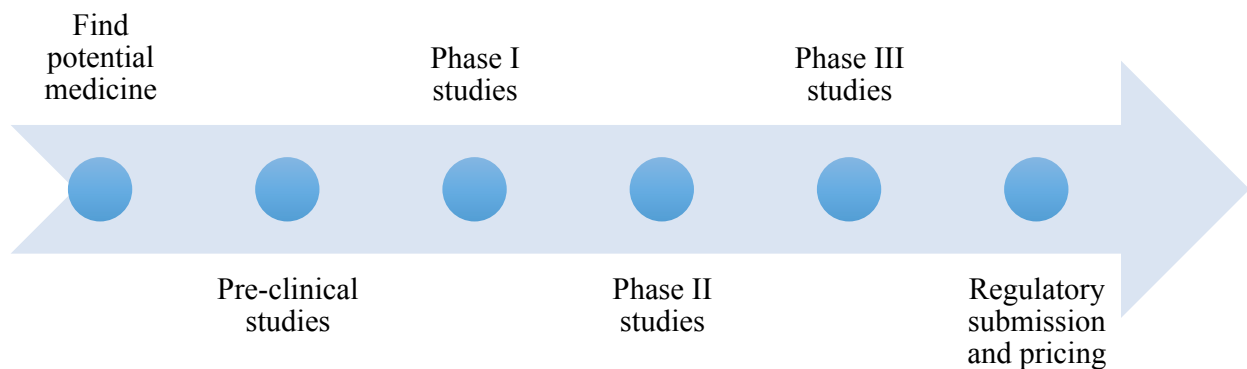


Figure 9: The research and development process at AstraZeneca (based on information from AstraZeneca, 2014:a)

4.2 Interviews AstraZeneca

In the following subchapters, the empirical information accessed through the interviews will be presented. The interviews were divided into two different groups of interest, namely line management and research/project management.

4.2.1 Interviews with representatives from Line Management

As stated in the research method, totally three people from line management were interviewed. Line Manager 1, that is called LM1 further on, is the president of AstraZeneca Sweden AB. As the president of AstraZeneca AB, the working tasks involves interaction with politics, policymakers and other businesses, as well as internal coordination. Line Manager 2, that is called LM2 further on, is the head of the BioVenture Hub that is presented above. As the head of the BioVenture Hub, the working tasks concerns different aspects of business development. Line Manager 3, also called LM3, works as Senior Director for Drug Metabolism and Pharmacokinetics. LM3 is the manager for the department, and LM3 is also the project leader for two projects that concerns larger molecules than the company is usually working with, and in that way it is a new area for AstraZeneca.

Table 2: Overview of interviewees from line management

Name	Work Title	Work Tasks
Line Manager 1 (LM1)	President of AstraZeneca Sweden AB	External interaction and internal coordination
Line Manager 2 (LM2)	Head of the BioVenture hub	Business development
Line Manager 3 (LM3)	Senior Director Drug Metabolism and Pharmacokinetics	Responsible for Metabolism and Pharmacokinetics department and two projects

4.2.1.1 The process of orphan innovation

Orphan innovations emerged through a change in the innovation expectations

In the interview with LM1, the interviewee told that there is no formal system for how orphan innovations should be managed. LM1 further explained that when an innovation becomes orphan because of a change in the innovation expectations, AstraZeneca is generally trying to sell the innovation to an external part in order to capture value through capital. However, this can be difficult as there is a risk that the external parties suspect that the innovation is not good enough as AstraZeneca has chosen to not internally proceed with it. Another way to proceed after such a change is through partnerships. LM1 further explains that partnerships are generally created only when required investments and the size of the project is large. It is also generally created when the company lacks either the knowledge or the ambition to commercialize the innovation.

LM2 agrees that there is no stated way for how orphan innovations should be managed. Furthermore, LM2 brings up that innovations sometimes are sold when they become orphan because of a change in innovation expectations in the project. LM2 means that what happens to the already invested project also depends on in which stage the project is in. If the project is in the early stages it is more difficult to sell it as possible stakeholders often are interested only if positive data exists for the drug, and in early stages there is generally no or little data accessible. LM 2 also stated that if the data is negative, nothing is usually done with the innovation as there are no actors interested in purchasing an innovation that does not work for the intended area. However, when the data is negative or when AstraZeneca cannot find any interested buyer for projects that the company does not want to invest in, the data is often

shared through the open innovation department in England, so that the academy can access the data.

In the interview with LM3, it was explained that there are many different ways to manage orphan innovations, but that there is no stated way for how it is done. However, there exists supporting activities regarding for example the patenting process and the partnership process. If the innovation is patentable the company first try to patent it, to later on sell it. If it is not patentable, the company tries to find possible ways to use the innovation internally or to publish an article about it in a well reputable journal as a part of the company's more open approach. The interviewee concludes the question by stating that also partnerships are a possible and used way for how orphan innovations are managed. LM3 gives an example of a project that was in line with the core business in the beginning but that suddenly was not in line with it anymore, i.e. the innovation became orphan at project level. In that case AstraZeneca created a partnership with Eli Lilly, resulting in shared costs and now AstraZeneca gets paid per milestone. That capital can later on be invested in other projects.

Orphan innovations emerged at individual level

When orphan innovations emerge at individual level LM1 generally has the perception that nothing is done with the innovation, much because they rarely are even known for the company, but also much because they often are small projects not likely to generate enough income compared to costs if they were developed in order to be sold.

LM2 also believes that there are many ideas and potential innovations that does not come forward at all. However, if they come forward, LM2 means that they are first brought up with the closest line manager, and the process further depends a lot on the response and attitude of the manager. If the response is positive it is possible that the area is looked into and further explored, and if not, then nothing is done. It can be assumed that the orphan innovations that emerge on individual level, has less data available, which makes it more difficult to proceed with such an innovation. LM2 stated that:

“The second line can almost be an idea about a prototype or some scattered data, but it will never have the massive data density that you have in a project that has gone the normal way. That is the difference. The ideas are not necessarily worse, but they are definitely less substantiated, which reasonably means that the risk is higher”

LM3 argues that AstraZeneca is much more focused today, and that it was much more common to run parallel projects that were outside of the organization some years ago. However, LM3 still means that if a valuable innovation emerges at individual level, and it is brought up by a researcher with strong individual preferences and will, and at the same time facing a manager with a positive attitude, it does happen that the innovation is proceeded with. Sometimes it is developed and patented to later on get sold, and sometimes it is published in order to offer transparency and to strengthen the public relations (PR) attractiveness for AstraZeneca.

4.2.1.2 Business Strategy and Business Value

Even though orphan innovation can be developed and sold through different incentives at AstraZeneca, most of the interviewees in the line management category promoted the focus and core business, when discussing orphan innovation. LM1 for instance, expressed the importance of closing projects in an early stage instead of proceeding when tendencies that it will lead beyond the core business exists. Otherwise, when projects have developed and reached a more mature stage, meaning it has more clinical data, AstraZeneca tries to sell orphan innovations to gain monetary benefits. Also, depending on the particular orphan innovation, partnerships or to externally leverage such an innovation, could be an alternative. Overall, LM1 thoroughly expressed the importance of priorities and keeping focus. But a way to help capture the value of orphan innovations could be within the boundaries of the BioVenture hub. However, as LM1 expressed it, AstraZeneca can by keeping a part in orphan innovations even though they have been put in their open innovation initiative for instance, create lottery tickets meaning if one of these orphan innovations becomes successful, AstraZeneca can exploit opportunities from this as well.

“I believe in a more open way to handle this kind of innovations... we will not put any resources to develop these sorts of off-strategy ideas, but we can participate and create for ourselves a number of lottery tickets by owning a share of these kinds of innovations, but instead receive an external evaluation... and if others are prepared to put money behind it, then I believe it could be a feasible way.”

LM1 also believes that orphan innovation could lead to motivation. However, even though it can be motivating and stimulating for the employees when an orphan innovation generates

business value, it is also important to be careful to not stimulate the research so it becomes uncontrollable and lose focus.

When asked if LM1 thinks that more resources should be spent on orphan innovations the interviewee states that it is easy to mistakenly believe that there can be much value in orphan innovations, however, he has the perception that it is more important to keep the focus, and that it is very easy to lose focus and control. The interviewee does not think that AstraZeneca should spend more resources on orphan innovations but instead try to find more structured ways to handle them.

According to LM2, the maturity of the innovation matter, meaning it depends on how much clinical data an innovation has and how well substantiated the project is. The more mature an orphan innovation is, the easier and more valuable it is to sell it. If the innovation is mature, it also means that a larger amount of resources and capital has been spent on it. However, when the company tries to find an alternative application area, it is easier to do this in an early stage, as the project is less complex and focused. LM2 means that the only time that AstraZeneca really captures the value from an orphan innovation is when it is sold to another external part. However, LM2 also expresses that there could be more value in orphan innovation and that AstraZeneca could be better at adjusting them to fit somewhere else, and in that case create a business case aimed to be sold. For instance, such an adjustment can mean to find another source of income for developing orphan innovations, perhaps with the help of the authorities when an orphan indicator can help in another rare disease. To better capture the value from orphan innovation, there needs to be a different economical business model where the alternative cost is lower than it is today. In that case, it can be valuable to adjust an orphan innovation. But today, the focus of the core business is important since the speed and how fast a pharmaceutical can be developed is significant to succeed in the industry. But even if the core business is the most important, orphan innovations still have some value and not only monetary value but also value in human resources. Orphan innovations can be motivational for the employees when something good comes out from innovations and ideas. Also, orphan innovation can create benefits related to PR, for instance when an innovation is not connected to AstraZeneca's core business, it can be given away to be developed by another external partner or the academia etc.

When asked about the resources that are spent on orphan innovations and whether the amount should be increased, the LM2 said that out of a corporate perspective, the answer leans more

towards a no than a yes. However, in order to utilize the value from the innovations it is needed to find a more structured and systematic way to handle these innovations.

As well as in the previous interviewees from Line Managers, LM3 also states the importance of focus and core business. But she also expresses the importance of orphan innovation and the different ways it can create value. First, the interviewee means that orphan innovations are a way to keep researchers and the organization creative, as it can be seen as a motivational factor. However, it is important that the researchers do not spend too much time on orphan innovations as it is not in line with the core business. Secondly, when turning those innovations into patents and selling them it results in financial value. Thirdly, when adopting orphan innovations and making them useful in other medical projects it creates internal value. Fourthly, when the orphan innovations enable articles that are published in journals with different amounts of impact factors it results in PR and increased attractiveness for AstraZeneca, and the company can become more attractive for external parties and possible future partners. Orphan innovations can, when being viewed this way, create great benefits for AstraZeneca. Internally AstraZeneca has in the recent years, changed strategy regarding the openness of the company. By not obtaining all knowledge in-house, open innovation solutions have helped with various problem statements and according to LM3 this could be seen as a way to create, capture and handle orphan innovations.

Also the third interviewee was asked about the resources spent on orphan innovations, and if they should be increased. LM3 argued that the amount of resources spent on orphan innovations today creates a good balance between the benefits and the costs, and that it should not be increased. The interviewee means that it is important to keep the focus.

4.2.1.3 Orphan innovation and management attitude

The management of orphan innovation is today most often present at a local level, where the enthusiasm of innovations outside of the core business and the awareness of such innovations relies on the closest manager to the project team and the particular researcher to bring it forward. LM2 especially points out the motivational benefits if something good comes out of an innovation, particularly for the individual behind the innovation. But LM2's previous experience about orphan innovations is that it is highly dependent on the manager's positivity regarding the innovation. If the attitude is not positive, the orphan innovation will not be proceeded with. Also, LM2 talks about the local business unit's decisions in this area and

mean that it is very much up to the researchers and the unit manager/department manager to decide upon.

The awareness of orphan innovation and how to handle it, differs depending on what part of the organization it is according to LM2. Within LM2's department (AstraZeneca's BioVenture hub) they are more aware of orphan innovation, and some awareness can also exist in the out-licensing department, but it does not mean that they can handle it right. Compared to only a year ago the awareness of this type of innovation was much lower. It could for instance be when one project-team wanted to proceed with an innovation but the company did not want to prioritize it. In that case, the department can reach out externally to find different ways to finance the project, for instance through Vinnova, that is an organization supporting needs-oriented research. In those cases, when financing has been accessed through Vinnova or other external parties, the purpose has not been to leave AstraZeneca, but in a later process bring it back if successful.

4.2.2 Interviews with representatives from Research/Project Management

As mentioned in the Research Method chapter, totally four people from research and project management were interviewed. Research/Project Manager 1, that is called RPM1 further on works as a clinical research physician, meaning that the working tasks involve medical responsibility to start, design and implement clinical studies. RPM1 works mainly within the area of diabetes and dyslipidemia. Research/Project Manager 2, later on called RPM2, works as senior director physician with responsibility for early clinical programs first in healthy volunteers and later on, in patients. RPM2's work is from the early stages of the clinical programs until phase three of the studies. RPM2's main areas are diabetes, cardiovascular diseases as well as hepatic diseases. Additionally, RPM2 is also writing articles for medical journals. Research/Project Manager 3, later on called RPM3 works as a Project Leader for Intelligent Pharmaceuticals, meaning a project leader for different kinds of support solutions, i.e. tools and devices to patients, with the aim to improve the treatment efficacy. Research/Project Manager 4, also known as RPM4, works with Site Lead for Innovation Medicine Operations where the team supports innovative medicines and everything related to project management.

Table 3: Overview of interviewees from research/project management

Name	Work Title	Work Tasks
Research/Project Manager 1 (RPM1)	Clinical Research Physician	Responsible for clinical studies
Research/Project Manager 2 (RPM2)	Senior director physician	Responsible for clinical programs
Research/Project Manager 3 (RPM3)	Project leader for intelligent pharmaceuticals	Developing supporting medical tools/devices
Research/Project Manager 4 (RPM4)	Site lead for innovation medicine operations	Supports the function innovative medicine

4.2.2.1 The experience of orphan innovation

RPM1 has experienced orphan innovation in previous work tasks at AstraZeneca where he worked with preclinical research concerning diabetes. At that time RPM1 was a part of driving one activity forward that was not a part of AstraZeneca's core business. To get the support he needed even though the innovation was outside of the core business, he went to the clinical part of the organization that made the strategic decision to present the idea, instead of trying to get support from his closest managers at that time. The idea was invested in, however the project was turned down later on when decisions were made based on the risks in the current portfolio, and the company wanted a more balanced distribution in the project portfolio.

RPM2 have experience of orphan innovation, both at AstraZeneca and his former employer. Especially at RPM2's former employer he found orphan innovation to be easier to develop since it was within a smaller biotech company. According to RPM2, it is more difficult to successfully develop an orphan innovation at AstraZeneca, being a large pharmaceutical company with a clear focus.

The third interviewee, RPM3, compared orphan innovation with his current profession. RPM3's work tasks are not completely in line with the core business, as they work with additional services such as tools and medical devices. Additionally, they try to incorporate these tools and medical devices as a part of the core business. Also, RPM3 was involved with

the development of an automatic laboratory at Södertälje with the possibilities to make own decisions, but later on because of strategy decisions, the machine became an orphan innovation and this particular innovation was no longer in line with core business.

The last interviewee RPM4 have had experiences of orphan innovations, both within her medical area, but also in an example of an orphan innovation that was developed in the blue sky initiative. The first case of orphan innovation was from the beginning not an orphan innovation as it was meant to be successful in its expected area but later on turned into an orphan innovation when it failed in its medical area. However, it was still successful in an area outside of AstraZeneca's strategy, within veterinary medicine which is not a part of their portfolio. The second case of orphan innovations was developed through the blue sky initiative driven by one individual at AstraZeneca who managed to set up a team working on that specific innovation where the team members spends 10-20% of their working time.

4.2.2.2 Business strategy and management attitudes

When RPM1 was asked about the management attitude towards orphan innovations, the answer was that the attitude is positive, but that there are some underlying issues that makes it hard to get an approval for the projects. The interviewee has the perception that there are not any problems to present the idea or innovation to the closest manager. However, when trying to present it higher up in the hierarchy in such a large company, the presentations get shorter and shorter and more simplified in order to make people that needs to make decisions in such different areas understand the possibilities with the innovation. The issue is that it is difficult to mediate the possibilities and the greatness of the idea or innovation to people that does not have any or much knowledge about the specific area. RPM1 suggests that it could be easier if the budget responsibility was moved downwards in the hierarchy, and if only the result was presented to the higher part of the hierarchy.

Also the Research/Project managers were asked about if they think that the resources spent on orphan innovations should be increased. RPM1 thinks that the amount spent on these innovations is just fine, and should not necessarily be increased. However, he has the perception that the work with orphan innovations could become more structured.

RPM2 also mentioned that at AstraZeneca, being such a large company, the hierarchy could be a restriction to orphan innovations. Line managers have the responsibility to make sure that their budgets and their focus is held, and when trying to get through many layers of line managers, it is quite unlikely that you will get an approval to continue and to get more

resources for the project. However, the interviewee also states that it is important for a large company to be focused, and to have clear strategic focus areas in order to win within that specific area. RPM2 continues by explaining that money is the reason for why it is difficult to develop orphan innovations. Money is needed in order to proceed with an innovation, and as AstraZeneca has a clear focus, it is sometimes hard to get the financial support needed for projects outside the company's core business. Related to finances is also that RPM2 has the perception that the workload for each people has increased, which leads to less time to spend on ideas and innovations outside the core business. RPM2 further explains that the easiest way for orphan innovations to be developed at the company is when they emerge in other projects' late stages. It could for example be when a drug is discovered to be able to help in two different diseases, where one is within the core business, and the other one is not. Anyhow, some research and projects that are not in line with the business strategy can be developed with the help of the academia, where resources are more or less free, and AstraZeneca has many connections with different academic actors.

RPM2 states the he does not think that more resources should be spent on orphan innovations as he believes that such a large company that AstraZeneca is, must keep its focus in order to not lose control. However, he believes that the work with the BioVenture hub is a good way for AstraZeneca to improve the work with orphan innovations.

Even though RPM3's work is within an area that is more or less outside of the company's core business the interviewee has the perception that AstraZeneca is good at keeping its focus, and that it is important to have that focus. However, the interviewee thinks that there is enough room for activities related to orphan innovations, such as within RPM3's own work, pharmaceutical innovations, but also within the BioVenture hub.

RPM3 states that he believes that AstraZeneca is good at balancing orphan innovations and the focus of the company. Furthermore, he does not think that more resources should be spent on innovations that are not in line with the core business.

Also the fourth interviewee from Research/Project management, RPM4, experiences that it is possible to work on projects that does not belong to the core business, however, she thinks that it was easier to do it before. RPM4 believes that the reason is because of the increase in competition in the market, which has caused increased restrictions in the budgets. Increased restrictions for the budget has also meant that the company has decreased the work force, and the workload for each employee has increased, resulting in less time to spend on ideas and

project outside the company's core business. RPM4 compares this with the past at AstraZeneca, when they were in a flourishing time of period and could be more generous regarding orphan innovations. Anyhow, RPM4 still thinks today that the management attitude generally is very positive and encouraging, even if it is regarding an orphan innovation.

RPM4 is a bit unsure about the resources spent on orphan innovations and whether they should be increased or not. In order to increase the efficiency of the management of orphan innovations more resources would be needed, however the interviewee still thinks it is important to keep the focus in order to be able to meet the increased competition on the market.

4.2.2.3 The entrepreneurial individual

RPM1 mentions that it is especially important that the individual driving force behind an orphan innovation is strong in order to survive and be further developed. This is due to the size of the company and the governance-structure. Because of the structure of the company and even more because of the industry itself, it is more likely that you are correct if you are negative towards a project. Very few ideas become successful projects that are launched in the end, approximately 1 out of 100 ideas is estimated by the interviewee, and because of that the likelihood of being correct if you are positive towards a project is very small. This explains why there are so many skeptical people that needs to be convinced in order for the project to be invested in, and also why the individual behind the project must be very strong in order to succeed to convince the people making the crucial decisions. RPM1 expressed it like:

“We are working in a field where being negative and not believing in the idea increases the chances of being correct. Hence, it is such a great probability that something fails if starting a new activity within the pharmaceutical industry, because there are very few ideas that actually proves to work in the final phases. So, out of 100 ideas there is only one that becomes a medicine and is commercialized. And in that situation it is incredibly difficult, both as an innovator and as a decision maker to understand what you should approve.”

Likewise, RPM2 also has similar experiences and compares how it was easier to develop independent innovation within a small biotech company. RPM2 also expresses the structure

of a big pharmaceutical company as AstraZeneca as a slow system for managing orphan innovations.

RPM4 explicitly explained the importance of the driving force and the entrepreneurial individual and how it was especially visible in the two different cases of orphan innovation; the orphan innovation with the development of veterinary medicine; and with the orphan innovation developed through the blue sky initiative. In these two cases of orphan innovation, the individual engagement differed significantly. In the first case where the innovation became orphan when it failed to succeed in its expected area and instead was turned into something else; a veterinary medicine that had very high chances of succeeding in the treatment of dogs with a specific heart disease. But in this case, since the innovation became a failure in the eyes of the department, it was not motivational to investigate the project further internally. According to RPM4, after the innovation became orphan, the management of this project was managed “with the left hand”, meaning it was managed half-hearted. RPM4 further states that the timing of the orphan innovation matters, especially when the orphan innovation has emerged because of some kind of change with regards to the strategy. For example, if the drug does not work for the planned application area, meaning that some kind of failure and disappointment exists. To then push that project to find other possible application areas can be difficult because of the disappointment and because it is rarely something that is put a lot of effort in. If the company would choose to wait with the investigation to find other potential application areas, the motivation and focus could be better, because the timing of when an orphan innovation occurs is of great matter according to RPM4.

“...I believe that the timing of when you bring up an orphan innovation is more important... because most often you do this because it is a failure from the expected trail and then you are not really mentally prepared to push it one hundred percent in an orphan direction... what had happened if we had kept this for a while? And then looked into the possibilities and achieve perhaps, a better impact... to achieve an effective management of orphan innovations, then timing must be the important factor.”

RPM4 also explained the occasion with the second case of orphan innovation, where the innovation more or less was orphan from the beginning and that it survived better when being orphan because of the individual behind the innovation. In this case it was an innovation

driven through the developer's own disease, and meant more on a personal level to the driving force behind the innovation.

4.3 Empirical Summary

- AstraZeneca has initiatives to handle orphan innovation; the open innovation center, the blue sky initiative and the BioVenture hub. But there is no stated and formal system for the management of orphan innovation.
- Only the interviewees from research/project management were asked about previous experiences of orphan innovations and all of the interviewees have connections to and have experienced orphan innovation on a work basis in their work both at AstraZeneca and/or at previous employments.
- When an orphan innovation occurs through a strategic change, the ways to proceed is through sales, sharing research, publishing an article and through different kinds of collaborations.
- When an orphan innovation occurs at individual level, the ways to proceed is the same as when the innovation occurs at project level. The interviewees from the line managers state that it is harder to succeed with orphan innovation occurred at individual level as it is often not noticed at all. The individual needs to be very strong and convincing in order for it to succeed, as well as it depends a lot on the attitude of the closest line manager.
- Line management especially, but also some interviewees from project/research management promoted the importance of keeping focused on core business, but at the same time some of them expressed that orphan innovation also could generate business value.
- It can be concluded from the interviews that there is potential value in orphan innovations in terms of capital, motivation as well as through increased reputation.

5. Analysis

The fifth chapter will compile the empirical and theoretical chapters into the analysis. In order to do this, the research questions will be used as a guideline for the subchapters. The first question is focused on the mapping of the orphan innovations management at AstraZeneca, where the sub questions focuses firstly on when they occur at project level through a change in innovation expectation and secondly when they occur spontaneously at individual level. The second research question and therefore the second subchapter in this chapter covers the aspects of business value divided into intangible and tangible business values, and also what the mapping of orphan innovation could further mean for AstraZeneca.

Orphan innovations was in the beginning of this master thesis something that was believed to exist within AstraZeneca. It was later on shown in the empirical findings that this subject is present and the existence of orphan innovations were stated through different experiences in different cases, which the respondents from the interviews shared. The two different emergences of orphan innovation, on project level and on individual level, were also shown to be present at AstraZeneca since several of the interviewees gave examples on both.

5.1 AstraZeneca - the management of orphan innovations

The management of orphan innovation can be assumed to differ significantly from the ordinary innovation process where innovations are within core business. This is since focusing on the core activities mean, in pharmaceutical industry, focusing on developing, selling and marketing pharmaceuticals that are within the company's therapeutical areas, and it generates greater value than focusing on non-core activities. In AstraZeneca's case, these therapeutical areas are cardiovascular, respiratory, metabolic, inflammation and autoimmunity diseases (AstraZeneca, 2016:b). However, far from all innovations within a pharmaceutical company are successful. For instance, one of the interviewees from research/project management gave the estimation that one idea out of one hundred innovations succeed to become a launched medicine.

5.1.1 Current initiatives at AstraZeneca

The general development process at AstraZeneca follows a distinct structure where innovations proceeds, but when an innovation is outside of the company's strategy there is no formal process in how to handle such innovations, neither for when they emerge at project

level nor at spontaneously at individual level. This is possibly resulting in a more difficult value capturing and value creation process. How the orphan innovation occurs does also matter in how it is handled, since orphan innovations emerged on an individual level are not as visible as orphan innovations occurred on project level. However, even though orphan innovations lack a formal structure for how they should be handled, informal structures exist to help move such an innovation further. These informal structures are for instance different kinds of initiatives, such as the open innovation center, the blue sky initiative or through an internal corporate venture such as the BioVenture hub that is mentioned earlier. Furthermore, supporting activities exist that can be used for orphan innovations as well as for innovations that are in line with the core business. The supporting activities are for example the open innovation center in England handling everything regarding open innovation as well as the IP department managing everything regarding patent applications and IP questions.

By examining Wolcott's and Lippitz's (2007) framework of corporate entrepreneurship adaptation, orphan innovation could be seen as managed through an informal structure with low levels of organizational leadership and at the same time not dedicated resource authority. This would put AstraZeneca and their management of orphan innovation within the opportunist model meaning decisions regarding orphan innovations are immensely sensitive to management attitude. If management attitude remains positive, the opportunist model of handling these kinds of innovations will be the most fitting model. On the other hand, if management attitude toward orphan innovations are negative, these kinds of innovations are most likely to be dismissed and neglected, which was also confirmed by several interviewees that brought up the managers' attitude as one critical factor impacting the likelihood of success for orphan innovations. Nevertheless, AstraZeneca has developed initiatives that could be useful tools when managing orphan innovations, which could be seen as a movement towards a different model in the framework of Wolcott and Lippitz (2007). Especially, the blue sky initiative where employees can contribute with 10-20% of their work time, could be traced to the enabler model where resource authority is dedicated. However, management attitude has been seen as an important factor impacting orphan innovations, and therefore AstraZeneca's management of orphan innovations could be seen to be more biased to the opportunist model.

The management of these orphan innovations will further be mapped and explained in the following subchapters, and is divided into when an orphan innovation occurs on a project level and when an orphan innovation occurs on individual level within the company.

5.1.2 Orphan innovations occurred on project level

Change in innovation expectations, that orphan innovations occurred on project level imply, means that the outcomes from an innovation will not turn out as planned, and is eventually due to this change not in line with core business. The reason for the change within the project can for example be when a drug is not efficient for the intended disease, but could be efficient for another disease that is not in line with the current core business. In some cases, the innovation can be used internally in another core area, but when the innovation becomes totally orphan, hence, that it does not fit with core business at all, this is not an option. AstraZeneca's management of such innovations is discussed below.

Sale opportunity

What was brought up by all line managers was that one way to proceed after a change in innovation expectation in a project resulting in an orphan innovation, is to sell the project, i.e. to internally end the project and to sell it to an external party before any further investments are being made. As AstraZeneca is operating in an industry where the projects have high uncertainty, related to for example efficacy and patient risks with the drug, decision making regarding sales should be ruthlessly determined, as recommended in similar cases by Meyer et al., (2002). However, the sale of an orphan innovation depends heavily on how far the innovation has come, how mature or immature it is, meaning how much clinical data has been collected and is accessible. The more elaborated the innovation is, the more valuable and easier it will be to sell it. If there is no clinical data available, it is very difficult to sell the innovation as the innovations does not have or have very little value. If the data is positive it is also easier to sell the innovation compared to if the data is negative. Positive data refers to data that shows a clear connection between a disease and treatment with a drug.

Another challenge with opportunities to sell orphan innovations that was brought up by one interviewee is the suspicion by the potential external parties interested in purchasing the innovation whether or not the innovation is good enough. When AstraZeneca has chosen to not proceed with the innovation internally, the suspicion that the innovation is not good enough comes quite naturally. However, positive clinical data can increase the chances to still sell the innovation to an external party, as that can show the potential of the innovation.

Realize through open innovation center

The second way to proceed with orphan innovations that came forward in the interviews is through collaborations and partnerships with different agreements and structures depending

on the particular innovation. AstraZeneca's open innovation center in England could also further be seen as a foundation for where orphan innovations can be leveraged into external parties and where AstraZeneca can reach out and access further possibilities and resources through their orphan innovations. By leveraging orphan innovations through for example licensing, cross-licensing agreements, joint ventures, partnerships or contract R&D that is presented by Arora et al. (2001) as a way to manage open innovation, the company can continue the development with the orphan innovation, but not in-house, in order to gain access to further possibilities. The realization of orphan innovation through open innovation that was presented in the interviews was for instance to work with external parties such as the academy, biotechnological companies or other pharmaceutical companies and so forth.

Partnerships and joint ventures are however only used at AstraZeneca when the project has a great potential and when the required investments in the project are large. This could be explained by the related transaction costs to the open innovation alternative as presented by Aurora et al. (2001) and Gambardella et al., (2007). To create a partnership or joint venture means that additional costs will occur and in order to believe that these costs will be covered later on it is reasonable to only proceed with project that have good potential. Sometimes, and most often when the data from clinical trials are negative, the research is shared only with the academy, through the open innovation center in England, without any intention to proceed with it internally. Even if the data is negative, there is a possibility that the academy can use it in further research, and it is furthermore a way for the company to show transparency.

Publication of research

If the orphan innovation lacks the possibilities for further development through collaborations and partnerships etc., or lacks the opportunities to sell, the research behind the orphan innovation can be made public by publications in scientific journals, preferably in journals that are reputable and have a high impact factor.

Nothing is done

In some cases it does also happen that nothing is done with an orphan innovation. It could for example be explained by lack of motivation that was stated by one of the interviewees. When a project has failed regarding the intended goal, it can be difficult to find the motivation to continue to find potential areas where the innovation can be used, to leverage the innovation through open innovation or to publish the research.

5.1.3 Orphan innovations emerged on individual level

Orphan innovations developed on individual level follow the same process and alternatives as stated for when orphan innovations have occurred at project level due to a change in innovation expectations, hence; through a sell opportunity, through the open innovation center, through publication of the research, or the orphan innovation is left out, meaning nothing is done with it.

However, when instead examining how orphan innovations are managed when they occur at individual level, it seems like the capturing of innovations is more complex as it was stated by two of the line managers. It is common that the company is not even aware of ideas and innovations that the individuals have. Several interviewees brought up that they have the perception that it was easier for the individual to work with additional innovations, for example orphan innovations or parallel projects, some years ago, as more time was accessible, and as the company did not have the strong focus that exists today. It is possible that employees want to further explore an idea before it is brought up with the closest line manager, but that the strong focus and the limited time makes that difficult, resulting in the idea not being brought up at all. This can also be seen as one reason for why, quite often, nothing is done with orphan innovations at AstraZeneca that have emerged at individual level.

When the orphan innovation is brought up, it has come to notice that what happens with the innovation depends on the line manager that the innovation is presented to and the attitude of the manager. If the manager has a positive attitude, it is more likely that the innovation is further explored than if the manager is restricted and very limited by the strategic focus of the company and the budget.

What furthermore can explain why these innovations are quite often not proceeded with is the time aspect, leading to the maternity of the project. When the innovation occurs at individual level the innovation generally is more immature than when an innovation is already invested in, which is the case when orphan innovations have occurred at project level. When a project is invested in, it has come further in the research and development process, and it is then easier to sell the project as there is more data available, and the incentives to get value out of the project can be assumed to be higher as resources have already been invested. It is likely that orphan innovations that have occurred at individual level have no or very little data available, and because of that it is more difficult to proceed as there is no or little data to support a sale, as there is no or little data to publish as well as there is no or little data to share

through the open innovation center. Furthermore, this statement is supported by Chiaroni et al. (2009) that means that in the pharmaceutical industry, outbound open innovation is generally more used in the later stages of the development process as more data then is available and the risks related to the development process are lower. Hence, it is generally more difficult to use outbound open innovation in the early stages, as the risks are higher with these projects, and that is also confirmed in the empirical study of AstraZeneca.

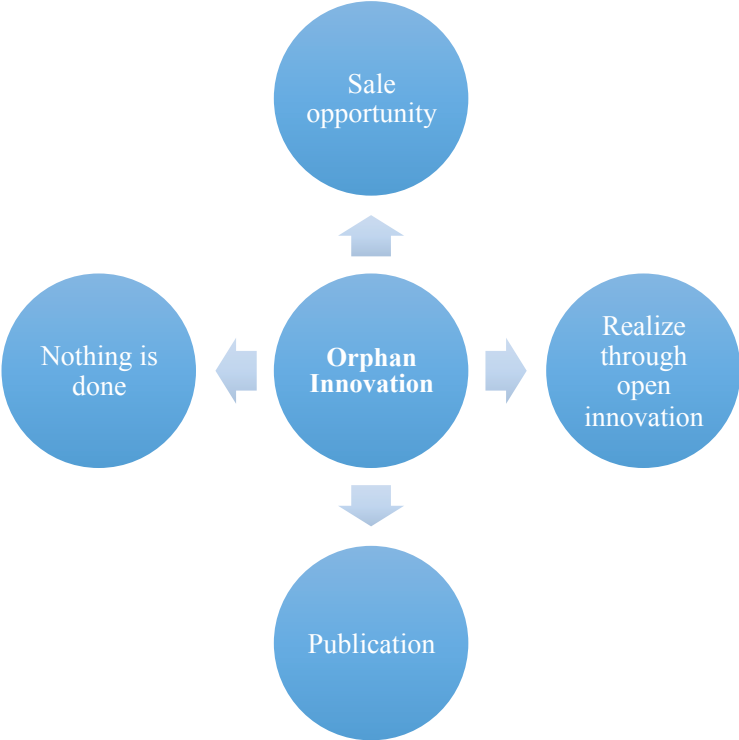


Figure 10: The management of Orphan Innovations at AstraZeneca

5.2 Business value through orphan innovations

It has shown that orphan innovations often fall behind the focus of the actual core business. From the empirical study, most of the interviewees did not see why further resources should be put on orphan innovations but, on the other hand, many of the respondents believed that the management of orphan innovations could be better compared to what they are doing today. Even though focus on core business is of utmost importance for a big pharmaceutical company, as AstraZeneca, there could still exist business value and management incentives to develop orphan innovations even though they are outside of the core business.

How open an organization is regarding their management of innovations can also play an important role, especially when it concerns the management and value capturing of orphan

innovations. Many of the respondents compared the past circumstances regarding orphan innovation with how they work more openly with these kind of innovations today. In this case, AstraZeneca has gone from more or less only in-house R&D to R&D processes more open to external parties that can affect the opportunities for orphan innovation, as it enables access to external knowledge and competencies but also as the research is shared through scientific journals and the open innovation center.

Instead of keeping idea generation, development and commercialization internally, as in closed innovation, innovations can be generated, developed and commercialized both internally and externally, as in open innovation presented by Chesbrough (2003:a). This basically means that the boundary is less visible between the organization and the external environment, and where IP's are both licensed in and out as a way to gain and share knowledge and competences instead of protecting them internally. In the case of open innovation, orphan innovations could in this case be compared to what Chesbrough (2003:a) states as "false negatives" which are otherwise, in closed innovation management principles generally neglected and dismissed. In the case study of AstraZeneca, the level of openness could be seen as high due to all the different incentives where orphan innovations have the possibility to continue to grow.

The concept of open innovation has further been divided into inbound and outbound open innovation by Chesbrough & Crowther (2006), and the outbound open innovation has particularly been seen to have coherence with orphan innovation in this specific case study. This is mainly due to the focus of when orphan innovations emerge within the actual company and how the company later leverage these innovations further with the help of the external environment. It can furthermore be seen as there are opportunities for the "false negatives", or what we call orphan innovations, at AstraZeneca, to continue to be developed and commercialized with the help of the surrounding environment, hence through outbound open innovation.

Outbound open innovation can, as in accordance with what is stated by Chesbrough (2003:b; 2003:c; 2006), create opportunities for something that previously has been ignored. As orphan innovations can be assumed to occasionally have been dismissed, outbound open innovation can be looked at as something creating opportunities for orphan innovations as the company is given more alternatives than to only neglect or dismiss the orphan innovation because it does not belong to the core business.

Furthermore, Chiaroni et al. (2009) explains outbound open innovation within pharmaceutical and biotech companies as “exploitation of innovation”, which can also be compared to the case of AstraZeneca. Outbound open innovation could mean that other external organizations could be useful and have better circumstances, other business strategies and capabilities, and other business models to better adopt an innovation that is seen as orphan within AstraZeneca. One example from this perspective is the veterinary medicine developed by AstraZeneca, however, the purpose was not that it should be a veterinary medicine from the beginning, and since veterinary medicine is not a part of their core therapeutic areas they later leveraged this particular orphan innovation to an external partner that was better suited to manage this innovation.

5.2.1 Tangible business value

Capital

For an orphan innovation that is valuable, all the interviewees said that AstraZeneca has the opportunity to sell the innovation. However, an opportunity to sell can refer to different outcomes depending on the actual innovation. If the company wants to continue to own a share in the orphan innovation, such as the one where AstraZeneca shared their costs through a partnership with Eli Lilly they could get paid per milestone. Another alternative is to sell the whole innovation and through that get resources in terms of capital. This income could later on be invested in for instance other projects that are more in line with the core business.

Nevertheless, the opportunities to sell an orphan innovation depends heavily on how mature the project is in terms of collected data. The more substance of clinical data it has, the more valuable it is to sell it. Furthermore, positive data facilitates a sell opportunity. Otherwise, if not much clinical data has been collected or if the data is negative, it is often not worth to sell the innovation as the costs for doing it are likely to be higher than the possible income of the sale. If the development process has come far, and if there is much positive data available, out-licensing is another way for how the company can manage the orphan innovation, and that can furthermore be seen as a way to gain capital value, that can later on be invested in projects in line with the core business.

Furthermore, if the data is negative, it is difficult to find a potential buyer or licensee. Lack of data and the existence of negative data can be seen as an obstacle to a sale, and such obstacles are discussed by Rivette & Kline (2000). This can prevent AstraZeneca from selling or out-licensing the orphan innovation as it affects the estimation of the innovation’s value. Also

when there is much and positive data accessible it can be difficult to estimate the value of an innovation and the value estimation is stated to be an obstacle to sales and out-licensing (Chesbrough & Rosenbloom, 2002). The problem with the value estimation as well as the occurrence of transaction costs related to the sale or licensing can prevent AstraZeneca to proceed with one of those alternatives for the orphan innovations that have emerged at the company.

5.2.2 Intangible business value

Motivation

Corporate entrepreneurship (CE) could help state how orphan innovations can generate the value capturing and the value creation. Rutherford and Holt (2007) state that the corporate entrepreneurship, that is explained as how companies can better adopt and apply their organization's individual entrepreneurial and innovative knowledge, skills and capabilities, depends on the process, context and individual characteristics of the employees. Within CE there are both the organizational level and the individual level, however, the organization's CE level is very much dependent on the individual level of CE. As explained by several interviewees in the empirical study, orphan innovations are very much dependent on the individual entrepreneurship within the organization. For example, the respondents explicitly stated that without a strong individual behind an orphan innovation, it is very likely that nothing will actually happen to it. In order for the innovation to survive the decision making process, which is usually controlled by line managers higher up in the hierarchy with the mission to make sure that the company keeps its focus as well as its budget, the individual behind the orphan innovation is very important. The individual behind an orphan innovation needs to be strong and believe in the innovation in order to be able to promote the innovation rightfully. This has been seen as a difficult task due to the knowledge difference between researchers working closely to the innovation and top managers that have not got the same understanding about the innovation and the research area as the researchers have, which could lead to the loss of vital information in the innovation. The most probable way for an orphan innovation without a strong individual behind it, is a sell opportunity, or simply that nothing is done.

Rutherford and Holt (2007) further describe the process of CE, i.e. the motivational part of CE, that can be seen as human resource management technique that depends on the leaders and how they are managing the CE strategy within the organization. According to Ireland et

al. (2009) the top-level managers are seen as a key factor for promoting the entrepreneurial behavior within the organization. Also, the way that AstraZeneca has adopted CE concerning orphan innovations, the innovations can be seen as opportunists according to the model by Wolcott and Lippitz (2007), meaning management attitude could determine whether or not such an innovation will be neglected. As told in the case study, the managers have the crucial decision to further motivate orphan innovations or not, when an employee comes with an innovation that is not in line with the core business. Most often in the study, it was said that the managers tend to have a positive and motivational attitude and that they often want the employee to investigate further possibilities within project, and in that way encourages it. But sometimes this flexibility is restricted by resources and especially in the early stages of an innovation and in the end of a project where “tunnel vision” exists because keeping focus is of great importance. This can also impact the CE strategy, for instance, as Ireland et al. (2009) mention, when resources are restricted and the focus is on the current competitive capabilities of the company which in this case could lead to some resistance towards CE.

Not only can corporate and strategic entrepreneurship create spillover effects of knowledge (Agarwal et al., 2007), it can also create new architectural opportunities (Morris & Ferguson, 1993). This aspect can be associated with orphan innovations, and how the individual behind such an innovation can create opportunities. In the case of AstraZeneca, the blue sky initiative and the open innovation center has been created in order for AstraZeneca to be involved in projects that are not within their core business. Orphan innovations could for instance in these cases, not only refer to pure value in terms of monetary value, but also soft values such as values related to human resource and motivation. Employees are motivated by the acceptances or approvals as well as feeling that the managers believe in you, and according to many of the respondents in the interviews this is one of the most important values that can be created with orphan innovations as motivated employees also can enhance the creativity of the employees. Enhanced creativity could possibly result in ideas and innovations actually in line with the core business. This statement is supported by the theory of CE by Rutherford & Holt (2007) since the motivational part is one of the cornerstones within CE.

Reputation

Orphan innovations, as stated in the research questions, have been studied within two aspects of their occurrence, on project level and on individual level. Typical characteristics for the latter occurrence of orphan innovation is that it probably has less substance, meaning clinical data, than orphan innovations occurred on project level. Clinical data has been seen to be a

crucial breaking point in how valuable an orphan innovation is. The more clinical data related to the orphan innovation, the easier it is to sell it and gain capital. However, even though in situations where the clinical data might not be sufficient, the company can still gain value from orphan innovations in terms of public relations. Kutvonen et al. (2011) explicitly state one of six different factors that could generate strategic long-term opportunities by outbound open innovation, as the “learning from knowledge transfer”. In this category, the author state that by joining the knowledge transfer on an active choice, it can lead to the attraction of other and possibly new collaboration partners. Thus, it can improve the reputation of the company. The open innovation center at AstraZeneca can be viewed as such an active choice where both other companies and future possible collaboration partners as well as the academy can join in, collaborating in this knowledge transfer.

Another way to create value of orphan innovations for AstraZeneca is to publish both successful research and research that has shown insufficient results in scientific journals, which is also a part of the company’s outbound open innovation. By one interviewee the importance of the journals’ impact factors was also stated, since AstraZeneca aims at publishing articles in scientific journals that are highly reputable. When research is published in this kind of scientific journals the company can show progress and the involvement in research in order to enhance the PR and the external perception of the company.

Access to new Knowledge

Gaining access to new knowledge can for instance be helpful when trying to leverage an orphan innovation with the help of new knowledge that does not exist within the company’s core business. By this way, AstraZeneca can benefit from another company’s knowledge portfolio (in accordance with the theory by Grindley and Teece, 1997; Rivette and Kline, 2000) and enhance the possibilities for further development of the orphan innovation that might benefit AstraZeneca in the end. Gaining access to new knowledge can also mean gaining access to new markets, new networks and decrease entry barriers (Davis and Harrison, 2001). And as pointed out from one of the respondents in the line management group, lottery tickets can also be created by joining, for instance, an open innovation initiative, where knowledge access can be both leveraged and retrieved. Also, another way to see how these lottery tickets can create value is by controlling technological trajectories (as discussed by von Hippel & von Krogh, 2006), which could mean that an orphan innovation possibly can create flows of technology to external parties that the company later on can reap benefits of scale from.

External exploitation, as stated by Koruna (2004), could also lead to the maintaining of leadership within the company's industry and create complementary production etc., which could lead to lock-in effects and could be the long term benefit and intangible business value from, for instance, licensing.

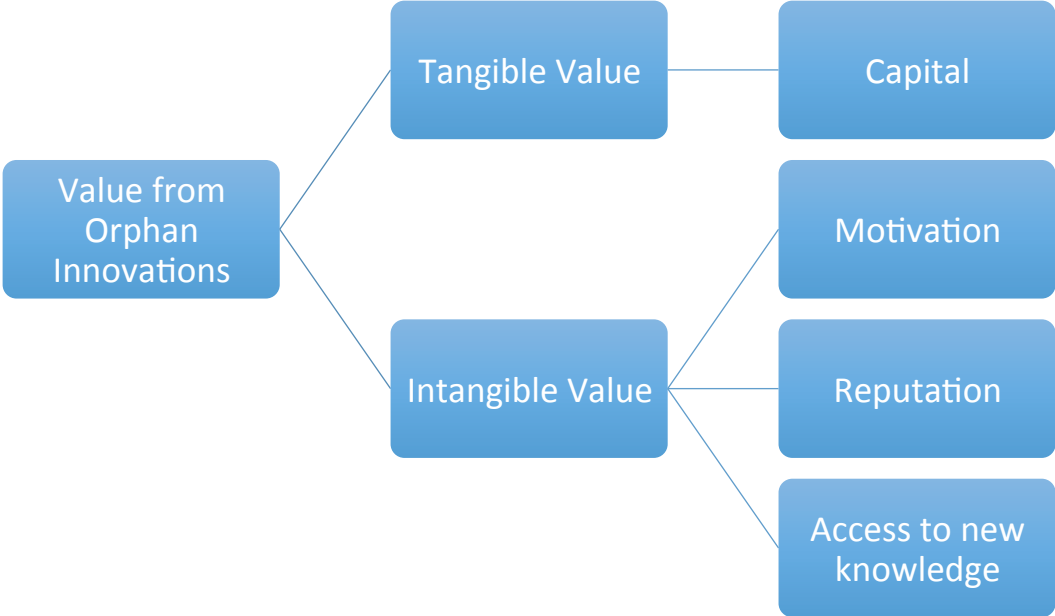


Figure 11: Value creation through Orphan Innovations at AstraZeneca

6. Conclusion

In the sixth and final chapter some concluding remarks are being stated. The conclusion focus thoroughly on answering the research questions that were stated in the introduction of this master thesis. Therefore, the conclusion aims at explaining the managing of orphan innovations at AstraZeneca today as well as what different business values, both tangible and intangible, that can be extracted from orphan innovations. Lastly, some possible further research areas are presented.

6.1 How does AstraZeneca manage orphan innovations?

Since there is no formal structure or system for how to manage orphan innovation at AstraZeneca, and since the previous literature on the subject is very limited, there is no right way in how to manage orphan innovations. What could then be discussed is the informal structures that exists and that could be beneficial in order to extract business value from an orphan innovation. These informal structures are for example the BioVenture hub, the blue sky initiative, the open innovation center as well as the IP department.

How orphan innovations are managed differs depending on for example how the innovation has emerged as well as on the specific characteristics of the innovation. The difference of how orphan innovations are managed focuses on when they have emerged at project level and when they have emerged at individual level. Additionally, characteristics that affect the management of orphan innovations and that also are partly connected to the emergence of the innovations, are for instance the amount of data available as well as if the data is positive or negative, hence, if there is a connection between the drug and the treatment of a disease. Moreover, the awareness of the innovation is also affecting the management of the orphan innovation.

6.1.1 How does AstraZeneca manage orphan innovations when they emerge in already invested projects?

If orphan innovations occur in already invested projects, the level of awareness of the orphan innovation is higher, compared to when they have emerged on individual level. The innovation has from the beginning been approved to be invested in, and because of that more resources have been spent on the project. This could be a leading factor in why the awareness level is higher. As a result, orphan innovations emerged on project level are most often more

substantiated, which could increase the possibilities to put further effort into finding different opportunities for these innovations. Additionally, the innovations can be considered to be more valuable as they generally are more mature than orphan innovations emerged on individual level since it is likely that more data is accessible. For instance, the sale opportunity for an orphan innovation increases with the level of maturity of the innovation meaning it has more substantiated clinical data. However, even though the opportunity to sell increases the more developed the orphan innovation is, there could still exist challenges to convince external parties to purchase the innovation when AstraZeneca has chosen to not bring the innovation forward themselves.

Other possibilities for how orphan innovation could be handled are for instance, by taking advantage of external exploitation such as the open innovation center at AstraZeneca, or by publishing the research in reputable scientific journals.

6.1.2 How does AstraZeneca manage orphan innovations when they occur spontaneously at individual level?

Orphan innovations occurred at individual level has the same possibilities to be managed within the present supporting initiatives at AstraZeneca, and the possible ways to proceed with the innovation are the same as for when they have occurred at project level.

However, orphan innovations occurred at individual level differs slightly from when they have occurred at project level, with regards to the awareness, the accessible data as well as the chances for it to be proceeded with. It is more difficult for orphan innovations occurred on individual level to reach to a higher level of awareness, as they often are not even communicated by the idea generator, which makes it more complex to capture these innovations. Management attitude could be seen as an important factor and management positive attitude is necessary in order for orphan innovations emerged on individual level to even be visible and to get an honest chance to be further developed. Additionally, orphan innovations occurred at individual level generally have no or less clinical data accessible compared to when they have emerged at project level, resulting in restrictions regarding the possibility to publish the research, to realize it through open innovations and to sell the innovation. Because of this, they are many times not proceeded with at all.

6.2. What tangible and intangible business values can be extracted from orphan innovations?

Tangible business values that can be extracted from orphan innovations is mostly capital. Through a sale opportunity, depending on how mature the orphan innovation is, the company can sell the whole innovation as it is, or partly. Also through out-licensing, as a part of an outbound open innovation approach, an orphan innovation can generate tangible business value in terms of capital. If the data from the research of the innovation is negative or if little or no data is accessible, it is more difficult to sell or license the innovation. Additionally, to determine the business value for this kind of innovation can be seen as difficult since it is outside of the core business of the company that developed the innovation, and because value estimation generally is difficult for products that are not fully developed or commercialized yet. Nevertheless, the expected transaction costs related to the sale opportunity or licensing in combination with the difficulties of the value estimation could prevent AstraZeneca from proceeding through a sale opportunity with an orphan innovation.

Intangible business values are if possible even more difficult to measure than tangible business values, but could still be seen as potential business values connected to orphan innovations. First, the organization can be benefited by orphan innovations since it could create motivation for the employees as a result of approvals and in the company believing in your idea and innovation. Increased motivation could lead to enhanced corporate entrepreneurship, resulting in increased creativity for the employees. Therefore, the attitude and leadership of the management is of importance in order for orphan innovations to not be neglected and easily dismissed. Furthermore, enhanced creativity as a result of orphan innovations is likely to also positively affect the creativity for innovations that are in line with the core business.

Other intangible business values that could be gained from orphan innovations are increased reputation that can be generated through sharing orphan innovations through the open innovation center as well as through publishing the research of orphan innovations in scientific journals. In summary, this could attract external parties and increase the PR for AstraZeneca.

Lastly, orphan innovations could lead to access to new knowledge. One example from this is especially the fact of “lottery tickets” as similar to the creation of opportunities with the help

of the knowledge from the external environment. Access to new knowledge could for instance lead to access to new markets, decrease in entry barriers, and so forth.

Even though it has been found that orphan innovations can possibly lead to both tangible and intangible business values, it is still important for AstraZeneca, being a large pharmaceutical company, to keep its focus on the core business. The focus is important in order to increase the growth and prosperity of the company to remain a competitive actor in the highly competitive industry that the pharmaceutical industry is. The focus on strategy is very much present throughout the organization but at the same time management is not completely resistant to the management and business values that can be extracted from orphan innovations.

6.3 Suggestions for further research

Throughout the research, some interesting viewpoints and inputs came forward that did not fit this specific subject of research. However, these viewpoints and inputs could be suitable for future research. In order to create inspiration and insights for future research some suggestions will be presented below.

Orphan innovation in a societal context

When discussing orphan innovation from a business perspective at AstraZeneca, also the societal aspect of orphan innovation was brought up by one of the interviewees. From a societal perspective the management, value creation and the importance of orphan innovation can possibly be viewed differently. For instance, orphan innovations that creates too little value for a company could be of importance for the society. This creates incentives to further explore the subject.

Innovation and budget decisions

One of the obstacles for orphan innovations that was brought up in the empirical study was that the budgeting and the decisions to proceed with a project or not are assigned to managers on a high hierarchical level. It was also stated that when a project is presented on a high hierarchical level, the presentations of innovations are generally shortened and simplified in order to increase the chances for the managers to understand the importance and value of the project. However, the outcome from this could be that valid information is left out, and as the managers making the decisions does not have the same knowledge and experiences as the researchers working with the specific therapeutic area, there could be a risk that a project with

good potential is declined. This can also be applicable for innovations that are in line with the core business. Thus, research regarding how the level of where budget decisions and responsibility is assigned in the hierarchy could be connected to innovation and the success, as well as revenue of the companies could be an interesting subject to further explore. Would it be preferable to lower the budget process closer to the research?

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8. Appendices

Appendix 1: Interview guideline for line managers

- 1) Name:
- 2) Working title/Position:
- 3) Amount of employed years within the pharmaceutical industry:
- 4) Working tasks:
- 5) Education:

Introduction of the path of orphan innovations according to Figure 1.

- 6) What happens with an orphan innovation when it has emerged at project level?
- 7) What happens with an orphan innovation when it has emerged at individual level?
- 8) What reasons are there to not proceed with some orphan innovations?
 - a) Internally?
 - b) Externally?
- 9) Which benefits has existed with orphan innovations at AstraZeneca?
 - a) Tangible benefits?
 - b) Intangible benefits?
- 10) Who has been benefited by the orphan innovations emerged at AstraZeneca?
 - a) Internally?
 - b) Externally?
- 11) How does AstraZeneca create/capture the value of orphan innovations today?
- 12) Does an organizational awareness exist for orphan innovations at AstraZeneca?
- 13) Is there a formally stated way for how orphan innovations should be managed at the company?
 - a) If yes, is that followed?
 - b) If yes, how is it followed?
- 14) How can AstraZeneca improve the capturing of orphan innovations?
 - a) When they have emerged at project level?
 - b) When they have emerged at individual level?
- 15) How can AstraZeneca in a better way capture the value of orphan innovations?
- 16) Do you think that the company should spend more resources on orphan innovations?
 - a) On orphan innovations that have emerged at project level?
 - b) On orphan innovations that have emerged at individual level?

Appendix 2: Interview guideline for research and project managers

- 1) Name:
- 2) Working title/Position:
- 3) Amount of employed years within the pharmaceutical industry:
- 4) Working tasks:
- 5) Education:

Introduction of the path of orphan innovations according to Figure 1.

- 6) Have you experienced the emergence of orphan innovations at AstraZeneca?
 - a) If yes, tell us about the experiences the last year?
 - b) If yes, tell us about the experiences from more than one year ago?
 - c) If yes, do you have any negative experiences?
 - d) If yes, do you have any positive experiences?
- 7) Do you have the possibility to develop own orphan innovations in your work? (Hence, spend time on non-prioritized research?)
- 8) Are you motivated by the company to develop own orphan innovations in your work?
- 9) Are you prevented by the company to develop own orphan innovations in your work?
- 10) Which attitude does the company has regarding spending time on orphan innovations?
- 11) Which attitude does the company has regarding spending resources on orphan innovations?
- 12) Do you think that the company should spend more resources on orphan innovations?
 - a) On orphan innovations that have emerged at project level?
 - b) On orphan innovations that have emerged at individual level?