Master Thesis

Adoption of Technological Innovations in Large Manufacturing Firms

A multiple case study

Author:	Steffen Kokozinski
Student number:	s1290282
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1st Supervisor:	Dr. ir. Erwin Hofman (University of Twente)
2nd Supervisor:	Dr. Rainer Harms (University of Twente)
3rd Supervisor:	Dr. Henrike Weber (Technische Universität Berlin)

UNIVERSITY OF TWENTE.

Technische Universität Berlin

Abstract

The topic of innovation adoption continues to be recognized as important both by practitioners as well as researchers. This master thesis contributes to this field by enhancing the knowledge around the question of how large manufacturing firms can increase the likelihood of an adoption of a technological innovation. A multiple case study within a large manufacturing firm was conducted to gain insights on the factors influencing the likelihood of an adoption and assess the main reasons for adopting or abandoning innovation projects within large manufacturing firms. The findings suggest, that within large manufacturing firms, a total of 13 different factors within the groups of (1) environmental characteristics, (2) organizational characteristics, (3) innovation characteristics and (4) user characteristics influence the likelihood of an adoption decision. Next to that several main reasons for adoption, such as a clear relative advantage of the innovation or freedom of the innovation teams were found. Main reasons for abandonment include the lack of a clear relative advantage or the mismatch between the innovation and the demands of the adopting firm. The results imply that large manufacturing companies can employ a set of practices and advises to increase the likelihood of an adoption. These practices can be clustered in the groups of (1) project focus, (2) structure and team, (3) technology, (4) user and (5) analysis.

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1. Introduction

In general, innovations are seen as one of the main elements and factors for organizational success (Cardozo, 1993). Furthermore, they are treated as a source of economic growth as well as competitive advantage, which makes them an interesting field to study, both for practitioners and researchers (Tushman, 1997). In the following introduction, first a problem statement and research gap in the field of innovation management will be described. Based on that, research questions will be outlined.

1.1 Problem Statement

Within the process of implementing innovations and technologies, an innovation team at a large manufacturing firm has already established some best practices. This experience and best practices can be mainly associated with the early stages in this innovation process. They have in depth knowledge on how to identify challenges and pain points. This includes everything from involving the effected people with the challenges at the very beginning, source the right technological solutions for the identified challenges and find the right partners, to creating working prototypes to test the solutions.

However, the process of implementing new technological innovations is very costly and time intensive. Projects can take several years from a first initiation until the final implementation in day-to-day operations. Because the team was established recently, they had very few projects yet, which fully went through the lengthy innovation process. Most of their projects are still in the development phase and only very few projects where decided to be adopted or not. Therefore, the team has only limited knowledge about the factors, which can have an influence on whether an innovation is going to be adopted, or not. This lack in knowledge could lead to overlooking important factors, which can influence the likelihood of an adoption and ultimately results in abandoning promising innovations or investing in projects, which have a very low probability of being adopted. Therefore, the team has an urgent need to identify the factors, which affect the adoption to ensure that projects are designed in a way, which maximizes the likelihood of an adoption.

1.2 Research Goal

Based on this problem statement, the goal of the study is to find out how to maximize the likelihood of an adoption of an innovation at large manufacturing firms. To do so, this thesis contributes in three different ways: 1) Identification of factors, which influence the adoption of innovation through a literature review, 2) Identification of differences between adopted and not

adopted innovation projects through case studies at a large manufacturing firm and 3) development of practical recommendations based on the case studies.

1.3 Academic Relevance

Not only for practitioners is it of great interest how the adoption of innovation works and how the likelihood of an adoption can be maximized. In addition, the academic world continuously investigates this topic. This research area can be subdivided into two major categories. The first research category directly deals with the adoption process, whereas the second category addresses the factors, which are likely to influence the innovation adoption process (Pichlak, 2015)

However, and even though there are many studies, there is still a knowledge gap about the factors which facilitate or at least influence the adoption of innovations (Damanpour & Schneider, 2006; Wisdom et al., 2013). Most researchers in implementation and diffusion research focus on the implementation, rather than the preceding adoption or the maintenance phase (Wisdom, 2013). Concerning the adoption phase, existing research already investigated a wide range of factors facilitating to innovation adoption on an environmental, organizational, innovation and individual level. However, there is only a limited amount of research, which includes empirical data to test the theories (Wisdom, 2013). No case studies where found that directly address this topic for innovation projects within big manufacturing companies. Therefore, it is of importance to investigate, to what extent the current state of research can explain or facilitate to the adoption process of technological innovations at large manufacturing firms.

The scope and research objective of this thesis is to close the research gap and contribute in providing empirical insights in this research field but also to give practitioners recommendations and guidance, on how to design their innovations to maximize the likelihood of an adoption in the context of large manufacturing companies.

1.4 Research Questions:

Based on the problem statements and academic relevance, the following main research question as well as sub-questions where developed:

Central research question:

‘*How can large manufacturing companies increase the likelihood of an adoption of a technological innovation?’*

Sub-questions:

1. Which theoretical criteria influence the adoption of a technological innovation?
    a. Which studies in the field of innovation adoption process research help to explain the adoption of innovation?
    b. Which studies in the field of innovation adoption factor research help to explain the adoption of innovation?
2. What are the differences between adopted and not adopted innovation projects at large manufacturing companies?
    a. What are the main factors of success of adopted innovation projects at large manufacturing companies?
    b. What are the main reasons to not adopt technological innovations at large manufacturing companies?
3. Which practices can be used by large manufacturing companies to increase the likelihood of an adoption of a technological innovation?

These research questions can be described as exploratory questions. This type of research question was selected to gain insights into a complex phenomenon, which is under this context, relatively little researched. Babbie (2010), argues that exploratory research is applicable whenever the researcher is entering new ground, where relatively little insights are available, or the researcher wants to find new insights to a complex phenomenon. Since no case studies were found, which analyze factors influencing the adoption of innovation at large manufacturing firms and no studies were found who give practical advises on how to design innovation projects to maximize the likelihood of an adoption for large manufacturing firms, this type of research question is applicable.

1.5 Thesis Outline

To successfully answer the research questions, a research model was developed.

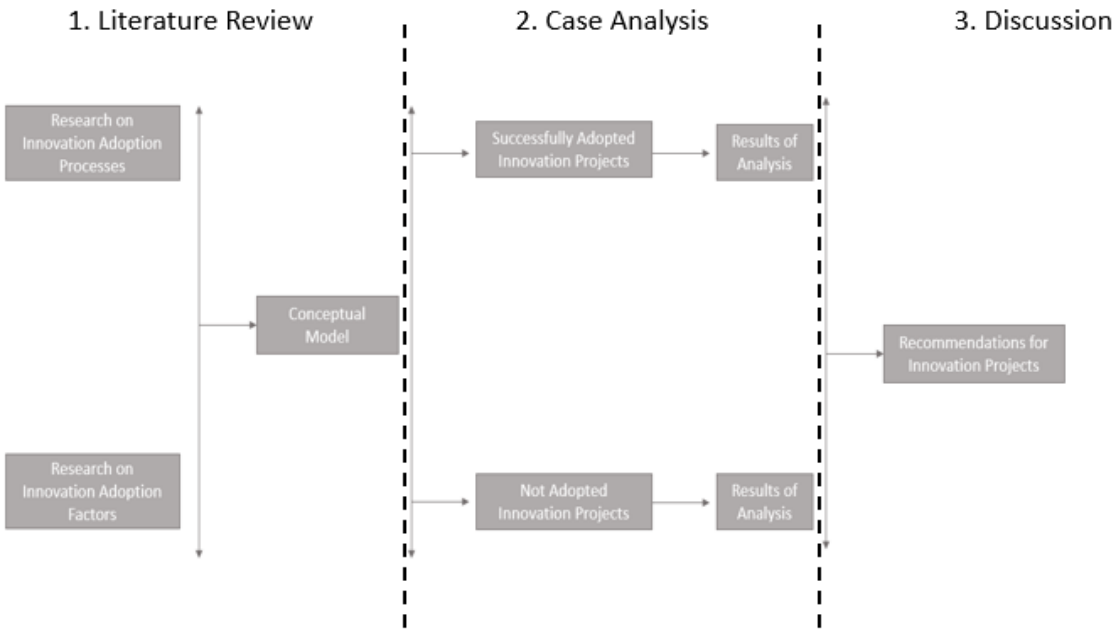

Figure 1: Research framework

This framework is a schematic overview of the steps that will be made to achieve the research objective (Verschuren and Doorewaard, 2010). First, a literature overview of the relevant research streams will be made to set the foundation for the conceptual model. Next to that, an analysis of both adopted innovation project and not adopted innovation projects will be made to draw conclusions for the research questions. To do that, qualitative research in form of a multiple case study at a large manufacturing firm will be conducted. The goal is to compare innovation projects, in which the innovation was not adopted with innovation project in which the innovation was adopted. Within this comparison, the main reasons for adoption and abandonment as well as practices that led to a successful adoption will be examined. Finally, and based on the answered research questions, recommendations for large manufacturing companies will be given to increase the likelihood of an innovation adoption.

2. Literature Review

The following literature review aims to answer the first sub-question of the research question. The literature was conducted in a systematic way. To gather and find relevant literature, the researcher used “Google Scholar’, “Scopus”, and “Web of Science”. As a starting point, the terms “Innovation Adoption”, “Innovation Adoption Process”, “Adoption of Innovation” and “likelihood of an innovation adoption” were entered the mentioned search engines. After that,

the most relevant papers in terms of citations and publishing date were gathered to explore the current state of the topic. Most important findings were than again explored individually. Furthermore, papers and general theories, which were often referred to by scholars were explored.

In the following chapters, these findings will be presented. To do so, the term innovation will be defined, and different types of innovations will be described. After that, the general innovation process will be outlined to give insights on how innovations might be adopted. Following this, the literature review will go into more detail and outline the relevant research streams on innovation adoption.

To allow for a comprehensive and full overview of all main terms and concepts which will be elaborated throughout the literature review, the main terms and concepts are summarized and shortly defined in the following table of definitions.

Table of definitions	
Innovation	
Innovation	An innovation is the "practical implementation of an idea into a new device or process" (Schilling, 2013; p. 18)
Technical Innovation	Innovation, which directly influences the basic activities of an organization. This can include products, processes and production technology (Damanpour & Evans, 1984)
Administrative Innovation	Innovation, which which indirectly influences the basic activities of an organization. This can include the organizational structure and administrative processes (Damanpour & Evans, 1984)
Product Innovation	Innovation, which includes new technologies or a merger of existing ones and are created to serve the demands of external customers or markets (Utterback & Abernathy, 1975)
Process Innovation	Innovation, which implements new aspect into the operation processes of an organization (Utterback & Abernathy, 1975)
Radical Innovation	Innovation that modifies the structure of something and is therefore completely new, unique and discontinuous (Norman & Verganti, 2014)

Incremental Innovation	Innovation that advances an already existing solution (Norman & Verganti, 2014)
Innovation Adoption	"The process through which an individual or other decision-making unit passes from first knowledge on an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision" (Rogers, 2005 p.20) With regard to this thesis, Innovation adoption can be further specified to adoption of innovations into an organization
Environmental Characteristics	
Network Externalities	Phenomenon at which a product or service increases is worthiness as the number of users grows (Economides, 1996)
Competitive Pressure	The pressure and presence of other competitors within the market (Frambach & Schillewaert, 2002)
Dynamism	The degree of uncertainty or speed at which the environment of an organization changes (Bstieler, 2005)
Hostility	The amount of accessible resources as well as the presence and amount of relevant other organizations, which are also interested in the same resources (Covin & Slevin, 1989)
Market Complexity	The diversity of the environment of the organization, which requires the organization to apply different organizational procedures to cope with those differences (Miller & Friesen, 1983)
Organizational Characteristics	
Financial Resources	Monetary resources, available to certain activities (Damanpour & Wischnevsky, 2006)
Human Resources	Creative and skilled staff within an organization (Akgul & Gozhu, 2015)
Organizational structure	Consists of different structural attributes of the organization. For the purpose of this paper, organizational structure include relative size as well as organizational complexity.

Managerial Leadership	Degree of top management support for a certain innovation project. This includes the attitude of top managers as well as the positive influence of top management towards the innovation project
Innovation Characteristics	
Relative Advantage	The extent to which an innovation is seen as superior in comparison to the current established solution (Rogers, 2005)
Compatibility	The 'degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 2005, p. 240)
Complexity	The extent to which potential adopters identify an innovation as relative easy to figure out and operate (Rogers, 2005)
Trialability	The extent to which a potential adopter is able to use and test the innovation in advance on a limited basis (Rogers, 2005)
Observability	The extent to which members of an organization other than the user group can observe and view the outcome of a certain innovation (Rogers, 2005)
User Characteristics	
Perceived Usefulness	The extent to which a potential adopter has the opinion that using a certain innovation would lead to an advantage (Davis, 1989)
Perceived Ease of Use	The extent to which a potential adopter assumes that a given technology is usable without much effort or complication (Davis, 1989)

Table 1: Table of Definitions

2.1 Definition and Types of Innovations

There is a variety of different definitions and understanding on what innovations are and how they can be defined. Commonly, the basis for innovation are creative ideas. During innovation, these creative ideas are successfully implemented (Amabile, 1988). The research area around innovation is very heterogeneous. Scholars in many areas, such as sociology, anthropology, education or economics are investigating this area from their perspectives and have own understandings and definitions on innovation (Subramanian & Nilakanta, 1996; Damanpour & Schneider, 2006). In the business area, regardless of a specific definition, innovations are seen

as one of the main elements and factors for organizational success (Cardozo, 1993). Other scholars like Schilling (2013; p. 18) define innovation as the "practical implementation of an idea into a new device or process". Furthermore, they are treated as a source of economic growth as well as competitive advantage, which makes them an interesting field to study, for both practitioners and researchers (Tushman, 1997). Some scholars, like Zahra and Covin (1994, p. 183) are even more drastic and consider innovation as the "life blood of corporate survival and growth". As across research areas, there are many different definitions of innovation in business research. A relatively broad definition by Zaltman et al. (1984) argues that an innovation is an idea, product or practice, which is new to the adopting unit. However, other scholars argue that this definition is too broad and does not take several important characteristics of innovation into account (Dewar & Dutton, 1986). Scholars argue that to understand innovations and its adoption, innovations need to be subdivided and distinguished by its types (Damanpour, 1991). The author identified three major typologies of innovation, which each consist of two types of innovations, namely (1) administrative and technical innovation, (2) product and process and (3) radical and incremental innovation (Damanpour, 1991).

(1) Technical innovations are defined as innovations who directly influence the basic activities, of an organization and can include products, processes and production technology. Administrative innovations in contracts affect the basic activities of an organization indirectly and can include the organizational structure and administrative process. Often administrative innovations are related to the management of organizations (Damanpour & Evans, 1984).

(2) Product innovations are innovations, which include new technologies or a merger of existing ones and are created to serve the demands of external customers or markets (Utterback & Abernathy, 1975). In contrast to product innovations, process innovations are defined as the new aspects, which are implemented into the operation processes of an organization. They can include equipment or machinery, which is used for production, but also task descriptions or information stream structures (Utterback & Abernathy, 1975).

Furthermore, innovations can be classified with respect to the degree of change they make (Damanpour, 1991). Norman and Verganti (2014, p.82) argue that (3) radical innovation modifies the structure of something, which means that it is completely "new, unique and discontinuous". The authors argue that three different criteria must be met to characterize an innovation as radical. The innovation must be completely new and needs to differentiate itself from earlier innovations, unique and needs to differentiate from prevailing innovations and

needs to affect the essence of prospective innovations (Norman & Verganti, 2014). Innovations, which do not meet these criteria, can be defined as incremental innovations. An incremental innovation advances an already existing solution (Norman & Verganti, 2014).

Next to those classifications, researchers from various research areas further classified and characterized innovations and included for instance business model innovations, ecosystem innovations or service innovations (Norman & Verganti, 2014). Whereas most of these definitions are out of the focus of this thesis and therefore will not be defined, the term technological innovation needs to be defined.

For the scope of this thesis, technological innovation will be defined based on the work of Rogers (2005). Rogers describes technological innovation as being based on technology and having two different components, namely a (1) hardware component and a (2) software component. The (1) hardware component consist of the underlying material as well as technological foundations out of which the innovation consists (Rogers, 2005). The (2) software component contains the information infrastructure of the innovation. Different technological innovations can have different proportions of the hardware and software components. Whereas in some innovations the hardware component is dominant, other innovations may predominantly consist of software (Rogers, 2005).

2.2 The Innovation Process

Dispite the fact that innovation is of major importance to organizations and many of them advocate the need to innovate, most of the organizations do not determine a process of innovation (Dobni, 2006). Desouza et al. (2009) defined the process of organizational innovation as a five-step process, which includes (1) generation and mobilization, (2) advocacy and screening, (3) experimentation, (4) commercialization and (5) diffusion and implementation.

In the (1) generation and mobilization stage, ideas are created. This can be done by either forming something completely new or by modifying existing products, processes or ideas and using them in another context (Krogh & Ichijo, 2000; Argote & Ingram, 2000). In the (2) advocacy and screening phase the generated ideas will be evaluated based on their potential and opportunities for the organization. Ideas are assessed based on their risk and worthiness and if necessary perfected (Desouza et al., 2009). As soon as this step of evaluation and refinement is finished, prototypes are created ad tested in the phase of (3) experimentation to test their fit under the given circumstances and the possibilities to use it. After that, strategies on how to sell or market the innovation need to be made, which happens in the stage of (4) commercialization.

At this stage of the innovation process, the process of developing the innovation is mostly finished and the attention shifts to creating market value (Desouza et al., 2009). In the (5) diffusion and implementation stage, the acceptance for the innovation is generated. On the customer side, the innovation is adopted and finally implemented (Desouza et al., 2009).

2.3 Innovation Adoption

2.3.1 Definition of Innovation Adoption and Classification of Research Streams

The adoption of innovation is characterized and described by a variety of scholars. The process of adoption of innovation can be seen as "the process through which an individual or other decision-making unit passes from first knowledge on an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision" (Rogers, 2005 p. 20). Within the scope of this thesis, adoption includes all cases, where an innovation is adopted into an organization.

Looking at the landscape of innovation adoption research, different scholars investigate innovation adoption at different levels of analysis (Pichlak, 2015). Gopalakrishnan & Damanpour (1997) identified four levels of analysis, namely (1) industry, (2) organizational, (3) subunit level and (4) innovation level. Furthermore, the research area around the adoption of innovation can be divided into two major research streams (Pichlak, 2015). The two streams characterized by its focus on either a factor approach or a process approach. Research within the process approach outline the practices of an organization within the adoption of innovations by studying the actions, which are critical to the innovation adoption process (Pichlak, 2015). In contrast to that, studies who take a factor approach point of view argue, that innovation adoption needs to be seen as a multidimensional phenomenon (Damanpour, 1991). These dimensions can be broadly described as (1) external- or environmental characteristics, (2) organizational characteristics, (3) innovation characteristics as well as (4) user characteristics (Damanpour & Schneider, 2006; Wisdom, 2013).

In order to gain insights and answer the research question on which theoretical criteria influence the adoption of a technological innovation, both research streams within the area of innovation adoption will be reviewed in detail.

2.3.2 Innovation Adoption from a Process Perspective

Several scholars studied the innovation adoption of organizations from a process perspective. The process has been described in various forms and depending on the author, include more or less steps, which are seen as important. Furthermore, they differ in their level of detail (Pichlak, 2015). In the following paragraph, relevant frameworks will be outlined and explained.

Gopalakrishnan & Damapour (1997) describe the innovation process as a process, which consist of two major levels, namely initiation and implementation. Furthermore, the authors argue that these two major levels each consist of several sub-levels (Gopalakrashnan & Damanpour, 1997). The initiation level contains (1) gathering knowledge about the innovation and gaining attention. After that (2) an opinion of the innovation is made. Finally, (3) the innovation is assessed and judged in the context of the organization (Ettlie, 1980). The implementation level again contains two sub-levels, namely trial implementation and sustained implementation (Zaltman & Duncan, 1984). During trial implementation the innovation is adopted in a narrow frame within the organization to check its feasibility and viability (Gopalakrashnan & Damanpour, 1997). After a successful trial implementation, the innovation will be completely incorporated and adopted into the organization. Its prosperity is measured by the degree of influence on the organizational processes and outcomes (Gopalakrashnan & Damanpour, 1997).

This two-step approach is generally in accordance with the innovation process description of Rogers (2005), who defined the two major steps of the process as initiation and implementation. The implementation phase contains all steps from collecting information to a definite decision to adopt an innovation (Rogers, 2005). This initiation stage can be subdivided into two sub-stages, namely (1) agenda setting and (2) matching. The implementation stage contains three sub-stages, which are (3) redefining/ restructuring, (4) clarifying and (5) routinizing (Rogers, 2005). (1) In the agenda setting stage, problems and needs are identified and possible innovations are identified. This step may take a relatively long period and can last up to several years (Rogers, 2005). During the (2) matching stage the identified problems are matched with innovations and tested for organizational fit and finally a decision whether to adopt or not adopt an innovation is made. In the (3) redefining/ restructuring phase, the innovation is accompanied by the organization. In this phase, both the innovation as well as the organization will adapt for optimal fit. Since especially technological innovation rarely fit into an organization entirely, adaptation by the organization is vital, but often underrated by the adopting organization (Rogers, 2005). During (4) clarifying the innovation is spread within the organization and employees or associates of the organization get to know to innovation. The author argues that it is important to not implement the innovation too rapidly to avoid bad consequences. Furthermore, and since confusion or other side effects may arise during the clarification phase, durable agreements and policies for the innovation might lead to a smother implementation (Rogers, 2005). The final stage of (5) routinizing the innovation has been completely integrated into the processes of the organization and used in its everyday tasks. Sustainable success and

usage of the innovation are not natural consequences. Especially if a small number of managers makes the adoption decision, the innovation is in danger of not being sustainably used, for instance if the managers leave the company (Rogers, 2005). To avoid that, employees or users of the innovation should be involved in the innovation process. Furthermore, the possibility to further assimilate the innovation by the user might lead to greater success during the routinizing stage.

In contrast to those two stage adoption process models, other proposed models on the innovation adoption process include more steps. Klein and Sorra (1996) for instance defined the innovation adoption process as a five-step process, which consists of (1) awareness, (2) selection, (3) adoption, (4) implementation and (5) routinization. However, the different proposed innovation process models with more or less phases can be summarized and assembled around three major phases (Damanpour & Schneider, 2006). This is in line with Pichlak (2015) who argues that the process model, which is used most commonly, can be defined as a three-step process, consisting of (1) initiation or pre-adoption, (2) adoption decision and (3) implementation or post-adoption (Pichlak, 2015).

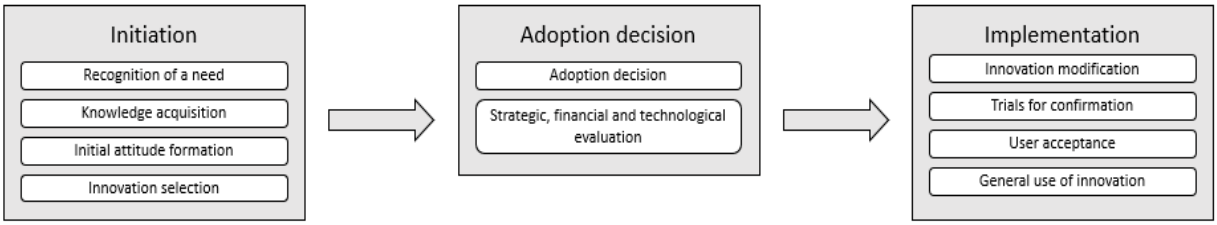

Figure 2: Innovation adoption Process (Pichlak, 2015 p.479)

During the (1) initiation or pre-adoption phase demands and problems are recognized and innovations, which could possibly solve these demands and problems are identified. This includes gathering information about different innovations, and deciding upon a certain innovation, which is then suggested for adoption (Damanpour & Schneider, 2006; Rogers, 2005). In the (2) adoption decision phase, the decision on whether to adopt or not to adopt the innovation is made. To make this decision possible, the suggested innovation is evaluated from different angles, namely from a financial, strategic, practical and technological angle (Damanpour & Schneider, 2006). Finally, the innovation is implemented during the (3) implementation or post-adoption phase. This phase includes every action from a possible alteration of the innovation to create a perfect fit with the innovation, preparation for implementing the innovation into the organization, trial implementation for validation and

finally the creation of approval of the members of the organization (Damanpour & Schneider, 2006; Rogers, 2005).

2.3.3 Innovation Adoption from a Factor Perspective

In contrast to the process perspective, research on factors influencing the adoption of innovation commonly defines the adoption of innovations as a multidimensional occurrence (Nystrom, Ramamurty & Wilson, 2002). Within this research stream, research has found a variety of different factors, that influence the adoption of innovation. These factors can mainly be summarized and grouped upon four main groups of factors or characteristics, namely (1) environmental characteristics, (2) organizational characteristics, (3) Innovation characteristics and (4) individual or user characteristics (Damanpour & Schneider, 2006; Pichlak, 2015; Wisdom, 2013). In the following sections, each group will be outlined and relevant theories which help to explain the respective group will be laid out. Based on the theories, factors will be derived. Following, the term factor as well as the term characteristic will be used indifferently and can be both translated into factors, which influence the likelihood of an adoption. To properly analyze the factors later in the case study, a theoretical proposition for each relevant factor will be formulated. This procedure of case analysis is based on the method of Yin (2016) and will be described more in depth in chapter 2.3.3.e.

2.4.3.a Environmental characteristics

There is a variety of factors and theories, which describe the influence of external environment on innovation adoption (Wisdom et al., 2013). Since organizations always act and therefore also innovate within a certain external environment, environmental characteristics have an influence on the adoption of innovation. (Frambach and Schillewaert, 2002). Furthermore, the adoption of innovation is often recognized as a reaction to alterations within these environmental circumstances, which makes environmental factors an important group of influencing factors (Tornatzky & Fleisher, 1990; Wischnevsky, Damanpour & Mendez, 2011; Pichlak, 2015). Frambach and Schillewaert (2002) argue that one important environmental characteristic, which positively influences the adoption of innovations, is the fact that other associated organizations within the network of a company have already adopted an innovation. This phenomenon is called network externalities (Frambach and Schillewaert, 2002).

Mahler and Rogers (1999) define network externalities as the phenomenon at which a product or service increases in worthiness as the number of users grows. This means that the more users use a specific product or service, the more beneficial the product or service becomes for the next customer (Economides, 1996). Katz and Shapiro (1985) define three major sources for

network externalities, namely (1) direct network effects, (2) indirect network effects and (3) network effects, that arise for long-lasting products, where the maintenance or service offers are likely to be better or more developed in case there are more users. A prominent example for (1) direct network externalities is the telephone. In case only one person would have a telephone, the product would be of very little value. However, it increases in value, the more people a person can call. (Mahler & Rogers, 1999). For (2) indirect network externalities this increase in value appears only indirect. An example would be the purchase of an operating system for a computer. In case very many units of a certain operating system are sold, it becomes more and more valuable for third party developers to develop software for this operating system. In turn, more software for a certain operating system makes it more valuable (Katz and Shapiro, 1985). Finally, yet importantly an example for (3) network effects of long-lasting products with maintenance or service is the automobile industry. Foreign car manufacturers may face decelerated sales, when entering a new market, since potential customers may be reservated to buy their cars, since they might see the lack in service and maintenances infrastructure as a downside (Katz and Shapiro, 1985). Missing network externalities might potentially lead to a decreased or slowed adoption rate. As soon as enough users have adopted a certain innovation, the adoption rate increases, and the likelihood of an adoption is higher. This phenomenon can be defined as the critical mass (Rogers, 2005). For further analysis, and based on these findings, the following theoretical proposition was formulated, which will be tested during the case studies: '*Positive network externalities increase the likelihood of an adoption'.*

Another environmental factor, which might have an influence on the adoption of innovation, is competitive pressure (Frambach & Schillewaert, 2002). The authors argue that in case an organization operates within a highly competitive market, a decision to not adopt an innovation might lead to competitive disadvantage, in case other competitors adopt the innovation. However, this might not be true for all types of innovation and might be related to the strategic relevance of the innovation (Frambach & Schillewaert, 2002). Accordingly, this led to the following theoretical proposition and will be analyzed during the case studies: *'High competitive pressure increases the likelihood of an adoption'*.

In addition, Pichlak (2015) argues that three major groups of environmental factors influence the adoption of innovation, namely (1) dynamism, (2) hostility and (3) complexity. (1) Dynamism can be defined as the degree of uncertainty or the speed at which the environment changes. This can be for instance the speed at which user desire changes (Bstieler, 2005) or

new governmental regulations or policies (Wisdom et al., 2013). However, it can also relate to the degree of competition, which is in line with Frambach and Schillewaerts (2002) concept of competitive pressure (Bstieler, 2005; Pichlak, 2015). Pichlak (2015) examines that a high degree of dynamism within the environment can lead to a higher probability of an adoption of innovations in all stages of the adoption process, but mostly during the initiation and implementation stage. This leads to the following theoretical proposition: '*High Dynamism increases the likelihood of an adoption*'. The factor (2) hostility describes the amount of accessible resources as well as the presence and amount of relevant other organizations, which are also interested in the same resources (Covin & Slevin, 1989; Miller & Friesen, 1983). Here a higher degree of hostility positively affects all stages of the innovation process, but mostly the adoption decision phase (Pichlak, 2015). Based on this, the following theoretical proposition will be tested: '*High Hostility increases the likelihood of an adoption'*. Finally, (3) complexity can be defined as the diversity of the environment of the organization, which requires the firm to apply different organizational procedures to cope with those differences (Miller & Friesen, 1983). As for hostility, Pichlak (2015) argues that a high degree of complexity positively influences the innovation adoption process and does that mostly during the adoption decision stage. This led to the proposition of '*High market complexity increases the likelihood of an adoption*'.

2.3.3.b Organizational Characteristics

Next to environmental factors, research has found several organizational factors, which influence the innovation adoption of organizations. Since innovation activities are often resource intensive, these activities do need an adequate amount of resources (Akgul & Gozlu, 2015). This concept can be described trough the resource-based view of the company (Pichlak, 2015). The resource-based view argues that the source of an organizations competitive advantage are the organizations resources. These resources can be described as (1) valuable, (2) rare, (3) imperfectly imitable and (4) non-substitutable (Barney, 1991). The resources, which are most important during the innovation process and are positively related can be identified as financial as well as human resources (Adams, Bessant & Phelps, 2006; Ahuja, Lampert & Tandon, 2008; Pichlak, 2015). Human resources can be defined creative and skilled staff within the organization (Akgul & Gozlu, 2015). Pichlak (2015) argues that the number of proficient staff positively influences the whole innovation adoption process. Financial resources also positively influence the adoption process (Pichlak, 2015). With sufficient financial resources, the organization can do innovation activities who bare a certain amount of risk, since the organization is able to afford the cost, which go along with non-successful projects (Damanpour

& Wischnevsky, 2006; Nystrom et al., 2002). Damanpour and Schneider (2006) argue that financial resources positively affect all phases of the innovation adoption process, the strongest impact will be in the adoption decision phase itself. This is because in the initiation or implementation phase, many parts of the organization are involved, which influence the adoption process in various ways, whereas during the adoption decision itself, usually a senior manager makes the decision whether to adopt or not adopt an innovation and is less influenced by a variety of different organizational parts (Damanpour & Schneider, 2006). Based on these findings around the resource-based view, the following two theoretical propositions were derived: (1) '*Sufficient human resources increase the likelihood of an adoption*' and (2) '*Sufficient financial resources increase the likelihood of an adoption'*.

Next to that, several scholars argue that the organizational structure influences the adoption process of innovations (Damanpour & Schneider, 2006; Pichlak, 2015: Frambach & Schillewaert, 2002). One example for an important structural attribute, which is mentioned by a variety of scholars is organizational size (Camisón-Zornoza, César, et al. 2004; Frambach & Schillewaert, 2002; Pichlak, 2015). However, there is contrasting research on the effect of size on the innovation adoption process. Whereas some scholars suggest, that size negatively influence the innovation adoption process, since they are faster and more flexible, others argue that organizational size positively influence the innovation adoption process, since in comparison to small organizations, large organizations are more urged to optimize their processes and are therefore more likely to adopt innovations to do so (Frambach & Schillewaert, 2002).Furthermore, research argues, that large organizations simply have more resources available to adopt innovations (Frambach & Schillewaert, 2002), which is again linked to the resource based view. Next to organizational size, organizational complexity is another example for a structural factor, which influences the innovation adoption process. Complex organizations usually benefit from a wide range and variety of expertise and information, which positively influences the innovation adoption process (Damanpour, 1996). All in all, there is a variety of different characteristics, which fall under the category of organizational structures, yet for this thesis, organizational structures will be limited to the relative size, and relative complexity. As research finds contrasting effects concerning the influence of organizational structures on the likelihood of an adoption, the following proposition was formulated and will be tested to assess the effect within a large manufacturing company: '*Organizational size and complexity influence the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*'.

Furthermore, several authors argue that leadership within the organization, such as top management support or opinion leaders have an influence on innovation adoption (Wisdom et al., 2013). This is supported by Pichlak & Bratnicki (2011), who argue that organizational leaders are important to advocate the innovation by the members of the organization and boost the innovation adoption process. Therefore, the attitude of top managers as well as organizational leaders influence the innovation adoption process across all phases (Damanpour & Schneider, 2006). Next to that top managers or even the CEO usually makes the final adoption decision. His own opinion towards the innovation therefore vastly influences the innovation adoption process (Hameed & Counsell, 2012). Accordingly, these findings led to the following proposition: '*Support of top-management increases the likelihood of an adoption*'.

Finally, several researchers argue that networking and collaboration with innovation developers or consultants might positively influence the likelihood of an innovation adoption (Wisdom et al., 2013). This concept will also be testes within the case studies, following the proposition of '*Network & Collaboration positively influences the likelihood of an adoption*'.

2.3.3.c Innovation Characteristics

There is a variety of research out there, which examines different innovation characteristics and their impact on the innovation adoption process. However, the theory which is used regularly and is perceived as best known is the diffusion of innovation theory by Rogers (Pichlak, 2015). Diffusion of innovation theory argues that the rate of adoption for a certain innovation is higher, in case the innovation itself encompasses five different attributes (Kapoor, Dwivedi & Williams, 2014). These five attributes can be described as (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability (Rogers, 2005). Despite the fact that Rogers (2005) examines the relationship of these attributes for individuals, research has used this framework to describe organizational innovation adoption as well (Pichlak, 2015). These innovation characteristics straightforwardly correlate with the adopter practices, which directly relate to the organizational adoption of the innovation (Hameed, Counsell & Swift, 2012).

(1) Relative advantage can be defined as the extent, to which an innovation is seen as superior in comparison to the current established solution. Relative advantage can be felt in various ways (Rogers, 2005). The author describes, that the specific way of relative advantage is driven by the type of innovation as well as the characteristics of the adopters. The dimensions include economic advantage as well as social advantage. Economic advantage describes the fact that an

innovation has some monetary advantage over the current solution. It may be for instance significantly cheaper to produce, which in turn makes the product itself less expensive (Rogers, 2005). This can for instance also include a clear advantage in terms of cost-efficiency (Damanpour & Schneider, 2006). Social status however, describes the behavior to adopt an innovation or even replicate the adoption practices of others to advance a certain social status (Rogers, 2005). However, there are certain types of innovation, who often lack the characteristic of relative advantage. These innovations can be described as preventive innovations. Through preventive innovations, the adopter decreases the chance of a future undesired effect. To overcome this lack or generally increase the relative advantage of an innovation, organizations can employ incentives. These incentives can both be monetary or non-monetary and are employed to increase the relative advantage of an innovation (Rogers, 2005). All in all, this leads to the following theoretical proposition: '*High relative advantage increases the likelihood of an adoption*'.

Next to that, (2) compatibility is described as an important innovation characteristic, which influences the adoption process (Rogers, 2005). Compatibility is defined as the 'degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters' (Rogers, 2005, p. 240). In case adopters identify a certain innovation as conflicting with their existing values, potential adopters might reject an innovation and do not adopt it. Next to that, the innovation must be consistent with formerly used solutions or innovations. This is because potential adopters use current solutions as benchmarks and see them as kind of a foundation to compare them against new innovations (Rogers, 2005). As for relative advantage, organizations may use tools to increase its perceived compatibility. Bundling new innovations in innovation clusters or adopting innovations, which fit into an existing technology cluster, increases the likelihood of an adoption (Rogers, 2005). Next to that, the author argues, that too often, organizations pay little attention in naming the innovation correctly. Giving innovations names, which are oriented towards the adopter and ensure that the message of an innovation is on point, can increase its compatibility and therefore the likelihood of an adoption (Rogers, 2005). Overall, these findings will be tested within the case studies based on the proposition of: '*High compatibility increases the likelihood of an adoption*'.

(3) Complexity describes the extent to which potential adopters identify an innovation as relatively easy to figure out and operate (Rogers, 2005). Complexity is always relative to a certain user group. Whereas early adopters of a certain technological innovation with much

technical knowledge identify an innovation as relatively easy to operate, other might not (Rogers, 2005). Based on this, the following theoretical proposition was formulated '*Low complexity increases the likelihood of an adoption*'.

(4) Trialability describes, whether or to what extent a potential adopter is able to use and test the innovation in advance on a limited basis (Rogers, 2005), Rogers (2005) argues that innovations with the possibility to test them in advance are more likely to be adopted, which leads to the proposition that '*High trialability increases the likelihood of an adoption*'.

Finally, yet importantly (5) observability can be seen as the extent to which other members of an organization can observe and view the outcome of a certain innovation. As described in chapter 2.2 a technological innovation usually encompasses both a hardware as well as a software element (Rogers, 2005). However, the software part is often difficult to observe. Therefore, innovations in which the software component is prevailing, the observability of the innovation is relatively low, which negatively affects the innovation adoption process (Rogers, 2005). All in all, the findings lead to the proposition that '*High observability increases the likelihood of an adoption*'.

2.3.3.d User Characteristics

Several research scholars argue that individual characteristics of users influence the likelihood of an innovation adoption (Wisdom et al., 2013, Pichlak, 2015). To describe user characteristics, research often refers to the technology acceptance model (Pichlak, 2015), which was originally examined by Davis (1989). The technology acceptance model builds on the theory of reasoned action by Fishbein & Ajzen (1975), which is widely used to illustrate and interpret individual actions (Wu & Wang, 2005). The technology acceptance model however examines the reasons why people might either accept or reject a certain technology (Legris, Ingham & Collerete, 2003). Davis (1989) argues that the technology acceptance model consists of two major components, which determines whether users adopt or not adopt a certain technology. These components can be described as (1) perceived usefulness as well as (2) perceived ease of use (Davis, 1989). Generally speaking, these two components are not restricted to a certain set of technologies or only valid in a narrow context, which makes them applicable to study at an organizational level (Agarwal & Prasad, 2000).

(1) Perceived usefulness refers to extent to which a potential adopter has the opinion that using a certain technology would lead to an advantage. In contrast to that, (2) perceived ease of use refers to the extent to which a potential adopter assumes that a given technology is usable without much effort or much complication (Davis, 1989). Based on this, the following to

theoretical propositions within the group of user characteristics will be tested during the case studies: (1) '*High perceived usefulness increases the likelihood of an adoption*' and (2) '*High degree of ease of use increases the likelihood of an adoption*'.

2.3.3.e Summary of Factors

Concluding, four different sets of factors where identified, which might influence the innovation adoption process and therefore influence the likelihood of a positive adoption decision. Within these set of factors (environmental-, organizational-, innovation- as well as user characteristics) several factors where identified. Summarizing, Figure 3 outlines the relevant set of characteristics, as well as all characteristics, which were found during the literature review.

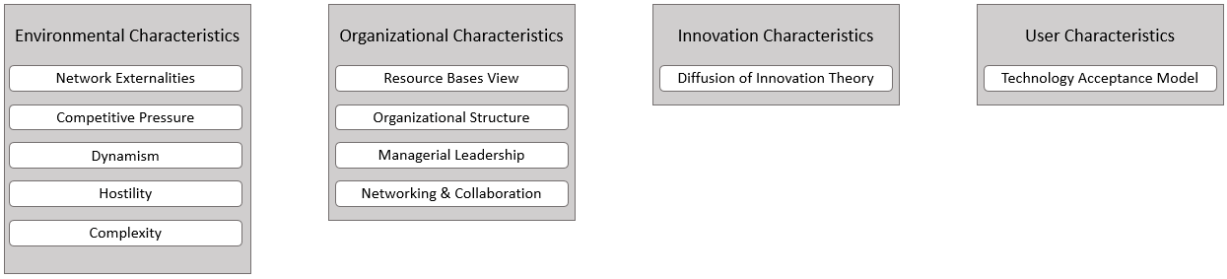

Figure 3: Characteristics, which influence the innovation adoption process

Summarizing, the following theoretical propositions were found and described during the literature study. Based on the method of Yin (2016) these propositions help to analyze the impact of the different characteristics on the likelihood of an innovation adoption.

Environmental characteristics:

1. Positive network externalities increase the likelihood of an adoption
2. High competitive pressure increases the likelihood of an adoption
3. High Dynamism increases the likelihood of an adoption
4. High Hostility increases the likelihood of an adoption
5. High market complexity increases the likelihood of an adoption

Organizational characteristics:

6. Sufficient human resources increase the likelihood of an adoption
7. Sufficient financial resources increase the likelihood of an adoption
8. Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively
9. Support of top-management increases the likelihood of an adoption

10. Network & Collaboration positively influences the likelihood of an adoption

Innovation characteristics:

11. High relative advantage increases the likelihood of an adoption
12. High compatibility increases the likelihood of an adoption
13. Low complexity increases the likelihood of an adoption
14. High trialability increases the likelihood of an adoption
15. High observability increases the likelihood of an adoption

User characteristics:

16. High perceived usefulness increases the likelihood of an adoption
17. High degree of ease of use increases the likelihood of an adoption

2.4 Conceptual Model

Based on the findings in the literature review, a conceptual model was developed. For the scope of this thesis, it was chosen to study the influence of (1) environmental characteristics, (2) organizational characteristics, (3) innovation characteristics as well as (4) user characteristics on the innovation adoption process in large manufacturing firms. The arrows pointing from each set of characteristics towards the innovation adoption process imply a relationship between each individual characteristic and the innovation adoption process.

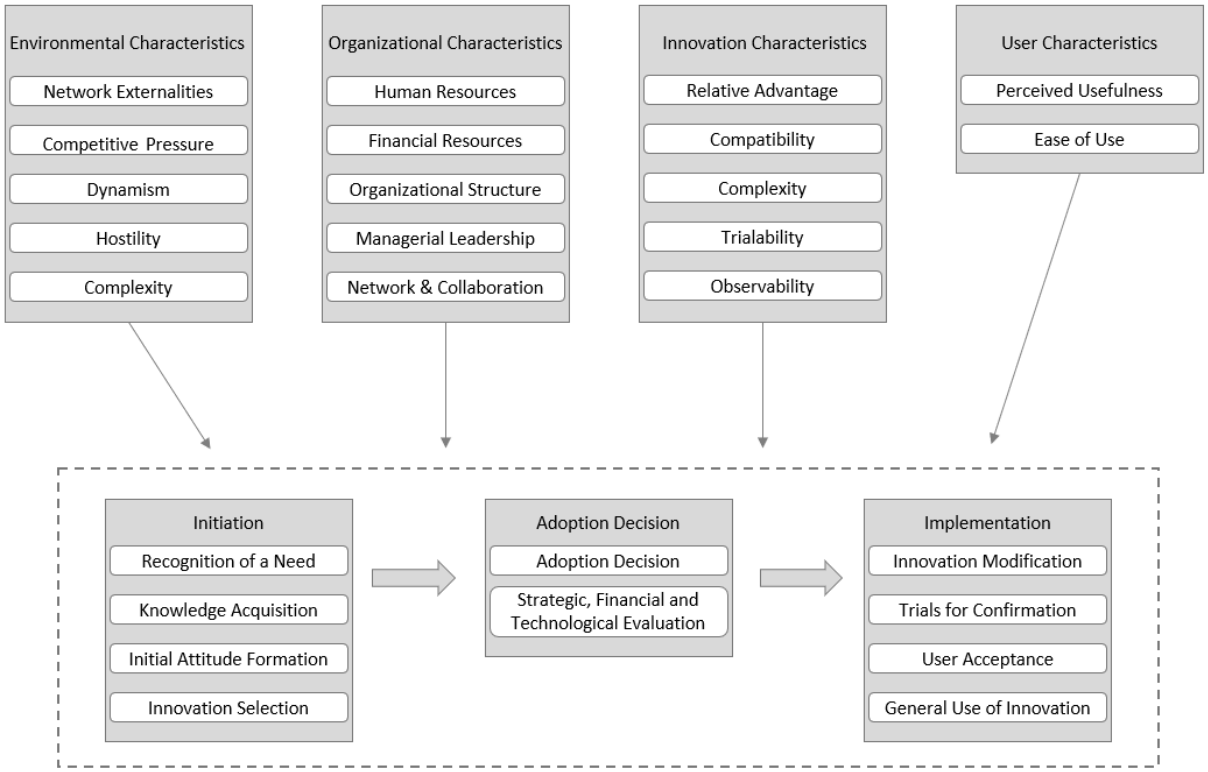

Figure 4: Conceptual model; following Pichlak (2015; p. 479)

3. Methodology

3.1 Multiple Case Study Method

Qualitative research is, among others, applicable in case the focus of the study is to understand complex processes and their context and to gain new insights on these processes (Denzin & Lincoln, 1994; Yin, 2016). Within qualitative research, the multiple case study method will be applied. Case studies have been used in many different areas of social science (Gibbert & Ruigrok, 2010) and is applicable to gain comprehensive insights into sophisticated phenomena (Noor, 2008). In doing so, the case study method aims to examine a certain phenomenon within a specific context (Eisenhardt, 1989). This approach is frequently examined to investigate topics, which are associated with innovation (Yin, Bateman & Moore, 1985). Next to that, it is suitable to study the complex process of adoption of innovation within a context, which is in this case innovation projects at large manufacturing firms (Baxter and Jack, 2008). The multiple case study makes it possible to study the differences between the cases, namely differences in innovation projects to compare and reproduce the findings (Yin, 2014).

Accoring to Yin (2014) the first major step in conducting a case study is to formulate clear case study questions. As described within the research question section, the central question can be defined as: '*How can a large manufacturing company increase the likelihood of an adoption of a technological innovation?'*. Yin (2014) argues, that case studies are especially valuable for

how and why questions, since they ask for the underlying reasons behind a certain phenomenon. To answer this research question, the multiple case study can help to answer the second and third sub-question. First, the cases will give insights on the processes of projects in a large manufacturing firm, where innovations should be adopted. Next to that, the cases will give insights on why certain innovations are not adopted, whereas others are. This will be linked to the reviewed literature, which was examined in part two, to check whether the found reasons for failure or success is represented by the found factors in the literature review. Lastly the case studies might uncover practices, which large manufacturing firms use to successfully adopt innovations.

3.1.1 Case Description and Sampling

To successfully conduct the multiple case study, the unit of analysis (the case) needs to be defined (Yin, 2014). In this study, two different types of cases can be defined. All cases will be done in a single large manufacturing company.

The first group of cases can be characterized as innovation projects, which successfully went through the whole innovation adoption process. Here a technological innovation was adopted by the organization and is at least within the final steps within the implementation. The second group of cases can be characterized as innovation projects, which did not go through the whole innovation process. At any point throughout the process, it was decided to abandon the given innovation and to not proceed with this project within the current context.

As described by Yin (2014), case studies can be conducted by using a variety of data sources. For the scope of this thesis, qualitative, semi-structured interviews with project leaders of innovation projects were conducted. Project leaders were chosen as eligible representatives, since they were responsible for managing the whole innovation adoption process and have a holistic overview of the underlying processes and decisions.

The sampling process was done in a qualitative, purposive way. First possible project leaders of innovation projects were identified in cooperation with managers at a large manufacturing firm. After that, appointments with the respective project leaders were made to clarify, whether their projects generally qualify for the case studies. Regarding the amount of cases, it was chosen to follow the method of theoretical saturation, which means that after the first interview is conducted, analysis starts right away. After that, new cases will be added until no further input will be generated, and theoretical saturation is achieved.

3.2 Interview Protocol

As described, qualitative, semi-structured interviews were conducted. To conduct the interviews, an interview protocol was developed. The protocol was developed as proposed by Galetta (2016). The author proposed to structure the interview in three broad phases, namely (1) opening segment, (2) middle segment and (3) concluding segment (Galetta, 2016).

During the (1) opening segment the main goal is to build the ideal environment to make the interview as effective as possible. To do so, first the aspirations of the interview need to be clarified. Next to that, a comfortable environment should be created, as a negative atmosphere during the interview could endanger gaining all possible insights (Galetta, 2016). During this first segment, the questions are open-ended, yet relative closely related to the research area. This enables the participants to elaborate on their experiences within the relevant topic, which makes it possible to explore the topic and lay groundwork for the next sections, which will be more theoretical (Galetta, 2016).

In the (2) middle segment, the goal is to explore the research topic in depth. In contrast to the opening segment, where the questions should be designed very openly, the questions in the middle section should be designed in a way which ensures that the research topic is fully covered, and the research questions can be answered (Galetta, 2016). During this segment the questions are designed more narrowly and might be more theoretical. However, it is important to not ask these questions too early during the interview in order to ensure that the participants are able to fully explore the topic from his perspective (Galetta, 2016).

Finally, but importantly, the (3) concluding segment is designed to rebound with parts of the participants story, which still need further exploration and elaboration. This section largely builds on the previous sections. Next to that the interviewee will increasingly contribute in 'meaning making' during this final phase (Galetta, 2016; p. 51). In the end, the final questions should be designed to allow for a summary and a question, whether the participant feels that anything should be added (Galetta, 2016).

3.2.1 Interview Guideline

As a general framework and starting point for the interview, the following set of questions where designed (the corresponding factors are indicated in italic and brackets):

Opening Segment
To start off, please describe how and why the innovation project was started.
How and why did you decide to look for an innovation?

Which technological innovation was selected and why?

From your perspective, how did the project proceed? Please explain the relevant milestones.

Middle Segment

From your perspective, what where the most difficult challenges that you faced during the project? How did you handle them?

Environmental characteristics

Please describe your external environment outside of your organization that is relevant to your work. Did it influence the decisions within innovation project? If yes, how?

- Do other companies relevant to you use similar innovations? How did it influence the decisions within the innovation project? (*proposition 1,2*)
- Did the environment change during the process (e.g. customer demands, political regulations, technologies)? How did it affect the decisions within the project? (*proposition 3*)
- Market complexity (the diversity of the market and the need to cope with this diversity) is often described as a factor which influence the likelihood of an adoption. Did this factor influence the decisions within the project? If yes, how? (*proposition 4*)
- The factor of hostility describes the amount of scare resources within the environment and the number of competitors fighting for those resources as well. Did this factor influence the decisions within the project? If yes, how? (*proposition 5*)

Organizational characteristics

Please describe organizational factors, which you think influenced the innovation project?

- The possibilities within a project are often tight to the financial as well as human capital. Please explain how financial and human resources influenced the decisions within the project? (*proposition 6, 7*)
- Please describe the organizational structure of your organization. How did this structure influence the decisions within the innovation project? (*proposition 8*)
- Did the top management know about the project? How did top-management in influence the decisions within the project? (proposition 9)
- Did you collaborate with external partners during the process? If yes, why? Did this collaboration influence the decisions within the project? If yes, how? (*proposition 10*)

Innovation characteristics

Please explain the innovation, which was/ should be implemented in detail. What are the advantages of the innovation? • Does the innovation have a clear advantage in comparison the current situation? Please describe how this factor influenced the decisions within the project? (*proposition 11*) • Would you describe the innovation as complex? If yes, why? How did the degree of complexity influence the decisions within the project? (*proposition 13*) • How does the innovation fit in the current organizational settings and values? Did the innovation or organization needed to be adapted? If yes, how? Did this compatibility influence the decisions within the project? If yes, how? (*proposition 12*) • Please describe the test periods of the innovation? What was most important during that time? How did test-periods affect the decisions within the project (*proposition 14*) • How do employees, who do not use the innovation, observe the innovation during daily operations? How did this influence the decisions within the project? (*proposition 15*)
User characteristics What did potential users think about the innovation? • Did users value the innovation as useful? How did this influence the decisions within the project? (*proposition 16*) • Did users value the innovation as easy to use? How did this influence the decisions within the project? (*proposition 17*)
From your perspective, what was most important during the project?
Which practices where critical for the success during the project?
What are the main reasons for abandoning the innovation (Only for abandoned projects) What are the main reasons for adoption the innovation (Only for adopted projects)

Closing Segment
To wrap up, which things would you advise other project leaders, who do similar innovation projects?
What would you do differently in following innovation projects?
Do you think we left out important parts, which should be included?

Table 2: Interview Guideline

3.3 Data Analysis

To properly analyze the qualitative data, the following data analysis strategies by Yin (2016) will be applied.

For this thesis, different qualitative case analysis styles will be combined. First, differences between adopted and non-adopted innovation projects should be identified and linked to the identified literature. For this purpose, the 'relying on theoretical propositions' strategy will be applied (Yin, 2016). Within this strategy, theoretical propositions, which are formulated based on the literature review will be used as a basis for analysis. As a first step, each case will be evaluated individually. Within each case it will be examined, which factors influenced the likelihood of an adoption and whether the main reasons for adopting or not adopting a certain technological innovation are related to the factors found in the literature review.

After each case has been evaluated separately, the findings will be compared and evaluated for cross case synthesis (Yin, 2016). With this strategy, it is possible to examine whether similar conclusions were found across cases. To do so, a table will be created, which consists of the findings from each individual case according to different categories. With this, it is possible to compare findings across cases and depict similarities and differences (Yin, 2016).

4. Analysis

4.1 Adopted Project 1

4.1.1 Case Description

The first adopted project can be described as a software solution within the area of procurement, that scans and screens contracts and texts, general terms and conditions on the one hand and annotations by suppliers and purchasers on the other hand and analyzes, whether these annotations by buyers or suppliers harm the contracts or terms and conditions. To do so, the system uses technologies like artificial intelligence and natural language processing.

This innovation project was initially started due to the perception, that machine learning and/ or artificial intelligence will be a major driver in the change processes within the next years (I1: 1:30-1:45). This was done though scenario analysis, which was done to evaluate how procurement will change until the year 2025. With this perception, the team wanted to tackle several questions. First, the team wanted to find out, to what extent the organization can use existing data for artificial intelligence or machine learning systems and how could those systems be integrated in the existing infrastructure. Next to those technical questions, also cultural questions were important, since the output of those machine learning or artificial intelligence software are currently done by humans and will be given to those types of software

soon (I1: 03:30-03:40). The interviewee argued, that those types of questions were the main driver for initiating the innovation project with the goal to show that machine learning and artificial intelligence is not just science fiction but working technology, which can be used and generate a variety of benefits. (I1: 04:10-04:14).

After identifying the main target area, a more specific use case was identified which served well to answer the mentioned questions. In procurement, purchasers need to read a lot of texts, compare them, interpret them and check whether remarks by suppliers and suppliers for instance harm the terms and conditions or other negotiated agreements (I1:06:10-06:30). These texts often do not have a specific and standardized format but are often natural written language in form of e-mails or notes.

As the specific use case was defined, the team went on to conduct a technology scouting, to identify companies, which have experience in artificial intelligence on the one hand and natural language processing on the other hand (I1: 06:50-07:10). During this scouting the team came across one Start-up, which had experience in analyzing contracts. Since both use cases need to handle relatively small amounts of data in comparison to big data use cases, and still need to make profound analysis the partner proofed to be an optimal partner. Next to that juristic language can be captious, which means the algorithms need to make very precise analysis.

As the Start-up, which could deliver the innovation was selected, it was decided to start a first pilot project with the aim to test a working prototype with real data. This initial pilot project was set to have a relatively small budget with around 50.000 euros (I1: 09:30-09:50). This budget was selected on the one hand because the budget of the team allowed to spend this money and no external funding was required and on the other hand the amount was small enough so that complex and long approval flows were not needed (I1: 10:10-10:20).

As this was decided, the process of officially place an order for the Start-up started. In parallel, both the innovation project team and the Start-up started to work in implementing the data of the large manufacturing firm into the software and adapting the innovation to the needs of the large manufacturing firm and the specific use-case. During this phase the teams updated each other once a week per skype conference, where both, technical things regarding the innovation, such as data models, but also the current situation of the official order process was discussed (I1: 10:30-11:36).

During this phase, the innovation was altered to the demands, processes and the general surroundings of the large manufacturing firm. For instance, the software needed to understand

German language and work with company specific data. But also, a new front-end solution was developed in cooperation with a large consulting company. With this, the team was able to show, that the innovation was able to work under the conditions of design expectations and user experience demands of the large manufacturing firm without already implementing the innovation in the real IT-Infrastructure of the company (I1: 12:50-13:36). Due to this, it was possible to show also conservative managers, that this innovation can bring benefit to their employees. Furthermore, it was always focused on developing a prototype, which could later be easily used to be implemented in the company infrastructure.

The presentation of the prototype was very successful, and the project team was able to demonstrate that the prototype of the innovation already had a clear advantage over the current process, which included a lot of manual work. With this, the team began to market the innovation more broadly to get support for further implementation projects (I1: 16:45-17:03).

Next, this the team got the adoption decision by the top management to implement the innovation into the company infrastructure (I1: 18:00-18:39). To do so, the frontend of the system was brought into the cloud infrastructure. In parallel, negotiations for contract agreement with the Start-up were made, which allowed to make a profound implementation project out of a smaller pilot project and further allow for more use case development (I1:17:30-18:00). This included data security, legal aspects but also the development of a licensing model for the innovation itself. This process took over a year, which was way longer than expected. During this phase the project could not continue (I1: 20:00-20:22). The main reason for the delay was the difficulties and not existing knowledge with those kinds of projects when going into negotiations with the Start-up. The responsible buying department for negotiating the agreements with the Start-up had difficulties to analyze and quantify the associated costs and resulting benefits for this project, since those types of machine learning and artificial intelligence projects, which are often billed as software as a service, rather than billed by time and material, where not made before and made the negotiation process complex. Since the negotiation was complex and the buying department did not clearly see the benefits of the project at first sight, the negotiation had a low periodization. This delayed the process to a large extent (22:00-22:43). As this process was completed, the team went into the last phases of the project and started rolling out the innovation within the firm, at which the innovation project is still to this moment.

4.1.2 Within Case Analysis of Adopted Project 1

4.1.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	High dynamism: positively influenced	No impact	No impact

Table 3: Environmental Characteristics – adopted project 1

Within this project, only one theoretical proposition from the group of environmental characteristics were mentioned to influence the likelihood of an adoption. The interviewee stated that one reason to start the project was the identification that machine learning or digitalization in general will drastically change procurement in the future (I1:30:32-31:00).

4.1.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Sufficient Resources: positively influenced	Sufficient Resources: positively influenced	Complex structures: negatively influenced	Support: positively influenced	No impact

Table 4: Organizational Characteristics – adopted project 2

Speaking of organizational characteristics, four out of five theoretical propositions can be confirmed. First, the interviewee mentioned that the spirit of the innovation team was crucial for the success of the project. Next to that, the team had a fixed budget, which was sufficient to conduct all necessary tasks within the project (I1:38:20-40:05). Speaking of organizational structure, the interviewee mentioned that due to the relative newness of the innovation, the procurement department had problems to quantify the value of the innovation and therefore negotiate the price for the innovation with the Start-up. This delayed the process drastically (22:00-22:43). Lastly, top-management support was found to have a large influence on the likelihood of an adoption in this project. During this project the top management was supportive in a way to allow the team some freedom to test things out and go unconventional ways. The interviewee stated that this was important especially in the early phases of the project, where the outcome and benefit of the innovation was relatively unclear (32:30-32:55). Next to that it also made it possible to do the first phases under the radar and involve as little people as possible. With this the team was able to present the innovation at a point where the benefits were very clear, which made it nearly impossible to reject the innovation (I1:44:50-45:30).

4.1.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
High advantage: positively influenced	High compatibility: positively influenced	Low complexity: positively influenced	High trialability: positively influenced	No impact

Table 5: Innovation Characteristics – adopted project 1

Regarding innovation characteristics, four different factors were found to influence the likelihood of an adoption within this project and it can therefore be concluded that these theoretical propositions can be confirmed. Firstly, the project had a large relative advantage in comparison to the current situation, which was one main reason for adoption (I1: 43:30-44:20). Next to that the innovation was greatly altered and adapted to the needs of the large manufacturing firm, which confirms the theoretical proposition of compatibility. Additionally, the innovation had a low complexity, due to a strict focus in user experience and user centered development (I1: 44:30-44:53). This user centered development can be also found in the factor of trialability. The interviewee stated that users were integrated into the process from the beginning on and were always able to test the innovation, which was very important during the project (I1: 52:00-52:41).

4.1.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
High p. usefulness: positively influenced	High ease of use: positively influenced

Table 6: User Characteristics – adopted project 1

According to the interviewee, both factors in the group of user characteristics had an influence on the likelihood of an adoption and therefore both theoretical propositions can be confirmed. Users were actively involved in the project to secure both the perceived usefulness and a high relative ease of use (I1: 44:30-44:54; I1: 55:20-55:39)

4.1.2.e Main reasons for adoption & summary

Within this innovation project, two main factors of success were mentioned by the interviewee:

1. The clear and concrete benefit of the use case (I1: 43:30-44:20)
2. The fact that the prototype worked well in the ecosystem of the large manufacturing firm (I1:17:30-18:00)

Overall, it can be mentioned that only one environmental factor was relevant within the project and was only mentioned as important in the initiating phase of the project. Next to that complex

organizational structures seem to influence the likelihood of an adoption in a negative way. However, this was managed for instance by freedom to try things out and top-management support.

4.2 Adopted Project 2

4.2.1 Case Description

The second implemented project is an analysis and reporting tool. The initial situation before implementing the innovation was that the employees had the ability to use over 50 different reports for different purposes throughout their daily work. These reports can be reached throughout different ways and are often very difficult to understand and interpret and are therefore rarely used. These reports however might be very important for the employees, since they might contain information like, where is the supplier also making offers at other brands or regions, or where do other people at the firm need similar products so that demands can be bundled together (I2: 0:00-01:30).

With this problem and need in mind, employees from the department began to talk to another department, which are responsible for solving such problems. Throughout the discussions with the other department, the team recognized, that there is already an innovation, which is under development for a different use case but might solve the problems of them as well (I2: 02:00-02:20). This innovation can be described as a report tool on the basis on the technology of an American analytics company (50:00-50:54).

After recognizing the similarities, the employees teamed up with the people of the other department and began to integrate their demands and the needs for their specific use case into the innovation. They did this without having a clear project plan, but they made sure, that the demands will be integrated, when the innovation was altered to the demands of the company (I2: 05:00-06:00). They did this through talking to many employees of different brands and regions within the large manufacturing company, who were possible users of the innovation and recording their needs and demands. These demands were than given to the people at of the responsible department, who integrated them into the innovation. This was an iterative process, where the demands were integrated into the prototype and then tested by users. This continuous test process was done throughout the development time sometimes with more users and sometimes only with one or two (I2: 06:30-06-57).

After the tool was fully developed and adopted to the needs of all departments, the team went on to present the innovation to the top management of the different departments. After they agreed to adapt and implement the innovation, the team went on to present the innovation in

every department meeting, so that every potential user was aware of the innovation, could ask questions about it and see a live demonstration of the tool (I2: 12:00-12:57). During these presentations in the different departments, the content of the presentation was adapted to each department, so that every employee had the possibility to see a demonstration, which was relevant to their daily work (I2: 12:57-13:06). With this it was possible to get the approval of users. They had the opinion that the tool finally solves a problem and is also easy to use. With this demonstrations in the departments it was positive to generate a positive feeling about the implementation of the innovation.

After the presentations within the departments, the users were able to use the tool. To make the rollout as smooth as possible, the team offered a quick how to use guide and walk in hours, where users could come and ask questions regarding the use of the innovation (14:00-15:00).

4.2.2 Within Case Analysis of Project 2

4.2.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	No impact	No impact	No impact

Table 7: Environmental Characteristics – adopted project 2

During this innovation project, environmental factors where not important. This accounts for all propositions on environmental factors. Therefore, it can be concluded, that external factors did not influence the likelihood of an adoption decision in this project and the theoretical propositions cannot be confirmed.

4.2.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Sufficient resources: positively influenced	Sufficient resources: positively influenced	Complex structure: negatively influenced	Support: Positively influenced	No impact

Table 8: Organizational Characteristics – adopted project 2

Within this project, most of the organizational factors influenced the likelihood of the adoption decision. As for human as well as financial resources, both had a positive influence on the adoption of the innovation. The team had sufficient financial resources and was able to do all necessary tasks (I2: 30:30-31:00). Next to that, the interviewees mentioned that they were

satisfied with the project team and everyone did their respective tasks (I2: 38:00-38:20). As for organizational structures, the interviewees argued that the complex organizational structures, and the need to communicate with and integrate internal stakeholders into the project slowed down the process (I2: 18:00-18:28). However, they also pointed out that this communication is very important to the success of a project and was one key factor of success (I2: 31:00-32:00). Next to that, top-management was very supportive and furthermore gave the team the freedom to do the innovation project, which was mentioned as another key factor of success (I2: 40:00-42:00). Since the team did not collaborate with any external parties, the factor Network & collaboration had no impact.

4.2.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
High advantage: positively influenced	High compatibility: positively influenced	High complexity: Managed negative influence	High trialability: positively influenced	No impact

Table 9: Innovation Characteristics – adopted project 2

Within this project most of the theoretical propositions can be confirmed. The interviewee mentioned that the innovation can potentially generate a huge economic benefit, which was also one of the key factors of success (I2: 58:13-58-30). Next to that, the innovation was greatly altered and adapted to the organizational ecosystem and the needs of the large manufacturing firm (I2: 32:05-32:20). Regarding complexity, the team interviewee argued that the innovation itself might be complex to use for some users, however this complexity was managed with walk in hours, where users could ask questions (I2: 50:35-50-48). Finally, since the innovation is an analysis tool for purchasers, observability did not impact the adoption decision.

4.2.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
High p. usefulness: positively influenced	High ease of use: positively influenced

Table 10: User Characteristics – adopted project 2

Within this project, both theoretical propositions can be confirmed. On the one hand users had the opinion of getting an innovation which really solved their problems, on the other hand users also had the impression, that the innovation was easy to use (I2: 14:15-14:37).

4.2.2.e Main reasons for adoption and summary

Within this case, three main reasons for adopting the innovation were identified and mentioned by the interviewee:

3. The economic benefit of the innovation and the clear visibility of the economic benefit (I2: 58:00-58:30)
4. The freedom, time and support from the top management to work on the project (I2: 58:30-59:00)
5. Involving different potential users and integrate their demands into the innovation when adapting it to the organizational needs (I2: 18:15-18:28)

Concluding, one can say that environmental characteristics were not important during this innovation project. Next to that, organizational characteristics mostly had a positive influence on the likelihood of an adoption. However, and similarly to the first project, complex organizational structures influence the likelihood of an adoption negatively. Next to that, the theoretical proposition of complexity can be confirmed for this innovation project, yet it is possible to reduce complexity.

4.3 Adopted Project 3

4.3.1 Case Description

The third implemented project can be described as a new hub display. One of the most difficult market for this is Central- and South-America, because products of the large manufacturing firm are sold at lower prices there and the pressure to implement innovations, which are as cheap as possible is highly prioritized. Due to this, an innovation contest was initiated in Brazil with the aim to find the cheapest possible alternative for the current solution. (I3: 03:00-04:01).

Within this contest, a company with a promising concept was found. This company was able to deliver an innovation, which can which was able to deliver the wanted results at a very low price. The South Korean company developed this innovation in cooperation with a federal institution, which both own the patent partly. Furthermore, the company already had an aftermarket solution on hand to prove this. (I3 00:00-03:00)

After the contest, the innovation was shown to an employee within the headquarter of the large manufacturing firm, who knew of the struggle of engineers to develop such a solution. In first talks with the technical development department, the engineers of the large manufacturing firm kept skeptical and wanted a proof, that the innovation is working (I3: 06:00-06:30).

The innovation was then brought to and tested in the development department of the large manufacturing firm. Since the innovation worked and has potential it was decided to implement the innovation. Furthermore, this solution was also cheaper in comparison to the current solution, which means that the innovation had an economic benefit. (I3: 06:30-07:20).

After getting the adoption decision, the team set down with the Start-up, began to deeply understand the technology of the innovation, to evaluate whether the technology works in cooperation with technology of the large manufacturing company, can deliver the quality standards and be integrated into one of their products. To do so, non-disclosure agreements were signed both by the manufacturing company and by the Start-up (I3: 10:00-11:37). After this evaluation phase, the team redesigned the innovation completely to adapt it to the ecosystem of the manufacturing company. This was also a hard phase, because both the private and governmental organizations were patent owners of this technology. This took a relatively long time but was managed in the end. Finally, this innovation will be integrated into future generations of products of the manufacturing company (I3: 13:00-14-27).

4.3.2 Within Case Analysis of Adopted Project 3

4.3.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	High comp. pressure: positively influenced	High dynamism: positively influenced	No impact	No impact

Table 11: Environmental Characteristics – adopted project 3

Two environmental characteristics, which influence the likelihood of an adoption where mentioned by the interviewee. First, the interviewee mentioned that the large manufacturing company also wanted to deliver the same experience as premium car manufacturers, which can be linked to competitive pressure (I3: 17:30-18:11). Next to that, the interviewee argued, that there is always the drive to deliver new innovations first (I3: 20:30-20:57). This once again links to competitive pressure, but also affects the degree to which users adapt to new innovations and change their demands, which is part of the concept of dynamism (Bstieler 2005). Therefore, the theoretical propositions of competitive pressure as well as dynamism can be confirmed.

4.3.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Sufficient resources: positively influenced	Sufficient resources: positively influenced	Complex structures: negatively influenced	Support: positively influenced	No impact

Table 12: Organizational Characteristics – adopted project 3

Within this innovation project, four different organizational characteristics influenced the likelihood of a positive adoption decision. As of human as well as financial capital, the interviewee argued that due to the clear economic benefit of the innovation, there was neither a lack in human nor in financial capital (I3:31:30-31:50). This in turn leads to the assumption that a clear economic advantage of an innovation might influence other factors, which in turn influence the likelihood of an adoption. Organizational structure however had a negative impact on the likelihood of the adoption. The interviewee argued that the structure slowed down the progress of the project and there is always the threat of not getting support of stakeholders due to other prioritizations (I3: 23:15-23:40). This is in line with Frambach and Schillewaert (2002) who argue that complex organizational structures might have a negative influence on the likelihood of an adoption. However, due to the high economic potential, the team was able to move around many standard processes (I3:33:00-34:00). Once again, this leads to the conclusion, that economic benefit influences other factors, which in turn influence the likelihood of an adoption decision. Lastly, the top-management also supported the innovation due to its economic benefit, which also influenced the likelihood of the adoption (I3: 27:00-27:45).

4.3.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
High advantage: positively influenced	High compatibility: positively influenced	Low complexity: positively influenced	High trialability: positively influenced	No impact

Table 13: Innovation Characteristics – adopted project 3

Four innovation characteristics, which were found in the literature, where also confirmed by the interviewee. First, the innovation had a clear advantage and a huge economic potential, which vastly influenced the project (I3: 06:30-07:20). Next to that, the innovation was highly adapted to the needs of the manufacturing company, which was a necessity in this case (I3: 43:00-44:00). Regarding complexity, the interviewee argued that the complexity was very low and can be compared to a display, which the user needs to look at (I3: 38:00-39:00).

Furthermore, the proposition of trialability can also be confirmed for this case, as the company had the innovation ready to be tested by the manufacturing company, which impressed the team (I3: 04:45-5:15). Finally, observability had no impact, since the output of the innovation is only used by users and has no impact on others.

4.3.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
High p. usefulness: positively influenced	High ease of use: positively influenced

Table 14: User Characteristics – adopted project 3

Both theoretical propositions regarding user characteristics can be confirmed for this innovation project. Since the functionality of the innovation is the same as it is right now, there is a clear demand for this functionality. The perceived usefulness is high and positively influenced the likelihood of an adoption decision. Next to that, also the perceived ease of use is high and positively influenced the likelihood of an adoption, since it the functionality is already used and proven (I3: 47:00-48:00).

4.3.2.e Main reasons for adoption and summary

The interviewee argued that there is one main reason for adopting and implementing this innovation. The clear relative advantage both economically as well as delivering a user experience compared to the current solution led to the positive adoption decision (I3: 15:00-15:19).

Concluding one can say that the project faced relatively little negative influence. Only organizational structure seemed to have a negative influence on the likelihood of an adoption, yet it was possible to manage, due to the relative and economic advantage of the innovation.

4.4 Adopted Project 4

4.4.1 Case Description

This innovation project was initiated after a workshop, where people recognized the problem that people within the same working area or even within the same department do not know each other very well. During the workshop they already developed a solution for this problem. Their idea was to arrange lunch meetings which can be used by employees to meet with people who they don't know very well or not at all yet during lunch time (I4: 00:00-01:00).

To do so, one employee of the department was asked to organize these lunch dates. He then went forward to think of a solution on how to arrange these meetings with the help of a software innovation. During his private time, he then started to develop a software, which could be used

to arrange such meetings to safe him as much time as possible during the planning of the lunch dates. The software was able to send invitation E-mails to people who are interested in participating in the lunch dates, creating the perfect match, based on the department of the participants and possibly previous lunch date matches and creating the lunch dates in outlook. This solution was developed within two weeks and were then used every week to plan lunch dates within his division. (I4: 01:00-03:30).

During these lunch dates, the division got to know each other better, new friendships were made and the pilot project itself was a huge success. Since this was the case, the developer, who developed the software during his free time decided to give the software to the large manufacturing company as a gift. Compared to the two weeks development time of the innovation, the adoption and implementation phase of the innovation took over seven months. This was because there was no clear process or plan on how to handle an adoption or implementation of an innovation, which was developed by an employee in his private time and then given to the company as a gift (I4: 03:30-04:20).

To get an adoption decision and successfully implement the Innovation the developer began to ask different official approval departments within the company such as the open source office, the legal department, the work council or the data security department. Together with each approval department, he then adapted the innovation to the needs and regulations of the manufacturing company (I4: 04:20-05.45). One example was the open source component of the innovation. Some open source models can be easily approved by the manufacturing company and others might be rejected. During these talks with the approval departments, the innovation therefore needed to be altered and developed to meet the standards of the large manufacturing company. After all these approval departments approved the innovation, the software was uploaded into the internal software store of the company, where every employee could download and use it for free.

In parallel to this process, the developer wrote a handbook, filmed video tutorials and made other guides to ensure that other users besides him could use the software correctly (I4: 05:45-06:02). In addition, first tests with potential users were made to get their feedback and demands for additional features, which were then implemented into an updated version of the software.

Right now, the software is downloaded several hundred times and can be used within the company, with the objective to roll it out also to other brands within the next month.

4.4.2 Within Case Analysis of Adopted Project 4

4.4.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	No impact	No impact	No impact

Table 15: Environmental Characteristics – adopted project 4

During this innovation project, environmental factors were not important. As this innovation was purely adopted and implemented based on specific internal needs, no environmental factors were mentioned to have an influence on the likelihood of an adoption decision. Therefore, no theoretical propositions can be confirmed

4.4.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Sufficient resources: positively influenced	No impact	Complex structures: managed negative influence	Support: positively influenced	No impact

Table 16: Organizational Characteristics – adopted project 4

Similarly, to the other adopted innovation project, four organizational characteristics influenced the likelihood of a positive adoption decision. First, the innovation project had enough human resources. Financial resources had no influence on this project. This was because the employee, who developed the innovation within his free time, gave the innovation to the manufacturing company as a gift. As he had all the needed competences to implement the innovation, other human resources were not needed as well (I4: 1:15:30-1:16:00). The interviewee argued that this was one of the main factors of success. Regarding organizational structure, the interviewee generally agreed that the complex structure of the large manufacturing company has a negative effect on the likelihood of an adoption in general. However, the interviewee kept the project as small as possible. Since he was able to do most of the things by himself, he did not need to involve other stakeholders which might negatively influence the project (I4: 19:00-19:20). Furthermore, the interviewee argued that support of the top management was very important for the project. He argued that it was especially important to get the flexibility and freedom for the project (I4: 24:00-24:40). Lastly, network and collaboration did not influence the likelihood of an adoption decision, as there was no collaboration with external partners.

4.4.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
High advantage: positively influenced	High compatibility: Positively influenced	High complexity: Managed negative influence	High trialability: positively influenced	No impact

Table 17: Innovation Characteristics – adopted project 4

For this innovation project, four propositions, which were derived from theory can be confirmed to influence the likelihood of a positive adoption decision. First, the innovation had a clear relative advantage both for the employees itself as from an economic standpoint (I4: 42:00-43:00). The interviewee argued that in general it is easier to adopt innovations which have a clear economic advantage (1:06:00-1:06:40), which is in line with Rogers (2005). Next to that, the innovation is highly compatible, since it was completely altered to the demands of the manufacturing company (I4: 09:00-09:34). In addition to that, the innovation could be complex to use for some users. However, the complexity was actively reduced with the help of handbooks (I4: 46:00-46:19) and tutorials and continuous improvement of the innovation with the help of user feedback (I4: 51:00-51:34). This is also characteristic of trialability, which also influenced the likelihood of a positive adoption decision, since the innovation was tested broadly (I4: 25:00-25:15).

4.4.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
High p. usefulness: positively influenced	High ease of use: positively influenced

Table 18: User Characteristics – adopted project 4

Both theoretical propositions regarding user characteristic can be confirmed in this project. First, the project was initiated based on the specific need of users for a lunch matching solution (I4: 00:00-01:00). Next to that it was very important throughout the whole project to adopt and implement a solution which was as easy as possible. In places, where there might have been to much complexity, tutorials and handbooks helped to reduce it (I4:46:00-46:19).

4.4.2.e Main reasons for adoption

The interviewee mentioned two main reasons for adoption, which were also represented by the theoretical propositions:

1. The major alteration/ adaption as well as the implementation could be done by the project lead. There was no need for stakeholder involvement, funding or more resources (I4: 1:15:30-1:60:00)
2. The project lead had the right environment to do the innovation project. This includes freedom to try things out, top-management support as well as support of co-workers (I4: 1:16:00-1:16:56)

All in all, the environmental factors had no influence. Next to that, only two factors could have potentially influenced the project in a negative way, yet this influence could be managed. As for organizational structure, bundling of competences and a project which runs under the radar helped to manage this factor. Regarding Complexity, the team was able to actively reduce complexity for instance with the help of manuals and tutorials.

4.5 Abandoned Project 1

4.5.1 Case Description

This project was initiated based on a strategic initiative within the area of procurement. In general, the procurement strategy includes different fields of actions. One of these fields is the qualification of employees. This includes different areas one of which deals with the question of how the division of procurement can qualify employees in the future (I5: 00:00-02:15). To tackle this area, one possible proposed solution was to use gamification approaches to further qualify and educate employees.

To do so a project lead was assigned with the task, who first went to conduct a start-up scouting to find potential partners who have new innovative solutions in the areas of qualification and/or gamification. During this, a Canadian based Start-Up was identified which could deliver an innovation, which was designed for this specific area. This software innovation targeted both fields and was designed to qualify and educate employees through gamification practices. The qualification aspect of this innovation was done predominantly through question and answer tasks (I5: 02:15-03:30). Here the method of educating through question and answer based tasked was not the innovation, but the fact that this was all done based on a platform and in combination of various gamification aspects and the possibility to gather and analyze various user data (I5: 05:30-05:52)

As this innovation matched the criteria of both gamification and qualification aspects, the innovation was presented to the top management, which supported the idea to test the innovation within a pilot project with a fixed budget and a time frame of six month, to see

whether this gamification approach could bring benefits to the area of procurement (I5: 03:52-04:15).

Next to that, it was decided to conduct the pilot study together with suppliers of the large manufacturing company, since integrating employees and gathering employee data would have led to administrative tasks (I5: 03:30-03:45). For this, suppliers should be further qualified for processes and systems of the manufacturing company, which are also used by employees of the manufacturing company, to allow for a representative study (I5: 03:45-05:15). Together with the top management a user-group as well as a procurement system, which served as the system for which the participants should be qualified for. (I5: 05:15-05:30).

However, there were also some clarity issues regarding the project for the project team. First, the company, which delivered the innovation was unknown and did not work with the large manufacturing company in the past. Next to that, there was a discrepancy on the expectations of the project between the company, which provided the innovation, which might have been caused to wrong contact persons at the company. After the pilot study would end, the large manufacturing company aimed for an innovation partnership to further develop the innovation or some parts of the innovation together and integrate it into the ecosystem of the manufacturing company. However, the responsible account manager of the company primarily wanted to sell their current product and did not show any interest to adapt or alter the innovation to the needs of the manufacturing company (I5: 06:00-06:30). In retrospective, the project lead of the project argues, that this discrepancy of expectation was not recognized clearly enough.

After the project scope was set, contract negotiations with the company began. This took a relatively long time. In parallel, the team started working on the project nevertheless. First, education content of the procurement system, which should be used, was gathered. For this, the team worked together with the supplier integration team, which is responsible for all suppliers. The management of the supplier integration team was skeptical and hesitant at first one the one hand because of extra work, but also because gamification is seen very skeptical at the manufacturing firm in general. Mainly in older generations, gamification is often blocked because they argue that gaming and gamification is nothing, which should be implemented in working environments and people could have the opinion that work is not taken seriously in case there are gaming aspects within their work. However, the management of the supplier integration team finally agreed to collaborate within the project without any official assignment, after the team members were convinced, which was very important and critical to the project

(I5: 08:00-10:50). From that point on the supplier integration team was involved in decisions and treated as part of the project team, which was also very important (I5: 15:00-16:55).

After all the content for qualifying the test users were developed, the team thought about how to start the test phase and contact all suppliers (I5: 18:30-18:50). For this, correspondence E-mails were developed together with the supplier integration team. Next to that, the test users were contacted. For this phase it was selected to test all gamification aspects, excluding prices, since there was a huge critique of allowing prices to internal employees.

However, during the first week of the test phase, the response rate of test users was relatively low. Therefore, the team decided together with the top-management to allow to integrate prices as another gamification aspect. These prices then changed the response and participation rate drastically (I5: 20.00-21:20).

During the test phase, the company, which delivered the innovation proved not to be very experienced in making projects with a large corporation. One example was support, which was needed on a 24-hour basis, since suppliers were located throughout the whole world, but some mistakes were only fixed after one day. Next to that, did not seem to recognize the range of the project (I5: 27:00-28:30).

After 50% of the test-period was over, a feedback survey was sent out to the participants, who highly valued the gamification aspects, but wanted more methods of teaching and not just question and answer-based tasks. This feedback matched with the impressions of the project team of the manufacturing firm, which had the impression throughout the whole project. Furthermore, the project was presented at an international supplier day, where the team only got little feedback from suppliers, since they did not see the project as very valuable, since it did not solve an immediate problem for them. (I5: 33:40-33:46)

At the end, the project lead held e presentation in front of the top management, where the user feedback was also presented and a final advice for further steps were given. During these presentations, the team advised to further test gamification elements, since the feedback was positive, but on the other hand to not implement the innovation of the company and do not continue to work with the company, as the expectations were so different (I5: 32:00-34:00).

Finally, the top-management decided to neither continue with the Canadian company to implement the innovation nor to further test gamification aspect within the division of procurement (I5: 32:00-34:00).

4.5.2 Within Case Analysis of Abandoned Project 1

4.5.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	High dynamism: positively influenced	No impact	No impact

Table 19: Environmental Characteristics – Abandoned project 1

During this innovation project, only one environmental factor was of importance and had an impact on the project. The interviewee stated that one of the reasons why the project was initiated based on an anticipated change within the society that, in the future, employees or suppliers want to learn in different ways in comparison to today (I5: 43:00-43:40). Next to that, no other environmental factor was mentioned as important. Therefore, only the theoretical proposition of dynamism can be confirmed.

4.5.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Not sufficient resources: Managed negative influence	Sufficient resources: positively influenced	Complex structures: negatively influenced	Both support/ no support: Both positive/ negative influence	Collaboration with innovation company: negative influenced

Table 20: Organizational Characteristics – Abandoned project 1

For this innovation project, all organizational characteristics, which were found in literature, are important and all theoretical propositions can be confirmed. Regarding human resources, the interviewee argued that despite herself, she had no human capital and was dependent to convince other people to work with her without any official order. If this had failed, the project would have stopped much earlier. Therefore, the theoretical proposition can be confirmed, and the project lead was able to manage the negative influence successfully (I5: 50:00-50:17). Next to that, the project had sufficient financial resources to do all the tasks within the project, as a fixed amount was committed (I5: 03:52-04:03). As for organizational structure, the complex and complicated structures led to slower processes within the project (I5: 42:00-42:20). Furthermore, since gamification was seen as skeptical by some other departments and internal stakeholders, it was hard to gain internal support (I5:24:00-24:50). During this project, top management had a mixed influence. In the beginning of the project, it was supportive and helped to convince other stakeholders to collaborate within the project. However, at the end the team lost top-management support. The interviewee mentioned that this might be because

potential users and suppliers did not value the innovation as something that would solve any concrete problem for them (I5: 32:00-35:00). Finally, Network & collaboration had a negative influence on the likelihood of an adoption. Differences in expectations between the Start-up and the manufacturing firm were mentioned as one of the main reasons, why the project was abandoned (06:00-06:30).

4.5.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
Low advantage: negatively influenced	Low compatibility: negatively influenced	Low complexity: positively influenced	High trialability: positively influenced	No impact

Table 21: Innovation Characteristics – Abandoned project 1

During this innovation project, four out of five innovation characteristics influenced the likelihood of a positive adoption decision. The fact that the innovation did not have a clear relative advantage negatively influenced the project largely and finally led to the loss of top management support (I5: 33:40-33:46; 32:00-35:00). Next to that, the fact that the innovation was not altered or adapted to the needs of the large manufacturing firm was often a reason for critique (I5: 56:00-56:45). Finally, the project had an extensive test phase, which allowed to get new insights and draw conclusions on the project.

4.5.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
Low p. usefulness: negatively influenced	High ease of use: positively influenced

Table 22: User Characteristics – Abandoned project 1

During this innovation project, both user characteristics that were found in literature had an impact on the project. Since users did not perceive the innovation as a direct solution to a problem, this factor negatively influenced the likelihood of an adoption (I5: 32:00-34:00). In contrast, the innovation was not complex, so that every user was able to use it properly, which had a positive influence.

4.5.2.e Main reason for abandonment & summary

The interviewee mentioned two main reasons for not adopting the innovation

1. No solution to a real problem and resulting of that the loss of top management support (I5: 32:00-34:00)

2. Difference in expectations between the manufacturing firm and the innovation partner (06:00-06:30)

Overall the project had been influenced both positively as well as negatively by a variety of factors, which were also found in the literature. First, environmental factors were only relevant in the beginning of the project (dynamism). Regarding organizational characteristics, several factors influenced the project negatively, however the team was able to manage a lack in human resources by convincing other people to collaborate and top-management support only turned negative after no clear benefit was proven. Lastly, discrepancies with the innovation partner were also not manageable. Other factors such as, low complexity or trialability, which influenced the likelihood of an adoption positively could not help to implement this innovation after all.

4.6 Not abandoned Project 2

4.6.1 Case Description

This project is based within the Innovation Hub of the large manufacturing firm, which has the general aim to implement and initiate partnerships with Start-ups in order to get new ideas and implement and adopt new technologies and innovations (I6: 00:00-00:40).

This specific project was started in cooperation with the two other companies. In the beginning, a public announcement was published, which called Start-ups to pitch their latest innovation in the area of cyber security. Furthermore, the Start-up with the best idea and innovation could win a pilot project in cooperation with the manufacturing company, which was worth 15.000€ (I6: 01:30-02:00).

After this Pitch day a Hungarian Start-up was selected which had the solution for a two-factor authentication. As a first step, a user of the solution would get a QR code to their mobile phone, which the user would hold in front of their laptop camera as a second step (I6: 02:00-03:30).

After the Start-up was selected, the procedure of onboarding the Start-up as an official partner began. Due to several difficulties both internal at the manufacturing firm and at the Start-up, this onboarding procedure took over two months. (I6: 03:30-04:00)

Next to this, the team found out, that a similar solution by another Start-up is already being developed at the manufacturing firm. However due to the size of the manufacturing firm it was not possible to know all innovation projects upfront before selecting the winning Start-up at the pitch day. Since the Start-up had won a pilot project together with the manufacturing firm, the team needed to change the scope. Luckily the Start-up had developed another solution, which

could identify QR codes on T-shirts. This could be used in the production area to see which respective role (e.g. technician, mechanic, electrician or others) is currently doing what kind of task at which specific location within the factory. This could then be used to predict possible problems within processes and adapt them before the problem even occurs (I6: 05:30-06:04).

After this use case was fixed, the team began to assign a project lead from the manufacturing firm to the project. Furthermore, the Start-up began to further develop and adapt their core innovation, which was the software which could identify QR codes on t-shirts and assign them to different roles and tasks.

However, various difficulties occurred. First, communication with the Start-up was difficult and often reason for timely delays. Next to that, the Start-up failed to adapt their Innovation to the quality standards of the production division of the manufacturing firm. The production division has very high-quality standards, since the processes are critical to the development of products. Every change of the processes and every implementation of an innovation or technology needs to meet these high-quality standards. The innovation of the Start-up was not ready to meet this high standard and therefore it was decided to stop the pilot project until the innovation is able to meet the quality standards of the manufacturing firm (I6: 07:00-09:10).

4.6.2 Within Case Analysis of abandoned Project 2

4.6.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	High dynamism: positively influenced	No impact	No impact

Table 23: Environmental Characteristics – Abandoned project 2

Regarding environmental factors, only dynamism was found to positively influence the likelihood of an adoption and therefore only the theoretical proposition of dynamism can be confirmed. The interviewee mentioned, that the project was initiated partly due to the rising needs of cyber security (I6: 20:30-21:00). However, it is unclear to what extent this rising need influenced later parts of the project.

4.6.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Sufficient resources: positively influenced	Sufficient resources: positively influenced	Complex structures: negatively influenced	Support: positively influenced	Collaboration: positively influenced

Table 24: Organizational Characteristics – Abandoned project 2

During this case, every theoretical proposition can be confirmed. As for human and financial resources, the interviewee mentioned that both human as well as financial capital were secured, which made it possible to do all necessary tasks during the project (I6: 25:00-25:47). Like in other cases, organizational structure was found to have a negative influence on the likelihood of an adoption. The interviewee mentioned that the process of onboarding the Start-up took a relatively long time, which slowed down the speed of the project (I6: 13:10-13:30). In contrast, the top-management was very supportive and involved in the project (I6: 26:30-26:50). Lastly, the factor Network & Collaboration was found to have a positive impact. The interviewee mentioned, that they do have plenty of external partnerships, which constantly deliver new insights and innovations (I6: 48:30-48:50).

4.6.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
No impact	Low compatibility: negatively influenced	No impact	High trialability: positively influenced	No impact

Table 25: Innovation Characteristics – Abandoned project 2

During this case, several characteristics of the innovation itself were found to impact the likelihood of an adoption. Speaking of the factor Relative Advantage, no clear impact was found. The interviewee mentioned that potentially the use case had potential, but since the Start-Up and the technology was not ready to be implemented or even tested, the relative advantage of this innovation remained unclear (I6: 07:00-09:10). As for the factor compatibility, the interviewee stated that the innovation was altered and adapted to a large extent to the needs of the manufacturing firm (I6: 32:00-32:17). However, it was not enough to meet the high-quality standards, which means there was a mismatch between the technology of the innovation and the infrastructure of the manufacturing firm (I6: 07:00-09:10). Lastly, trialability, complexity as well as observability were not found to have an impact, since the project did not reach phases, where the impact of those factors could be assessed.

4.6.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
No impact	No impact

Table 26: User Characteristics – Abandoned project 2

Similarly, to trialability, complexity and observability within the group of innovation characteristics, no User characteristics were mentioned to have an impact, since the project did not reach a point, where users or potential customers were involved.

4.6.2.e Main reason for abandonment & summary

During this project, one main reason, which led to the abandonment of the project was mentioned:

1. The innovation from the Start-up did not meet the high-quality standards of the manufacturing firm and therefore there was a discrepancy between the technology of the innovation and the technological ecosystem of the manufacturing firm (I6: 07:00-09:10)

Concluding, one can say that the project was influenced by many different factors. Many of them had a positive influence on the likelihood of an adoption. However, two factors affected the project negatively. Like the other projects, the complex organizational structure has a negative influence. More important however, the only reason why the project stopped is due to a mismatch in technology and the inability to adapt the innovation fully to the needs of the manufacturing firm (I6: 07:00-09:10). This leads to the conclusion that even if many factors strongly and positively influence the likelihood of an adoption, the project can still be abandoned due to technological mismatches or quality issues.

4.7 Not abandoned Project 3

4.7.1 Case Description

This innovation project dealt with an innovation that could be used to transform web-applications into mobile apps, so that employees could use internal web-based solutions as apps on their smartphone. (I7: 05:00-05-28).

The project was initiated within the area of procurement. Originally, this division went on a technology fair, at which the Start-up was discovered. The manufacturing firm has a variety of different web-based solutions within their procurement processes in the Intranet. In the light of digitalizing the processes, the solution of transforming these web-based solutions into mobile apps, which could be used on smartphones, seemed promising. Therefore, the manufacturing

firm was directly interested in implementing the innovation of the Startup into their ecosystem (I7: 04:00-05:00).

After this initial contact, the department of process optimization contacted the department of IT, to start the adoption and implementation process together. The role of the IT department within these types of innovation projects is to accompany the project from a technological perspective, check the technological feasibility and handle the technological implementation process. This early involvement was highly appreciated by the IT department, since the IT department is often involved relatively late into the project and has a hard time to test technological feasibility and potentially alter the innovation to the needs of the ecosystem of the manufacturing firm (I7: 16:00-17:46).

After establishing the contact to the IT department, the Start-up was invited to present their idea to the IT department again, which was also impressed and liked the idea in general. As a first small project the start-up was then assigned to transform one web-based solution, which was accessible from the internet, into an app. As this also worked out well and the technology proved to be working in general, the IT Team at the manufacturing firm started evaluating the technology of the innovation to check, whether to what extent it had to be altered or adapted to meet the needs of the firm. As it turned out, the innovation was only usable for web-solutions, which are accessible through the internet and not for web-solutions within the intranet (I7: 17:50-.20-57)

As the Start-up was not able to alter their technology in such a way that it would be able to run within the intranet of the manufacturing, the decision was made to abandon this innovation and cancel the project (I7: 17:59-19:13). Furthermore, the responsible project lead from the IT department pointed out that from a technology perspective, it would be relatively easy to place the web-solutions of the manufacturing firm into an internet environment. However due to different rules and regulations, this was not allowed. (I7: 07:00-07:29).

4.7.2 Within Case Analysis of abandoned Project 3

4.7.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	High dynamism: positively influenced	No impact	No impact

Table 27: Environmental Characteristics – Abandoned project 3

Like the 2nd abandoned innovation project, the only factor which influenced the likelihood of an adoption during this project is the factor dynamism. This factor influenced the initiation phase of the project. The interviewee stated that the rising importance of mobile devices and the resulting demand for mobile solutions for employees led to the start of this project (I7: 21:30-22:21).

4.7.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
No Impact	No Impact	Complex structures: managed negative influence	No Impact	No Impact

Table 28: Organizational Characteristics – Abandoned project 3

During this project, only organizational structures were found to have an impact on the likelihood of an adoption. This was since the project was cancelled relatively fast. As for the factor organizational structure, the interviewee argued that the manufacturing firm is generally organized in departments, where each department acts according to its specific targets. As these interests might differ between departments, which makes communication relatively hard and sometimes inefficient. However, the interviewee also stated that for this specific case, this was not an issue, and communication positively influenced the project. The IT department was contacted very early on, which made a technological evaluation directly after the start of the project feasible (I7: 26:00-27:00).

4.7.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
No impact	Low compatibility: negatively influenced	Low complexity: positively influenced	No impact	No impact

Table 29: Innovation Characteristics – Abandoned project 3

Two different innovation characteristics, which were found in the literature, that were also relevant within this innovation project. The first important factor is compatibility. During this project, compatibility was the main reason for canceling the project. According to the interviewee it was impossible to match the technology of the Start-up with the ecosystem of the manufacturing firm (I7: 07:00-07:29). Next to compatibility, complexity was found to have an impact on the likelihood of an adoption. Due to the low complexity of this innovation, both in

terms of usability and from a technological point of view, it was possible to assess the feasibility of this technology early on and relatively fast (I7: 37:00-37:24).

4.7.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
No impact	No impact

Table 30: User Characteristics – Abandoned project 4

During this project, none of the user characteristics were found to have an impact, since the project did not last long enough to involve potential users or customers.

4.7.2.e Main reason for abandonment & summary

Within this project, one main reason for abandonment was found:

1. The Mismatch between the technology of the Start-up and the high security standards of the large manufacturing firm and the resulting inability to close this mismatch (I7: 37:45-38:00)

Summarizing the case, relatively few factors influenced this innovation project in comparison to the other cases. One main reason for this is the fact that the project was abandoned relatively fast. However, it is important to notice, that the negative influence of organizational structure was managed through open communication and early involvement of the IT department. Next to that, the low complexity of the innovation had a positive effect, yet the discrepancy between the technology of the innovation and the security requirements of the manufacturing firm made it impossible to implement it after all.

4.8 Not abandoned Project 4

4.8.1 Case Description

This innovation project was initiated to offer and sell E-bikes to customers of the manufacturing firm. (I8: 00:00-00:33). Originally this project was initiated based on the strategy of the manufacturing firm to develop itself from a classical original equipment manufacturer into a provider for mobility. The project started, as employees from other brands of the manufacturing company contacted an internal investment fond of the manufacturing company, which aims to fund ideas around new business models within the firm. Another internal brand had developed an own E-bike and wanted funding to further develop it and implement it at the manufacturing firm. After employees from the innovation fund evaluated the idea together with the other brands, they all saw huge potential (I8: 00:33-02:10). After that, colleagues from the manufacturing firm, and the other brands formed a team and officially applied for funding from

the innovation fund. As the innovation fund granted an annual funding for the project, the financial aspect was secured (I8: 2:20-05:00).

The team then went on to alter the E-bike and further develop it to the demands of the manufacturing company and integrate several unique selling points for which the manufacturing company is known, into the E-bike (I8: 05:30-05:45). One aspect, for which they are known, is great technological innovations. Therefore, the team argued that customers of a E-bike would want that great technology also within their bikes. Therefore, the team developed automatic gears and built it into the E-bike. (I8: 03:30-05:30). Next to that, the products of the manufacturing company is known for great safety. Therefore, the team developed together with a Start-up an anti-blocking system (ABS) for the breaks of the E-bike. This ABS system was adapted from the ABS system of the manufacturing firm. In addition, the team integrated special lights, which were developed by another Start-up into the E-bike. These lights had special daylight, fog and night modes as well as breaking light, just as in cars of the manufacturing company (I8: 05:45-08:20).

With all that, the team was confident, that it could easily revolutionize the bike, if it would be integrated into the offers of the manufacturing firm. (I8: 08:20-09:32)

To make the E-bike affordable for customers, the team needed to make it possible that the bike would be sold in huge quantities. Therefore, the team developed a platform strategy, where other brands of the group of the manufacturing firm, would sell altered versions of the E-bike, which would all be based on a single technological platform (I8: 10:00-11:44).

To produce the bike, the team spoke to different production sides to check whether it was generally feasible to produce parts of the bike in these factories. This tests also proved, that it would be possible. (I8: 14:00-15:00). For the final assembly of parts, the team spoke to one of the biggest bicycle manufacturers of the world, which agreed to a cooperation and wanted to assemble all parts of the bike. (I8: 17:00-17:38).

Next, the team developed a strategy on how to market and sell the E-bikes. The bikes should be prominently placed into the stores of the manufacturing firm to promote micro mobility. This should attract especially younger customers, since the manufacturing firm struggled to attract young people to their car-stores (I8: 19:00-20:43).

After this first development phase, where the innovation was mainly altered and adapted to the needs of the firm, the team went on and started initiatives to get a positive adoption decision from the board of directors. To do this, the team went to different internal stakeholders to get

support for this innovation. This was done to have a broad range of support when the team would go into a board meeting to get the positive adoption decision for the innovation. (I8: 25:00-27:17).

At this point, the project turned around. Whereas the management was relatively positive during the initial phases of the project, the top management of the respective internal stakeholders, such as a production plant, or the director of the board of management became more hesitant to publicly promote an adoption of this innovation. Most of them had the impression that their company should concentrate on selling cars and not bikes. Next to that, many of them tried to avoid deciding by themselves and rather pointed into to the management board and the CEO of the manufacturing firm. (I8: 27:17-27:57).

To solve this issue a new project lead was assigned, who should gather the support of the top management and finally get a positive adoption decision. However, this decision seemed to be wrong. The new project lead chose the wrong strategy in forming alliances with the top management of other internal stakeholders, which was to criticize them and try to convince them with pressure. As this did not work, it was decided to directly present the idea to the board of management. During this meeting, the concept, strategy and innovation itself was evaluated. However, part of the innovation team had the impression, that the new project lead failed to communicate to the board in the right way and presented the innovation in the right way (I8: 28:00-32:36). Therefore, the team got the decision from the board of directors to put the project on hold and not implement the innovation.

The next important thing, which greatly influenced the project was a public scandal, which was not related to the project. During this time, a lot of top managers where changed, including many of the initial supporters of the project, as well as the CEO of the large manufacturing firm. As this happened, the team had new hopes and changed the plan of approach. It therefore went to a big retailer conference, where many of the biggest retailers and importers of the manufacturing firm where present. At this conference, the team presented the E-bike and got very positive feedback. Almost all the retailers would be whiling to sell the E-bike and had the impression that the market was very profitable (I8: 33:00-37:00)

However, as the team returned from the conference and went on to promote the feedback to the top management, the top management did not believe them or downplayed the feedback and its importance. Nevertheless, the team went on and presented the innovation and the feedback from retailers to the new CEO. However, they also got a negative decision, with the justification that

in the light of the affair, the manufacturing firm has more important tasks, than starting to sell E-bikes. (I8: 37:00-90:00).

Despite this, the team did not give up and tried to convince the top-management one last time. As a last step and final try, the team went on and presented the E-bikes on a large innovation fair to the public. As for internal presentations and presentations to the retailers, the feedback for the E-bikes were very positive and the press wrote many stories with very good critique. (I8: 39:00-44:00).

However, this feedback did not change the opinion of the top-management as well as the board of directors, which is why the innovation was not adopted after all (40:00-40:44)

4.8.2 Within Case Analysis of abandoned Project 4

4.8.2.a Environmental characteristics

Environmental Characteristics				
Positive network externalities increase the likelihood of an adoption	*High competitive pressure increases the likelihood of an adoption*	*High Dynamism increases the likelihood of an adoption*	*High Hostility increases the likelihood of an adoption*	*High market complexity increases the likelihood of an adoption*
No impact	No impact	High dynamism: positively influenced	No impact	No impact

Table 31: Environmental Characteristics – Abandoned project 4

Like all other projects, in which the innovation was abandoned, only the factor of dynamism was found to be influence the likelihood of an adoption. The trend for ecological mobility in comparison to traditional cars was one important reason to start the project (I8: 57:30-57:45). Next to that, no factor has been mentioned to have an influence on the likelihood of an adoption.

4.8.2.b Organizational characteristics

Organizational Characteristics				
Sufficient Human resources increase the likelihood of an adoption	*Sufficient financial resources increase the likelihood of an adoption*	*Organizational structure influences the likelihood of an adoption, yet it is unclear whether it affects it positively or negatively*	*Support of top-management increases the likelihood of an adoption*	*Network & Collaboration positively influences the likelihood of an adoption*
Low resources: negatively influenced	Positively influenced	Complex structures: negatively influenced	No support: negative influence	Positively influenced

Table 32: Organizational Characteristics – Abandoned project 4

During this innovation project, all the theoretical propositions, which were formulated based on the findings in the literature, can be confirmed and had an impact on the likelihood of the adoption. First, human resources negatively influenced the project. The interviewee mentioned that the project lead was not able to communicate correctly with the top-management and was not passionate enough for the project to fight against internal resistance (I8:32:00-32:36). Next to human resources, financial resources positively influenced the likelihood of an adoption within this project. Due to an annual funding from the innovation fund, the project was always

secured from a financial point of view (I8: 1:05:30-1:05:50). Regarding the factor of organizational structure, the interviewee stated that the organizational structure of the firm influenced the likelihood of an adoption to a large extent. Since E-bikes is something completely new and was not tried by the manufacturing firm before, there were no responsible departments or persons to contact. Therefore, no one felt responsible to implement such an innovation and did not want to make any decision (I8: 1:04:00-1:04:34). This is connected to the factor of top-management support. During this project, the top-management was very supportive in the beginning. However, as the project became more concrete and top-management from various departments, which should have been involved in the project argued that the board of directors needs to decide on the adoption of this innovation. The interviewee argued that this was done out of fear to not make any unpopular decisions (I8: 20:17-20:57). Lastly, the factor of network and collaboration was found to have a positive impact on the likelihood of an adoption within this project. It was stated that the team had collaborated with several different Start-ups within the project (I8: 05:45-08:20). This was done to get new external perspective and fresh input (I8: 1:11:00-1:11:45).

4.8.2.c Innovation characteristics

I2: Innovation Characteristics				
High relative advantage increases the likelihood of an adoption	*High compatibility increases the likelihood of an adoption*	*Low complexity increases the likelihood of an adoption*	*High trialability increases the likelihood of an adoption*	*High observability increases the likelihood of an adoption*
High advantage: positively influenced	High compatibility: positively influenced	Low complexity: positively influenced	High trialability: positively influenced	No impact

Table 33: Innovation Characteristics – Abandoned project 4

During this innovation project, four different innovation characteristics were found to have an impact on the likelihood of an adoption. First, the innovation had a clear relative advantage and an economic benefit, since the e-bike was superior to current market solutions (I8: 08:20-09:33), the business case was positive (I8: 20:45-21:30) and placing the bikes prominently in stores, could have attracted a broader audience and therefore increase the customer base (I8: 19:00-20:43). Next to that, the original innovation was greatly altered and adapted to the needs of of the manufacturing firm. Features were added, and the innovation was completely redesigned to fit into the brand (I8: 03:30-05:30). Furthermore, the complexity of the innovation was relatively low, since it was usable like a normal bike, which customers already know how to use (I8: 1:13:00-1:13:43). Lastly, the factor of trialability also had a positive influence on the likelihood of an adoption. The bikes were tested broadly with potential customers, which was very important during the project and secured initial support (I8: 1:14:00-1:15:45).

4.8.2.d User characteristics

I2: User Characteristics	
High perceived usefulness increases the likelihood of an adoption	*High degree of ease of use increases the likelihood of an adoption*
High p. usefulness: positively influenced	High ease of use: positively influenced

Table 34: User Characteristics – Abandoned project 4

During this innovation project, both theoretical propositions from the group of user characteristics can be confirmed. As the E-bike was objectively superior to other e-bikes in the marked, users valued the innovation as highly useful. Even after the project was stopped, the team continued to receive mails and calls from potential customers asking when the bike would be offered for sale (I8: 1:17:00-1:18:06). Next to that, as the bike was used in the exact same way as other bikes, the perceived ease of use was also very high (1:13:30-13:13:43).

4.7.2.e Main reason for abandonment & summary

Within this project, two main reasons for not implementing the project were identified, which both are interconnected:

1. The lack of responsibility in the organizational structure to implement innovations for end-customers that are not related to cars and the resulting lack of decision making (I8: 1:04:00-1:04:34)
2. Fear of the top-management to make unpopular decisions and the resulting pin-pointing to the board of the manufacturing firm for a decision (I8: 20:17-20-57)

All in all, this case was influenced by many factors and the influence of most of them were positive. The innovation had a clear relative and economic advantage, consumers valued the innovation and all innovation characteristics had a positive influence on the likelihood of an adoption. Yet the project was abandoned, and the innovation was not implemented. In this case and contrasting to all other cases, the negative influence of organizational structure of the manufacturing firm was not manageable. Combined with the fear of management to make unpopular decisions, the team lacked top management support. Therefore, and even though the innovation was very promising, and many factors influenced the likelihood of and adoption positively, the project was cancelled.

4.9 Cross Case Analysis

In this section, the findings from each individual case will be compared and assessed for cross case synthesis. This will be done first by comparing all factors influencing the different innovation projects and then comparing the main reasons for abandonment.

4.9.1 Comparison of Factors

4.9.1.a Environmental Characteristics

	Theoretical proposition	Confirmed	Rejected	No impact
Environmental Characteristics	Positive network externalities increase the likelihood of an adoption	NONE		ALL
	High competitive pressure increases the likelihood of an adoption	adopted project 3		Adopted project 1,2,4 Abandoned poject 1,2,3,4
	High Dynamism increases the likelihood of a positive adoption decision	Adopted project 1,3 Abandoned poject 1,2,3,4		Adopted project 2,4
	High Hostility increases the likelihood of a positive adoption decision	NONE		ALL
	High complexity increases the likelihood of a positive adoption decision	NONE		ALL

Table 35: Cross Case Analysis – Environmental Characteristics

The first factor of the group of environmental characteristics, which was found in the literature is network externalities. According to Frambach and Schillewaert (2002) positive network externalities increase the likelihood of an adoption of an innovation. During the case study, this effect could not be observed as not a single interviewee mentioned network externalities as an influencing factor.

Next to that a high degree of competitive pressure was found in the literature to have a positive influence on the likelihood of an adoption of an innovation (Frambach & Schillewaert, 2002). Within all cases, competitive pressure was only mentioned once and, in a project, where the innovation was used in a car. These leads to the conclusion that the factor of competitive pressure is more relevant in cases where the innovation is implemented in cars itself. However, the general proposition that competitive pressure increases the likelihood of an adoption was confirmed within this case.

The factor of dynamism was described in the literature as that a high degree of dynamism within the environment of the organization increases the likelihood of an adoption (Pichlak, 2015). During the multiple case study, the concept of dynamism was relevant both in 50% of the adopted cases and in all abandoned cases, the concept of dynamism, mainly in form of changed customer demands due to digitalization had a positive effect on the adoption of the innovation. In accordance with Bstieler (2005), this effect was mostly present during the initiation phase of the projects.

As for the factors of hostility and complexity, the literature stated that a high degree of hostility and a high degree of complexity within the environment of the organization both positively

influence the likelihood of an adoption (Pichlak, 2015). However, these factors were not mentioned once during the case studies. This leads to the conclusion that neither hostility nor complexity within the environment of the organization has an influence on the likelihood of an adoption. 4.9.1.b Organizational Characteristics

	Theoretical proposition	Proposition confirmed	Proposition rejected	No impact
Organizational Characteristics	Sufficient human resources increase the likelihood of an adoption decision	Adopted project 1,2,3,4 Abandoned poject 1,2,4		Adopted project 4 Abandoned poject 3
	Sufficient financial resources increase the likelihood of an adoption	Adopted project 1,2,3, Abandoned poject 1,2,4		Adopted project 4 Abandoned poject 3
	Organizational structure influences the likelihood of an adoption yet it is unclear whether it affects it positively or negatively	Negative Effect: ALL		NONE
	Support of top-management increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned project 1,2,4		Abandoned project 3
	Network & Collaboration positively influences the likelihood of an adoption	Abandoned project 1,2,4		Adopted project 1,2,3,4 Abandoned poject 3

Table 34: Cross Case Analysis – Organizational Characteristics

The first two organizational factors, namely financial as well as human resources, can be grouped together under the umbrella of resource-based view as proposed by (Pichlak, 2015; Barney, 1991). Pichlak (2015) argued that a high level of human as well as financial resources increase the likelihood of an adoption of an innovation. These theoretical propositions were also found at the large manufacturing firm where 3 out of 4 (adopted project 1,2,3) projects benefited from sufficient financial resources, whereas the last project did not need any financing, due to bundled competences. For abandoned project, financing was not a problem as well. 3 out of 4 projects had enough financial resources (abandoned project 1,2,4), whereas the last project was abandoned before there was a need for finance. Speaking of human resources, the findings in literature can be generally confirmed. 5 out of 8 interviewees argued that sufficient human resources influenced the likelihood of an adoption positively (adopted project 1,2,3,4; abandoned project 2). Two cases had not sufficient resources, which influenced the likelihood of an adoption negatively (abandoned project 1,4), whereas it was possible to manage the negative influence through convincing people to collaborate in the project anyway (abandoned project 1).

The influence of the factor of organizational structure was not clear based on the literature. Whereas some authors argue that smaller and less complex organizations are more likely to adopt innovations, other authors argue the exact opposite (Frambach & Schillewaert, 2002).

During the case studies, it became clear that in all cases, the factor of organizational structure had a negative influence on the likelihood of an adoption and slowed down the process in every case. However, it was possible to manage the complex organizational structure by bundling competences to decrease the need of stakeholder involvement (adopted case 4) or through freedom to try things out (adopted case 1 & 2).

According to literature the factor of managerial leadership has a positive influence. Scholars argue that support of top-management increases the likelihood of an adoption decision (Hameed & Counsell, 2012). This was also found across cases. All four adopted innovation cases had the support from the top-management either as a direct support or through the freedom within the projects to try things out (adopted cases 1 & 2). Within the abandoned cases, only one case (abandoned case 2) had top management support throughout the whole time. Abandoned case 1 lost top-management support after the innovation had not proven any direct benefit for customers. In abandoned case four the top-management was not supportive. To conclude, a clear economic benefit or a clear relative advantage might help to get top management support.

In theory the factor of network and collaboration with innovation developers or consultants has a positive influence on the likelihood of an adoption (Wisdom et al., 2013). However, this effect was not mentioned by interviewees of the adopted innovation projects. Only projects which were abandoned mentioned the importance of network and collaboration. For one project, this effect was negative, since there was an expectation discrepancy between the innovating Start-up and the large manufacturing firm (abandoned project 1). Abandoned project 2 and 4 mentioned the positive influence of networking with external innovation developers. Concluding one can say that the effect of network and collaboration is still unclear, as it had various forms and effects within the innovation projects.

4.9.1.c Innovation Characteristics

	Theoretical proposition	Proposition confirmed	Proposition rejected	No impact
Innovation Characteristics	High relative advantage increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned poject 1,4		Abandoned poject 2,3
	High compatibility increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned poject 1,2,4		Adopted project 4 Abandoned poject 3
	Low complexity increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned project 1,3,4		Abandoned project 2
	High trialability increases the likelihood of an adoption decision	Adopted project 1,2,3,4 Abandoned project 1,2,4		Abandoned project 3
	High observability increases the likelihood of an adoption	NONE		Adopted project 1,2,3,4 Abandoned poject 1,2,3,4

Table 35: Cross Case Analysis – Innovation Characteristics

For the group of innovation characteristics, diffusion of innovation theory by Rogers (2005) was used in this thesis. Within this theory, four out of five innovation characteristics had an influence on the likelihood of an adoption across cases.

According to the literature, a clear relative advantage increases the likelihood of an adoption (Rogers, 2005). This factor was very important within every adopted case. Every innovation which was adopted had a clear relative advantage. On the other hand, the lack of an relative advantage was one of the main reasons to not adopt the innovation (abandoned project 1). Yet a clear advantage is not a guarantee for an adoption. As in abandoned case four, the innovation had a clear advantage, yet it was not adopted.

Next, the factor of compatibility was found in literature to have a positive influence on the likelihood of an adoption. Rogers described compatibility as the degree to which the innovation meets the needs and values of the potential adopter (Rogers, 2005). Within the large manufacturing firm, compatibility was mostly relevant in terms of technological and user compatibility. Within every adopted case, the innovation was altered to the technological needs of the firm. Next to that, user needs, and demands were considered in every adopted case. Within the abandoned cases, mismatch between the innovation and the technological and security needs of the manufacturing firm was one of the main reason for abandoning the innovation (Abandoned project 2 & 3). Therefore, the factor of compatibility can be confirmed and marked as very relevant in the context of the large manufacturing firm.

Furthermore, the factor complexity was found in the literature to have a positive influence on the likelihood of an adoption in case the users value the innovation as easy to use and operate (Rogers, 2005). This factor was relevant for all adopted innovation cases. For adopted project 1 and 3, the effect was positive, due to low a low complexity of the innovation. However, adopted innovation project 2 and 4, had a relatively high complexity of the innovation, yet it was possible to actively reduce the complexity with the help of tutorials or handbooks.

The next relevant factor in literature is trialability. Rogers (2005) argue that the ability of users or potential customers to test the innovation upfront increases the likelihood of an adoption. This factor can also be approved within the case studies. Within all adopted cases, tests with users were done and were mentioned as important for the success of the project and was mentioned within adopted project 2 as a main reason for success. Speaking of abandoned projects, the factor of trialability was relevant within abandoned project 1 and 4. Here the effect was also positive. Within project 2 and 3, the project was cancelled before the innovation was tested.

Lastly, the factor of observability was described by Rogers (2005) as the degree to which the output of the innovation is observable by other members of the organization. He argues, that a high degree of observability positively increases the likelihood of an adoption (Rogers, 2005). This factor was not mentioned as important by any interviewee. Therefore, this factor is not relevant within the context of the large manufacturing firm. Additionally, Rogers (2005) argued that for innovations, where the software part of the innovation is relatively large, the output of the innovation is hard to observe and therefore the effect of observability for those innovations is negative. Yet this could not be observed at the large manufacturing firm. The innovation of adopted project 1, 2 and 4 as well as for abandoned project 1,2 and 3 were mainly based on software. Here no negative influence due to a low degree of observability could be recognized.

4.9.1.d User Characteristics

	Theoretical proposition	Proposition confirmed	Proposition rejected	No impact
User Characteristics	High perceived usefulness increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned poject 1,4		Abandoned poject 2,3
	High degree of ease of use increases the likelihood of an adoption	Adopted project 1,2,3,4 Abandoned poject 1,4		Abandoned poject 2,3

Table 36: Cross Case Analysis – User Characteristics

The group of user characteristics based on the technology model of Davis (1989). This model consists of two components, namely perceived usefulness and perceived ease of use.

Perceived usefulness was described as the degree to which potential users perceive the innovation as an advantage (Davis, 1989). This factor was also found to be relevant across cases. Within all adopted cases, the perceived usefulness was high and had a positive influence on the adoption of the innovation. Within the abandoned innovation projects, project 1 and 4 had a positive influence of perceived usefulness, whereas the abandoned project 2 and 3 where cancelled before users or customers had contact to the innovation.

Perceived ease of use was found in literature to have a positive influence on the adoption of an innovation (Davis, 1989). This can be confirmed in the case studies. Similarly, to the factor of complexity, adopted project 1 and 3, the effect was positive due to the relative ease of use. However, adopted innovation project 2 and 4 were perceived as harder to use, however it was possible to make the use easier for instance through handbooks or tutorials. For abandoned projects, the effect was either positive (abandoned project 1 and 4) or there was no effect at all, since the project was cancelled before users had contact to the innovation (abandoned project 2 and 3). Therefore, the theoretical factor and direction can be confirmed for the large manufacturing firm, yet a high perceived ease of use does not guarantee the adoption.

4.9.2 Main reasons for adoption

Within the four cases of adopted innovation project a total of eight main reasons for adoption were mentioned. A main reason for adoption, which was mentioned in three out of four cases and therefore was crucial for nearly all the adopted project is the clear and concrete relative advantage in comparison to the current situation (adopted project 1, 2 and 3). This factor is also represented by literature and described by Rogers (2005).

Next to that two out of the four projects (adopted project 2 and 4) mentioned that the right environment, including the freedom to try things out and connected to that support of the top-management, which allowed for this freedom, was one of the main reasons of adoption. This can be also linked as a countermeasure to the complex organizational structures, which had a negative influence on all cases.

In addition to the major success factors, which were mentioned by several cases involvement of user needs was mentioned once as a major factor of success (adopted project 2). Next, a having a working prototype was mentioned as one of the main reasons for success, as it could prove the benefit of the innovation (adopted project 1). Finally, bundling of competences to reduce stakeholder involvement and allow for an efficient project was also mentioned once as a major factor of success (adopted project 4). Again, this can be also interpreted as a countermeasure for the complex organizational structures at the large manufacturing firm.

4.9.3 Main reasons for abandonment

Speaking of the main reasons for abandoning an innovation and stop the project, a total of six main reasons were found across the cases. The first reason, which was mentioned by two abandoned projects as one of the main reasons for failure is the mismatch between the technology of the Innovation on the one hand and the demands and the ecosystem of the manufacturing firm on the other hand (abandoned project 2 and 3). This factor was also found in the literature under the frame of compatibility (Rogers, 2005).

Next to that several main reasons for abandoning a project were mentioned, however none of these reasons were mentioned several times across cases. First, no solution to a real problem was mentioned once (abandoned project 1), which links to the factor of relative advantage, one of the most important factors within adopted projects. Additionally, difference in expectations (abandoned project 1) or organizational structures and resulting of that fear of decision making (abandoned project 4) were mentioned main reasons for abandoning a project.

4.9.4 Significance of factors

To assess the impact and importance of the different factors, it is also important to assess whether the same effect from factors occurred between adopted and abandoned cases. So far, it was confirmed by interviewees that 13 out of 17 factors are relevant. However, the same effect of factors occurred both in adopted as well as in abandoned project. One example is high trialability of the innovation. All four adopted innovation projects had a high trialability of its innovation and interviewees mentioned that a high trialability of its innovation positively influenced the adoption. However, also three abandoned innovation projects (abandoned project 1,2 and 4) reported a high trialability of its innovation and mentioned that this affected its project positively. Yet the projects were cancelled. Therefore, the impact on the likelihood of an adoption as a standalone factor must be questioned. The following table depicts the cases, where the exact effect of the theoretical proposition was found.

Theoretical Propositions	High competitive pressure increases the likelihood of an adoption	High competitive pressure found in adopted project 3
	High Dynamism increases the likelihood of a positive adoption decision	High dynamism found both in adopted project 1, 3 and abandoned project 1, 2, 3, 4
	Sufficient human resources increase the likelihood of an adoption decision	Sufficient human resources found both in adopted project 1 , 2, 3, 4 and abandoned project 1, 2,
	Sufficient financial resources increase the likelihood of an adoption	Sufficient financial resources found both in adopted project 1 , 2, 3 and abandoned project 2, 4
	Organizational structure influences the likelihood of an adoption yet it is unclear whether it affects it positively or negatively	Negative effect of organizational structure found both in adopted project 1 , 2, 3, 4 and abandoned project 1, 2, 3, 4
	Support of top-management increases the likelihood of an adoption	Support of top-management found both in adopted project 1, 2, 3, 4 and abandoned cases 2,
	Network & Collaboration positively influences the likelihood of an adoption	Network & Collaboration foun in abandoned cases 2, 4
	High relative advantage increases the likelihood of an adoption	High relative advantage found both in adopted project 1, 2, 3, 4 and abandoned project 4
	High compatibility increases the likelihood of an adoption	High compatibility increases found both in adopted project 1, 2, 3, 4and abandoned project 4
	Low complexity increases the likelihood of an adoption	Low complexity increases found both in adopted project 1, 2, 3 and abandoned projects 1 , 3, 4
	High trialability increases the likelihood of an adoption decision	High trialability increases found both in adopted project 1, 2 , 3, 4and abandoned project 1, 2, 4
	High perceived usefulness increases the likelihood of an adoption	High perceived usefulness found both in adopted project 1, 2 , 3, 4 and abandoned cases 4
	High degree of ease of use increases the likelihood of an adoption	High degree of found both ea adopted project 1, 2 , 3, 4 and abandoned project 1, 4

Table 36: Significance of Factors

The table shows that in out of 13 relevant factors at the large manufacturing firm, 11 factors were found in both adopted as well as abandoned projects with the same effect. Competitive pressure was only found to be relevant within one adopted case, which lowers the overall importance of this factor. Furthermore, the factor of network and collaboration was found to have a positive effect only in abandoned projects. No adopted projects mentioned the positive influence of network and collaboration on the likelihood of an adoption.

5. Discussion

5.1 Discussion on conceptual model and analysis

Generally speaking, most of the theories, which were found during the literature study were confirmed during the case studies. Interviewees identified 13 out of 17 theoretical propositions, which were derived from theory as relevant in their context. Coming back to the initial conceptual model, the following adapted model examines the characteristics, which were mentioned as relevant during the case studies:

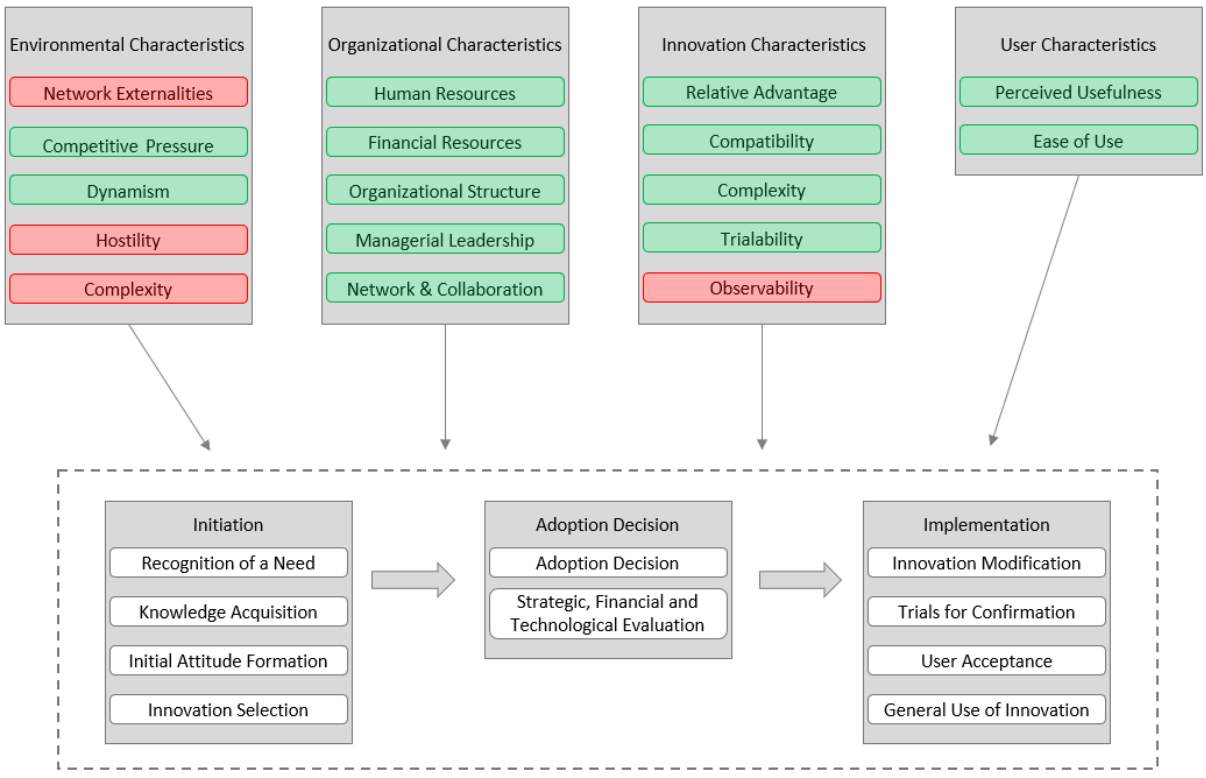

Figure 5: Adapted Conceptual model; following Pichlak (2005; p. 479)

Overall, one can say that environmental characteristics were not as important during the case studies compared to other groups of characteristics. Competitive pressure was only mentioned within one interview (adopted project 3) and therefore the strength of this characteristic must be questioned. Next to that, the characteristic of dynamism was only mentioned as a reason to

start projects. Later, towards the adoption decision, this factor was not mentioned as important. Therefore, the importance of this characteristic regarding its influence on the likelihood of an adoption must be questioned as well. Therefore, one can conclude, that environmental characteristics are relatively unimportant in the likelihood of an adoption decision within the large manufacturing firm. Another interesting finding is that the factor of network and collaboration was confirmed, however only abandoned project confirmed the positive influence of network and collaboration. Therefore, the importance of this factor also must be questioned.

Next on, the positive influence of each single factor on the likelihood of an adoption needs to be questioned. As described in chapter 4.9.3 a positive effect of nearly all factors was observed both in adopted and abandoned cases (see table 36). Therefore, the influence of each individual factor must be questioned. It can be concluded that the influence of no individual factor is large enough to guarantee the adoption of an innovation. One example is the factor of relative advantage. This factor was observed in all adopted cases and interviewees mentioned that this factor is a main reason for success. However, also abandoned project 4 had a clear relative advantage, yet it was still abandoned. This leads to the conclusion, that the positive influence of one or even a group of factors alone is not sufficient enough to guarantee the adoption of an innovation. As it could be observed, the absence of a single factor might be reason enough to abandon a project. An example is the factor of compatibility. Abandoned project 2 and 3 mentioned that a mismatch between the technology of the innovation and the ecosystem of the manufacturing firm did not match. This proves the point that a high compatibility (e.g. abandoned project 4) is not sufficient alone to guarantee the adoption of an innovation. In reverse, the absence of compatibility alone is strong enough to abandon a project, even if other factors influence the likelihood of an adoption positively. This leads to the conclusion that 13 out of 17 theoretical propositions and therefore factors can be confirmed, yet the positive influence of each individual factor is limited and the absence or negative effect of a single or more factors can lead to abandonment of a project. Therefore, it is more sufficient to conclude that the presence of factors might be a necessity to adopt the innovation rather than to state that the presence of a factor influences the likelihood of an adoption positively. As seen during the cases, the necessity of certain factors might vary between innovation projects. To handle this, practical recommendations will be given in chapter 5.3.

5.3 Practices to increase the likelihood of an adoption of a technological Innovation

In order to answer the main research question, '*How can large manufacturing companies increase the likelihood of an adoption of a technological innovation?',* a literature study was conducted in order to gain theoretical insights on the adoption of technological innovations.

During this literature study four groups of factors, namely environmental-, organizational-, innovation as well as user characteristics, with a total amount of 17 factors were found to influence the likelihood of an adoption. Out of these factors, only 4 factors (network externalities, hostility, environmental complexity, observability) were found to have no influence on factors at the manufacturing firm. The other factors, which were found in literature, can be confirmed. Next to that the main reasons for adoption or abandonment of an innovation were assessed within the case studies.

To properly answer the main research question, the last sub-question of "*Which practices can be used by large manufacturing companies to increase the likelihood of an adoption of a technological innovation?*" will be answered in the following discussion part. The recommendations for the manufacturing company to employ concrete practices were given based on the theoretical groups of factors from the literature, the analysis of factors at the manufacturing firm and the main reasons for adoption or abandonment of an innovation.

The practices, which could be used to increase the likelihood of an adoption can be grouped into five main groups, namely (1) project focus, (2) structure and team, (3) technology, (4) user and (5) analysis.

The category of (1) project focus centers around the factor of relative advantage, which was both described in literature by Rogers (2005) as well as one of the main reasons for success at three out of four innovation projects. Furthermore, having a clear relative advantage can also secure top management support (adopted project 2). Vice versa, not having a clear relative advantage could lead to the loss of top-management support (abandoned project 2), which in turn can lead to the abandonment of the project. To increase the likelihood of an adoption, the large manufacturing company is advice to lay a strong focus on the relative advantage of the innovation. This could be done for instance through business case calculations early in the project. Next to that the development of prototypes can help to prove the relative advantage of the innovation, as seen in adopted project 1, where having a working prototype was one of the main reasons for adoption.

The group of (2) structure and team is centered around the factor of organizational structure from the literature. Whereas in the literature there were contrasting opinions to whether a large and complex organizational structure has a positive or negative influence on the likelihood of an adoption (Damanpour & Schneider, 2006; Pichlak, 2015: Frambach & Schillewaert, 2002). Yet the factor of organizational structure had a clear negative influence on the likelihood of an adoption at the manufacturing firm. Within all eight projects, the structure of the firm influenced

the likelihood of an adoption negatively. In order to manage these influences, the manufacturing firm is advised to form small interdisciplinary project teams with bundled competences for their innovation projects. With this, the need for stakeholder involvement with additional skills is reduced and innovation project can run more smoothly. This bundled competences and little need for stakeholder involvement was mentioned by adopted project 4 as a main reason for success. Next to that the manufacturing firm is advised to allow these teams freedom to try things out and make many decisions on their own as this was mentioned by adopted project 2 and 4 as main reasons for success. With this, the negative influence of complex organizational structure might be lowered.

The group of (3) technology centers around the theoretical factor of compatibility. According to Rogers (2005) a high compatibility between the innovation and the needs of the adopter increases the likelihood of an innovation. To maximize this effect, the manufacturing firm is advised to assess the technological feasibility of the innovation as soon as possible. The mismatch between those was a main reason for abandonment within two out of four abandoned projects (abandoned project 2 and 3). To do so, early involvement of technical departments, which are responsible for those technological assessment, as seen in abandoned project 3, is advised.

Next, the group of practices of (4) user is based on the technology acceptance model by Davis (1989) as well as the factor of trialability and complexity, which is in literature by Rogers (2005). These two factors proved to be relevant for the manufacturing firm as well. In every adopted project, user tests were important and had a positive influence on the likelihood of an adoption. Within adopted case two, the constant and close user involvement was mentioned as a key factor of success. As the technology acceptance model involves the factor of perceived usefulness, the advice to closely involve user also benefits the advice to focus on a clear relative advantage. Next to that, perceived ease of use and the factor of complexity depict that a low complexity and a high perceived ease of use positively influences the (Davis, 1989; Rogers, 2005). As seen at the manufacturing firm, the negative effect of high complexity or low perceived ease of use can be actively decreased by using handbooks or tutorials (adopted project 2 and 4). Therefore, the manufacturing firm is advised to employ those measures in all mercenary cases.

The group of (5) analysis build on the conclusion that the positive effect of factors alone is not sufficient to guarantee the adoption of innovation. As discussed in chapter 4.9.3 and chapter 5.1 the absence or negative factor of a single factor might lead to the abandonment of an innovation,

which makes having certain factors a necessity for the project. To analyze, which important factors might have a negative influence on the project, the following scoring model for innovation projects was developed:

Factor	Answer		How large is the influence of this factor to the success of the project?		
	Yes	No	Small	Medium	Large
Does your project have sufficient human resources?					
Does your project have sufficient financial resources					
Do you operate wihtin a simple organizational structure?					
Do you collaborate with external innovation developers or consultants during the project?					
Does the top management support your project?					
Does your project have a clear relative advantage?					
Is the innovation compatible with the technological and cultural ecosystem of your organization?					
Would you describe the innovation as complex to use or operate?					
Is it possible to conduct test phases with users prior to adopting the innovation?					
Do potential users value the innovation as usefull?					
Do potential users value the innovation as easy to use?					

Table 37: Scoring Model

This scoring model can be used my project leaders of innovation projects at the large manufacturing firm. First, every question, which is linked to one relevant factor, which were identified during the case studies. An exemption are the factors from the group of environmental factors, as these factors were mentioned to be relevant to initiate a project and had no influence on the adoption itself.

First, the project lead needs to fill out the scoring model and assess the importance of each factor to the success of the project, which means the successful adoption of an innovation. As discussed above, the positive influence of factors alone is not sufficient to guarantee the adoption. Therefore, after filling out the scoring model, the project lead is advised to closely assess the factors, where no positive effect can be observed (questions, which were answered with “No”). Next on the project lead can pick out the factors, which have no positive or a negative impact right now and where the influence of the factor to the success of the project is marked as high. These factors critically endanger the adoption of the project and should be managed to increase the likelihood of an adoption. In case one or several factors, which have no positive or negative effect and cannot be managed, the manufacturing firm is advised to rethink and assess the worthiness to continue with this project. Furthermore, project leaders are advised to fill out the scoring model regularly in order to allow for effective trouble shooting and to minimize the amount of resources invested into the project in case the project is not worthy to be continued.

6. Conclusion

In Summary, this thesis tackled the main research question of '*How can large manufacturing companies increase the likelihood of an adoption of a technological innovation?'*. To answer this main research question, three main sub-questions were answered.

First, a literature review was conducted to answer the first sub-question of "Which theoretical criteria influence the adoption of a technological innovation?" During this literature review, four main categories of factors were identified, which, according to theory, influence the likelihood of an adoption decision. These four groups of factors can be called (1) environmental characteristics, (2) organizational characteristics, (3) innovation characteristics and (4) user characteristics. Based on the factors within the factors within the groups, a total of 17 theoretical propositions were formulated. These propositions depict the influence of a factor on the likelihood of an adoption.

To assess the relevance of the factors in practice, eight semi structured interviews were conducted. Four interviews were conducted at innovation projects, which are already adopted, and four interviews were conducted at innovation projects, which were abandoned. Within these interviews, the interviewees were asked to validate the theoretical factors and furthermore assess the main reasons for adoption or abandonment of the project. These interviews were then summarized and analyzed in eight cases to answer the second sub-question of "What are the differences between adopted and not adopted innovation projects at large manufacturing companies?". Resulting, 13 out of the 17 theoretical propositions were found to be relevant at the large manufacturing firm. Next to that several main reasons for adoption, such as a clear relative advantage (adopted project 1,2 and 3) or the freedom and support of top-management to try things out (adopted project 2 and 4). However also a variety of reasons for abandon a project such as a mismatch between technologies (abandoned project 2 and 3) or the lack of a clear relative advantage (abandoned project 1) were found. Next to that a very important finding questions the influence of each individual factor on the likelihood of an adoption. Most of the factors were found to have a positive influence on the likelihood of an adoption both in adopted cases as well as in abandoned cases. In abandoned cases, the absence or negative effect of one or more factors led to the abandonment of a project, despite the presence of other factors, which positively influenced the likelihood of an adoption. Therefore, it can be concluded that specific to a certain innovation project the presence of certain factors becomes a necessity to the success of the project. In turn, the positive effect of other factors influencing the likelihood

of an adoption are less relevant in case the needed factors are absent or do influence the project negatively.

Bases on the theoretical factors from the literature as well as the analysis of cases, the thirst sub-question of "Which practices can be used by large manufacturing companies to increase the likelihood of an adoption of a technological innovation?". Within this part, the practices and advices were clustered into four major groups, namely (1) project focus, (2) structure and team, (3) technology, (4) user and (5) analysis.

To conclude, these five groups of practices and advices, large manufacturing firms can increase the likelihood of an adoption of technological innovations with the awareness that the likelihood of an adoption is influenced by a variety of different factors, as seen in this thesis, and by employing a set of practices and advices to increase the positive influence of some factors while decreasing the negative effect of others.

6.1 Limitations & Further Research

Even though this thesis added value both in theoretical as well as practical ways, this study also has its limitations.

First of all, the qualitative nature of this study did not allow for a concrete assessment of the extent to which the different factors influence the likelihood of an adoption. Whereas interviewees stated that some factors are very important, or the impact of some factors are larger in comparison to others, the assessment is subjective and not measurable. Quantitative research, which aims to assess the exact relationship between the factors found in the literature and the influence on the likelihood of an adoption.

Additionally, external validity or generalizability of the conclusions from the case studies at the large manufacturing firm is very limited. This is a general drawback of the case study method (Noor, 2008) It is important to state that all finding can only be confirmed within the cases and generalizability is not given. The factors identified cannot be transferred to other industries or companies. Findings within this case study are only relevant within its specific context. There is a vast body of literature on the adoption of innovation in other industries yet comparing these findings to findings in other industries does not fit into the scope of this thesis. Future research in other companies or industries needs to be done to compare the findings of this thesis with other industries and companies.

Next to that, only one person per case was interviewed. As described by Baxter and Jack (2008), using a variety of data sources and perspectives can lead to better insights. Therefore, future

research should use additional data sources, such as reports or meeting protocols and additional interviewees within each case to get an even fuller picture of the situation.

Finally, the case study method can possibly face the bias of specifically searching for and interpreting results, which prove the theoretical propositions or expected outcome. This effect is especially relevant for relatively inexperienced researchers (Guba & Lincoln, 1981). Additional research should be done with multiple researchers both during the interviews and during the analysis part, to limit this bias.

Further research should also investigate the findings that the presence and positive effect of factors alone does not influence the likelihood of an adoption to such a large extent that it guarantees the adoption of an innovation. The findings, that the absence or negative effect of a single or more factors can lead to the abandonment of a project, even if several other factors strongly influence the likelihood of an adoption should be further assessed and tested in future research, as the findings of this study cannot be generalized.

Next to that it is also interesting to further develop and test the scoring model. Firstly, the scoring model needs to be tested within real innovation projects to assess whether it is generating any insights or benefits and whether more or different factors should be added. Next to that, quantitative research could examine whether there is a specific point (for instance number of highly relevant factors with a negative effect) at which a project becomes not worthy to be continued. This could lead huge benefits for practitioners as the scoring model could become a general tool to evaluate innovation project in terms of their likelihood of an adoption.

6.1.1 Critical Assessment of Interview guideline

Next to general limitations and recommendations for future research, the interview guideline itself can be seen as a limitation. Generally speaking, the interview guideline served as a good tool to assess the different theoretical propositions. Especially the opening and closing segment proved to be well designed during the study. During the opening segment, the questions served as a good tool to initially break the ice and guide the interviewee to tell a story about the respective innovation project. However, it has to be noted that the interviewees were very open and did not need many questions. This might be different in other settings with other interviewees. During the middle segment, where the different theoretical propositions were assessed, the interviewees had sometimes trouble to understand the question. Next to that it became clear after the interviews that some questions needed to be formulated in a more specific or in a different way to allow for more in depth insight.

As for questions regarding environmental characteristics, the first (proposition 1,2) and third question (proposition 4) should be redesigned in following studies. Asking for network externalities and competitive pressure within one question needed a follow-up questions in nearly every interview, since the interview either focused on competitors or on partners using similar innovations. This spontaneous follow-up question, which was not intended originally could have been avoided in case the interview guideline includes two separate questions on network externalities as well as competitive pressure. The question regarding proposition 4 should also be explained in a different way. Interviewees had problems to understand the concept of market complexity and needed more explanations. However, this could also be linked to the fact that no interviewee has observed this characteristic or had previously thought about this concept.

As for questions regarding organizational characteristics, questions regarding proposition eight and ten should be redefined in further studies. The question regarding organizational structure (proposition eight) was too broad and could have led to various interpretations or relevant findings. Yet all interviewees identified organizational size and organizational complexity as relevant within the concept of organizational structure, which was also intended originally. This strengthens the findings; however, the question should have been designed specifically to identify these concepts. The same issue accounts for the question regarding proposition ten, as it is too broad to just ask for collaborations or partnerships. In future studies, this question should be specifically designed to explore collaborations with innovation developers or consultants.

Finally, also some questions regarding innovation characteristics should be redesigned in future studies. The question regarding proposition 13 needs more explanation, since interviewees did not get the concept of complexity right away. This question should include a specification that complexity can be seen as complexity to use or operate the innovation. This was often mistaken with technological complexity. Furthermore, the question regarding proposition 15 needed further explanation, as users did not always understand the concept of observability.

All in all, the interview guideline served as a good tool to gather needed information and data, which allowed for a profound analysis. Yet some questions need to be redesigned in further studies in order to gain more specific and in-depth insights into some concepts.

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