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Wien, 14. August 2017

Daniel Shatkin

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Abstract

The implementation and use of organizational innovations is seen as one of the key success factors for enterprises, nowadays. Regardless its importance, which most researchers of this field agree on, only little is known about this topic. This thesis wants to contribute to the knowledge about organizational innovation. An own definition for the most important characteristics of organizational innovations has been formulated. This thesis features a list of a number of organizational innovations, which are parted in the three categories processes, management methods and organizational structures, which have been identified during the research. As one of the biggest blank spots in the literature, the diffusion of organizational innovations has been identified. In order to learn if a pattern in the diffusion process of organizational innovation exists, five case studies have been built. The bulk of the data for these case studies originate from two surveys, which have been carried out in the course of this research. As participants Austria's 500 most successful companies, as well as Austria's members of the AEC industry have been chosen. The research revealed, that in four out of five cases a logistic function was the right approach for the creation of a saturation model for the diffusion processes. The fifth diffusion process followed the model of exponential growth, which can be explained by the fact that the process finds itself in a very early stage of the overall diffusion process. This results in the learning that diffusion processes of organizational innovations are following the same pattern as the diffusion processes of product innovations, which are more present in the existing literature.

Kurzfassung

Die Implementierung und die dazugehörige Verwendung organisationaler Innovation wird heutzutage als einer der wichtigsten Erfolgsfaktoren für den Aufschwung von Unternehmen angesehen. Trotz ihrer Wichtigkeit, der sich die meisten Forscher in diesem Forschungsfeld einig sind, ist vergleichsweise wenig zu dieses Thema bekannt. Diese Masterarbeit möchte zu dem Wissensstand bezüglich organisationaler Innovationen beitragen. Eine eigene Definition für die wichtigsten Merkmale organisationaler Innovationen wurde im Rahmen dieser Arbeit formuliert. Teil dieser Arbeit ist eine Liste einer Anzahl von organisationalen Innovationen, die in die Kategorien Prozesse, Management-Methoden und organisationale Strukturen geteilt wurden, welche im Rahmen der Recherche identifiziert wurden. Als eine der größten Lücken in der Literatur wurde die Diffusion organisationaler Innovationen identifiziert. Um herauszufinden ob der Diffusionprozess organisationaler Innovationen einem bestimmten Schema folgt wurden fünf Fallstudien erstellet. Der Großteil der Daten der Fallstudien resultierte aus zwei Umfragen, welche im Rahmen der Forschungsarbeit durchgeführt wurden. Zur Teilnahme eingeladen wurden sowohl die 500 erfolgreichsten Unternehmen Österreichs, als auch alle Planungsbüros Österreichs. Die Forschung ergab, dass in vier von fünf Fallstudien die logistische Funktion als Sättigungsmodell für die Modellierung des Diffusionprozesses verwendet werden konnte. Der Diffusionsprozess der fünften Fallstudie folgte einem exponentiellem Wachstum. Dies kann dadurch erklärt werden, dass sich momentan der Diffusionsprozess in einem früheren Stadium befindet als jene der anderen. Dies resultiert in der Erkentniss, dass Diffusionsprozesse organisationaler Innovationen dem selben Schema wie Diffusionprozesse von Produktinnovationen folgt, welche in der Literatur wesentlich zahlreicher vertreten sind.

Contents

CHAPTER 1

Introduction

The first chapter of this thesis is written in order to provide an overview and an outlook for the reader of this work. At first the core topic of the thesis is going to be teased, afterwards the motivation for researching in this field is going to be explained. Also the formal foundation of this thesis, the research question is going to be presented.

Due to the development of technology, the way the majority is communicating at work is changing over the years and decades. For instance, business meetings with participants that are localized in three different countries, at the same time, wouldn't be possible without innovative ideas from the Information Technology (IT) industry. At the same time, the industry and the lifestyle of many employees forces companies to implement new work time models. Throughout the history organizational structures in enterprises changed in order to encourage efficiency and self governance. These three short examples show us that the tools and the routines in organizations have to be adapted in order to stay effective.

In order to survive on the competitive market it is important to implement the right innovations at the right time. While some innovations are very successful, other innovations don't get adopted at all. Each adoption is a big chance to improve the business processes and a risk to lose a lot of money, without any benefit, at the same time. This results in the insight, that for modern companies it is very important to know a lot about organizational innovation. Researchers agree, that the concept of adoption of organizational innovation is very important for the competitiveness of enterprises [2]. Nevertheless, only a very little amount of research has been done regarding this topic. In contrast a lot is known about innovation itself. It is almost a buzzword, that is often featured in different types of media. Most often the term is linked to the research and development of new products [2]. Therefore a lot is known about product innovations.

This thesis deals with the distribution and the adoption of organizational innovation over time, the so-called diffusion of organizational innovation. While a lot is known about

the diffusion of product innovations, until now no study was published with the goal to explore the nature of the diffusion of of organizational innovation. Research revealed, that for most product innovations the same pattern for its diffusion process exists, which will be explained in detail in the next chapter. The writer of this thesis wants to find out if the diffusion of organizational innovation also follows a significant pattern. If yes, the pattern has to be identified and it's interesting to find out if both diffusion patterns are alike.

1.1 Literature review

This section presents a sample of literature that was found after an intensive literature research. In order to be mentioned in this chapter, the observed literature had to deal with the adoption of innovation, the diffusion of innovation or with the relationship between the characteristics of organizations and its ability to implement innovations. This chapter should point out which aspects and research fields already are represented in the literature in order to clarify the interest and importance of answering the research question of this thesis.

There is a big number of papers that target to find and to analyze patterns of organizational innovation. The data that is used in several studies differ regarding their sample size. Also the methodologies that are used vary. The most common used methods that have been found are the meta-analysis and the case study.

There is a wide array of literature concerning the diffusion of innovation. [61] features an analysis of 20 years of literature concerning innovation diffusion from 1990 to 2009. Ying and Mengqing also forecast that the research in this academic field will increase in another, more specialized case driven, form. In [53] Sangmoon explored the diffusion of the internet between 1994 and 2007. Gurbaxani conducts a diffusion study concerning the diffusion of the access points of a network provider in [41]. The relevance of the diffusion of this particular innovation is not very high for this thesis, but Gurbaxani proposed that the diffusion curve of technological innovations follows a logistic growth function, which is very interesting for comparable research of diffusion in the future [41]. Sangmoon conducted a study [53] in which he examined the diffusion of the internet. He followed Gurbaxani's theory that the logistic growth function models the growth of diffusions, which was confirmed by his study. In addition he also studied the adoption level per nationality, which revealed that white people are the biggest group of internet users and hispanic people are the smallest group.

The authors of [25], [42] and of [20] use a very big sample of organizational innovations. This approach leads to very generalized assumptions. The authors in [25] and [42] perform a meta analysis in order to accumulate several findings of different studies. Both paper aim to find determinants that have an impact on the diffusion process of organizational innovation. In [25] Damanpour uses a very broad definition of organizational innovation which helped him to generate a big sample for his study. In the paper he performs a literature research in order to find the 13 most important key determinants of the

organizational innovation adoption process. At first the researcher provides his expectation based on literature research on how each determinant correlates with the ability of a company to drive organizational innovation. The hypothesises later got tested with the results of the out carried analysis. In general, the results of this meta-analysis suggest that the relations between the determinants and innovation are stable, although previous surveys claimed their instability. Another finding was that the type of organization which is examined, is a more important determinant than the type of innovation or the stage of adoption. In [42] the researchers perform a meta-analysis of ten organizational factors in order to determine their relative impact on the adoption of IT innovations. They reviewed 92 published empirical studies on the adoption of IT innovations that examine specifically the organizational context.

Two other paper also follow the approach of using big samples. Damanpour and Mumtaz summarized and accumulated the findings of historic studies, the authors of [20] and [63] used questionnaires to gather the data from several companies. The focus of their work relies on the search for patterns in the diffusion process of organizational innovation. In [20] also a very big sample for their study was used to find patterns in the diffusion process of organizational innovations. Specifically they aimed to examine the relationship between four types of organizational capabilities and radical innovation performance. As data for their research, they used constructed questionnaire and sent invitations to the top 500 Taiwanese manufacturing firms to participate in the survey. A priori they formed four hypotheses that basically say that organizational openness capability, organizational integration capability, organizational autonomy capability and organizational experimentation capability are positively correlated to radical innovation performance. In [63] the researcher examines the incidence and intensity of organizational innovation and the factors associated with investments in organizational innovation at manufacturing and non-manufacturing businesses in the United States of America (USA) during the 1990's. She tries to find the factors that are crucial to answer the question, why some firms decide to invest in organizational innovations and some others decide not to do so. The data used in this paper comes from questionnaires that were part of a survey performed by the *Educational Quality of the Workforce National Employers Survey*. The paper provides evidence that there is a positive correlation between the adoption of organizational innovations and factors like skilled workforce, high profits, significant past investments in information technology, non-unionized business and a young age of the company. The results verify all of the hypotheses that have been stated before.

The authors of the next two papers used a very small sample for gathering their findings. For the data collection they followed the approach of case studies. [54] analyzes how big firms implement organizational innovations. The data based on case studies that portray how a couple of German firms implemented a mass customizing strategy. It aims to answer questions like, how much external knowledge firms need, in order to implement this strategy and whether social, organizational or spatial proximity between the actors in the innovation process is relevant for the knowledge exchange. The writer of [35]

analyzes how the pattern of use of the two organizational innovations *Qualitiy Circles* and *Business Process Reengineering* evolved during the 1990's in the UK. In particular, this paper aims to explore how changes in the use of an organizational innovation across time are related to changes in the characteristics of innovations, like for example the content or the functionality of it.

Another two papers deal with the building and gathering of theory regarding organizational innovation. They help the reader to learn more about the nature and importance of organizational innovation, but belong to another category, because they are no empirical studies that try to find a pattern in the diffusion of organizational innovation. [15] focuses on the effect, organizational innovation has on the generation of technological products and process innovation capabilities. In its second part the researchers also analyze the impact of organizational innovation and technological innovation capabilities on the performance of firms. The researchers used empirical data of 144 Spanish companies. In the conclusion the authors of the paper summarize that organizational innovation has direct effect on the development of process innovation capabilities. Finally, the authors also discuss the increase of product innovation capabilities of companies. The authors of [34] performed a very broad literature review in order to gather as much information about the adoption process of organizational innovation as possible. In the beginning the authors summarize and discuss their findings regarding the categories of adoption, innovation characteristics, adopter characteristics, risk, environmental influences, social networks, network externalities and competitive pressure. After building and defining a strong theoretical foundation the authors proposed two graphical frameworks in order to increase the understanding of the complex process of organizational innovation adoption. The first framework targets to plot the process of organizational innovation adoption. It points out that that after the company decides to implement the organizational innovation and continues to use it the next critical factor is the individual acceptance of the workforce of the organization. Therefore they additionally create a framework that aims to sketch the process of individual innovation acceptance in organizations.

1.2 Motivation and Research Question

The author of this thesis aims to find out how the diffusion process of organizational innovation behaves and how it can be modeled. As the last section pointed out, the existing literature solely reported about the adoption of organizational innovation, but this thesis treats the diffusion of organizational innovation. In order to answer this question a number of case studies have been built, analyzed and compared. The growth function of the examined cases have been analyzed, a within-case and a cross-case analysis as proposed by Eisenhardt in [31] has been performed. The most comparable paper to this thesis is [35] by Freitas. She also used a very small sample of organizational innovations in the form of case studies.

This thought results in the following research question for this thesis: *Which pattern does the diffusion of organizational innovation follow?* A priori, the hypothesis exists, that

the diffusion of organizational innovation follows the same pattern as the diffusion of product innovation. In order to answer the research question of this thesis, case studies are going to be built and analyzed. The observed data will originate from literature and from two surveys that will be carried out. The surveys will focus on Austrian organizations or at least on companies that have an office in Austria. The biggest part of modern organizational innovations are only possible because of new inventions from the IT industry. Since the writer of this thesis originates form an IT background, the main part of the examined innovations will be related to IT technology. At this point no comparable scientific work, regarding the combination of the topic and the method, has been published.

To remain innovative as a company as well on the outside, in the contact with the customers, but as well on the inside, in the organization of work and employees, has to be one of the main goals of every company. Otherwise it is very hard to survive as a company on this highly competitive market. Therefore it is very important for the wealth of the industry to know as much as possible about the processes that are driving the economy. With the answer of the research question of this thesis a little step in this direction will be taken.

1.3 Thesis Outline

This thesis is structured in seven chapters. After the introduction, in the second chapter the state of the art of the research field of organizational innovation is going to be presented in a compact way. At first the fundamentals of innovation are going to be explained. After this broad entry into the research field of innovation, detailed information about the different types of innovations, adoption in organizations and diffusion of innovation will be provided. Another very important part is the formulation of a working definition of organizational innovation, which was important for the researcher in order to continue the work on this thesis, because for now no general definition for this type of innovation exists. After reading this chapter, the reader should know which aspects and research fields already are represented in the literature. The writer of this thesis wants to point out which aspects of this topic already have been treated and where in the research field is a blank, that still has to be filled. The third chapter provides a list of a big number of important organizational innovations. It features as well historical innovations that have been established a long time ago, as well as very new innovations. Each of these innovations fulfil the characteristics of the working definition for organizational innovation from the second chapter that was formulated by the author of this thesis. After reading the the second and the fourth chapter the reader should already have a clear picture about the characteristics of organizational innovations. In the fourth chapter, the empirical part of this thesis starts. At the beginning of this part possible methods that were applicable for the research are going to be presented. Afterwards, the research framework that was used for the empirical part of this study is going to be presented and explained in detail. The goal of this chapter is to explain to the reader how the research for this thesis has been carried out in detail. Another important question

that has to be answered by this chapter is also, why the research was carried out exactly this way. Finally, the fifth chapter will provide the gathered results. At the end of this chapter, the research question will be answered. The last chapter will conclude the thesis. Afterwards the limitations of the study are going to be discussed in detail. At the end of this thesis, the author will discuss the possible future work that could be done in this research field in order to increase the understanding of organizational innovation. While it isn't a typical chapter, the reader shouldn't forget to take a look at the Appendix at the very end of this thesis. The appendix features both surveys that have been designed in the course of this study.

CHAPTER 2

State of the Art

The word innovation is derived from the Latin word *innovatio*, which means change and also renewal. Nowadays innovation is known as one of the most important key drivers for economical success and progress. Entrepreneurs are realizing that in order to cope with the globalization of economy, the fast technological progress and the more evolving focus by the customer, that is set on quality and price, innovations have to be driven and realized. Companys that want to survive on the market, on the long run have to fulfil this transformation, co-create it and take this chance for self-development [43]. Being an innovative company is not as simple as implementing an invention at a single time in the companies history. In order to be innovative one has to be aware of constant change and use it for it's own advantage. Therefore this is an ongoing process.

One of the first persons that got aware of the correlation between innovation and economical growth was Joseph Schumpeter. He used to describe innovations with phrases like "enforcement of new combinations" or "creative destruction" [81, p. 3]. For Schumpeter innovation consisted of creating new products, implementing new production methods, open up new sales markets, open up new supply sources and the reorganisation of companies [56]. The relationship between innovation and industrial change has always been central in Schumpeter's work [17]. Innovation research has undergone important changes during the research field's lifetime. Schumpeter's early theories focused mainly on innovation that was driven by individual entrepreneurs and their economic effects. He later recognized that there also should be more emphasis on the innovation processes in large firms.

2.1 Innovation

The definition for innovation by the Organisation for Economic Co-Operation and Development (OECD) is: “An innovation is the implementation of a new or significantly improved product (good or service), process, marketing method or a new organizational

method in business practises, workplace organization or external relations [71, p. 46]." The minimum requirement by the OECD for an innovation is that the product, process, marketing method or organizational method must be new or significantly improved to the organization [71].

Adopting an innovation can be risky since there are no guarantees for success or economic victory. Many researchers like Cooper and Schilling claim that failure is the most likely outcome of new innovations. It is also possible that the imitator gets more profit than the innovator [70]. In the course of *innovation* the word *invention* is also often mentioned. An invention is the technical realization of a new solution for a problem that results in research and development [43].

2.1.1 Types of Innovation

Innovation is a broad concept. Several persons and institutions tried to create subcategories of innovation. According to [56] researchers typically distinguish between product innovations, process innovations and social innovations. A product innovation can be a new product or a new service. Process innovations renew or change manufacturing- or organizational processes of a company. The goals of these innovations are for instance the increase of efficiency, increase of the performance on the global market, increase of profit, savings of resources, enhancement of the bond to the customer, increase of the prestige of the company or the generation of new workplaces. Social innovations change or renew the models of how human resources are organized in an enterprise, like alternative work time models or staff development for instance. The goals of social innovations are for example the increase of reputation of the company, the enhancement of the bond to the employees or the acceptance of social responsibility. In reality these three categories of innovation are hard to distinguish, because they often are overlapping in the implementation. New products can often only be produced with new manufacturing processes. In some cases, new processes demand new work time models. This means that the realization of a product innovation can demand also a process and a social innovation.

Schumpeter used a more differentiated categorization of innovation with a different approach. The following list summarizes the different types of innovation brought up by Schumpeter and published in [71] [30]:

- Product Innovation
  A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics and its use.
  Examples: New medicine with significantly improved effects, cameras in mobile phones, Internet services such as online banking or bill payment systems.

- Process Innovation
  A process innovation is the implementation of a new or significantly improved production or delivery method.

Examples: Installation of new or improved manufacturing technology, automated packaging

- Marketing Innovation
  A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
  Examples: A fundamentally new design of a product, first-time introduction of direct selling or exclusive retailing.

- Organizational Innovation
  An organizational innovation is the implementation of a new organizational method in the enterprise's business practise, workplace organisation or external relations.
  Examples: Establishing a new database of knowledge, introduction of an integrated monitoring system for firm activities.

- Input Innovation
  The taking of a new source of the supply of raw material or intermediate input is an input innovation. This type of innovation sets up the basis for a radical new technology and can be seen as the consequence of a scientific or medial breakthrough.

Another rather scientific categorization of innovations by Schumpeter are Schumpeter's Mark 1 and Mark 2. He identified two major patterns of innovation activities. Schumpeter's Mark 1, also known as creative destruction or widening, is characterized by market entries and innovation activities performed by entrepreneurs and new (small) firms as well as high turbulence in the hierarchy of innovators. Schumpeter's Mark 2, also known as creative accumulation or deepening, consists of dominant and (large) established firms as well as stability of the leading innovators [22].

2.1.2 The Importance of Innovation on the Market

Table 2.1 lists the ranked top 10 of Fortune's annual roster of the Worlds Most Admired Companies from 2016.[1] Most of these companies are located in different industries, but they share one important characteristic. The ability to innovate. Apple changed the way we are communicating by introducing the smartphone. Alphabet, which is the mother corporation of Google, is developing a lot of very different software- and hardware products. Amazon.com revolutionized the web shop and apart from this it's developing new business models, like for instance cloud computing. These three short examples show empirically that nowadays the successful development and implementation of innovations is a skill that is important to be effective in today's turbulent business environment.

Companies executives are aware of this factor, as the key results of a global survey from 2010 shows, which involved over 1,500 senior executives. 72 percent of the respondents

[1] `http://fortune.com/worlds-most-admired-companies/`, 29. April 2016

Table 2.1: Ranked list of the world's most admired companies

Apple	Starbucks
Alphabet	Southwest Airlines
Amazon.com	FedEx
Berkshire Hathaway	Nike
Walt Disney	General Electric

ranked innovation as one of their top three strategic priorities. 61 percent responded that their companies are planning to increase the spending on innovation. The satisfaction with the outcome of the innovation is mixed. This shows that people are aware that the implementation of innovations is important for the success of the company, but trying to innovate doesn't guarantee success and costs money [14].

2.2 Organizational Innovation

Organizational innovations are one of the central key drivers for organizational learning and continuous business transformation. Both is important in order to grow as a company and to survive in the environment.

2.2.1 The Definition of Organizational Innovation

According to [55] the existing literature about organizational innovation is voluminous and diverse, but it's review of the literature reveals no consensual definition of the term *organizational innovation*. Various ways to define organizational innovation have been found. Amabile simply defines it as the successful implementation of creative ideas within an organization [1]. A different definition for organizational innovation comes from Daft. It says that organizational innovation involves the adoption of an idea, material artefact or behaviour that has to be new to the organisation that adopts it [24]. Gumusluo Iu and Ilsev define organizational innovation as the development of new or improved products or services and their implementation in organisations [40]. Organizational innovations can be seen as organizational changes in enterprises. Pleschak and Sabisch define them as "[...] the redesign or the improvement of the process or structural organization in enterprises" [54, p.86]. The OECD defines organizational innovation as the implementation of a new organizational method in the firm's *business practices*, *workplace organisation* or *external relations*.
The intentions of these innovations can be the increase of the performance of a company by reducing administrative costs or transaction costs, improving workplace satisfaction or reducing the cost of supplying goods.
An example for organizational innovations in *business practices* is to adopt a new method for organizing routines and procedures like the implementation of new practices to improve

learning and knowledge sharing within the firm. Innovations in workplace organisation involve the implementation of new methods for responsibility management and decision making among employees. If a company implements a new organizational model that gives the enterprise's employees greater autonomy in decision making, one would call it an innovation in *workplace organisation*. An example for a new organizational method in the *external relations* of a firm is the implementation of new ways of organising relations with other firms or public institutions or a new method of integration with suppliers and customers [71].

As written in [71] organizational innovation and process innovation seem to overlap very often, because both types of innovation try to decrease costs through new and more efficient concepts of production, delivery and internal organisation. Organizational innovations are always changing processes of the enterprise itself. Therefore it is very important to define the border between both. It is helpful to look at the type of activity of the process. While process innovations almost only deal with the implementation of new equipment, specific techniques or procedures, organizational innovations mainly deal with people and the organisation of work. Organizational Innovations might affect divisions of a firm, the whole firm or even the cooperation with suppliers and the customers. A possible reason for an implementation might be to change the socio-cultural setting, existing structures or the strategy of a firm. The concept and implementation of an organizational innovation can be very complex. It is not advised to simply imitate or copy new solutions from other firms. Instead firms have to find their own way to change their process and structure. Therefore firms often rely on external knowledge in order to be able to implement the organizational knowledge successfully [54].

This description of organizational innovation started with the statement by Konczak, telling there is actually no clear definition which innovations actually belong to the type organizational innovations. After an intensive literature research the writer of this thesis also came to the same point. Damanpour for instance used a very broad definition while working on his study in [25]. This very broad definition had the effect that he was able to generate a big sample of innovations that got part of his study. Since the researcher is going to use the method of case studies for the analysis of the quality of the sample is more important than its size. In order to continue with the analysis of organizational innovations a clear definition is needed. With the help of this definition, organizational innovations can be chosen for the analysis. Therefore the researcher developed the following list of characteristics that have to be fulfilled by the innovation in order to be considered as an organizational innovation in this thesis.

An organizational innovation can be a product, a process, a management method or an organizational structure. The implementation of organizational innovations changes the way that workplace items, for example workforce, machines or data, are organized. The implementation of an organizational innovation requests the restructuring of already existing processes or structures of an organization. The aim of these innovations is to increase the efficiency, regarding time and money, of the processes that are fulfilled in an organization.

The following three short examples of organizational innovations should help the reader to understand the variety of organizational innovations:

- *Assembly lines* are commonly used for assembling complex items like cars for instance. The process of building an item is split up in very simple work steps. Each work step is fulfilled by one worker that is specialised for it. The assembly line method made the assembly of goods much more time- and cost efficient.
- *ERP Systems* are usually a suite of integrated applications used to connect the data of all business processes of a company. The benefit of using Enterprise Resource Planing (ERP) Systems is that the business processes of a whole company is integrated in one connected system. This can save time and expenses. Also decisions can be made faster by the management.
- *Lean management* is a management approach that comes from the automotive industry. It follows the concept of continuous improvement. The goal is to systematically achieve small, incremental changes in order to improve quality and efficiency.

In the first moment one could think that the assembly line is a clear process innovation and doesn't belong to the type of organizational innovations. While the implementation of the assembly line clearly changes the product development process its biggest impact, though, is the change of the process to a sequential structure of repetitive very simple actions. The assembly line changes how the workforce and the machines are organized which leads to higher efficiency. ERP Systems can be seen as a product or a service. Therefore they also clearly belong to the type of product innovations. They also are an organizational innovation, because the implementation of an ERP System changes the way that information flows through the whole organization and beyond. Again, this leads to an increase of efficiency of the whole company. Lean management is neither a process or a product. It is a framework of management method that aims to minimize unneeded work steps by the workforce. This change of processes again leads to an increase of efficiency.

A more detailed description of a bigger number of organizational innovations, which fit's the definition for this thesis, can be found in chapter four of this thesis.

The Importance of Organizational Innovation

In recent times, firms recognized the importance of organizational innovations. They answer the question how firms can handle the challenges imposed on them by a tightening competition and changing market conditions, the pressures to decrease costs and to raise quality standard [54].

Innovation can be understood as a process of learning and knowledge creation. New problems are discovered and defined, new knowledge has to be developed to solve these

problems. Theories of organizational learning and knowledge deal with the question of how organizations translate individual insights and knowledge into collective knowledge for the whole organization. This continuous development of knowledge in the organisations is also called organizational learning. Most theories of organizational learning stress the importance of collective knowledge or at least the ability to recall it as a source for organizational success. Collective knowledge is the accumulated knowledge of an organization stored in rules, procedures, routines and shared norms that are used to solve specific problems [55]. March writes in [65] that in order to grow, organisations have to choose if they rather use the path of exploration or the path of exploitation. Exploration means creating and adapting new innovations. In the long term exploration is the way that should be preferred by the managers in charge. The downside of it are that exploring new ideas can be very risky and that it's uncertain if there are going to be any benefits. Exploitation of old certainties is the short term way. The outcome of the use of an old concept is well known to the organisation that is using it. According to March companies will favour exploitation in order to produce fast results in the short run. He also points out that in the long run this approach is self-destructive. As stated in [82] to enhance innovation capacity, a company must become a learning company. This can be accomplished by a combination of adoptive learning, generative learning and exploratory learning.

2.2.2 How Organizational Innovation can be encouraged

Gumusluo and Ilsev point out that managers should become transformational leaders in order to encourage organizational innovation in their organisations [40]. Daft mentioned that the precise role of organization leaders in the innovation process is not clear, because there are findings in the literature that there are leaders that force innovation, while in other findings they restrict it. Daft also finds in his research that innovations in an organization are used to be proposed by individuals who are experts in a particular field. The people who are bringing up the idea for an innovation are the ones that will use it later. Another finding was that often the experts suggested a fundamental reinterpretation of the processes in the company they have been using. Following his theory, organizations consist of two cores. A technical and an administrative core. Each core has its own participants, goals, problems, activities and technology. The model suggests that innovations get delivered both at the front line where technical experts change the processes in their particular field and at an organizational level, where executives make big changes that have an effect on the whole company. Innovations that get proposed from the technical core follow the bottom up approach, while innovations that come from the management in the administrative core follow a top down approach. This thought leaves to the conclusion that if innovation in a micro level, in the technical core, is desired it is useful to hire highly professional employees in order to get the best input to be an innovative company [24].

Sawyer and Bunderson write that the most important element for the success of organizational innovation in a company are groups, because they are where individual

creative ideal is combined to generate the innovation. The use of teams is promising, because every single member can deliver innovative ideas by combining the various types of knowledge and perspectives, then combine the creative ideas to finally generate organizational innovation structure and management is needed. Examples for teams include cross-functional task forces, process improvement committees, new product development teams and top management groups. The found key characteristics for successful teams are: team composition, diversity, organizational climate and culture, leadership, incentives and motivation [14].

2.3 Diffusion of Innovation

Without diffusion, innovation would have little social or economic impact. In the study of innovation, the word diffusion is usually used to describe the process by which individuals and firms adopt a new technology, or replace an older technology with a newer.

2.3.1 Definition of Diffusion

Adoption is the implementation of an innovation by one potential customer, diffusion is the sum of all adoption processes of one innovation in the network of potential customers. Every single adoption is one more step in the process of diffusion [43]. Following the definition of diffusion for innovation by Everett Rogers, diffusion can be seen as the process which communicates an innovation from participant to participant in a social system over time [78]. The interest of exploring innovation diffusion theory increases, because the according to [61] the goal of this research is to predict the future of enterprises and products.

2.3.2 Adoption theory

Adoption theory is concerned with the search of determinants that lead to the adoption or the rejection of a innovation by one single entity. The decision to adopt or to reject is the result of a complex mental process that is gone through by every possible customer [43].

Therefore several stage models can be found in literature that are explaining the process of the adoption of a new innovation in an enterprise. Rogers defined the following five typical stages of this process in [78]. The process can be cancelled in every stage. If it is cancelled before reaching the final stage, the adoption process fails.

- Awareness
  In this first stage, the potential customer realizes that the product exists.
- Interest
  The demander gets interested in using the possibility to use the product as an solution for a problem of his. Therefore he gets informed about it.

- Evaluation
  The information gets analyzed. The advantages and disadvantages of this particular solution have to be evaluated.

- Trial
  After a successful evaluation the potential customer tries out the solution in order to see if it meets his expectations and needs.

- Adoption
  If the trial stage is positive the innovation finally gets adopted.

In [78] Rogers provides the following set of five categories that label the attributes that influence the potential adopters of an innovation:

- The relative advantage of the innovation.
- Its compatibility, with the potential adopter's current way of doing things and with social norms.
- The complexity of the innovation.
- Trialability, the ease with which the innovation can be tested by a potential adopter.
- Observability, the ease with which the innovation can be evaluated after trial.

Later Rogers extended his framework with more sociological aspects, like the question if the decision to adopt is made collectively, by individuals or by a central authority. Another important characteristic for Rogers were communication channels. He believed that people react different whether they acquire information about innovation through mass media or interpersonal. An also very important aspect is the nature of the social systems in which the potential adopters are embedded and its interconnectedness.

The marketing literature on diffusion focuses primarily on how to encourage consumers and customers to purchase new products or technologies and how to forecast the success of an invention on the market. Since 1969 the preferred diffusion model in marketing is the Bass model, which has been widely applied to various industries [61]. It assumes that mass media are crucial in the early stage of an invention. The model explains the impact of so-called marketing variables, such as price, competition, reputation and advertising, on the performance of new inventions. Accompanied with networks and information, costs are one of the most important determinants for the decision of adoption. Not only the costs of acquiring the invention is important for an adopting decision. Also very important are the costs of the complementary investment and for the learning required in order to use the newly acquired technology. Such investments can involve training of workers or buying other new technology [55].

2.3.3 Adoption of Innovations in Organizations

Each adopted innovation runs through a certain process in the enterprise it gets implemented in. Many various factors decide about the success or the failure of the implementation of each innovation. The implementation of a new innovation in an organization is a much longer process than its acquisition and therefore can't be compared with the adoption process of a product innovation. Often at the beginning of the adoption process, the innovation is only used as a pilot project in a small area of the whole company. As an answer to the question if the company implemented the innovation, it could say bot, yes and no. Only a very small fracture of the whole company uses the invention, therefore the implementation process has not ended at this point. According to [2] the positive effect of the implementation may not be relevant at all, at this point. The writers of the papers found out that only a small part of the enterprises that are using certain organizational innovations have fully implemented it in the whole company. To differentiate between the certain levels of adoption is very complex.

In literature, there is a big number of categorizations and visualizations of stage models for product- or process innovations. Although there is plenty literature about organizational innovation, there is no stage model for it based on empirical evidence. Figure 2.1 shows Roger's model of the innovation adoption process specific for organizations. Regarding to [54] the adoption process of new ideas formulated by Rogers is a good way to portray the implementation process of organizational innovations. The implementation of a new idea in a social group is divided into five sequential stages. The process starts with the *Initiation* part. This part is divided into *Agenda-setting* and *matching*. In the *Agenda-setting* segment the problem in the organization is identified and the need for a new solution is revealed. In the *Matching* segment, the actors search for a solution for the problem that was identified in the previous phase. Afterwards the *Implementation* part starts. Organizational Innovations rarely can be integrated into existing structures. Therefore the organizational structures have to be modified to fit to the need of the innovation in the *Redefining/Restructuring* segment. In the *Clarifying* stage, the innovation becomes anchored in stable structures and processes. Finally, in the stage of *Routinizing* the innovations has become an integral part of the processes of the company.

Figure 2.1: Rogers' model of the innovation- and adoption process in organizations [54]

The fourth chapter of this thesis will point out that a big number of organizational innovations is relying heavily on IT technology. Kown and Zmud created a stage model

seen in figure 2.2 for IT implementations, which can be used for a big number of organizational innovations which are going to be presented in this thesis [75]. Kown and Zmud's stage model is quite similar to Roger's model that was already explained. The big difference is that, since it is developed especially for IT implementations, it focuses more on the product and less on the organizational structure that implements the innovation. Another important difference is that this model sees the need for innovation as an endless iterative process which has to be continued in order to stay competitive on the market. Therefore the end of one implementation iteration means the beginning of a new loop in the near future. The process starts in the *Initiation* stage. This stage is similar to

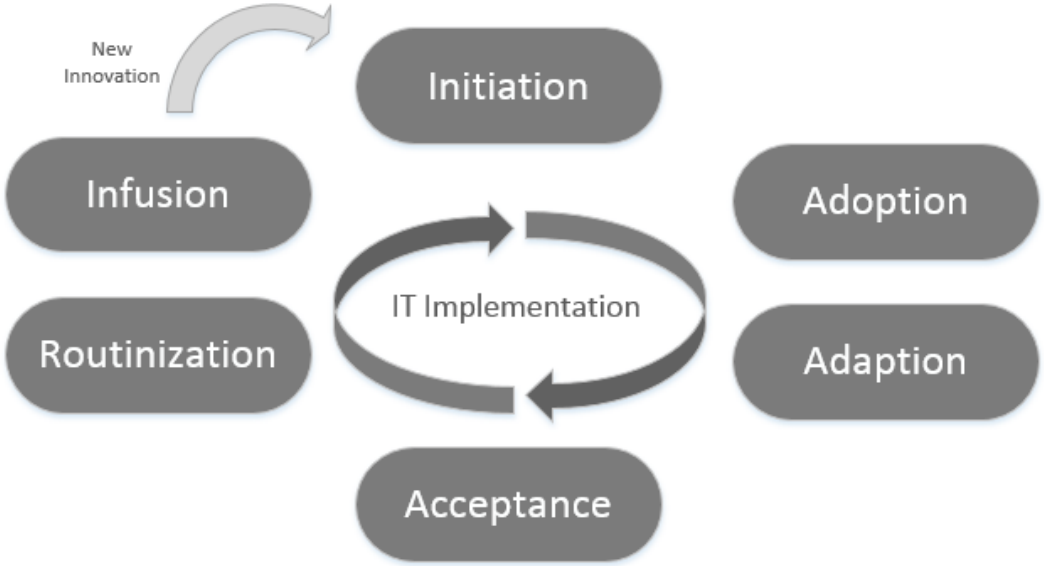

Figure 2.2: Kwon's and Zmud's IT implementation stages

Roger's stage model. The need for a new solution to a problem was identified. The market has to be analyzed in order to solve the given problem. This stage is followed by the *Adoption*. This stage is equal to the *Matching* station of Roger's model. The most suitable innovation has to be chosen. Afterwars the *Adaption* starts. The implementation and training activities begin. Later the innovation eventually comes into *Acceptance*. The System is used more often. Possible system modifications to fit the needs of the user are carried out. Afterwards the stage of *Routinization* has been reached. The most important flaws of the product and the usage have been corrected. Using the system is already a routine activity for the power users. Finally the stage of *Infusion* is reached. The IT integration is realized, using the system is a common task. Since the organization wants to stay competitive it starts looking for the next invention that will enhance the process.

2.3.4 The S-Shaped Curve

According to Rogers, when the number of users of a new product or invention is plotted versus time, the resulting plot shows an S-shaped curve. The yellow curve in figure 2.3 shows the cumulated number of adopters of an innovation. That is an example for the described s-shaped curve. One can implicate that the overall process of diffusion starts slowly and accelerates over time as the innovation spreads through the network of potential adopters. Finally, it slows down at the end since the relevant population of potential adopters was saturated. The blue curve at figure 2.3 shows the slope of the adoption function. At first, only a very small group is interested in buying the new invention. This group are the so-called *Early Adopters*. If enough early adopters buy the inventions and do advertisement for it by using it there is a chance that afterwards the *Early Majority* and the *Late Majority* also decide to use the innovation. At this point the peak is reached. It is very likely that the last group, the so-called *Laggards* will also join the group of users and then most of the potential customers are saturated [78].

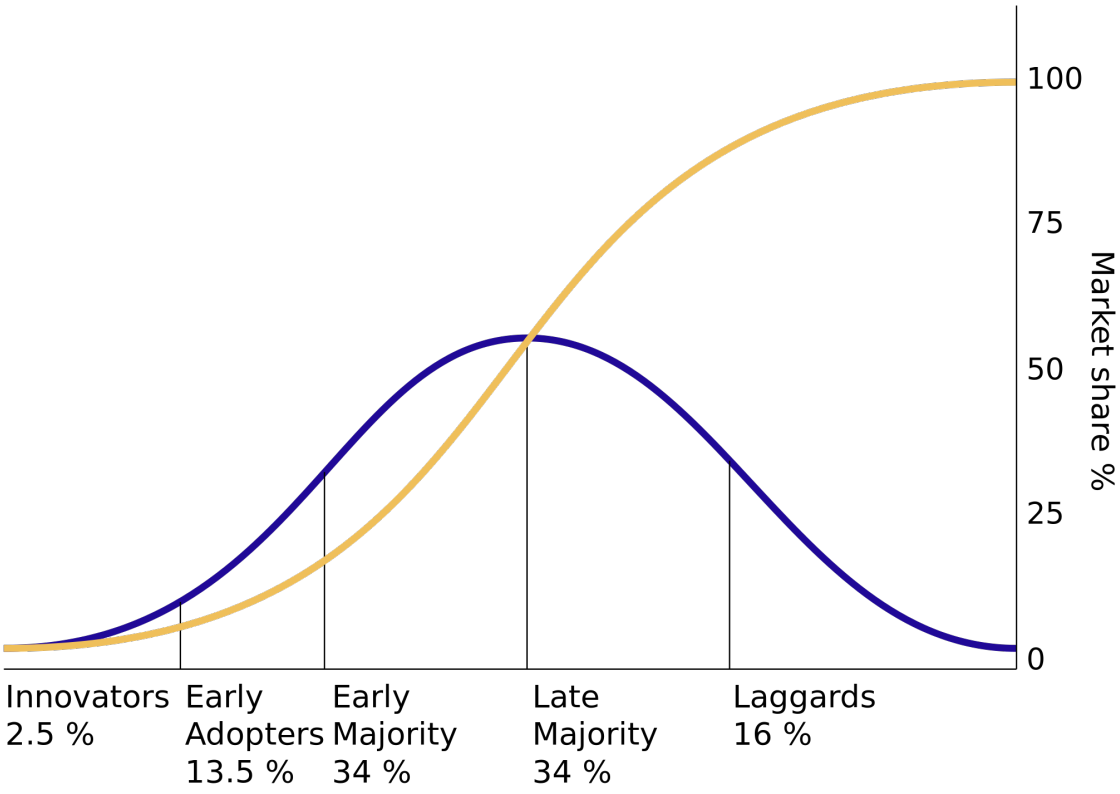

Figure 2.3: S-shaped curve of diffusion of innovations according to rogers.

In literature researchers presented several approaches to explain the origin of the S-shaped curve. A way is to use an epidemic model. In this model every consumer has the same

preferences, the cost of the invention is constant over time. Every potential customer is connected within a network. Because every actor learns about the technology from neighbour nodes, as time passes, more people adopt the technology until the network got saturated. The process of adopting an invention in a network is similar to the infection from a disease in a population. The plot of an epidemic, with the right parameters, is known as a s-shaped curve. Another important model, the heterogeneity model, assumes that different consumers get different amounts of benefit from an innovation. If the distribution of benefits over consumer is normal, the cost of the new product is constant or reduces over time and it is assumed that customers decide to adopt if their benefit is higher than their cost, the diffusion curve for the product will have an S-shaped curve [55].

$$N(t) = \frac{A}{1 + e^{\frac{K-t}{b}}} \tag{2.1}$$

In order to model the diffusion of innovation one can use already existing models of the spread of diseases. This is a useful approach to determine the growth function of diffusion in order to analyze the diffusion rate and maybe predict its future development [51]. According to [41] a promising approach to define the function of the S-Curve of Diffusion as shown at figure 2.3 is the use of a saturation model. These models base on the assumption that every growth in a network has a saturation level, which is exactly the case in diffusion. The growth rate of the diffusion curve is positively influenced by the number of existing implementations and the difference between the saturation level and the number of existing implementations of the innovation. Gurbaxani conduected a study [41] in which he examined the distribution of a telecommunication provider. He wanted to find out if diffusion can be explained with the model of exponential growth, the Gompertz function or a logistic function. Since exponential growth has no saturation level it is clear that diffusion can't follow this behaviour, because at one point every innovation reaches every possible node in a network and is saturated at this point. The Gompertz curve and the logistic function are both used to model epidemic processes. However, Gurbaxani's studies revealed the logistic growth function as shown at equation 2.1 fitted his data better and is also used in other diffusion studies [53]. The logistic growth function is defined through the parameters A, b and K,whereas A stands for the estimated saturation level, which is the limit of the growth of the diffusion. The parameter b is the gradient per year t and K is a parameter which adjusts the dimension of t. If a scholar uses very low levels for the time parameter, the K is also low. Otherwise if one uses for instance year dates for the time parameter, K will be very high.

CHAPTER 3

Examples of Organizational Innovations

This chapter presents and describes a number of different organizational innovations. A comparable listing couldn't be found in the existing literature. Every single one of the chosen innovations fits the criteria of the following definition:

An organizational innovation can be a product, a process, a management method or an organizational structure. The implementation of organizational innovations changes the way that workplace items, for example workforce, machines or data, are organized. The implementation of an organizational innovation requests the restructuring of already existing processes or structures of an organization. The aim of these innovations is to increase the efficiency, regarding time and money, of the processes that are fulfilled in an organization.

The Assignment of examples to specific types of innovations and categories is challenging, because they often belong or can be assigned to more than one category. This results in the fact, that the assignment often depends on the individual point of view. For example, the ERP system can be seen as a product innovation for the company that produces and sells it. For the company that is implementing it, it is clearly an organizational innovation. This section is structured in the following three subcategories: Processes, Management Methods and Organizational Structures. Each presented innovation has been assigned to one of those subcategories.

3.1 Processes

The change or the implementation of processes can be seen as the most typical category of organizational innovations. Changing the way that workers or machines are organized in a production process has a lot potential in increasing efficiency. Often the change

of the existing process is initiated by the use of a new product that has an important effect on the company's process. In this case, the new product dictates the change of the process in order to function.

3.1.1 Assembly Lines

Assembly lines are designed for the sequential execution of production steps using workers, tools or machines. The practice of assembly lines in the production process is used for mass production, which can lead to higher profits. Mass Production gives the chance to benefits from economies of scale where the costs per unit falls more quickly than the production costs per unit. Typically each worker fulfils one simple operation. Therefore each operation has a minimal need of mechanical movement. After finishing one step, the unfinished good proceeds moving on the line to the next production step until the good is finished. While the concept of division of work and automation wasn't something new in the early 1910's, Ford's development of the assembly line was a break through and changed the industry [29].
The use of assembly lines didn't only change the production processes, it also changed the conditions for the workers that were part of it. On one hand there have been improvements for them like an increase of income, because of the higher productivity. Also the physical strain of the workers got lower since they didn't have to do any heavy lifting, stooping or bending over anymore. On the other hand the automation of the whole workprocess and the machinised isolation of each manufactur step made special training unnecessery. So the job that before was done by specialists got taken over by cheaper workers [23]. The workers have become easier to replace. The increase of wage in the beginning led to lower loans in general. Another downside of the use of assembly lines are sociological problems like social alienation and boredom that many workers feel, because of the repetition of doing the same step all day long. Also there is a lack of job satisfaction since the workers never see the finished product they worked on [8]. Assembly Lines are clearly an organizational innovation, because the use of it changes the production processes, in the way that work items like workers and machines are organized, fundamentally.

3.1.2 Mass Customization

The Mass customization strategy links the advantages of standardization with the advantages of customized production. The idea is to target the individual ideal-point of the consumers. At this point the consumer's preference of the product is at its maximum. So the producer gains a differentiation advantage to the competitors in the market.

Usually the customization of the product or service is carried out via a web-platform in order to act time- and cost efficient. There the customer can choose from a variety of options to order his preferred product [54]. Using this technology modules can be combined in order to create a more or less individual product without the need to hire a big number of shop assistants.

According to [54] Mass Customization can be seen as an organizational innovation, because the shift from mass production or customer-ordered individual production to mass customization changes the strategy of the entire company. The implementation of mass customization requires new procedures and methods. Also the organizational structure has to be changed, perhaps. The interaction with the customer is changed, which also leads to changes in divisions of the company. These changes lead to a different business culture, which has to be driven by the management and lived by the employees.

3.1.3 Collaborative Design

Collaborative Design is used to solve a problem, in example the manufacture of a product like a house, together as a group of a range of actors. Often the actors originate from different disciplines and are residing in different locations than the other actors, while working. The processes of every actor are deeply connected with each other. It is a form of cross-company integrated collaboration over the whole life cycle of a product or a technology. Collaborative Design targets the collaborative elaboration of advantages that wouldn't be possible by working alone. With the development of the internet collaborative design techniques got developed and used more often.[1] Since the exchange of knowledge and data is the central idea behind collaborative design, the development of the internet made a big step forward in achieving the possibility to collaborate. Collaborative Design tools vary from from shared calenders and mail systems to shared data storage and workflow support. Advantages of collaborative design are low costs, shorter elaboration times, by contracts defined quality standards of every actor, increase of reaction- and innovation-abilities [27].

An example for collaborative design from the construction industry that has a lot potential is Building Information Modelling (BIM). BIM is based on the idea of using one digital Building model in its whole lifecycle. This model can be shared and changed between actors of different disciplines from the Architecture, Engineering and Construction (AEC) Industry that are involved in designing a building. All of them can use the same model in their different computer programs. This leads to an iterative design process of the building. With using this interface a lot time and money can be saved. Otherwise for every step in the design process, every change that has been made has to be transformed to another model in order to be able to work, which leads to a higher error possibility and time waste [9].

3.1.4 Agile Software Development

The technique of agile software development had a major influence in software development. It changed how a big number of software developing projects are planned, how the work is coordinated and how developers communicate with customers and external stakeholders. Williams and Cockburn noted that agile software development is about feedback and the

[1] `http://wirtschaftslexikon.gabler.de/Definition/collaborative-engineering.html`, 04. June 2016

responding change. The non-linear process helps the developers to face the challenge of an unpredictable world. Agile methods contribute to the efficiency, quality and simplicity of the production process. The center of every agile method are short feedback loops [28]. Using this new structure, which is based on short feedback loops adjustments, projects can be carried out very fast, because not the whole project is planned in every detail from the beginning. Popular agile software development methods are for instance Scrum, Adaptive software development or Feature-driven programming.

3.1.5 Business Process Integration

The digital integration of business processes is a logical step in the evolution of companies. In [19] integrated business processes are conceptualized as processes with minimal information flow between its activities. Therefore the organizational activities are coupled tighter. This leads to a minimized human effort concerning the communication and coordination in the daily business. The integration of business processes leads to an environment that is less error prone and more efficient. This approach is a common and very often used strategy for business process reengineering. Common strategies and tools for accomplishing business process integration are discussed in the next couple of paragraphs.

ERP systems nowadays can be seen as the backbone of information systems in most large and medium companies [39]. They form a category of business management software that typically is a suite of integrated applications. The integration part is the biggest and most important aspect of ERP systems. Before ERP systems were used, workflows of different business activities used to work parallel without any interconnection. The software modules of ERP systems help to monitor and manage important business activities like supply chain, inventory, projects, human resources, finance, product lifecycle and manufacturing for instance. With the use of ERP systems the workflows of the company are connected which leads to a better manageability of the daily business activities. Another surplus is that the organization can collect the data of every business activity to analyse it later in order to adjust the business strategy. The management has insight to the performance of the key performance indicators in real time. Therefore the decisions of the management are data driven.[2] The implementation of an ERP System changes the processes of the whole company fundamentally. In order to use an ERP System the way its meant to be used, it has to be integrated with the other software systems that the organization uses. Also often the workflows of the company have to be adjusted, which leads to big activities in the change management, employee retaining and business process reengineering. Those are the reasons why the implementation of an ERP system is often seen as a difficult and costly organizational experiment [39].

Custom Relationship Management (CRM) systems are helping the companies to meet their goals in terms of CRM. The CRM of a corporation covers all aspects that lay between the company and its customer. According to the listing at [3] a good CRM

[2] `http://searchsapp.techtarget.com/definition/ERP`, 27. May 2016
[3] `http://www.webopedia.com/TERM/C/CRM.html`, 08. October 2016

Strategy covers the following areas.

- Understanding the customer.
- Retain customers through better customer experience.
- Attract new customers.
- Win new clients and contracts.
- Decrease customer management costs.

CRM systems help the business to meet these goals. Also the central storage of the whole customer data in one single location is a big advantage. This approach gives the management and the employees immediate access to all the data they need, instead of browsing through decentralized data in different formats. Maintaining the data is possible in one single system. Changes don't have to be made on multiple locations, which again, leads to a less error prone system and less time is wasted. The data is stored in an analytical engine which offers the user of the software predictive analytics about business opportunities.[4]

ERP- and CRM systems are connected deeply with each other and often the developer of ERP systems like SAP, Microsoft or Oracle also offer CRM systems that are working together. While ERP systems integrate processes that are set inside of the company, CRM systems are mapping the processes that are between the company and its customers, retailers or partners.[5]

Electronic Data Interchange (EDI) systems are used for the collaboration between companies. Data that otherwise would be transferred manually is sent and received automatically through the internet. The business information has to be structured in an agreed format, which has to be issued by a certain authority. Complex business processes can be mapped, which creates an efficient and error resistent [49]. Problems can arise when the agreed format is changed by an authority. The system logic has to be adapted regarding to the new message structure, which results in new maintenance costs. If the adaptions aren't made in time, the communication between the companies won't work and the automated business processes would fail.

3.1.6 Knowledge Sharing

According to [87] in the era of knowledge based economics, intangible resources and competences are one of the key drivers for the wealth of enterprises and allow them to survive in nowadays dynamic environments. Knowledge often is uneven distributed within an organization. With knowledge sharing managers try to identify, capture, create

[4] `http://www.webopedia.com/TERM/C/CRM.html`, 08. October 2016
[5] `https://www.crmswitch.com/crm-value/understanding-crm-erp/`, 25. September 2016

and accumulate the knowledge of their organization which should lead to an improvement of the performance of the company. Knowledge sharing can be seen as the process of interaction, communication and coordination of knowledge and expertise. Processes are improved and the work tends to be more easy when knowledge is shared. The structural holes between unconnected actors are bridged and the translation, coordination and alignment of knowledge between communities is facilitated. With the further development of IT-Systems sharing knowledge got easier from the technical side. One of the most common solutions for knowledge sharing is the open source solution named wiki [88].

In [27] the implementation of a sharing knowledge system named *MaFo-system* at the German company T-Systems is described. They've created a web platform for their employees that provides every information the company knows about their worldwide accounts and markets. Every market investigation that the company owns can be found at this system. According to Forrester Research the big players spend 2.5 Billion Dollars per year for IT-based market investigation [27]. Often the same topics get ordered more than once, because employees often don't know which knowledge already is available in the company. This implementation saved T-Systems money for redundant market investigations and made the employee's process for gathering knowledge easier and more transparent.

3.1.7 Online Services

The invention, development and distribution of computers made it possible that a vast majority has access to the internet. Through time many processes that traditionally were carried out manually have been automated. Users from the whole world can enter and use them through the internet. On the one hand the offer of such online services saves money for labour and on the other hand it increases the value for the customer, because processes can be executed from every place where an internet connection is available, at every time of the day. The business model of many companies had to be changed through the arrival of the internet and its possibilities [44]. Also automated processes tend to have a lower error potential and run through faster. As already hinted, the implementation of an online service changes the internal processes in a radical way. Also changes regarding the staff have to be done, since there is less or no use for the persons that used to carry out the processes before manually. Well known examples for such online services are online banking or online shopping. The use of online services also makes a personalization for the masses possible and achievable. Using this technology for the customer tailored content and services can be provided through an online service [58].

3.1.8 Paper Free Office

Implementing the idea of a Green Office can have two positive effects for the company. The first obvious one is the reduction of several costs in the daily business. The other positive effect is that the company can create positive advertising with the fact that they act *Eco* and support sustainable developments. Companies that use the Green Office

paradigm can increase the positive perception of their potential customers and turn this into a competitive advantage [4].

One Organizational Innovation that drives the implementation of the Green Office is the Zero Paper policy. Since most companies heavily rely on electronic communication like e-mails for instance it is easy to implement this policy. The employees are told to print as few documents as possible. E-mail signatures that tell the reader not to print the e-mail due to environmental reasons are used quite often [18]. This policy doesn't only have a positive effect on the environment. It also saves a lot of paper waste.

3.1.9 Enterprise 2.0

The invention of computers, the internet and finally of the e-mail changed the way people are communicating inside and in between of companies drastically. The e-mail offers a very convenient and time effective communication channel. Information can be send global with basically no time lag. Since the e-mail originated in the 1990's especially in the last couple of years new innovative approaches have been developed in order to increase the efficiency and effectiveness of communication inside and between companies.

The french IT-Servicecompany Atos calculated that their employees spend up to 40 percent of their daily work time writing and reading e-mails. Another problem with using e-mail is that employees tend to gather their useful information in self constructed e-mail archives. One problem that comes up with this approach is that following the calculations from Atos up to 20 percent of the working time is used to gather information from e-mail archives. The other problem is that the useful information is hidden in the archive and is not available for the rest of the company. Another person might also benefit from the respective information. If the employee decides to leave the company the information is lost for the company, since the archive belongs to the employee and the structure isn't standardised. Another problem that arises with the use of e-mail is that the communication is always one to one or one to many, but the collaborative working on one piece of information is not possible. Nowadays almost everyone is confronted with a constant stream of digital information. Therefore it becomes more likely that a person that is informed by e-mail won't respond to the message or maybe even read the message at all. The change from a push-based to a pull-based communication can bypass this phenomenon. If the employee decides to look for the certain information when it suits its time schedule instead of getting a message at a random time while working, the propability that the employee processes the information properly, rises [59].

These discoveries led to the assumption that the e-mail might not be the best communication channel for every scenario in enterprises. The so-called *Zero e-mail* attempt can be implemented by a mixture of defined work rules for e-mail communication and the use of other technologies like for instance Enterprise Social Networks (ESN) or chat clients.

In the last years the term Enterprise 2.0 got created, which follows the term Web 2.0. Enterprise 2.0 companies are enterprises that are using Web 2.0 technologies for their communication, data sharing and knowledge sharing. McAfee created the acronym

SLATES, which summarizes the needs of employees for a good working communication, which should be fulfilled with the use of Web 2.0 technologies [83]. The acronym stands for:

- *Search*: Content should be easy retrievable with the help of search functions.
- *Links*: Helpful content has to be able to be referenced via links.
- *Authoring*: It has to be easy and convenient to create new content or to edit already existing one.
- *Tags*: In order to categorize the content it has to be possible to add tags to the created posts.
- *Extensions*: The behaviour of the user should be automatically analysed in order to come up with suggested content, the user might be interested in.
- *Signals*: Push Notifications should inform the user about new content he might be interested in.

The properties of this acronym are valid for an array of Web 2.0 technologies like wikis, blogs, social networks or instant messengers. The success of the implementation of the paradigm of the Enterprise 2.0 depends highly on the culture of the company and the way the adoption is accompanied by a change process [52].

According to [32] businesses use social networks primarily for two types of communication. First for the communication with external parties like customers, vendors and the public. For this type of communication they are using well known social networks with a big number of users. Second businesses also use social networks for their internal communication. The so-called ESNs are software solutions with the look and feel of popular social networks. In general they offer additional useful features like blogs, wikis or document sharing.

The authors of the article [60] form the following definition for ESNs: Web-based platforms that allow workers to:

- Communicate messages with specific co-workers or broadcast messages to everyone in the organization.
- Explicitly indicate or implicitly reveal particular co-workers as communication partners.
- Post, edit and sort text and files linked to themselves or others.
- View the messages, connections, texts and files communicated, posted, edited and sorted by anyone else in the organization at any time when required.

While the single use cases of ESNs have been covered by a number of tools already in the past, the outstanding feature of those Social Networks is that all of these features are implemented in one tool for the whole corporation and every action is documented in it.

Typical ESNs are not made for direct lightweight one to one communication. Quite often the content that is generated by one to one communication by colleagues doesn't have to be stored or archived, because the content is irrelevant for future purposes. Therefore the overhead of communicating simple daily content through an ESN would be too big. In the survey [69] most participants stated that they used Instant Messaging at work for getting a quick response to a question, avoiding to use the phone, knowing who is available and to clarify a question quick. For these use cases it makes sense to use an instant messenger, since its use is much more light weight in comparison to the use of e-mail. The whole conversation is presented in a stream of small messages, while communicating through e-mail creates a new object with each message that comes with a lot of overhead for a possibly only little information.

3.2 Management Methods

Management methods can be seen as tools that help the executive personal to increase the efficiency of production- and administration processes inside of an organization. Implementing a new management method is less radical than implementing a new organizational form, since it only reforms the processes.

3.2.1 Lean Management

According to [74] Lean Management is seen as one of the most revolutionary change in organization since the introduction of the assembly line by Ford. Lean Management can be seen as a conglomerate of different organizational methods in order to increase the efficiency of processes which aim to remove waste from every production process. The core idea is to produce goods without creating waste. This is getting achieved by business process reengineering principles like the elimination of tasks and hierarchy and the merging of tasks and organizational units.

The idea of Lean Management originates from Japanese workplace practises, but it has been also implemented in organizations in the western world. The Japanese auto mobile manufacturer Toyota was significantly involved in creating the methods that later became Lean Management. It defined over-production, unnecessary inventory, inappropriate processing, unnecessary transportation, unnecessary delay, unnecessary defects and unnecessary motion as its seven wastes in the production processes, that had to be removed [77]. The most important elements of Lean Management are the focus on the customer, optimization of business processes, focus on core competences, continual improvement, team work and self reliance. Examples for visual frameworks that help to implement Lean Management in a company are for instance 5S or CANDO [77].

3.2.2 Lean Production

After Henry Ford's huge success of mass production using the assembly line, Japanese manufacturers tried to adapt this principle in their country after the second World War. Due to big differences of the Japanese to the American culture, like a much smaller market, a more homogeneous, better educated and better trained labour force, a big number of modifications had to be done [55]. The Japanese car manufacturer Toyota got world famous for its several innovations of its organizational structure and production processes that led to the increase of efficiency and turnaround. Lean Production is based strongly on the so called Toyota Production System. The main principle of Lean Production is to identify and erase waste in every process of the organization. This waste can be found in production processes as well as in management processes. Waste can be defined as every activity that adds costs to the production, but doesn't add value for the customer [21]. Lean Production can be seen as a framework of tools that involves quality circles, Just in Time Production, Continual Improvement and more.

3.2.3 Total Quality Management

Total Quality Management is less a management method than a organization wide effort to create a climate at an organization that forces and encourages the employees to continuously improve its processes. The aim is to deliver products and services to the customer with the highest possible quality. Total Quality Management can be implemented with the use of tools like Six Sigma or Lean manufacturing for instance. The actual chosen method depends highly on the company and its employees.

One well known example for a useful tool to fulfil Total Quality Management is the quality circle [64]. A quality circle consists of a small group of workers that are doing similar work. It seeks to identify and to solve quality problems that arise in that particular functional area of the organization. It achieves continuous quality improvement with using the philosophy of *spontaneous employee participation*. Quality circle follows a bottom up approach where useful ideas that aim to improve the quality of the production process get brought up from workers. The workers act self driven, identify quality problems and create methods for the improvement of the quality. Usually the workers in a quality circle are volunteers. Participating in quality circles can lead to various benefits like for instance gaining higher self esteem and increasing the job satisfaction.

According to [64] the following benefits are achieved when Total Quality Management is implemented with quality circles:

- The quality of the product is improved and maintained, to reach customer satisfaction.
- The reliability of the product and assurance for quality of the products are improved leading to improved competitiveness.

- The productivity is increased mainly through reducing the quality failure cost and the quality prevention cost.

3.2.4 Job Rotation

Job Rotation is a management method that is used to increase the efficiency of the production processes with reducing negative symptoms like monotony. "Rotation refers to any change in assignment, usually indicated by a change in title or department, that does not involve a change in compensation level" [84, p. 1519] is the definition for Job Rotation by Campion, Cheraskin and Stevens. When using job rotation, as the name implies, employees rotate their assigned jobs while staying in their employment. Job Rotation is a method that is used to enhance the flexibility, employability, qualifications of the workforce of a company [16]. Another important benefit of using job rotation is the decrease of monotony at the workplace. Especially the employees that have to perform a big amount of manual labour profit from this idea. This approach is a contrast to the trend of companies seeking more and more workforce with very specialised skills. Experts hope that Job Rotation can solve two problems at a time. At first the increase of qualified specialists and second the decrease of unemployed people [72].

3.2.5 New Ways of Working

The last decades showed an evolution from the classical work model to a new, more flexible, way of working. This progress comes hand in hand with the sociological factors and is made possible by the recent developments of communication technology. According to [46] there is a rise of arrangements enabling flexibility in corporations driving to enable a more stable work/life balance. Citing this paper by 2013 about 55 percent of the companies in the USA allow employees to complete at least a part of their workload from home. Between 14 and 19 million workers in the USA even work at least one day per week from home. This trend is called home office and offers advantages on both sides, on the side of the employee and of the employer. The employee obviously benefits from a more flexible time schedule since the employee doesn't have to travel to the office and back. Parents have the additional bonus that they can look after their children during office hours. Employers have the chance to achieve strategic business goals like cost reduction, enhanced job performance, increased job satisfaction and reduced stress. A good relationship and working moral has to be established inside the company in order for the work model to function.

A high amount of homeworkers makes the typical idea of an office obsolete. Therefore many companies adopt the idea of shared desks. In these companies no one has a standard seat for himself. This cut delivers big flexibility. People working on different projects can change their seats in order to work together and enhance their communication. The mixture of shared desks and using new technology is also often called virtual offices [46].

[86] enumerates the following empirically found main effects from the New Ways of Working:

- A slightly positive effect on productivity. The reduce of travel time allows better concentration and therefore a better use of skills.
- The communication gets less productive since there is absolutely no face to face communication.
- The pressure from the management got higher since with a more flexible time schedule everyone was accessible and able to work the whole day for the whole week.
- The work-life balance increased. Although the author of the survey stresses that not everyone is able to cope with more flexibility. The stress of some of the participants increased in because of their increased work-life balance.
- Some participants felt isolated while working at home.

3.2.6 Outsourcing

Outsourcing gives companies better chances to focus on their core business, since every activity that doesn't belong to the core business can be outsourced to another company [7]. There is a variety of definitions for the phenomenon of outsourcing. In [68] a list of different definitions is provided. An example comes from Lei and Hitt. They defined outsourcing as "the reliance on external sources for the manufacturing of components and other value-adding activities" [68, p. 6]. Linder writes outsourcing is "purchasing ongoing services from an outside company that a company currently provides, or most organizations normally provide, for themselves" [62, p. 27].

In [68] Mol summarizes the parts that all of the definitions have in common to the three following points:

- Outsourcing refers to those activities that are undertaken by outside suppliers.
- Outsourcing refers to the transfer of activities and possible assets from a firm to an outside supplier.
- Outsourcing refers to those activities that are undertaken by outside suppliers but could also be undertaken by the firm.

Mol writes that he can't confirm the overall truth of the third point since a company can also outsource activities that they can't perform themselves.
Advantages of outsources are strategic focus, reduction of assets, the effect of complementary capabilities, lower production costs, strategic flexibility, avoidance of bureaucratic costs and relational rent. Examples for disadvantages are rising transaction and coordination costs, limitation of learning and limitation of innovation and increased dependence on suppliers [68] [7]. Today the outsourcing of workers and services is a very often used option to be able to save resources and to be more efficient. Since the use of outsourcing changes the processes of the company by nature, it clearly is an organizational innovation.

3.3 Organizational Structures

The implementation of innovative organizational structures changes the way that the whole company is organized. In most cases this leads to smaller project- or topic based groups that have much more self governance compared to groups in typical hierarchical companies. This approach can lead to various benefits, like for instance the enhancement of efficiency.

3.3.1 Spaghetti Organization

Oticon, a Danish electronic producer, is a market leader in hearing aids. The company became world famous for their radical organizational transformation. After some conservative tries to increase the turnaround of the company, like cost cutting for example, a new CEO came up with the idea to change the company's structure of the organizational processes, job contents and careers of its workforces. In order to increase competitiveness, human and technological resources had to be utilized in a more efficient way.

Therefore the five following actions had to be taken:

- The hierarchical job structure got replaced with a project-based organization. In the new organization every employee was involved in a number of projects, where each project was considered as a busines unit with its own resources, time schedule and success criteria [57].
- Traditional managerial jobs got abandoned. The managerial duties got transferred to members of each business unit.
- Paper communication got reduced drastically by establishing electronic scanning of all incoming written messages.
- Physical mobility got facilitated by creating an open space office. There where no fixed seats and every employee got a cart or trolley for their work items.
- Career development inside of the company got changed. Titles, fast track programs, internal management courses, succession plans, vertical progression got obsolete. The possibilities for career development got linked to the work situation of the company itself. If there was a need for a particular skill, the job got written out internal. So motivated persons could choose to claim more responsibilities.

Overall the Oticon experiment is considered as a successful example of organizational innovation. Nevertheless some flaws in the implementation and the rising frustration among employees led to a retreat from the radical spaghetti organization [55].

3.3.2 Sociocracy

Sociocracy is a form of governance that originated in the USA in 1881 by Lester Frank Wart and Kees Boeke. It derives from the word *sociocrate*. It targets to improve the self governance ability of teams in businesses. Boeke designed the model of sociocracy to create a world of peace and harmony. In the early 1970 Gerhard Endenburg made the first try to apply Boeke's model in a business environment. He created the method called *Sociocratic Circle Organizing Method* that was based on the circular feedback theory [11].

Sociocracy follows four principles, that are the following [33]:

- *Consent governs policy decision making:* Every policy decision is made by consent of every participant. Every member has the right for a veto, which has to be reasoned. Consent in this context means that every member of the circle can live and work with this decision. It doesn't have to be their favourite option.
- *Organizing in circles:* Enterprises that use the form of Sociocracy consist of hierarchical circles that are linked with each other. The circles act semi autonomous. If a policy decision can't be made because of a veto the decision is taken up to the next circle with higher authority.
- *Double-linking:* Every circle has a connection to the next higher and next lower circle, if there exists one. The connection is made by two members that are full members in the decision members of their circle and the next one with higher authority.
- *Elections by consent:* Every member is elected to various roles and responsibilities in open discussion. The elections must also be made by consensus of all decision making members of the circle, like in principle one.

The advantages of using sociocracy is that outcomes of decisions that are taken in consent tend to be more effective. The feedback structure of circles that involve all members of the organization, which are communicating with each other, ensures a united organization [79].

3.3.3 Holacracy

The idea behind Holocracy was developed at an IT company named Ternary Software. Their founder Brian Robertson wanted to change the organization structure of his company in order to increase the importance of each employee inside of the organization. This idea started in 2007. Since 2010 Robertson was convinced enough of this organization structure, that he decided to focus his business on helping other companies to adopt Holacracy as well as a consultant. Holacracy draws influences from Sociocracy and from agile software development. Robertson was able to use his experience as a leader of a software development company using agile techniques to create a new organizational

structure that borrows features from other already existing structures in an eclectic way [50].

At [6] Robertson describes the four most important aspects of Holacracy:

- *Organisational structure:* The word Holacracy is derived by *holarchy* which was introduced by Arthus Koestler in 1967. The teams are organized in circle structures that organize themselves. They act autonomous and self-reliant, but also depend on the whole company. Each circle finds itself in one big circle. The circles are connected to the big circle through a so-called doubled link that consists of a *lead link* and a *rep link*. The members of the double link are sitting in the meetings of their small circle and also in the meetings of the big circle. So the small circles, that act autonomous, are connected to the whole company and can follow its mission and strategy.
- *Organisational control:* Decisions tend to be taken fast and incrementally with maximal information. A fast decision that is not the best is preferred to an optimal solution that would need more time to figure out, because decisions can be updated any time. This leads to a natural evolution of the management.
- *Core practices:* For governance and operations, regular circle meetings are mandatory. Those are important to uncover and assign the roles that are needed to reach the aim of the respective circle. In Holacracy every employee has one or more roles instead of a job. Every role follows a clear purpose.

[6] `http://www.integralesleben.org/fileadmin/user_upload/images/DIA/Flyer/Organization_at_the_Leading_Edge_2007-06_01.pdf`, 03. June 2016

CHAPTER 4

Method

Until this point of the thesis the whole information that was provided originated from already existing literature and therefore followed the theoretical research paradigm. In the next section a couple of practical research methods are going to be discussed. Afterwards the research framework that was used for the empirical research will be explained in detail.

4.1 Research Methods

Before beginning with the research it's important to explore and to discuss common research strategies in order to use the one that fits the research question and the situation. Therefore a set of different empirical research methods that are applicable for this field of research are discussed in the next paragraphs.

4.1.1 Qualitative and Quantitative Research

In general two important research paradigms exist: qualitative- and quantitative research. The mixture of those two paradigms, the so-called mixed research is a combination of both worlds, usually tailored to the given use case.

In the quantitative research paradigm mathematical, statistical or computational methods are used to explain observable phenomena. Mathematical techniques are used to generate numerical data, which is quantified in meaningful variables based on the topic. Those numbers can be generalized using statistical distributions. A central part of this paradigm is the process of measurement. This provides the connection between the observation that is done empirically and the numbers that are the outcome of the research. Quantitative research is a popular research paradigm in natural- and social sciences [37].

The qualitative research paradigm is used for gaining a general sense of the examined phenomenon. Data that has been collected in fieldwork is used for the building of

theories, which later can be tested using quantitative methods. Qualitative research has a descriptive and exploratory nature. In comparison to quantitative research, the data can't be simply expressed by numerical data. The researchers are more interested in the *why* and the *how*. This paradigm is widely accepted in the field of sociology [37].

4.1.2 Content Analysis

Content Analysis is a widely used set of methods to retrieve information of artifacts of different nature like for instance written texts such as scientific papers or books, oral texts like interviews or speeches or audio-visual media, such as movies, music or TV shows. Content analysis methods aim to extract the interesting information off the artifact, in order to use the retrieved information for a later analysis. Every content analysis technique uses a series of procedures that transforms part of the source [80]. A common way of transformation is to slice the artifact in several parts. Each part forms an atomic statement that is relevant for the research. Afterwards a coding frame will be generated, which has to be justified by the researcher. Otherwise the research is not scientifically comprehensible. According to [47] in a conventional content analysis, the categories of the coding frame are derived from the data source. Finally the several atomic parts are coded to the categories of the coding frame. This technique transforms unstructured data, like for instance an interview, to quantitative data, which can be used for further analysis or comparison between each other.

A more specified content analysis technique is the meta-analysis. This analysis is used to cumulate the results of a bigger number of empirical studies. If statements about a field of research want to be made, the research based on already existing findings is a valid option. In 1976 Glass defined meta-analysis as the statistical analysis of a large collection of analysis results for the purpose of integrating the findings [38]. At first an initial population of studies has to be taken to have the data for starting the meta-analysis. As written in [26] the population should be narrow enough, so that the included studies are describing the same phenomenon, but broad enough so that there is a value added by the synthesis of a number of studies. It is very likely that the underlying studies use different statistical methods like correlation, regression or discriminant analysis. In order to make a successful meta-analysis, the different approaches have to be standardised. Otherwise studies of the secondary literature that are using a different statistical measures can't be put in the initial population of the meta-analysis. After selecting a population of surveys, a coding scheme has to be created. The coding frame is generated from information of secondary literature. Again, the justifiability is an important characteristic. The coding scheme acts as the list of variables that are interesting for the meta-analysis. Finally the standardised results of the single studies are coded to the coding scheme. After the coding the mean effect sizes have to be computed. The effect sizes make the cross analysis of different studies possible. It is used to encode the selected research findings on a numeric scale. Then the effect sizes have to be examined and the impact of the moderating variables have to be analyzed [48]. This approach leads to a single meta-analysis that includes the findings of every item of the initial population.

4.1.3 Online Questionnaires

The aim of every type of survey is to investigate a specified population, that consists of defined objects like households, companies or individual persons. Every survey is made with a scientific objective. This scientific objective is achieved by analysing the data that is retrieved through the design and the conduction of the survey. For every survey a statistical population is set, which acts as the sample, that is being investigated. The statistical population has to be set carefully, because the goal is to generalize the findings of each survey, which is based on the sample. A survey can either be structured, unstructured or semi-structured. The form of communication can vary from oral communication to postal communication or electronic communication. In general surveys can be parted in the categories questionnaire and interview [80].

Due to reasons of efficiency, electronic surveys gained big popularity since the development of the internet. Usually these surveys have the form of a questionnaire. Online questionnaires have the appearance of forms. The surveys can be answered through a browser by the participants, the accumulated results usually get stored in a data analysis engine immediately. Every written survey has to be strictly structured. These surveys can only be used for close-ended questions. This approach has proved to be very effective for consumer investigations. A spontaneous take on different parts of the topic is not possible, since there is no direct interaction between the participant and the researcher [80]. [6] lists a big number of reasons why online data collection is a promising tool collecting data. It also defines best practises for designing a web survey.

In mail based surveys, the researchers have to define a certain time frame for the participants in which they are able to answer the questionnaire. When the time is over, the scholar has gathered answers from a certain number of participants, from the ones within the response rate. In most cases a number of potential participants won't answer the questionnaire inside the defined time frame. If there exists a non-response bias in the survey, the researcher can formulate statements about the part of the survey participants that didn't send an answer. Theory distinguishes between two types of non-responses [10]. If the participant leaves out questions regarding one or more specific topics that are being investigated, one can name this *item non response*. This is resulting in missing values in responses. If a potential participant doesn't respond to the invitation to fill out the survey at all, this is called *unit non response*. More information and examples regarding non-response bias can be found in [3].

There is no given rule for how to find out if there exists a non-response bias in the not received answers from a questionnaire. One statistical option to test the data for an existing non-response bias is to sort the data according to the response data and part the answers into three segments. Later the first and the last segment can be compared with the help of a t-test. If significant differences between the first and the last third of the data has been found, the existence of a non-response bias might be possible [3]. However, this approach is criticised in [66]. The critics say that a found difference of participants that submitted their answers late doesn't consequentially give insights about

potential participants which didn't submit an answer at all. As an alternative it is advised to compare certain variables between responders and non-responders, like for instance the size of the company. This homogeneity test can be done with an t-test or an Chi-square-test.

4.1.4 Case Study Research

Case study research is a research strategy which focuses on understanding the dynamics present within single cases or settings [31]. Following Yin in [89] the scope of a case study is to examine a contemporary phenomenon, which can be seen as the case. This case is investigated in depth within its real world context. Often the boundaries between the examined case and its boundaries to the context are not clearly evident. A speciality of case studies is that usually they are built on multiple sources of data. Case studies can consist of various different types of qualitative and quantitative data like archives, interviews, questionnaires and observations, but a case study doesn't have to fulfil this characteristics. For example a case study that consists of quantitative data only, can also be seen as a case study and so on. The researcher simply adds every data that fits to the topic to the case study and analyzes each part of it and how they are affecting each other.

Yin points out that following his definition of case study research, this research method covers the logic of design, data collection techniques also leads to special approaches for data analysis. Hence case study research shouldn't be mixed up with being a data collection tactic [89]. Following Yin case study research is not limited to the investigation of a single case. Multiple-case studies are an often used research practise.

According to [89], in order to build well serving case studies, the following design components of research are most important:

- The question that should be answered through the case study. Every case study should at least cover a part of the research question of the whole study.
- The data units that are used for the analysis.
- The propositions that the case study delivers.
- A logical linking from the data to the propositions. Yin points out that this step is especially important for the evaluation of the findings of the case study.
- Criteria for interpreting the findings in perspective to the research question.

With case study research not every aspect of the phenomenon or the group of phenomena can be investigated. Instead the researcher specifies on one or a small number of objects in this group and examines its rules and characteristics. In order to make assumptions for the whole defined group that is in interest for this study *statistical generalization* or

analytical generalization is used. The second type of generalization is more important for the research paradigm of the case study. In analytical generalization the findings of the case study can be reinterpreted for the other cases of the group. A more generalized approach is to build theory on the foundation of the findings that came from a set of case studies. Yin points out in [89] that the principles that are build upon the learned lessons of a case study may potentially apply to an array of similar cases.

In [31] Eisenhardt builds a framework for generating theory using case studies. Eisenhardt's methodology was published 27 years ago. Despite its age, Eisenhard'ts approach is still cited and used by a big number of researches. Ravenswood pointed out in [76], that to the end 2008 Eisenhardt's article from 1989 has 2509 citations, many of this articles got published in high ranked journals.

After gathering the case studies, each of them has to be studied and analyzed. Eisenhardt advises to take field notes while going through the collected data and to ask yourself questions like "What am I learning?" and "How does this case differ from the last?". The whole process is highly iterative. Eisenhardt points out that if a new data collection opportunity arises or if a new idea comes up while research it is allowed to add data to the collection to view the topic from a new perspective. Later the single case studies have to be compared with each other in order to find out if there are any similarities between them. The output has to gather new ideas instead of being a summary of historic cases. The result of the cross case study should be more than the sum of its parts. Eisenhardt advises to select categories or dimensions and then compare the data of the single category of each case study with each other.

The next step is to form hypotheses that are backed by the data from the case studies. In this iterative process the theory is compared with the evidence from each case. A close fit is important to build valid theory. When building theory is finished, the results of the research are going to be presented in the thesis. It is important to explain to the reader of the thesis how the researcher reached the results that are presented. Since there is no generally accepted set of guidelines for evaluating the new built theory, the explanation of the analytical procedure has a high priority.

4.2 Research Framework

The first part of the method chapter introduced some often used practices in the sociological research that can be applied for innovation research. After the analyze of these options a research framework was built that is used for the research of the diffusion of organizational innovation. As written in the Chapter *State of the Art* in the beginning of this thesis, diffusion of innovation can be seen as the process by which an innovation is communicated through a network over time [78]. Therefore it was important to find data that shows the dates of implementation of certain organizational innovations. Afterwards this data can be plotted, similar to the plot of the *s-shaped curve of diffusion of innovation* as in 2.3. The x-axis shows the time and the y-axis shows the percentage

of implementation of the statistical population. Combined the plot shows the grade of implementation for a given time period.

As the literature review in the beginning of the thesis revealed, no data that could be worked with completely has been found in literature. So new data had to be collected for this thesis. For the data collection, the online survey in the form of a questionnaire was chosen. In the subsection *Surveys* both executed surveys are explained in detail. Each of the chosen organizational innovations have already been discussed in chapter 3. These organizational innovations have been grouped to form five case studies. A very little percentage of papers revealed data about the diffusion of innovation that is helpful to understand the diffusion of the respective innovation, but in every case the data was too old and the method that has been used was not sufficient enough for a generalization. Therefore the data was simply added to the fitting case studies and discussed separately. If possible, a connection between the data from literature and the collected data was established and explained in detail.

4.2.1 Case Studies

This is a list of all case studies that had been build for the data collection in this thesis. Each case study encapsulates a different group of organizational innovations. Since every organizational innovation had been named in a generalized way, concrete examples for each case study had to be chosen. It's important to mention that all of the examined organizational innovations are from the category *Processes* of the chapter 3. Even further it is important to state that each case study deals with organizational innovations that are linked to developments in the IT technologies. The implementation of some chosen innovations are based on software products completely, others are supported by them. This restriction was made in because of a number of reasons. First, the writer of this thesis originated in the field of computer science and wrote this thesis in the context of his business informatics study. Another reason is that those organizational innovations are the youngest. Changing the organizational structure or the use of new management methods are processes that can be seen through the whole evolution of corporations, but using software systems for more efficient workflows in every day's business is a new movement, in comparison. Therefore very little is known about the diffusion of these innovations and that makes the research in this field even more interesting.

Enterprise 2.0

Case study 1 examines how many companies are using tools for the modernization of their communication. In the last years the term Enterprise 2.0 emerged, which follows the term Web 2.0. It describes companies that are using Web 2.0 technology to increase their communication, data sharing and knowledge transfer [36]. Communication can be seen as one of the most important supporting pillars in every day's business. The product or the strategy of a company can be good, but without a working communication a company can't function and therefore in fact looses a lot of money. The last 20 years showed us that communication is transforming from its analogous nature to a digital

form. This change is only possible because of the development in the IT-sector. This is the reason why it is very interesting to see how the communication got transformed in the last couple of years using technology. Communication in the working world is a very broad term and consists of many important sub topics. The first is the typical communication where information is being transmitted, either in oral or written form, mostly digital. Another sub part of communication is the communication of documents that are used for several work processes.

Another part that is being explored is the sharing of knowledge inside of companies, which is a very important task in the long run. Why knowledge sharing is important is already stated in 3.1.6. The way knowledge is communicated inside of companies is a complex and important question. Knowledge has to persist for a long time in the company until it isn't valid or interesting any more. Also it has to be retrievable any time by any person that is allowed to do so. Like the communication channels that have been discussed before, knowledge sharing solutions also rely heavily on IT-technology.

In the last couple of years all of these types of communication have been transformed due to new technologies, which are examined in this case study. The main part of the data of this case study originates from Survey 1.

The applicable questions from survey 1 for the first case study were:

- Do company wide policies for the reduce of e-mail transfer exist? If yes, since when?
- Does the company use instant messengers for internal ad-hoc communication? If yes, since when?
- If yes, which tool is used?
- Does the company use cloud based data management solutions like Sharepoint, OneDrive, Dropbox or Google Drive? If yes, since when?
- If yes, which tool is used?
- Does the company use ESNs? If yes, since when?
- Does the company use wiki pages for the sharing knowledge inside of the company? If yes, since when?
- Does the company use software solutions, that are not Wiki pages, for sharing knowledge inside of the company. If yes, since when?
- If yes, which solution is used in the company?

These questions star an interesting mix in different aspects of the use of communication technologies. The e-mail is a widely accepted and often used tool for communication. With the use of e-mail, written information can be sent, as well as documents. Nevertheless

more and more companies realise that using e-mail is not the best solutions for every case. More about the problems can be read at 3.1.9. Instant Messengers are, like e-mail, also a widely known communication technology. For the task of fast communication, where no filing is needed, they are still a good solutions for communicating information. In the last decade a new pattern of collaboration tools arrived which helps groups to organize and share documents in often so-called workspaces information and documents that belongs to one specific topic or project can be aggregated. These collaboration tools also offer a versioning system. Another advantage is that the documents can be shared with a group of people to view and for editing. This behaviour is not achievable with document transactions using e-mail or instant messengers. These tools like for instance Sharepoint, OneDrive, Dropbox or Google Drive are designed for document sharing only, therefore communication regarding these documents have to be done using other Communication Tools.

A very new technology that promises to revolutionize the overall communication of big companies is the ESN. With the use of ESNs both mentioned types of communication are possible. It also relies on the pattern of workspaces, but in addition adds ideas from common social networks.

Two questions other of this case study concern the topic of knowledge sharing. Both questions differ only in the chosen solution that is used to solve this task. Since wikis are very popular and wide spread, the researcher was interested if other web based solutions are also this popular for knowledge sharing. On one hand wikis are a very simple and common solution for the sharing of information. The use of these pages is self explaining. On the other hand the functionality reaches its limits very fast, which can be overcome by other solutions. Overall, the mixture of these questions offer a good overview on the implementation of communication- and collaboration tools over the last couple of years.

At [1] the report of a study that investigates which picture the employees of 264 German companies have about the term Enterprise 2.0 can be found. This study was done annually from 2005 to 2015 by the same institute. Therefore the data from the iterations can be compared with each other. An interesting study observed the introduction of chat clients in business organizations [69]. It was released in the year 2003 which was the beginning of the introduction of chat clients to the business world. Researchers from the Fraunhofer Institute in Berlin carried out a comparative study on the use of web 2.0 technologies in enteprises. They analyzed ten different studies regarding this topic and summarized the findings in this paper [36]. Other publications regarding the use of Web 2.0 technology in enterprises that are used for this case study are [45] [12] [13].

Paper Free Office

The second case deals with the diffusion of policies that enforce paper free offices. Case study 2 features data that was collected in the course of Survey 1. The so-called paper free offices can be achieved very easily. People seem to tend more and more to depart

[1] `https://www.feelgood-at-work.de/enterprise-studie-2015`, 21. October 2016

from printing every document.
Technology can be seen as a second driver that encourages employees to save paper in their everyday's workflows. Instead they can enjoy the advantages of reading documents on their computer or tablets. Another driver to enforce the paper free office is clearly the reducing of costs.

Following questions from Survey 1 have been used for the second case study:

- Does the company tell every employee to print as little as possible on paper. If yes, since when?
- Does the company tell its employees to use disclaimers that tell the reader of the e-mail to think about the environment before printing the e-mail. If yes, since when?

These two questions investigate if the invited companies implemented policies in order to be more productive and save money while renouncing paper. The outcome of the second questions seems especially interesting, because the use of these disclaimers is very cheap to implement, while the effect can be very big, because the company can increase its eco-image.

Business Process Integration

In case study 3 data is collected about the diffusion of business process integration. The integration of business processes is an indispensable step for every bigger business nowadays. An, in comparison, new term is the so-called *digital transformation* which is offered and accompanied by various IT service providers. This expression stands for the connected use of modern IT technology in order to optimize every day's business of large companies. Aside from customizing or programming the used solutions, an important part of integrating business processes is also the surveillance and the leading of the change process. One can say that the most important product that is used for business process integration are ERP systems. It's not only a very often used pattern for business integration, but also one of the oldest that is based on IT systems. Another very important pattern that comes from the same area, but has another focus, is the CRM system.

This case study features data from survey 1, which deals with the diffusion of the following topics in Austria's 500 most successful companies:

- Does the company use ERP systems like for example SAP, Microsoft Dynamics or Infor. If yes, since when?
- If yes, which ERP system is used in the company?
- Does the company use CRM systems like for example Salesforce, SugarCRM, SAP CRM or Microsoft Dynamics CRM. If yes, since when?

- If yes, which CRM system is used in the company?

Both systems mark the beginning of business process integration. Therefore these two simple questions have been added to survey 1, to find out how many of Austria's 500 most successful companies decided to use these system for their business process integration.

One report was found that offered useful information regarding the diffusion of ERP- and CRM systems [5].

New Ways of Working

Case study 4 examines the diffusion of policies in Austria's 500 most successful companies that enforce the so-called new ways of working. Case study Enterprise 2.0 pointed out the important fact, that with the change of technology also the way people are communicating is changing. The digitalisation of communication provides the chance to change the way people are working, also. With the invention of the internet, people don't have to be in the same room for communicating. Modern web based solutions made it much easier to work together over distance. In the next years technology will improve in order to enhance the digital workplace. On the one hand these new technologies increase the flexibility for the employees regarding office hours and working location. On the other hand companies have the chance to save money and are also more flexible. Flexibility in the work though is a double-edged sword, which means that employees don't only benefit from this change.

Following questions from Survey 1 have been relevant for this case study:

- Does the company give ita employees the possibility for working from home for at least one day per week. If yes, since when?
- Does the company have Shared Desk offices. If yes, since when?

With the ability to work from outside of the office, home office got popular recently. Being able to work at least one day from week at home can be a big advantage for employees. On the other hand work and private life is mixed up more, which is not preferred by everyone. Also, the company has to be able to trust its employees to work as efficient as in the office, otherwise home office is bad for the company's business. One of the side effects of home office is that since less persons are in the office, less working places are needed. Also the structures are becoming more project orientated. Therefore in the last couple of years so-called shared desk offices got popular. These two aspects are good examples for the changes that were made in the last couple of years regarding the way of working. While home working is nothing completely new, but is driven more with better technology, shared desk offices are comparably a new trend.

Collaborative Design - BIM

Collaboration often is an indispensable part of every day's work. As already stated, the progress of technology changed the way we are communicating. This progress of technology also changed the way certain people are collaborating. Case study Enterprise 2.0 already treated collaboration as a part of communication, but there collaboration between the entities were really simple. One important example was the process of document sharing, which has a comparable low complexity.

Case study Collaborative Design - BIM focuses on collaboration tasks that follow more complicated workflows. A very good example for a collaborative workflow that concerns many entities is the pattern of BIM. Also the workflow of BIM relies heavily on software products, which makes it a perfect example for the exploration of collaboration tools. This case study contains data about the diffusion of BIM which is introduced in the example section earlier 3.1.3. Therefore this case study dedicates to the diffusion of BIM in Austria's AEC industry.

This case study uses data from survey 2, which offers diffusion data about the following topic:

- Does the planning office use BIM technology for their projects? If yes, since when?
- If yes, which BIM level is implemented?
- If yes, what are the advantages of BIM?
- If no, why isn't the company using BIM?
- Is the company planning to increase its BIM usage or to start using it at all?

The very informative German book about BIM [9] has a chapter where the worldwide distribution and diffusion of BIM is discussed. It doesn't offer data how the implementation of BIM changed over time, but has interesting information about its distribution and therefore it will also be discussed in this case study. Other found reports regarding the implementation of BIM are [73] and [67].

4.2.2 Surveys

To make this research possible two different surveys have been designed in the form of online questionnaires. In the design process the best practices that can be read in [6] have been considered. After designing the surveys, the invitations for the questionnaires have been submitted to the respective companies through e-mail. The deadline to complete the questionnaire were 30 days. Since only Austrian companies have been invited to take part at the survey, both questionnaires are completely in German. Both surveys delivered the bulk of the data for the results of this thesis. The complete questionnaires are attached to this thesis in the appendix of this thesis.

Survey 1: Austria's 500 most successful companies

The first survey was built to retrieve data for the first four case studies. In general the questions of survey 1 are built with the same pattern. The researcher wanted to find out if the participant implemented a specific organizational innovation. If yes, then it was also important to know in which year the implementation took place in order to plot the data for the analysis of the diffusion of the organizational innovation. An exemplary pair of questions where it was asked if the company uses ESNs would have been:
Does your company use ESNs?
The possible answers were *no* or *yes*. If the participant would have answered *yes*, a follow question appeared since which year the company uses this tool. As answering options, the participant could pick the year of implementation. Therefore the survey basically consists of 14 such formed pairs of questions. In some cases, the participants additionally have been asked which tool they are using. So it was possible to see if some solutions are more popular than others.

The implementation of each organizational innovation of these case studies has a bigger effect in big companies. For instance the use of an ESN in a small company that consists of five people would be counter effective. Imagine that the whole team of the company works in the same room in their office. In this case electronic communication is a less important topic in comparison to companies that have multiple offices across the country or across the world. Therefore the researcher decided to invite Austria's 500 biggest companies measured by their number of employees to answer survey 1. Research revealed that a list featuring these companies could not be retrieved. A look at the annual report by the [2] regarding the number of employees in each line of business revealed that in the end of 2015 there have been 431 Austrian companies with 500 or more employees. *Trend 500* released at [3] a list of Austria's 500 most successful companies measured by their net turnover. After sorting the list based on the number of employees it was clear that 415 out of these 500 companies have 500 or more employees. Since almost every company that belongs to Austria's biggest companies is represented in the list of Austria's 500 most successful companies, the companies on the list have been invite to take part on the survey instead. Therefore the statistical population for this survey are Austria's 500 most successful companies.

Survey 2: Planning Offices in Austria

The questionnaire for survey 2 which consists of five questions was developed by my colleague Judith Tiefenthaler and edited by the writer of this thesis. Judith Tiefenthaler wrote her Bachelor thesis about the diffusion of BIM in Austria in the same time as the writer of this thesis wrote this Master Thesis. Therefore we decided to team up and use the synergistic effects. The first questions checks if the participating planning office uses BIM, therefore the two possible options as answers are *yes* or *no*. The second

[2] `http://wko.at/statistik/jahrbuch/unternehmen-GK.pdf`, 06. October 2016
[3] `https://shop.trend.at/trend-top-500/top-500`, 06. October 2016

question has to be filled out only if the first question was answered with *Yes*. It asks the participant when the company implemented BIM. The combination of the first two build the data for the diffusion graph that is going to be plotted after analysing the data. Question 3 and question 4 are also only relevant if the company implemented BIM. We decided to add these questions to gain a little more insight about the maturity level of Austria's BIM implementations. Question 3 asks if the company uses *little BIM* or *big BIM*. While *little BIM* means that the company uses BIM software solutions for a couple of use cases, *big BIM* portrays the the use of BIM software solutions through the whole life cycle of the building, which is definitely the implementation with the higher maturity. Question 4 asks the company which BIM Level according to [9] from level 0 to level 3 the company implements. The fifth and final question asks if the company plans start using or to increase their use of BIM in the future. The answers of this questions can give interesting insights if Austria's planning offices think that BIM is an idea worth to invest time and money in it.

In order to create case study Collaborative Design - BIM data about the diffusion of the implementation of BIM was needed. In the first survey the type of business of the companies that took part on the survey hadn't had an influence on the criteria if they were added to the statistical population of the survey. Since the use of BIM is only relevant for companies in the construction industry, the researcher looked up the names and contacts of every planning office in Austria. The *Firmen ABC* database revealed 1502 planning offices in Austria.[4] The research of the diffusion of an innovative solution like BIM in the line of business of a whole country seemed like a good counterpart to the first survey. Therefore the statistical population for this survey are members of Austria's AEC industry.

[4] `http://www.firmenabc.at/firmen/wien/architekturbueros-und-ingenieurbueros_BtO`, 20. October 2016

CHAPTER 5

Results

After introducing the reader of this thesis to the research field of organizational innovation and stressing its importance for the economy, this chapter presents the results that have been gathered with the help of the research framework that was explained in the previous chapter.

19.4 percent of the potential participants of survey 1 submitted an answer, which are 97 datasets. After receiving the results, the data has been analysed in order to find out if a non-response bias existed. 78 potential participants responded with an e-mail stating that they strictly aren't answering any questionnaires, because they are getting a high volume of invitations to participate at a survey. These are 15.6 percent of the sample. A homogenity analysis on certain variables as proposed in [66] couldn't be carried out, because no fitting variable could be determined, because the survey was completely anonymous. Nevertheless the sample of potential participants was chosen regarding their company size, therefore a determination of a plausible variable would be not possible anyway. A t-Test on the first and the last third of the data, as proposed in [3] has been done. As variables the boolean answers of the questionnaire have been chosen. The differences between the first and the last third of the submissions haven't been statistical significant. As mentioned in [36] and in [12] organizational innovations are especially important for large companies. Therefore a general lack of interest in a specific part of the sample and a resulting non-response bias in the data of survey 1 seems unlikely.

In contrast survey 2 had a significantly lower response rate of 10.59 percent. 159 out of 1502 companies delivered an answer. A test regarding the answer if the company implemented BIM revealed no significant difference between the early and the late answers. Again, since the submissions are completely anonymous no more tests are applicable. Therefore it can't be said if a non-response bias exists. The detailed analysis of the fifth case study will show that BIM is a term that got more important in the last couple of years. The group of people from the AEC industry are parted when it comes to this topic. Some are very eager in trying and investing in this new type of designing, while others

don't want to change their already working processes. It is likely that the respondents belong to the group of people who have either a very positive or a very negative opinion about BIM. The big group of non responders could consist of people who either don't know about the existence of BIM or don't see its relevance. So the reader has to keep in mind that the analysis of the fifth case study is mostly about the diffusion of the people that are already in contact with BIM.

5.1 Within-case Analysis

As stated before, the researcher built five different case studies concerning the grade of implementation of various organizational innovations. This chapter starts with the presentation of the results of each case study. Most of the data has been gathered with the help of two online surveys, which have been explained in detail in chapter 4. The original version of both surveys can be looked up in the appendix of this thesis. Since the survey was addressed do Austrian companies only, the surveys are completely in German. The main focus in the result presentation of each case study is the explanation of the gathered results from the online surveys. The case studies also have been presented in the previous chapter. If additional data has been found in literature it is also presented and commented in the given context. Figure 5.1 shows the adoption rates of each organizational innovation that was considered in both surveys. The bars are showing the adoption rate as a percentage. The number of adoptions are shown in the square brackets.

While the adoption- and the diffusion rate of each representative tangible innovation is interesting information, the writer of this thesis wants to form more abstract statements about the diffusion of organizational innovation. Instead of focusing on one single innovation per case study, each case study explores the diffusion of innovations in a certain field that defines the way of working in enterprises.

For example the first case study inspects the implementation of Web 2.0 technology in companies. For measuring the adoption rate of Enterprise 2.0 companies, the participants of survey 1 have been asked if they implemented a representative tangible organizational innovations in the history of their company. An example for an actual Web 2.0 technology is the ESN. If a company implemented an ESN in the last years or is planning to do this in the near future this shows that it is interested in following new trends in order to try to increase the efficiency of their group. So the adoption rate for the idea of Enterprise 2.0 is measured by analysing the adoption rates of actual Web 2.0 technologies in Austria's 500 most successful companies. The adoption rates of the organizational innovations have been assigned to the corresponding case studies and aggregated in order to form adoption rates of the groups of organizational innovations. Therefore it is possible to form abstract statements, while the current trends of the last couple years have been examined.

In consequence the results of each question have been aggregated. For analysing the diffusion of the organizational innovations two questions per innovation have been essential.

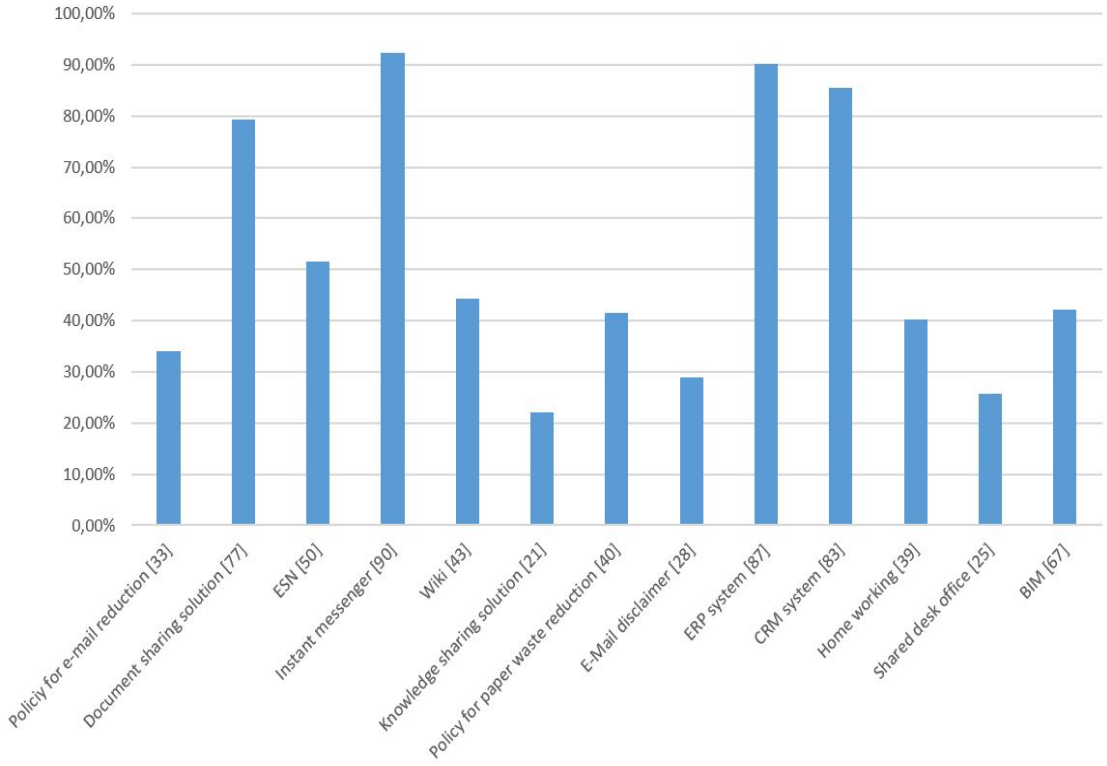

Figure 5.1: Adoption rates per innovation

Company ID	Org. Innovation A	Org. Innovation B	Aggregated Value
1	Yes	Yes	Yes
2	Yes	No	Yes
3	No	No	No

Table 5.1: Aggregation rule for adoption

The first was if the company already implemented the innovation, for example if it uses an ESN. This information doesn't give enough information to talk about diffusion, which is the main topic of this thesis, but tells a lot about the willingness of the sample to change their corporate strategy and enriches the data. Table 5.1 shows a couple of example to explain the rules how the data was aggregated. If at least one of the organizational innovations, that belonged to the same case study , was implemented, the subsample increased the adoption rate. Only if a company didn't implement a single of the mentioned innovations of one group, the examined subsample didn't contribute positively to the adoption rate, as seen for company number three in table 5.1.

The second important question per innovation was the implementation date of the representative innovation. Since it was interesting to find out at which year the companies

Company ID	Org. Innov. A	Org. Innov. B	Org. Innov. C	Aggregated Value
1	2017	2013	2011	2011
2	2009	2010	-	2009
3	2013	-	-	2013
4	-	-	-	-

Table 5.2: Aggregation rule for diffusion

of the sample implemented an organizational innovation in order to change their strategy in the given area, the diffusion curves have also been aggregated. Table 5.2 portrays examples that explain the rule that was used to generate the aggregated diffusion curves. If a company implemented more than one organizational innovation of the observed area, the year which is furthest back in the past was chosen for the aggregation.

This chapter will feature the plots with the aggregated values and curves for each case, as well as the detailed plots for each individual innovation. As explained in the introduction of this thesis, the researcher uses a logistic function as shown and explained at figure 2.1 to build a model for the diffusion rates. In order to estimate the parameters A, K and b for the model, a non linear least squares regression was conducted for every sample. In most cases diffusion already peaked in the past, meaning that the saturation got reached. The parameters of the logistic function are explained in detail in chapter two. In the other cases a forecast using the growth function that was crated with the estimated parameters was used to create a forecast for the following years.

5.1.1 Enterprise 2.0

The relevant questions for this case study in English can be found in the previous section 4.2.1. The first case study that is presented devotes itself to various tasks, where communication is needed. Those tasks are communicating, document sharing and knowledge sharing. All of these tasks could be performed simply with the use of e-mail. However in the last couple of years new solutions were developed in order to perform these actions more efficient. Although a big number employees tend to perform every communication task by e-mail it seems important to use the right tool for the right case. Introducing a new tool in an environment is not an easy task. In most cases the employee doesn't see the big picture and therefore can't know about the overall benefits of changing old habits.

As seen at figure 5.36 more than 90 per-cent of Austria's 500 biggest companies took steps in the last couple of years in order to change the internal communication by implementing new tools. The questions starred a mix of different aspects in the effective use of information technology. A look at the barplot which shows the adoption rates per innovation reveals that the biggest part of the 93 per-cent of the aggregated results of this case study comes from the use of instant messengers for instant communication and document sharing platforms.

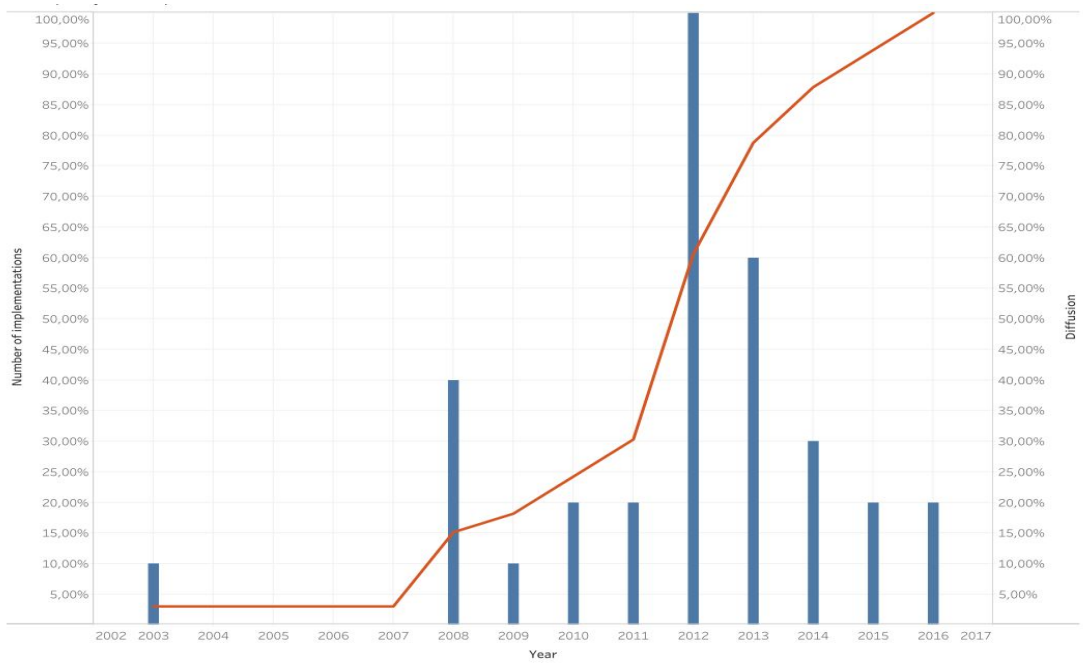

Figure 5.2: Policy for e-mail reduction - diffusion

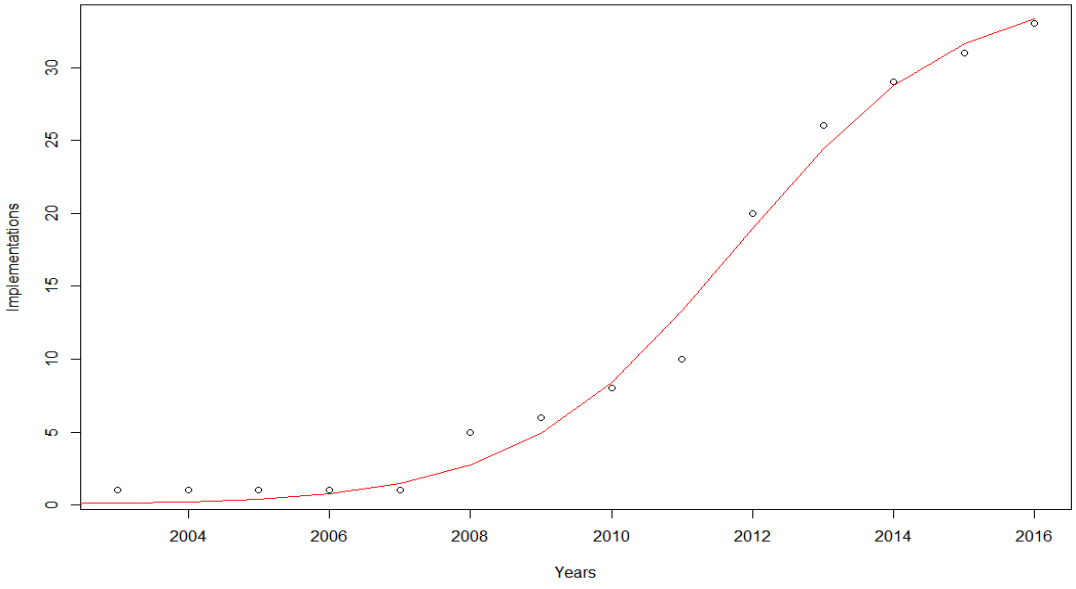

Figure 5.3: Policy for e-mail reduction - comparison of sample and diffusion model

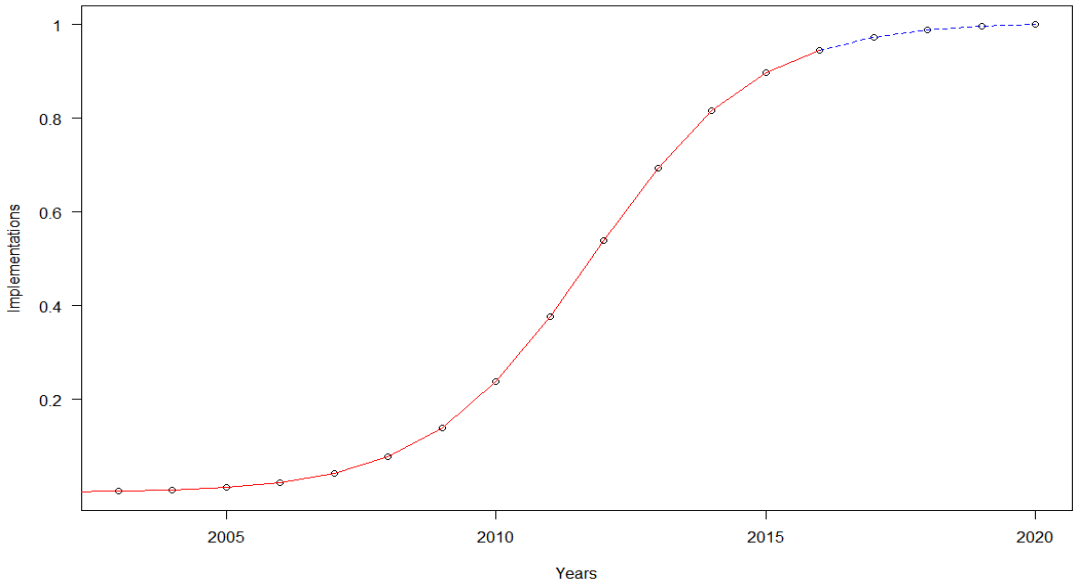

Figure 5.4: Policy for e-mail reduction - forecast

On the one hand 66 per-cent of the asked companies don't take a strong position on the opinion that the use of e-mails has to be reduced by a certain strategy. On the other hand it has to be pointed out, that using instant messengers and ESNs is decreasing the e-mail traffic by design. Especially the last three years had very low adoption rates which shows that the growth definitely already saturated. 34 per-cent answered that they implemented company wide policies to lower the use of e-mails as seen at figure 5.1. The diffusion of policies that try to reduce the use of e-mail can be seen at figure 5.2. This plots shows us that precautions in order to confine the use of e-mails started in 2008. The diffusion peaked in the year 2012, which fits to the beginning of the so-called *Zero Mail* attempt by the french IT-Servicecompany Atos. This year seems to be the point were most big companies realized that using e-mail only, slows the communication. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process. They can be seen in figure 5.3 and were the following K: 35.39, A: 2011.77 and b: 1.52. The model revealed that the diffusion process ended yet, therefore it is highly likely, that in the near future more companies will decide to enforce other communication tools in order to decrease the use of e-mail. Following the constructed forecast, portrayed in figure 5.4 the diffusion process will end somewhere around 2020, which is pretty soon.

Figure 5.1 shows that 92 per-cent of the asked companies are using instant messengers for their internal communication. This value backs the assumption that instant messenger are widely accepted for communication in the business world. The diffusion curve for

the use of instant messengers for internal ad-hoc communication can be seen at figure 5.5. As well as the diffusion processes of policies to reduce the use of e-mail, which can be seen at figure 5.2, this diffusion process also starts basically in 2008. This can be explained by the fact that the increasing the use of instant messengers, decreases the use of e-mail. The plot shows us that once started, the growth went on rapidly, resulting in a peak already in 2009. This shows us that the instant messenger isn't only a very popular organizational innovation, it is also one that is easy and fast to implement. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, portrayed at figure 5.6, which were K: 73.01, A: 2009.17 and b: 1.25. By far the most often named instant messenger in the results were Skype For Business and its predecessor Lync by Microsoft. Also named were Lotus Sametime by IBM and Google Hangouts. The plotted diffusion curve at figure 5.5 shows that the adoption of instant messengers already peaked and reached its climax in 2009.

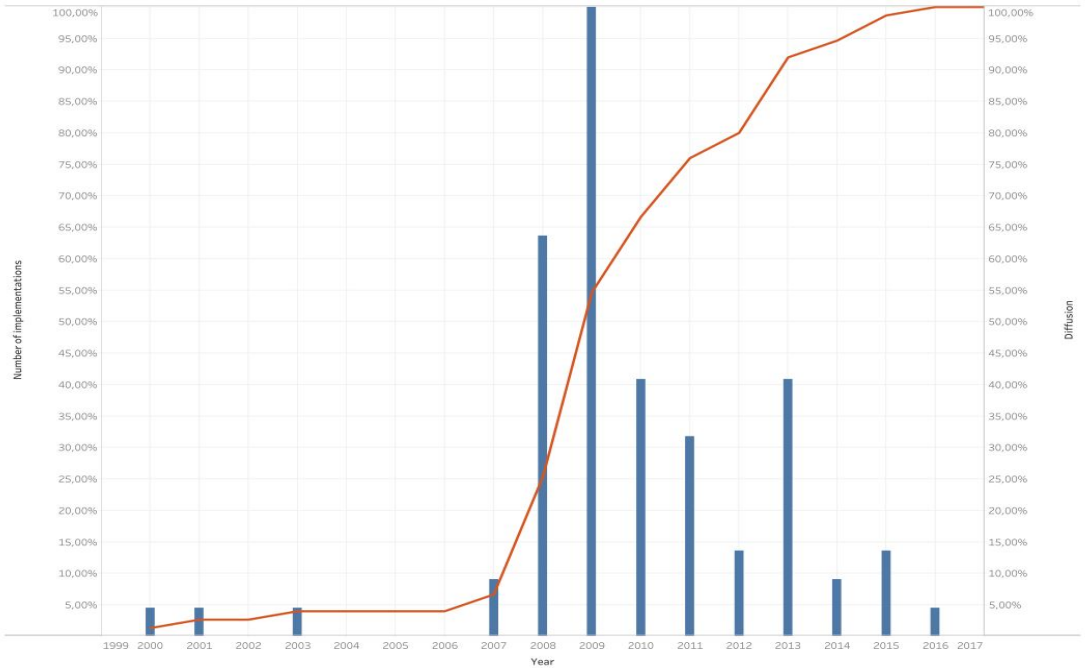

Figure 5.5: Instant messenger - diffusion

According to figure 5.1 circa 80 percent of the asked companies are using solutions that are designed for the specific purpose to share documents. This high value shows that the ability to send documents via e-mail or instant messengers is not useful enough. Instant messengers like Skype and document sharing platforms like Dropbox or Sharepoint for instant are accepted widely. Besides the functionality, one reason for this is that most people are used to use this products in their private life as well. In most cases companies are using a specific business version of the tool, but the differences between these versions are quite small. The diffusion curve for the use of document sharing solutions can be seen at figure 5.7. Comparable to the diffusion of instant messengers, this diffusion process

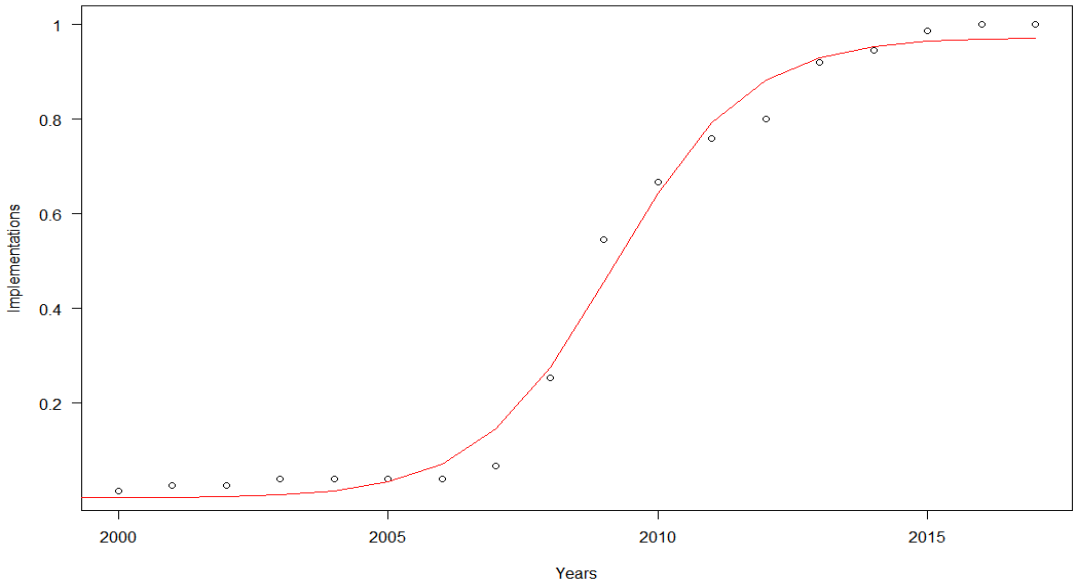

Figure 5.6: Instant messenger - comparison of sample and diffusion model

went on rapidly reaching its climax in 2010 once it started in 2009. This development also can be seen as a reaction to the need of replacing the e-mail. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, seen at figure 5.8, which were K: 73.38, A: 2009.36 and b: 1.02. The most often mentioned document sharing solutions was Sharepoint by Microsoft, followed by the business solution of Dropbox and Owncloud. Most companies are using the Office Suite and Windows operating System by Microsoft. Therefore many companies also rely on Sharepoint for their document sharing tasks. This solution offers a wide array of functionalities, but with more functions comes bigger complexity. In most cases more simple document sharing and cheaper solutions should suffice. According to the results, the growth of document sharing solutions in the business world has also already saturated.

The company wide sharing of specific knowledge is an important, but complicated task. The information has to be able to be found very fast, therefore the system must provide an intuitive structure and search function. It has to be possible for a novice to find the needed information without any help from other people. Employees might come and go, but information persists. Wikis are a widely accepted and known solution for keeping record of knowledge. They are easy to set up and there are no license costs, since this technology is open source. Therefore the barrier for using this option is very low. A look at figure 5.1 shows that 45 percent of Austria's most successful companies are using wikis for the notation of knowledge.

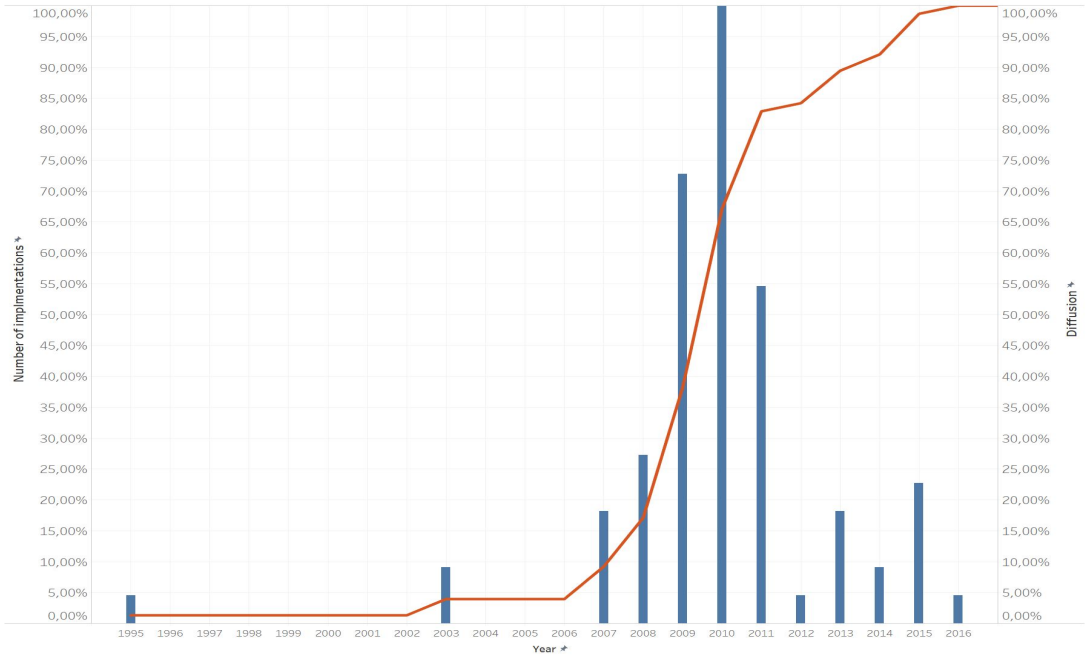

Figure 5.7: Document sharing solution - diffusion

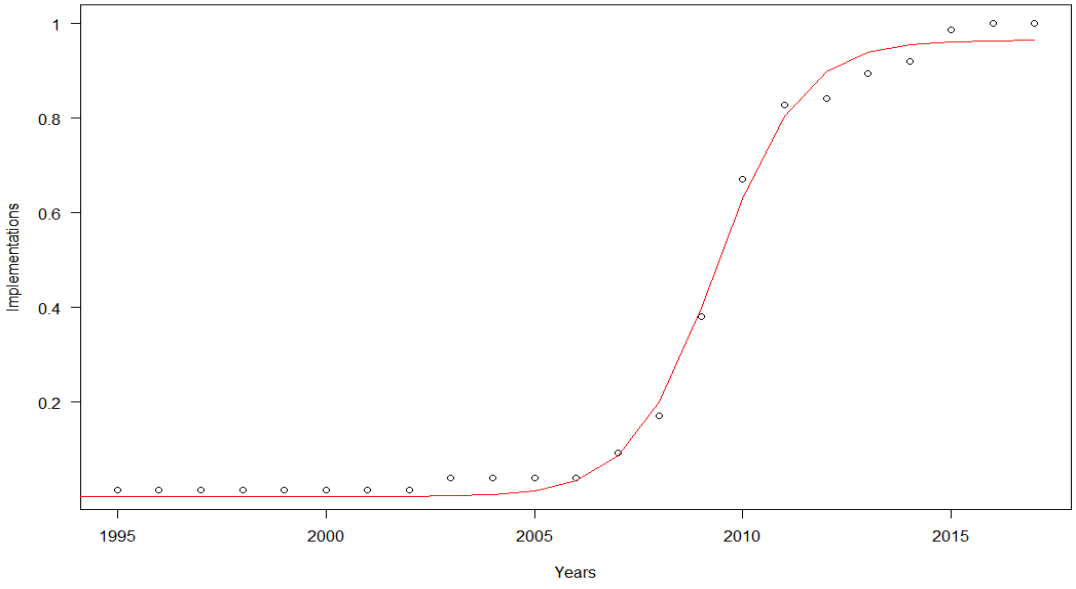

Figure 5.8: Document sharing solution - comparison of sample and diffusion model

The diffusion curve for the use of wikis for the company internal knowledge transfer can be seen at figure 5.9. This plot shows that wikis were used at some companies for a longer time before the peak of this technology in 2007. In comparison the double s-curve is less steep than most other of this study. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, seen at figure 5.10, which were K: 43.34, A: 2006.25 and b: 1.92. Hester writes in [45] about the advantages of wikis for knowledge sharing. She praises its characteristics of open editing which makes it to an environment of social computing. Fuchs in [36] writes that the most often used Web 2.0 tools in enterprises are wikis. In comparison only 22 percent stated that they are using other solutions than wikis for the sharing of knowledge, as seen at figure 5.1. This shows that the first option is far more often used than specific knowledge sharing solutions. Another interesting finding is that 17 percent of the companies that stated to use specific knowledge sharing solutions are also using wikis. In [45] Hester criticises common knowledge sharing solutions. Although there are very powerful systems on the market, the adoptions seems to remain enigmatic. She also references to studies that showed that often even already implemented systems remain unused. 51 percent of Austria's 500 most successful companies stated that they are using a wiki or another solution for their knowledge sharing. According to the importance of this aspect a higher value was expected by the writer of this thesis. The results of these questions deliver the impression that most companies don't want to invest in the persistence of knowledge, which can be a risky move.

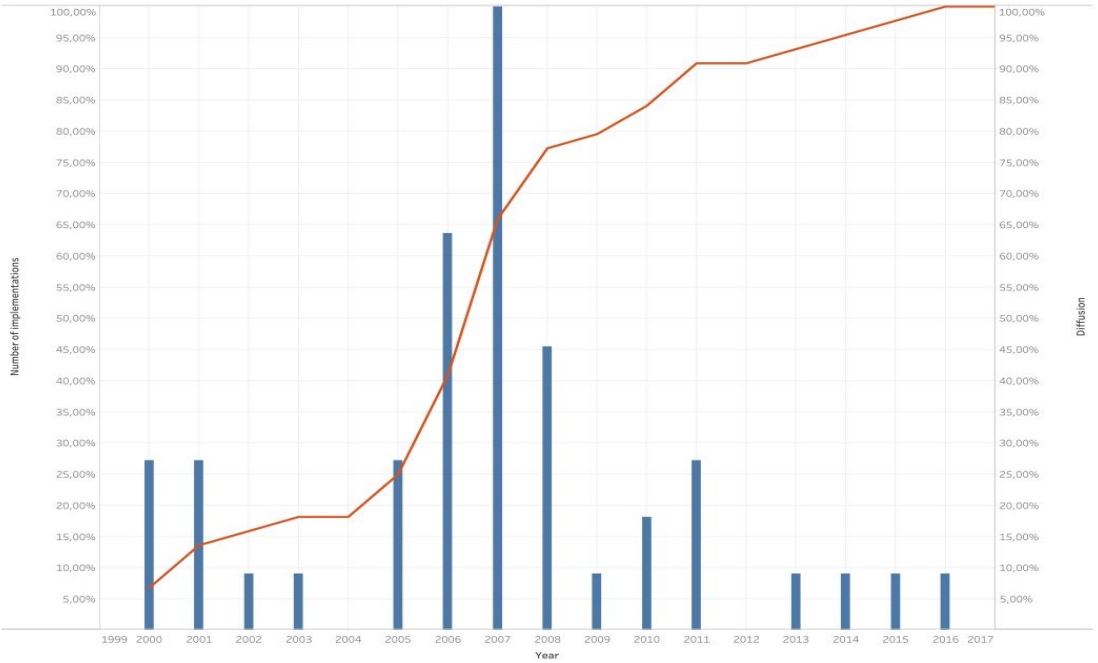

Figure 5.9: Wiki - diffusion

While the use of wikis had its climax in the year 2007, as seen at figure 5.9, the specific

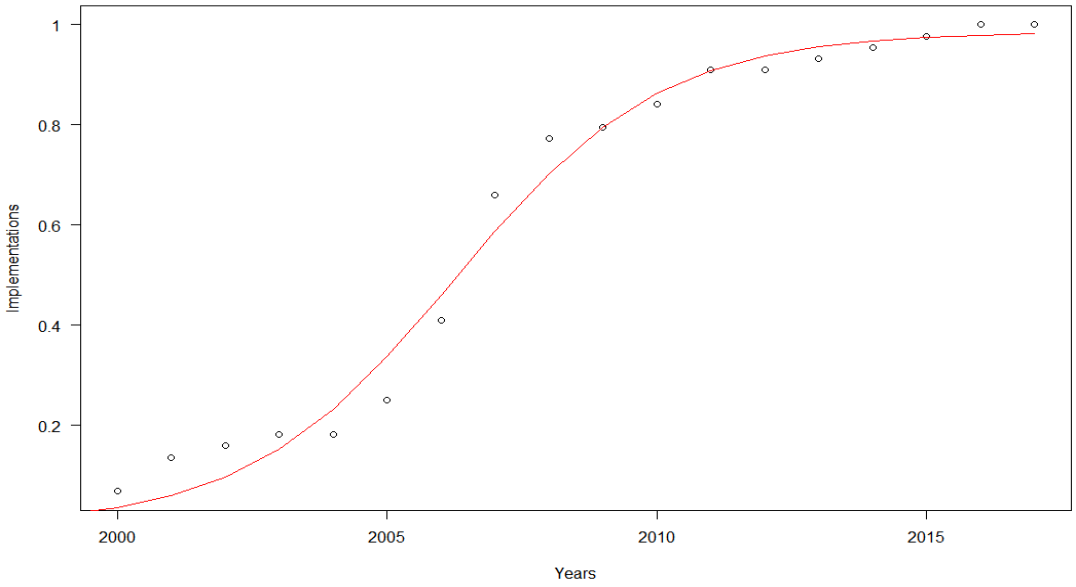

Figure 5.10: Wiki - comparison of sample and diffusion model

software solutions had their climax three years later. This can be seen at figure 5.11. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, as seen at figure 5.12, which were K: 40.17, A: 2010.39 and b: 3.12. This results in the finding that the diffusion process of more specific knowledge sharing solutions is not over yet. The estimated values for the growth function that have been gathered by a non linear least squares regression indicated that specific knowledge sharing solution should saturate in the year 2028, as seen at figure 5.13, therefore it may be possible that its successful time might come in the near future. More probable though is that knowledge sharing systems might be superseded by ESNs.

The ESN is a comparable new technology which can be used for every task that is discussed in this case study. With its help it's possible to communicate in specific workspaces and share documents. Since these workspaces are persistent and searchable, they are also very useful for the sharing of knowledge. As seen in the detailed plot concerning the diffusion of ESNs at figure 5.14, the nation wide adoption is still processing. Temporary 2016 is the climax for its adoption. It is not possible to forecast the future development of the growth rate of ESN adoption, because no parameters for the logistic curve with the help of the non-linear least squares estimation could be found. Approximately the half of the companies said that they are already using ESNs, following figure 5.1, which shows that this invention is quite popular. Especially when considering that the rise of the ESN started in 2014.

Although the fact that companies are buying and implementing ESNs doesn't guarantee

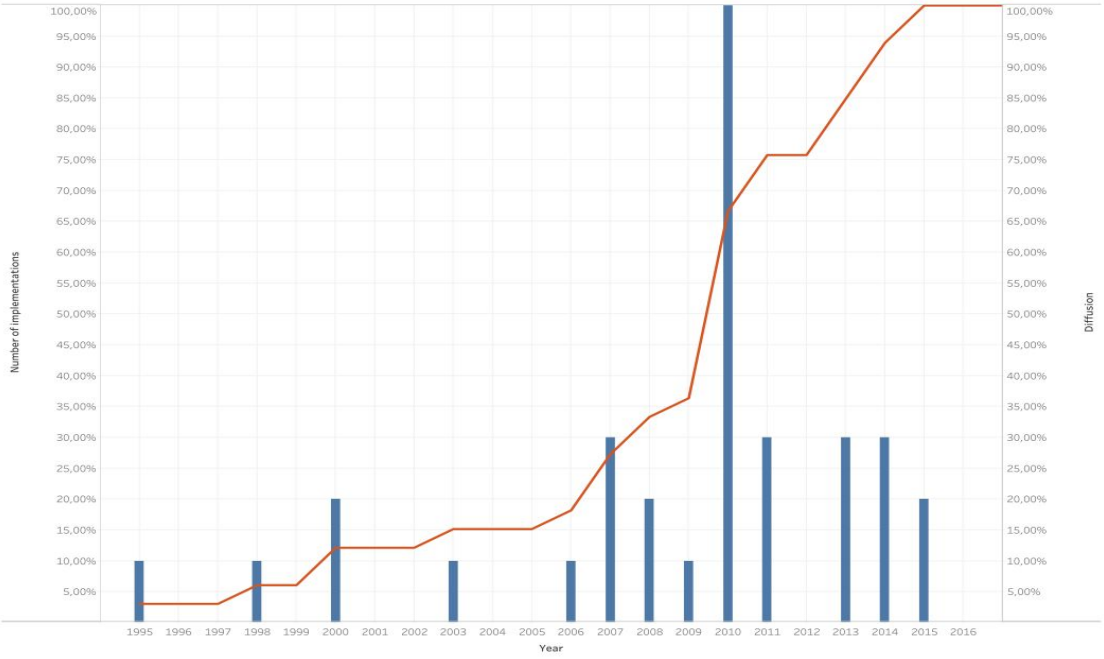

Figure 5.11: Knowledge sharing solution (no wiki) - diffusion

that they are used in a proper way. By virtue of the, in comparison, very young age of this technology no reports regarding this topic do exist. Since the number of implemented ESNs is still on the rise it was not possible to estimate a logistic function for determining the growth of this innovation. Logistic functions are saturation models, therefore a saturation level has to be estimated, which is not possible if a decrease of growth isn't ascertainable. Since most working people tend to use e-mails for almost every communication task it doesn't seem probable that one would become a strong ESN user, without any strict guidance by the company or external consultants.

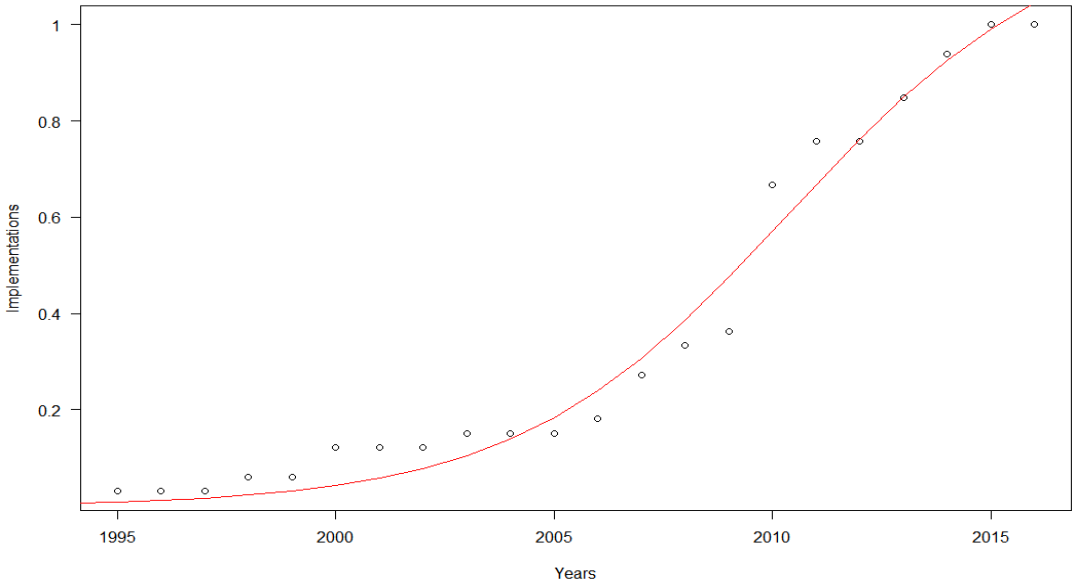

Figure 5.12: Knowledge sharing solution (no wiki) - comparison of sample and diffusion model

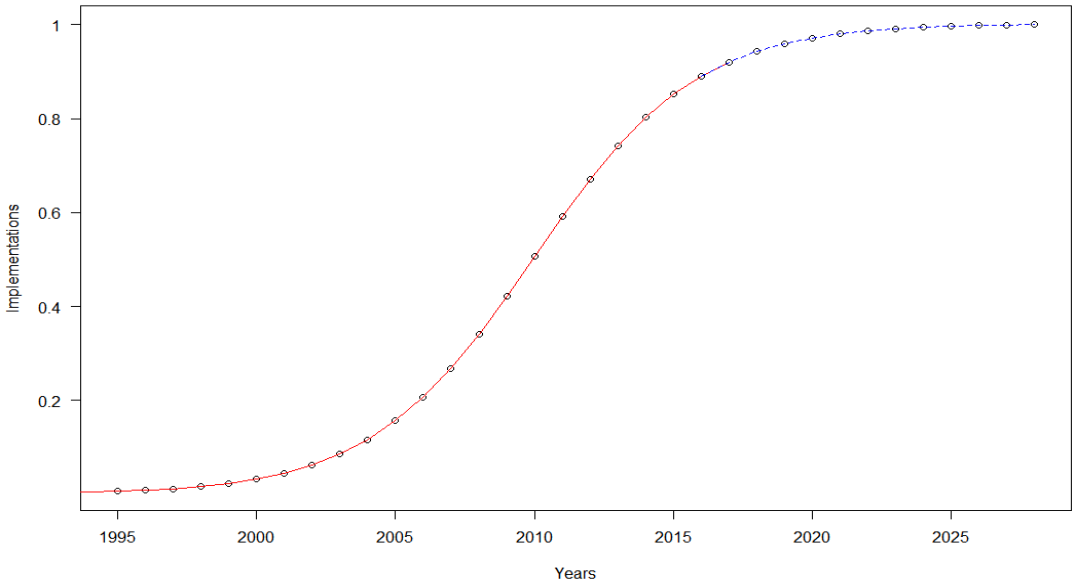

Figure 5.13: Knowledge sharing solution - forecast

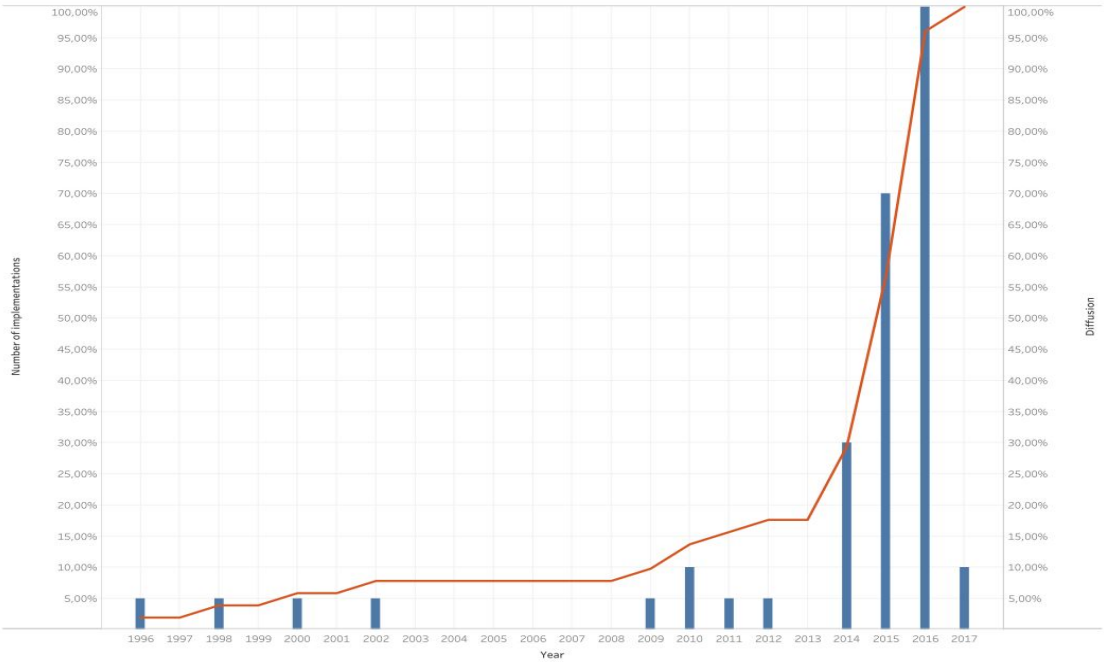

Figure 5.14: ESN - diffusion

Researchers from the Wiesbaden Business School carried out a study regarding the acceptance of the topic Enterprise 2.0 by employees of various companies of small- as well as middle- and big sized companies. The study was conducted three times, the first in 2010, the second in 2013 and the third and for now last time in 2015 with 213 to 281 participants. Each year the scholars from the Wiesbaden Business School asked the participants how they understand the term Enterprise 2.0 at this moment and which tools they were using at this moment. In the report of the summary of this study [1] multiple plots show that in each iteration of this study the employee's awareness regarding the digitalization of communication channels has risen. According to this study the trend of dealing with Enterprise 2.0 began in the year 2005 where four percent of the companies could be called Enterprise 2.0 active companies. This value has risen steadily over the last years resulting in the result that 81 percent of the participating companies are now using Enterprise 2.0 technology. The value of 81 percent in the year 2015 seems very high, but backs the result of this case study that the growth of companies that are using new Enterprise 2.0 is now in its saturation phase.

At figure 5.15 the development of the number of actions that have been taken to transform the way of communicating in big companies can be seen. As already pointed out before, a big part of this information has been taken from the answers regarding the use of instant messengers and document sharing solutions, because almost every big company is using these technologies. It is very unlikely that the number of companies that is taking pro-active steps against the high numbers of e-mails will increase.

Using the data that was gathered with the help of the survey a non linear least squares regression, seen at table 5.3 was carried out to estimate the parameters for the growth function for case study 1. Later the logistic function was plotted, seen at figure 5.16. As one can see, the implementations of actions for changing the way of communication, from e-mail communication only, to the use of other messaging tools, in big companies already saturated in the last couple of years. Of course the way employees of big companies are communicating and sharing their documents will change often in the next decades and new communication paradigms, that are not part of this study, will arrive. At figure 5.16 one can see the logistic growth curve of the results of case study 1. The estimated parameters and its resulting model fit the sample.

Parameter	**Estimate**
K	79.63706***
A	2008.087***
b	1.078481***
R^2	0.9959781

*** Significant at the level <0.001

Table 5.3: Enterprise 2.0 - non-linear least squares estimation

[1] https://www.feelgood-at-work.de/enterprise-studie-2015, 21. October 2016

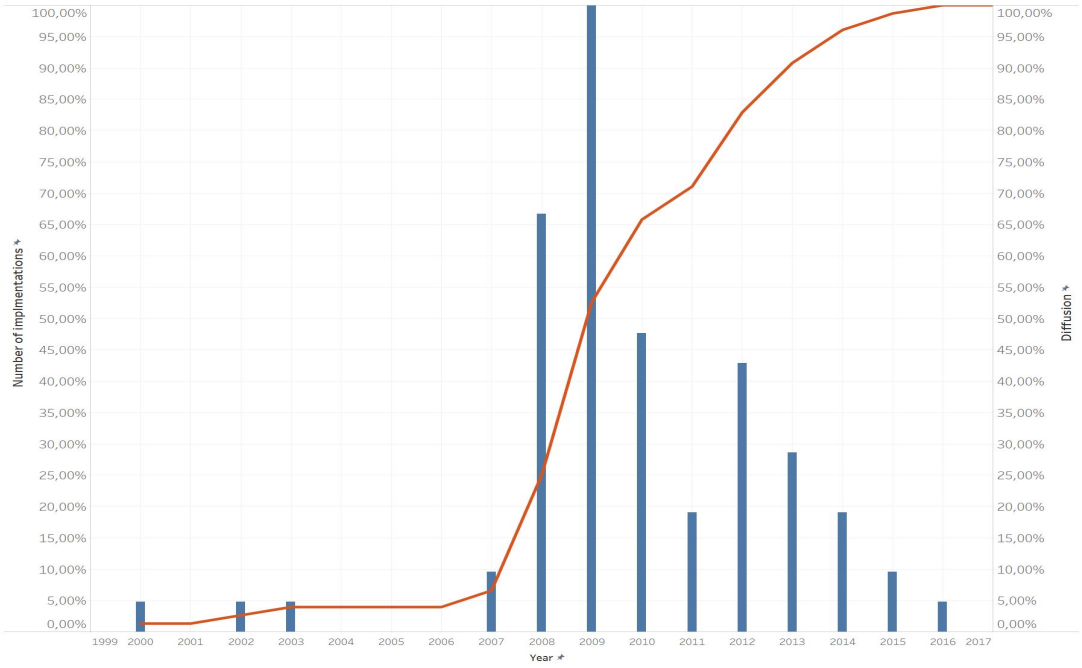

Figure 5.15: Enterprise 2.0 - diffusion

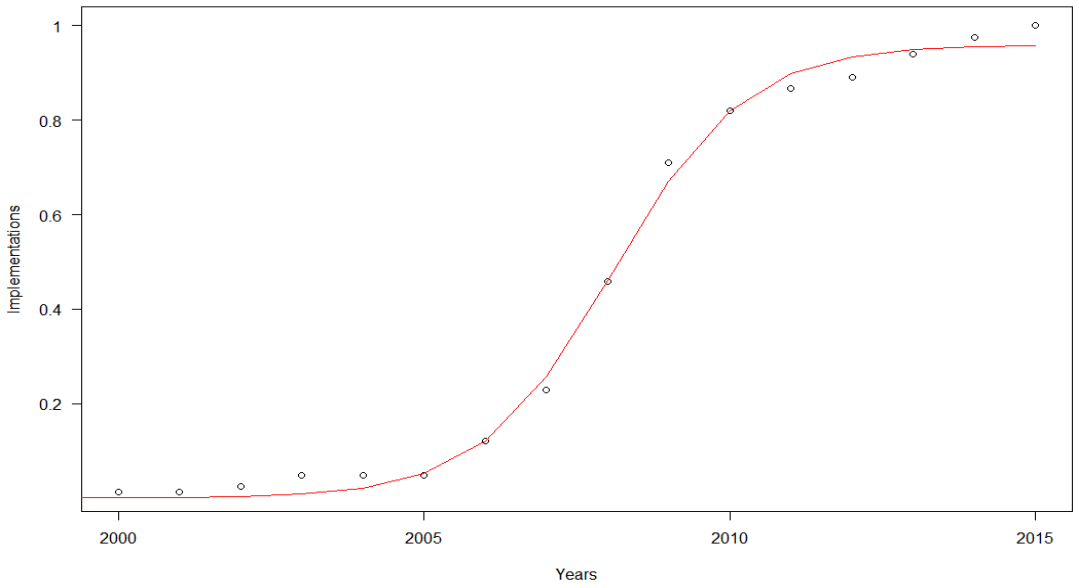

Figure 5.16: Enterprise 2.0 - comparison of sample and diffusion model

The comparative analysis of ten studies regarding the diffusion of Enterprise 2.0 [36] revealed similar findings. On the one hand, the scholars of this meta study state that most of the studies they reviewed say that companies are already using Web 2.0 technologies for their communication. 90 percent of the companies know about wikis, instant messengers and social networks, which are the technologies that were the main topics of this case study . The researchers of [36] stated that only 70 to 80 percent know about the possibility to use RSS feeds, tagging or bookmarking. On the other hand, the researchers of this meta study say that some studies are using a different definition for Enterprise 2.0 companies. This results in a much lower percentage of found Enterprise 2.0 companies, which is around 10 to 30 percent. Most of the analyzed studies revealed that the usage of Web 2.0 technologies in companies depends heavily on the business sector of the company as well as in the size of it. The affirmation of these technologies is the biggest in the IT sector. In survey 1 the researcher didn't differentiate the companies between its business sectors. Though an important factor for being considered was the business size. The participants have been chosen regarding the assumption that the importance of powerful communication tools increases with the size of the company. This is an explanation for the high affirmation rates of the answers of survey 1.

Bughin carried out two studies regarding the acceptance of Enterprise 2.0 across 68 countries including every industry. The first [12] was published in 2008, the second [13] in 2010. The studies reveal that by 2010 approximately two thirds of all companies that participated in this study know about the possibilities of Web 2.0 technologies in the business world. While in 2008 one third of this part already adopted at least one Web 2.0 technology in its company, the report says that in 2010 more than the half is using these technologies. Already relevant in the report where ESNs. Following the results of survey 1, in Austria ESNs began to be relevant in 2014. This could show that trends in Austria are adopted later than in other parts of the world, like in the USA for example. The report also enumerates measured business benefits that were reported by the participants, which is good marketing for the idea of the Enterprise 2.0 and might help its overall growth.

5.1.2 Paper Free Office

In the second case study the researcher explored the tendency of large companies towards the implementation of actions in order to run a paper free office, or a so-called green office. According to the answers to the two questions that belonged to the second case study approximately 47 per-cent tend towards the paper free office, as seen at figure 5.36. Circa 40 per-cent of Austria's most successful companies claimed that they already implemented policies for the reduce of paper usage, as seen at figure 5.1. The diffusion curve for company wide policies in order to reduce paper waste can be seen at figure 5.17. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, as seen at figure 5.18, which were K: 41.37, A: 2009.75 and b: 1.60.

As seen at figure 5.1 this step began to be very popular since the year 2009 with having a

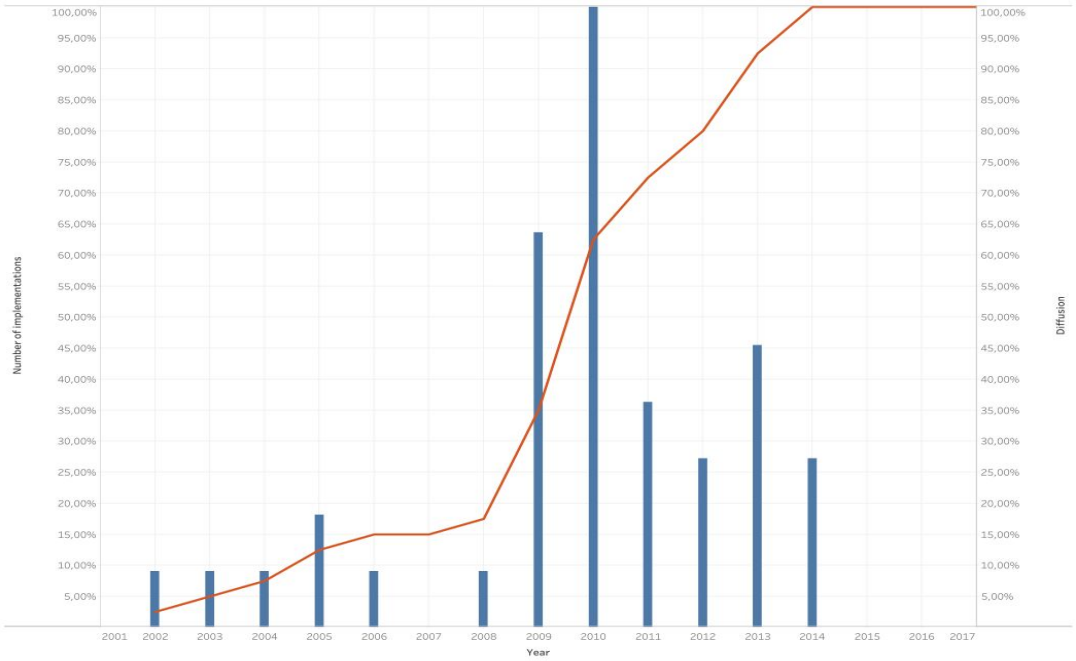

Figure 5.17: Policy for paper waste reduction - diffusion

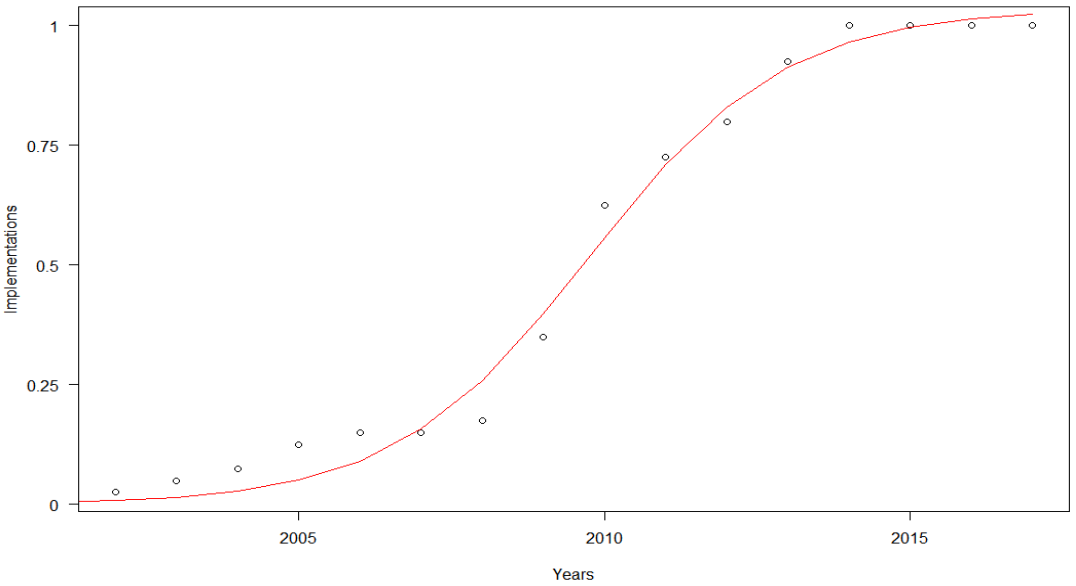

Figure 5.18: Policy for paper waste reduction - comparison of sample and diffusion model

climax in 2010. As often, the way the idea was implemented, decides if the change process was successful or not. Reducing paper waste can be part of bigger change processes that are often important to increase the efficiency of the company, for example as a part of a lean process.

Approximately a quarter of the companies claimed that they are using disclaimers in their e-mail as a standard that is encouraging the reader not to print the message on paper, as seen at figure 5.1. The plot of the time data, portrayed in figure 5.19 fits very good to the plot regarding the question before. One can see that the growth of using a disclaimer was completed a little bit faster, which comes from the fact that the implementation of this action is very cheap and easy to accomplish. Also an accompaniment of a change management process is not needed in this case, because there is absolutely no change in any business process. Therefore the whole diffusion process can be much shorter, at least in theory. The non-linear least squares estimation for the gathered sample provided the parameters for the model of the diffusion process, portrayed in figure 5.18, which were K: 28.97, A: 2009.75 and b: 1.60. Table 5.4 features the result of the non-linear least square regression, which are the estimated parameters for the logistic growth function. As one can see the calculated logistic growth function fits the data pretty good, as seen at figure 5.22. Also the calculations revealed that the diffusion process is still not over and approximately will go on until 2020.

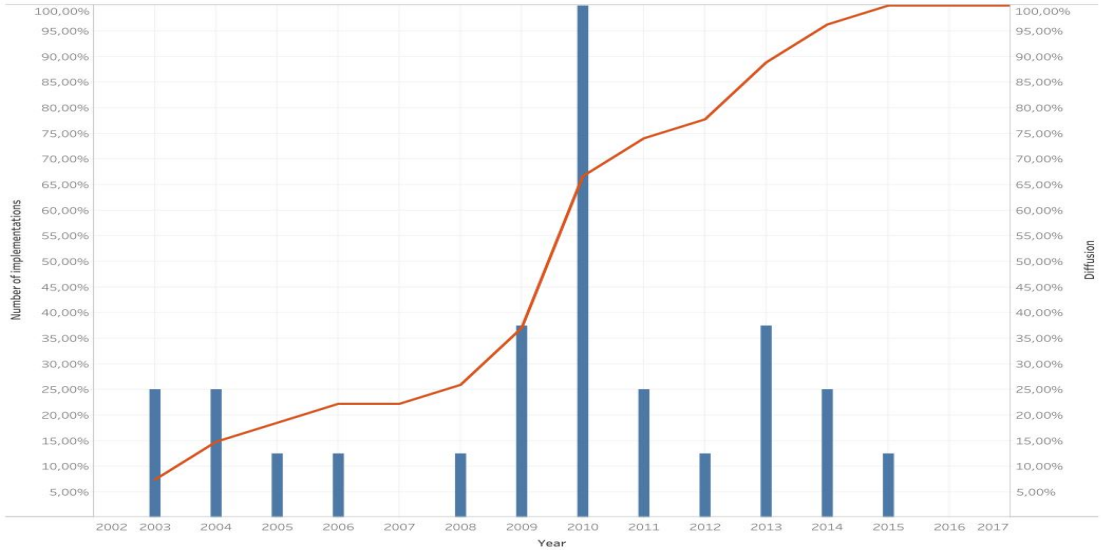

Figure 5.19: E-mail disclaimer for print reduction - diffusion

Following this simple forecast, in the next couple of years some other big companies will also start to reduce their paper waste in order to reduce costs. As already mentioned, actions like these are often part of a bigger change process, which needs a big budget and is planned by long hand. Approximately after 2020 no new implementation of a paper free office is expected.

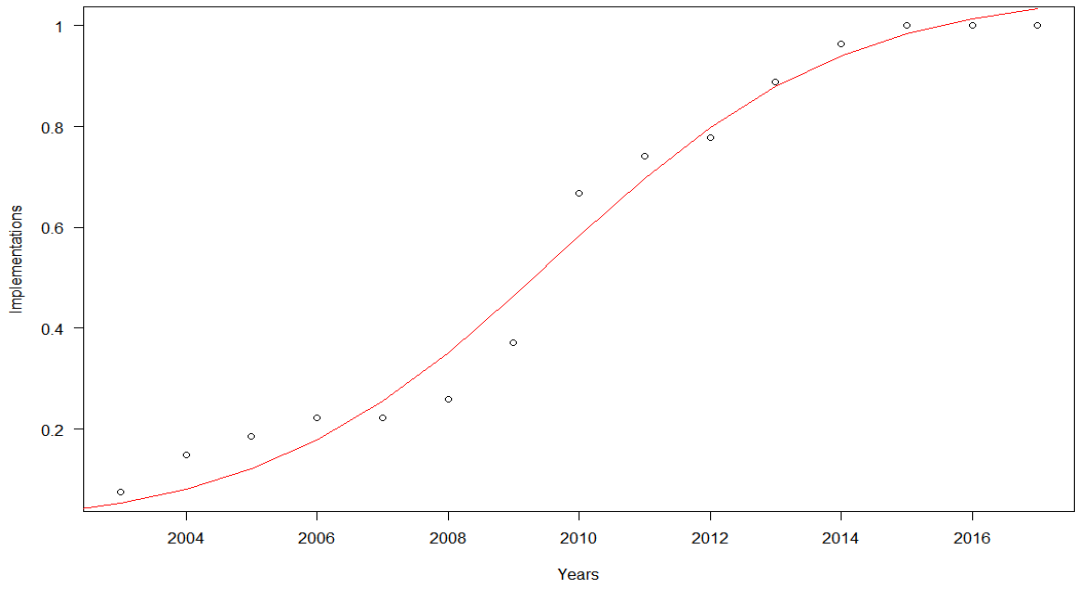

Figure 5.20: E-mail disclaimer for print reduction - comparison of sample and diffusion model

Parameter	**Estimate**
K	48.4862***
A	2009.8547***
b	1.8518R***
R^2	0.9881145
*** Significant at the level <0.001	

Table 5.4: Paper free office - non-linear least squares estimation

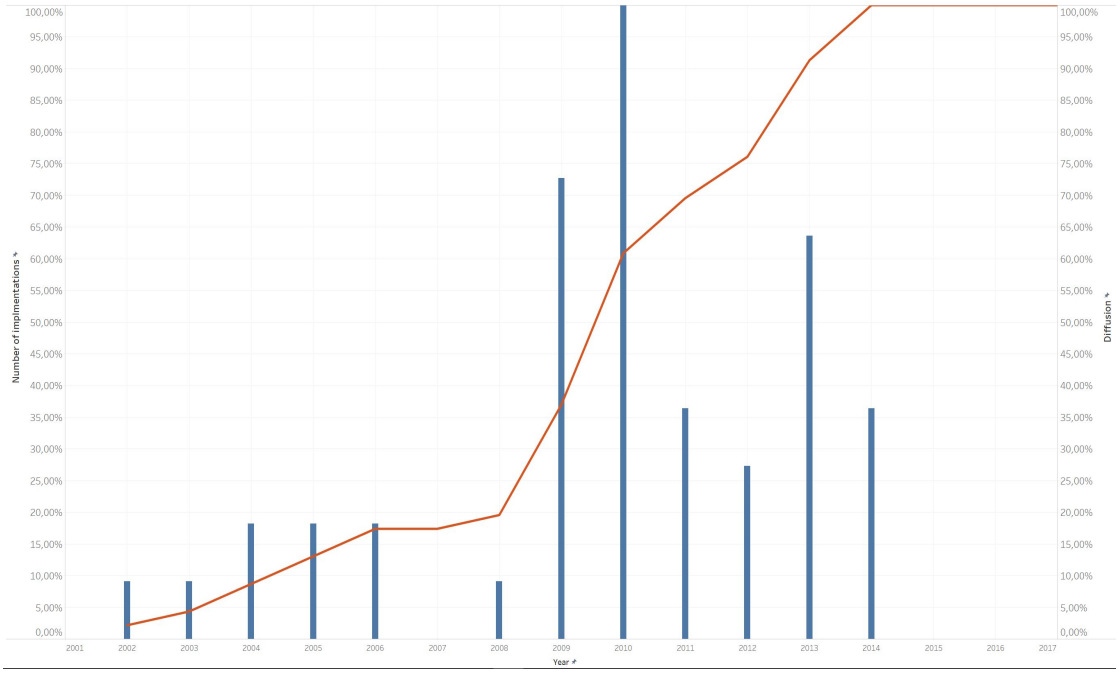

Figure 5.21: Paper free office - diffusion

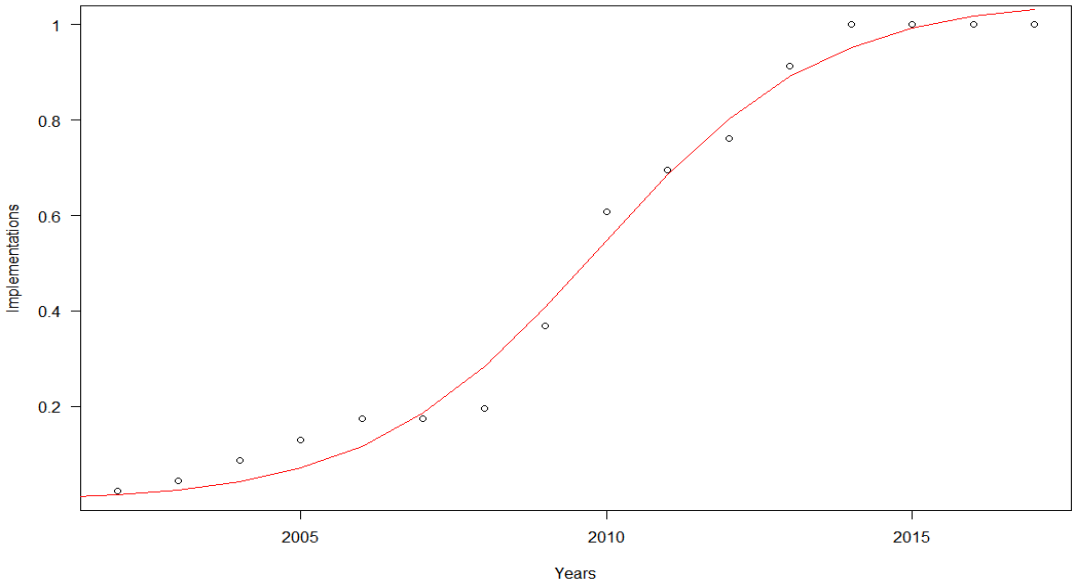

Figure 5.22: Paper free office - comparison of sample and diffusion model

5.1.3 Business Process Integration

The integration of business processes can be seen as one of the archetypes of organizational innovations that are deeply connected with IT technology. At the center of each software solution, that enforces business process integration lies a very complex data model which connects various aspects of the company. Without the use of such software solutions the the processes are logically separated. Nowadays the logical connection of business processes is an indispensable step for every bigger company. With business process automation the overall system is more efficient and less error prone. Therefore it comes with no surprise, that more than 90 percent of Austria's 500 most successful companies decided to integrate their business processes either with using an ERP- or an CRM system, which can be seen at figure 5.36. Most asked companies are using both mentioned types of systems. Nevertheless still the ERP-system is used more by circa five percent, as portrayed in figure 5.1. The diffusion curves for ERP systems and for CRM systems can be seen at figure 5.23 and at figure 5.25. Both diffusion curves share the same characteristics. Therefore also their saturation models are very similar. The non-linear least squares estimation for the ERP system adoption provided the parameters K: 84.34, A: 2000.08 and b: 1.74 for the plotted model that can be seen at figure 5.24. The parameters for the adoption of CRM systems were K: 79.34, A: 2004.08 and b: 1.19 and the plot of the corresponding model can be found at figure 5.26. Both plots are looking very similar, only a look on the parameters of the models show us that the ERP systems reached a little bit more companies and were established some years before the CRM-system.

At some point of the survey it was asked which ERP- and CRM system the company is using. With no surprise, the most often mentioned ERP system is *SAP*, followed by *Microsoft Dynamics* after a wide gap. Other mentioned ERP systems are *BMD*, *IFS* and *NAV*. Surprisingly some also mentioned that they are using their own developed ERP system, which seems like a highly uncommon solution. The results showed that Microsoft is far more successful with its CRM solution than with its ERP system. The most often mentioned CRM system was *Microsoft Dynamics CRM*, closely followed by the CRM System by *SAP*. For CRM system, the percentage of companies that are using their own created CRM solution was even higher.

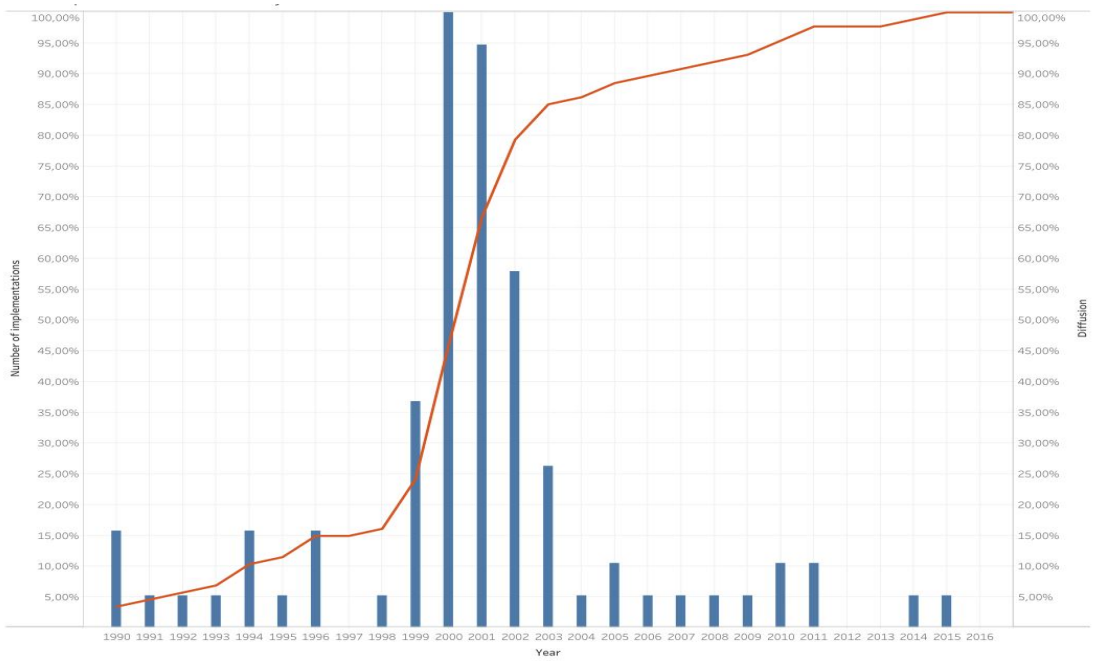

Figure 5.23: ERP system - diffusion

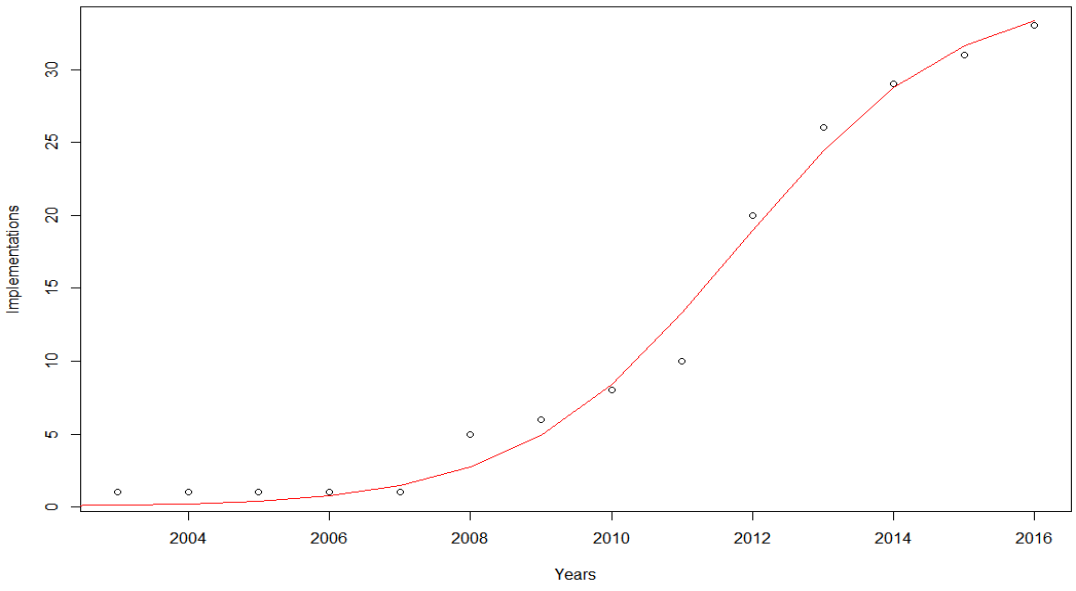

Figure 5.24: ERP system - comparison of sample and diffusion model

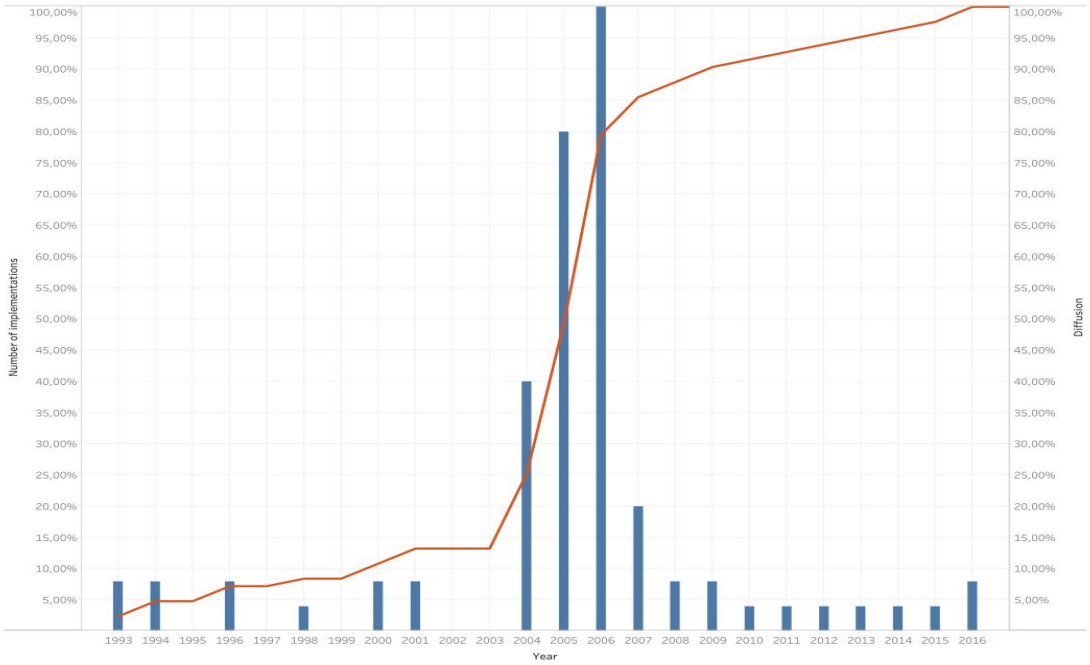

Figure 5.25: CRM system - diffusion

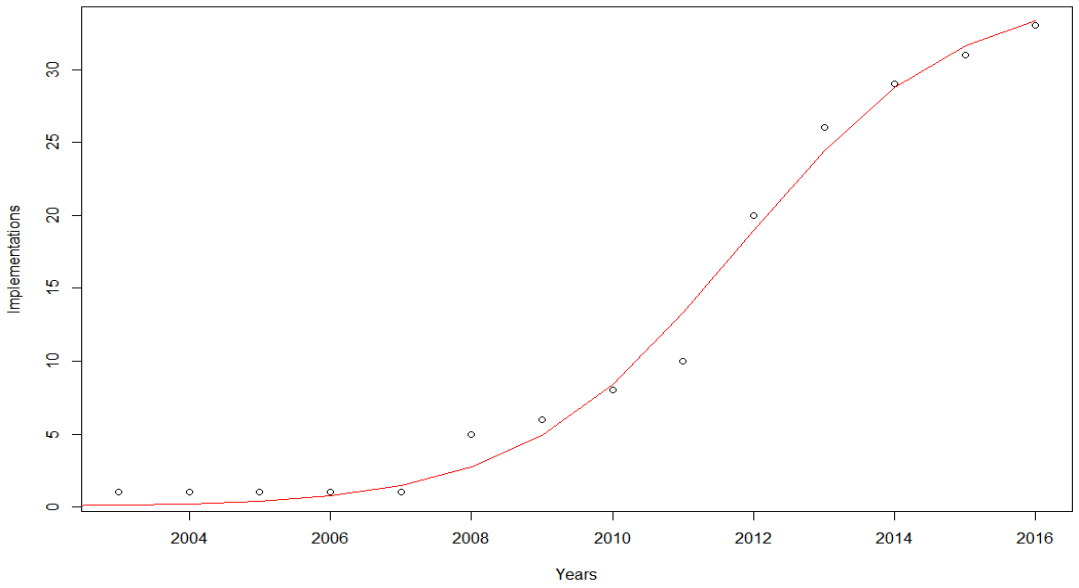

Figure 5.26: CRM system - comparison of sample and diffusion model

Since the ERP- and the CRM systems are the most common and most historic examples for business process integration it comes with no surprise that the diffusion process already started very early, in the beginning of the 1990's, which was the time were computers, as we know them today, got invented. The climax and biggest hype regarding solutions that are enforcing business process integration were during the change of the millenniums, as portrayed in figure 5.27. This plot is informative, but also has to be examined with awareness, because one should not forget the characteristics of the sample that was asked to fill out the questionnaire. Most of Austria's 500 most successful companies are established for more than 10 years. A look at the diffusion plot at figure 5.27 could give the idea that nowadays ERP systems aren't implemented any more, which is not true. It is known that almost every bigger company uses ERP systems for their business process integration. This thought results in the conclusion, that the diffusion plot and the calculated logistic growth function, seen at table 5.5 and figure 5.28, are useful for understanding Austria's 500 most successful companies, which were the sample for survey 1, which is the foundation for this research, but the resulting insights can't be adopted for the business process integration diffusion process overall. This conclusion is also valid for the diffusion of CRM systems.

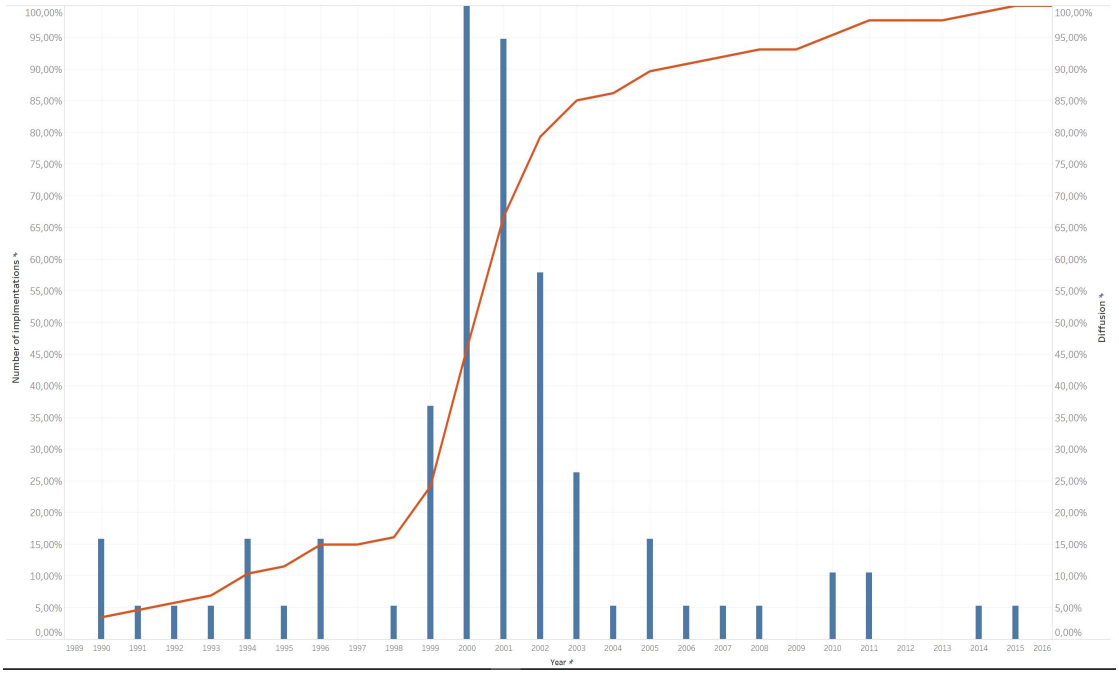

Figure 5.27: Business process integration - diffusion

Bernoider explored the difference of adoption rates of ERP and CRM systems between small or large enterprises [5]. He found out, that by 2005 approximately 70 percent of the participating large companies were using ERP systems, while only 16 percent of the small companies were using these systems. Following this report, the same statement can be made about CRM systems.

Parameter	Estimate
K	84.5571***
A	2000.0842***
b	1.7252***
R^2	0.9878365

*** Significant at the level <0.001

Table 5.5: Results of non-linear least squares estimation for the Logistic Function of case study Business Process Integration

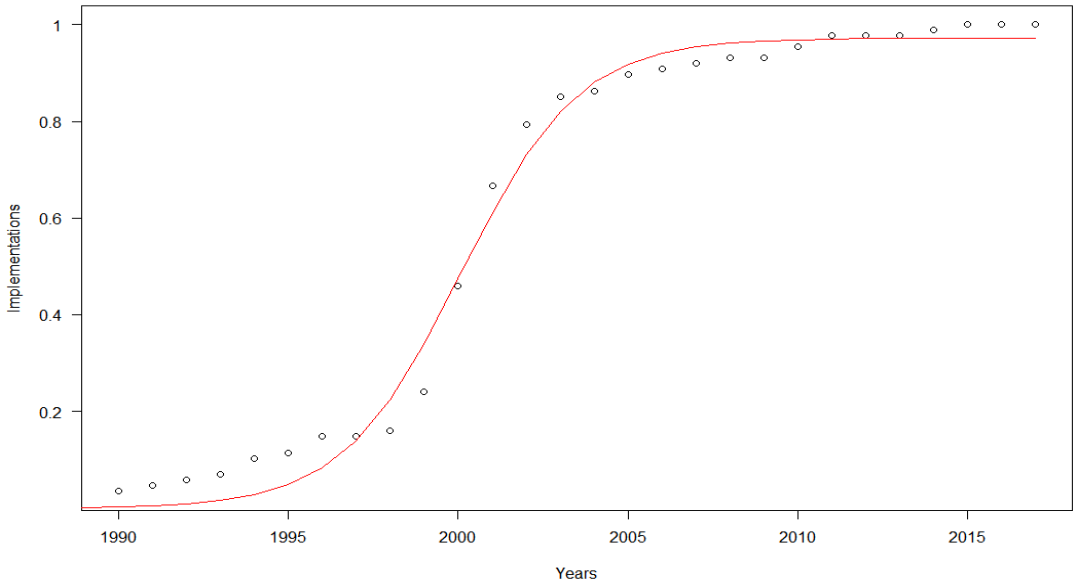

Figure 5.28: Business process integration - comparison of sample and diffusion model

5.1.4 New Way of Working

Writing about the diffusion of innovations which enable new ways of working is the hardest part of the result report in this thesis. For finding out more about these changes, the organizational innovations home office and shared desk offices got chosen. As one can see on the determined diffusion curve at figure 5.29 of home office, the idea of this type of working in Austria started more than 20 years ago. The non-linear least squares estimation for the implementation of home office provided the parameters K: 44.44, A: 2006.78 and b: 4.97 for the plotted model that can be seen at figure 5.30. In contrast the shared desk office is a relatively new idea, what can be seen at its diffusion curve at figure 5.31. The sharing desk office is the result or the reaction to home office and the developments of improving the digital workplace. It is also a result of more project

orientated team structures. For the implementation of sharing desk offices major rebuilds and restructuring of the office are needed. Therefore it's most likely to implement these types of offices when the building is getting renovated, redesigned or a new building is used.

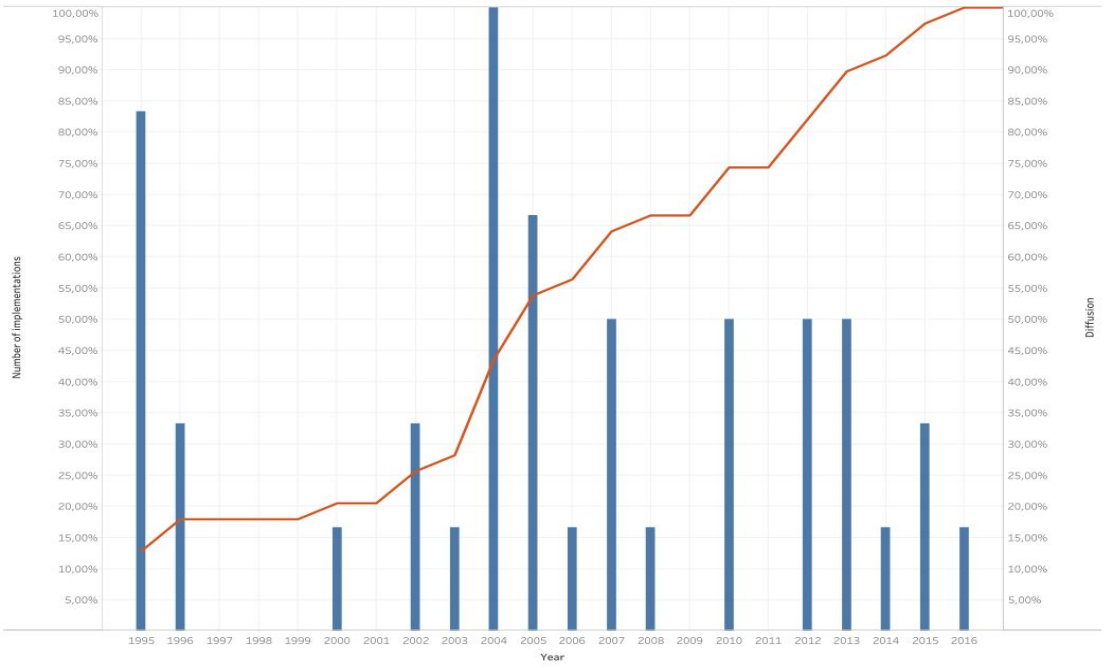

Figure 5.29: Home working - diffusion

Following the diffusion plot of shared desk offices, many of the asked companies started to have shared desk companies in the last years and it's highly probable that this trend will continue in the next years. Technology is developing further and employers and employees are seeking for flexibility. Since there is no saturation level foreseeable in the near future it wasn't possible to estimate any parameters in order to build a growth function for this organizational innovation.

At figure 5.33 the growth function for the aggregated data of the whole case study can be seen. The estimated parameters of the aggregated data from table 5.6 pointed out, that following the created model, the growth will saturate in 2047. The graphical forecast for the growth of the data from this case study is plotted below at figure 5.34. According to the results of this study, 45 percent of Austria's most successful implemented at least one of the two organizational innovations. This low value supports the statement of the model that the growth of these innovations will saturate approximately in 30 years. The way that organizations function is changing through time and it's highly probable, that in the future more companies will change their way of working. Nevertheless though, the statement of a saturation in 30 years seems very unlikely, because in a period that is that long technology will be developed further and enable completely new

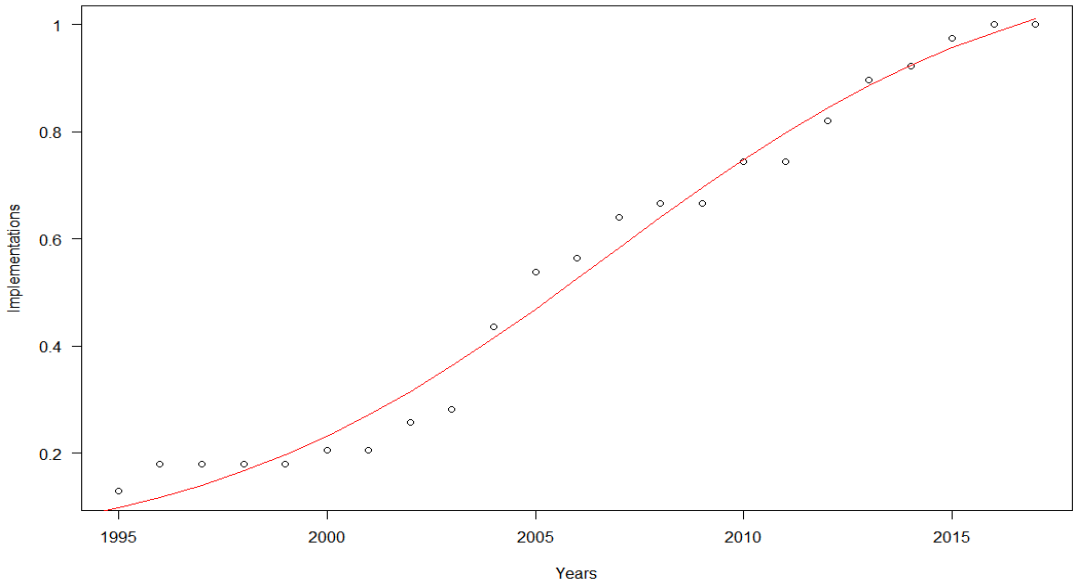

Figure 5.30: Home working - comparison of sample and diffusion model

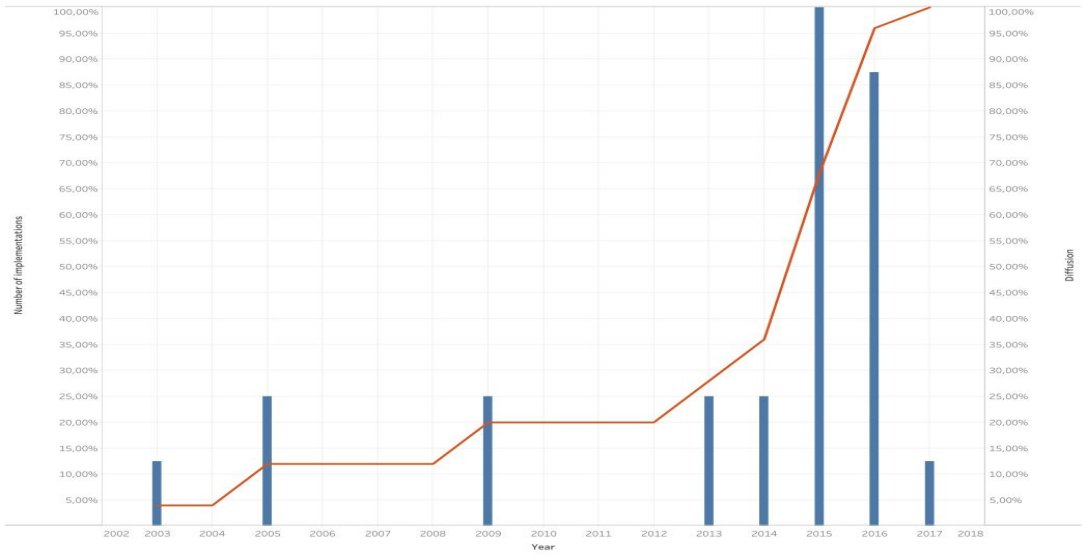

Figure 5.31: Shared desk offices - diffusion

ways of working. From today on it seems likely that the idea of the digital workplace will be developed further. With the progression of technology new possibilities will be implemented. Therefore the writer of this thesis is highly sceptical regarding this result and the calculated forecast.

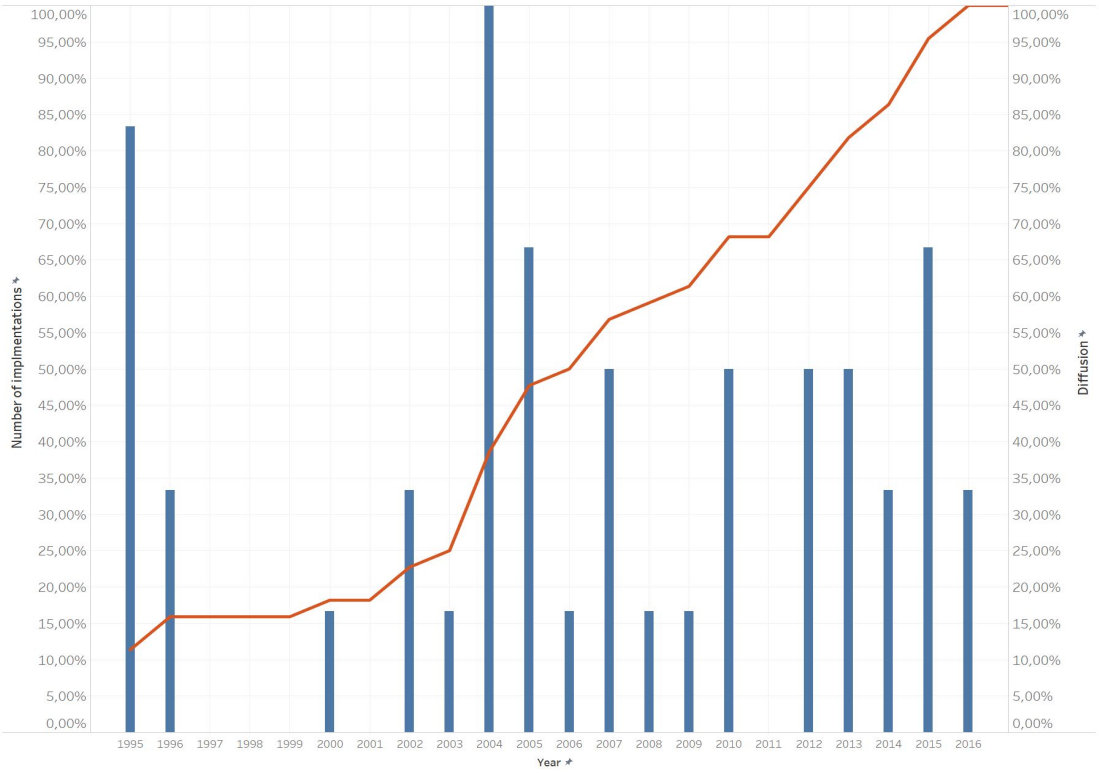

Figure 5.32: New way of working - diffusion

Parameter	**Estimate**
K	55.0596***
A	2009.0633***
b	5.6355***
R^2	0.984454

*** Significant at the level <0.001

Table 5.6: New way of working - non-linear least squares estimation

At the beginning of this case study it was stated, that this case study was especially hard to analyse, because it only consists of two organizational innovations, which are very different in their nature. Also the dates of the implementations have differed a lot. This resulted in the creation of a model which delivers doubtful results. In 30 years from today companies that exist today won't discuss if they will start offering home working or create shared desk offices. Further developments will create new possibilities and the new way of working will be changed completely. These questions are part of the strategy of a company. In hindsight the aggregation in this case study may not have been the most useful strategy for a valid analysis.

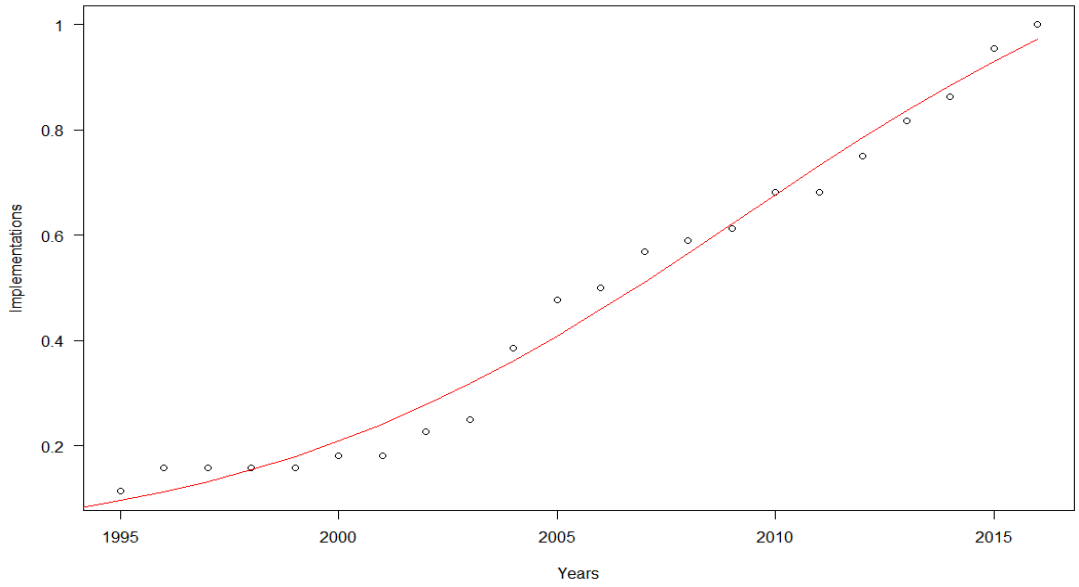

Figure 5.33: New way of working - comparison of sample and diffusion model

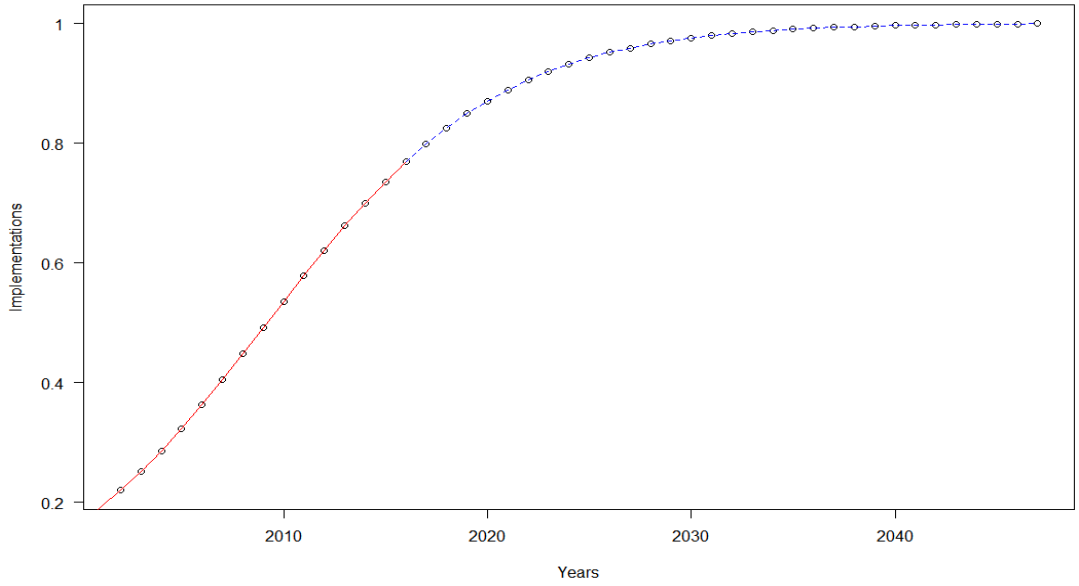

Figure 5.34: Forecast for the Growth of case study New Ways of Working

5.1.5 Collaboration tools - BIM

As already stated in the beginning of this chapter the response rate of the respective survey was 10.59 percent. This case study analyses the diffusion of BIM in the part of the AEC industry that already got in contact with it. It is not possible to draw statements for the whole AEC industry. BIM is a very interesting and promising workflow pattern, which is used to design and to maintain buildings. The peculiarity about BIM is that actors from different disciplines are involved and are working using the same document. The experts can continue to use the programs they have used before, for their tasks. Connectors have to be installed in order to import the new used data format, that can be used by everyone in the process. This approach is less error prone and more efficient. The collaborative aspect of designing a building is emphasized in using BIM. Even though a number of people that are active in this field of work think that BIM is a good idea, the growth of this innovation is going on slowly. One barrier are of course the costs of the software. The change of a workflow also costs a lot time and money. Another problem is that, at this point, the provided software solutions seem not to be ready for using them in real life projects as BIM is still in its infancy.

In the definition of BIM, levels got developed to categorize the quality of the real life workflows of planning offices regarding the ideal of BIM. Another, more simple, categorization is the distinction between little- and big BIM. Little BIM means, that BIM software solutions are used as insular solutions in the planning process for specific parts of the process. Big BIM classifies the continuous use of BIM software for the collaboration in the designing workflow. According to the results of the survey 42 percent of Austria's planning offices are using BIM in their design processes, as portrayed in figure 5.36. 74 percent of the interviewed planning offices, that are using BIM categorize their usage level as little BIM, which puts the high value of 42 percent into another perspective.

According to [9] the forerunners in BIM adoption are Singapore, Finland, the USA, the United Kingdom of Great Britain (GB) and Australia. In Singapore, since 2004, construction documents have to be transmitted online in the neutral format *.ifc* that is used for BIM. In the USA state clients demand the use of BIM technology for construction projects. Since 2007 the government of GB promotes projects to facilitate the nationwide adoption of BIM in order to decrease pollution and increase the competitive advantage on the international market. In [73] Panuwatwanich is examining the diffusion of BIM in the AEC industry. He mentions its potential to increase efficiency as it encourages the integration of the stakeholder of the projects. Nevertheless the diffusion of BIM remains behind its potential. By 2009 the adoption rate of BIM is approximately at 50 percent, while by 2010 the adoption rate in Europe is at 36 percent. The results of survey 2 revealed, that in Austria the adoption rate of BIM is around 42 percent, which is in comparison, a low value.

The survey featured a section where people got asked why they are using or why they are not using BIM. The most often called reason for implementing BIM, was the enthusiasm and conviction regarding the idea of BIM. Changing a core process is never easy for

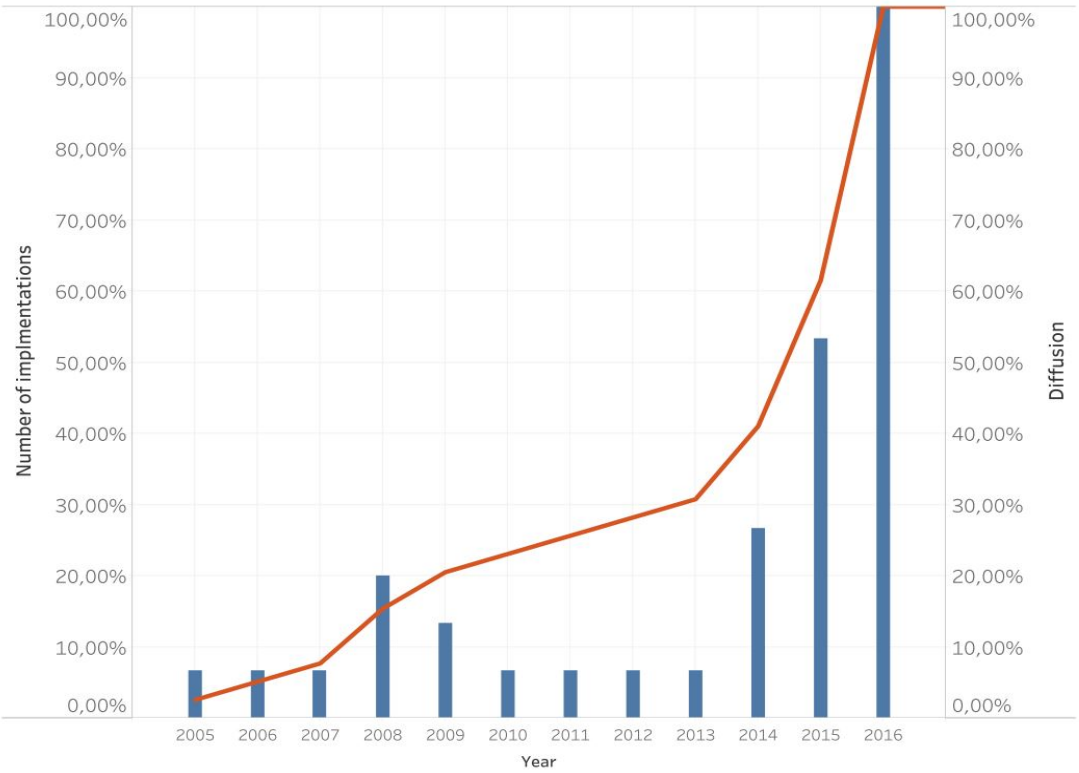

Figure 5.35: BIM - diffusion

a company. If the company sees the positive aspects of the change, the motivation is much bigger and the change process is more likely to end up positively. The second most often called reason is that the usage of BIM often is a requirement by the clients of the planning office. Other reasons ware curiosity and the urgency to use technology and workflows that are state of the art in order to stay competitive.

In comparison the researchers who published [73] found very similar reasons that are drivers for BIM adoption. The most important driver is also that BIM is a requirement by the clients and other team members. Especially big projects seem to profit from the use of BIM technology. [67] is the reported case study of a hospital that has been built in Hawaii with the help of BIM. This was the first BIM project for the team, therefore the learned lessons regarding the adoption were interesting. In the case study it's pointed out that especially big building projects benefit from the use of BIM. It's important to have employees, that act as technology drivers, in the right positions in order to implement a new way of working. At first the team was against the use of BIM, because they had to buy software licenses, but in the end they saved time in because of this decision, which resulted in a bigger project turnout.

There have also been a number of reasons why some actors of the AEC industry are refusing BIM. One often mentioned reason was that the change of the planning process

costs too much time and money. Why change a process that worked for several of years? Another very often called reason is that BIM might only be interesting for very big building projects. Those couple of planning offices wrote that they are involved in small projects only and therefore BIM would be simply an overhead for their processes. Many planners answered that the BIM software solutions on the market don't fulfil their qualitative standards. This is a well known problem which should be solved with the ongoing maturity of BIM. The same reasons were named in [73]. Small projects don't seem to profit from using BIM technology and workflows, because the modeling process becomes more time consuming. Also it's stated, that adequate training and support aren't provided. One of the biggest barriers remains that the change of functioning workflows costs a lot of money and time. The benefits of changing the processes are not tangible enough as a warranty.

Judith Tiefenthaler, who carried out survey 2 with the writer of this thesis, used the answers of the open questions of this survey to identify the most important categories of reasons for and against the implementation of BIM. In order to achieve this, she conducted a qualitative analysis. Tiefenthaler created a category scheme, that based on the data. Later she coded each answer to its corresponding category and visualized the results of this study in her bachelor thesis [85].

A look at the diffusion curve from the sample at figure 5.35, shows that the growth of the diffusion process of BIM is still on the rise. According to the data, in 2016 were almost double as many implementations of BIM as in the year before. Due to the high rise in the last couple of years, again a saturation level couldn't be estimated and therefore a logistic growth model couldn't be built. From the data that was collected exponential growth can be observed, but as pointed out before, diffusion processes are always growing towards its saturation level. As part of the survey 42 percent stated that they are definitely planning to start using or increase their use of BIM in the near future. 36 percent stated that they think, they might start using BIM as a foundation for their planning processes. The aggregated value of 78 percent shows that people are interesting in this topic and therefore the use of BIM might grow rapidly in the next couple of years.

5.2 Cross-case Analysis

The aggregated adoption rates of each case study can be compared at figure 5.36. This plot shows that organizational innovation that are enforcing the so-called Enterprise 2.0 or are integrating business processes are far more often adopted than the other considered groups of organizational innovations. This can be explained by the fact that case study Enterprise 2.0 featured, by far, the most innovations, therefore this comparison is a little biased of course. Another reason for the high adoption rate of the innovations of the first case study is that these organizational innovations are driving and enhancing everyday's communication at the workplace and therefore are very important to the enterprise. The integration of business processes, like for instance the use of ERP systems, is mandatory for the success of companies. This is the case especially for large companies, which were

the focus of the first survey. On the other hand, the enforcement of a paper free office or the implementation of a new way of working is not as crucial or important for an enterprise to work properly. The adoption of BIM has to be seen from another view, since this way of collaborating is comparable new and its need is still discussed in the AEC industry.

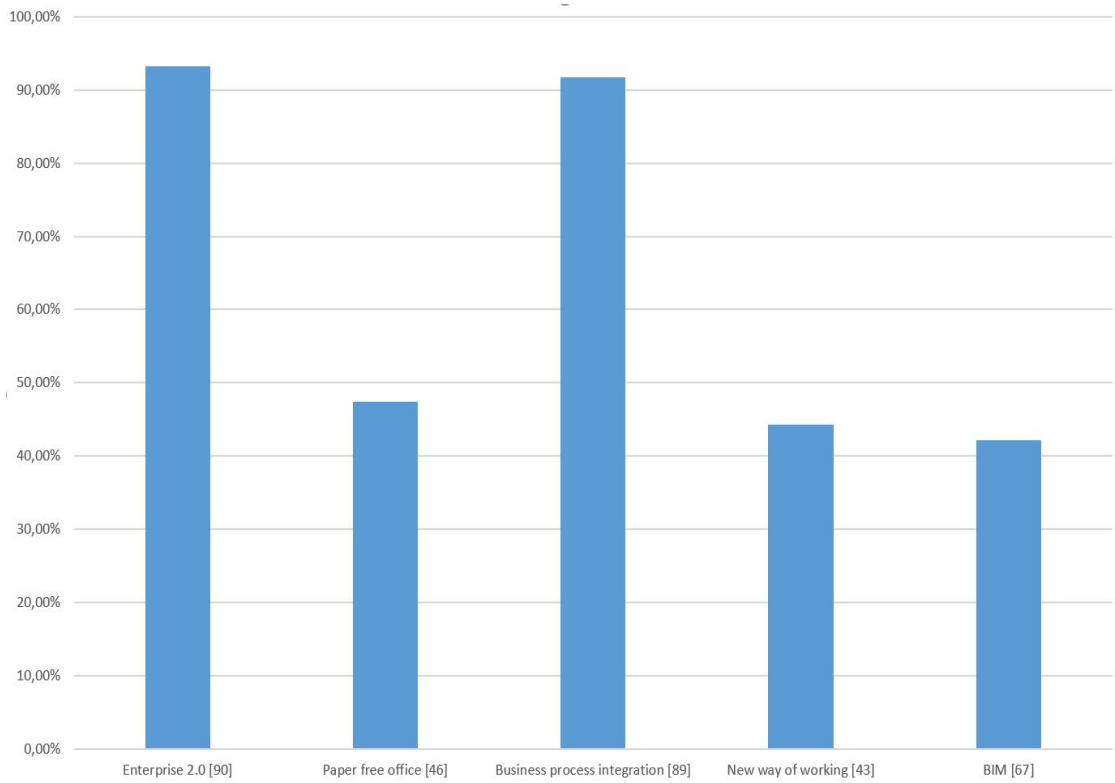

Figure 5.36: Adoption rates per case study

The analysis of the five different case studies showed, that there are definitely parallels between the characteristics of the analyzed diffusion processes. The comparison of the diffusion curves of the five case studies can be seen at figure 5.37. A look at this picture reveals, that every single of the five curves is following a comparable pattern. There were big differences though, between the diffusion curves of case 1 to 4 and the one from case study BIM. Overall one can say, that there were no big surprises while analysing the case studies, because the diffusion of organizational innovation seems to follow the strict pattern of logistic growth.

In the introduction of this thesis, the fundamentals of diffusion of innovation were explained. At figure 2.3 an exemplary plot shows how Rogers portrayed the typical diffusion curve, which is parted in 5 stages. In the first stage of the diffusion of innovation the upward slope is very low which is resulting in a very slow growth. This is also valid for the diffusion curves that have been constructed for this thesis. Each of them begins at

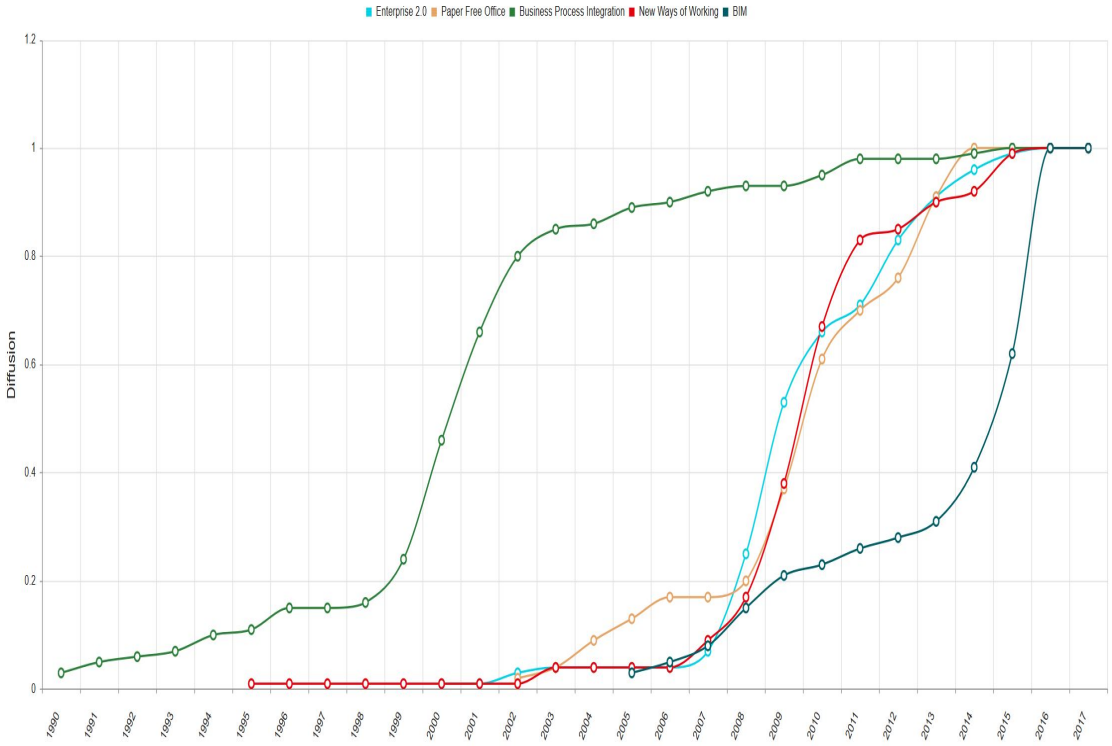

Figure 5.37: Comparison of all five diffusion curves

the *Innovators* phase, which can be seen on the very slow growth at the beginning of the curve. This phase is followed by thw *Early Adopters*- and the *Early Majority* phase, the upward slope of the function is getting higher with ongoing time. The end of the third phase results in a turning point of the diffusion curve. From this point on, the upward slope lowers, which results in a slower growth. The phase of the *Late Majority* is reached.

This is applicable for the diffusion processes of case study 1 to 4. For each of it, the logistic function was the right model in order to model the collected data. In contrast, the diffusion curve of case study BIM can be modeled with exponential growth, but as pointed out in the introduction of this thesis, an exponential adoption rate is not possible on the long run. As one can see, at this point, that this diffusion curve didn't reach its turning point. This shows us, that for now, the diffusion process didn't saturate and it finds itself now in the stage of the *Early Majority*. Since the turning point of the growth function isn't reached yet, it is not possible to determine at which time it will saturate. Therefore it wasn't possible to build a model for the diffusion of BIM in Austria using a logistic function.

Each of the other diffusion processes already reached their saturation or at least its turning point. The four diffusion curves are looking very similar, since all of them are sharing the typical characteristics of diffusion curves. Especially the diffusion curves

Case study	Stages reached					Saturated	Model	
	Innovators	Early adopters	Early majority	Late majority	Laggards		Exponential function	Logistic function
Enterprise 2.0	X	X	X	X	X	X		X
Paper free office	X	X	X	X				X
Business process integration	X	X	X	X	X	X		X
New way of working	X	X	X	X				X
BIM	X	X	X				X	

Table 5.7: Characteristics of the diffusion processes of each case study

of case study 1, 2 and 4 are looking very similar, because according to the plot, the implementations were carried out in the same time frame. The integration of business processes in Austria's 500 most successful companies, though, started earlier, which results in the horizontal shift of its curve. Apart from this difference, the curves are sharing every other important characteristic.

The comparison of the most important characteristics of the constructed diffusion curves that have been identified can be seen at table 5.7. This comparison shows that case study 1 and 2 diffusion processes already saturated, since they reached the *Laggard* stage. The diffusion processes of case study Paper Free Office and 4 remain in the stage of the *Late Majority*, for now. All of these processes can be modeled with a logistic function. Only the diffusion process of case study five is, for now, in the stage of the *Early Majority* and therefore is following exponential growth. This shows, that in this study, a diffusion process has to enter the stage of the *Late Majority* in order to be modeled by a saturational model.

This leads to the conclusion that the diffusion of organizational innovations follows the same pattern as the diffusion of product innovations, which was the hypothesis of this thesis. The s-shaped curve, that was presented in the second chapter of this thesis is used in literature to describe the diffusion of product innovations. Even though there is plenty of literature about organizational innovation, the diffusion pattern of it was never researched. Four of five analyzed diffusion processes support the hypothesis of this thesis. Case study BIM shows, that the development of diffusion curves can't be predicted with mathematical methods only, if the stage of the *Late Majority* hasn't been reached yet. In order to construct statements about the future development of an innovation, other data like reports or interviews also has to been taken into account.

CHAPTER 6

Conclusion and Future Work

This thesis is structured in six chapters and is dealing with the diffusion of organizational innovation. In the introduction the motivation for writing and researching about organizational innovation was explained. This chapter also features a review of the already existing literature that is dealing with the treated subject. In order to be mentioned in this review section, the observed literature had to deal with the adoption of innovation, the diffusion of innovation or with the relationship between the characteristics of organizations and it's ability to implement innovations. This section should have pointed out which aspects and research fields already are represented in the literature in order show the reader which aspects of this topic already have been treated and where in the research field a blank is that still has to be filled. After the importance of organizational innovations for the economy has been stressed, the research question was presented. The writer of this thesis wanted to find out if the diffusion process might follow a pattern. If a pattern could be identified, it was important to find out if it follows the same pattern as the one product innovations follow. After the introduction, in the second chapter the fundamental knowledge about innovation, organizational innovation and diffusion was explained. This chapter also featured information about detailed adoption stage models for innovations in organizations. In order to continue the research, a working definition for organizational innovation was formulated, which is the foundation for the third chapter. In the third chapter a list of important organizational innovations was provided, since no comparable list has been found in literature before. Since, for now, no global definition for organizational innovation exists and often these innovations are deeply connected with process innovations, it is hard to enumerate them. Each of these innovations fulfilled the working definition for organizational innovation that was formulated by the author of this thesis. The author identified three types of organizational innovation, which were *Processes*, *Managament Methods* and *Organizational Structures*. After reading the second and the third chapter, the reader should already have a clear picture about the characteristics of organizational innovations. The following chapter explained possible

methods, which were applicable for the research of this topic. After this enumeration, the research framework was presented. The researcher decided to create a number of case studies. The names of the case studies were *Enterprise 2.0*, *Paper Free Office*, *Business Process Integration*, *New Way of Working* and *Collaborative Design*. These case studies feature data from already existing literature and from data that has been gathered from two different online surveys. Both surveys have been conducted in the course of this thesis. The first survey delivered data for case study 1-4 and it was addressed to Austria's 500 most successful companies. The results of the second survey were used for the fifth case study. The survey was addressed to Austria's members of the AEC industry. The bulk of the data that has been worked with were the results from both surveys. If applicable, information from existing literature was used to put the data in context. Finally, the gathered data has been analyzed in the fifth chapter.

As explained in the second chapter, diffusion processes of product innovation follow logistic functions. Therefore a non-linear least squares estimation for the data of each case study has been carried out. For the case studies 1-4 the logistic function turned out to be a proper way to model the collected data. It wasn't possible to create a model that is following this function for case study BIM. A closer analysis on the data shows, that for now the turning point of the diffusion process, where the upward slope starts to lower, isn't reached yet. Therefore the saturation model for the diffusion of BIM in Austria couldn't be built yet. At the end of the results chapter, the diffusion curves of each case study have been compared with each other. In conclusion, pattern in the diffusion processes of organizational innovations have been found and identified. They can be modeled with the saturation model of the logistic function and share the same characteristics as product innovations.

The research of this study underlies a big number of limitations, that have been identified during the process of the research. First the research has only been carried out for Austrian companies. Although it is very likely, that studies regarding the characteristics of diffusion curves in other countries would reveal the same results, adoption rates differ all over the world. The comparison between the findings from the field research in Austria and the international literature, revealed that in international comparison Austria is slower in adopting new inventions.

The first survey didn't contain a distinction between the lines of business of the sample. The sample was chosen in regard to the business size, because larger companies are relying more on organizational innovations. While designing the survey, the lines of business were in no interest to the writer of this thesis. In hindsight a comparison of the innovation adoption rates between different lines of businesses would have been interesting and easy to achieve. Also the adoption rates of case study 1-4 are biased, because large companies would implement organizational innovations more likely than small companies. The researcher was aware of this fact while creating the research framework for this survey. Since the priority number one was to get as much data about the diffusion of organizational innovations as possible, the writer of this thesis traded off bias free adoption rates in favour for richer diffusion data.

The diffusion of innovation is a complex process, which depends on a big number of variables. In the course of this study the writer of this thesis solely focused on the quantitative aspect of diffusion. For each innovation or group of innovations, simply the number of implementations for a certain year has been determined and examined. This results in the fact, that the provided information can be seen as rather flat. The research delivered data about the number of implementations of certain innovations at a given time, but not about the story behind the implementations. The constructed diffusion curves simply tell the reader how many companies implemented a certain innovation. It doesn't tell us anything about the maturity of the implementation. We don't know if the whole company is using the invention successfully or if the usage of the adoption is restricted to a certain fracture of the whole enterprise. This leads to the insight, that the simple question, if a certain organizational innovation is used or not, is not enough for a good analysis. The simple fact, that the management of a company dictates to use a tool at a certain time, doesn't guarantee that it is used in a proper way by the employees. In order to find out why innovations got implemented and if the implementation worked out positively, interviews with the participants would have been needed to carry out. This would add insights to the quantitative data and maybe put the quality of the research in another dimension. Due to the simplicity of nature of the second survey, the implemented levels of BIM have been asked, as well as reasons for and against an implementation. However, the capacities for the research in the course of this thesis limited the possibilities, but this results in the insight that a lot of potential in the future research regarding the diffusion and adoption of organizational innovation has been found.

In order to be able to understand the process of diffusion of organizational innovation the research in this direction has to be continued. On the one hand, future surveys should as well gather more qualitative data in order to sketch diffusion curves from other countries. A finer partition, like for instance in lines of businesses or demographic characteristics of the employees would be also nice to have. The more data is gathered, the more statements can be formed afterwards. On the other hand future surveys should also try to connect diffusion with adoption. Only if detailed information about a number of adoption processes has been gathered, the overall diffusion process can be interpreted properly. Therefore the addition of qualitative data in the form of interviews or focus groups would be advisable. Following these suggestions, future publications can add important insights to the knowledge about organizational innovation.

List of Figures

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Appendix

Online Questionnaires

Datenerhebung Organisationale Innovationen

Vielen Dank, dass Sie sich die Zeit nehmen um an unserer kurzen Umfrage teilzunehmen!
Diese Datenerhebung wird im Rahmen eines Forschungsprojekts an der Technischen Universität Wien durchgeführt. Dieses beschäftigt sich mit der Verbreitung von Organisationalen Innovationen in österreichischen Unternehmen.
Sie werden nun befragt ob das Unternehmen in dem Sie arbeiten bestimmte Organisationale Innovationen implementiert. Sollten sie die Frage mit Ja beantworten tragen Sie bitte als Antwort der darauf folgenden Frage das Jahr ein seitdem diese Organisationale Innovation in Ihrem Unternehmen verwendet wird.
Wir bitten Sie sich die Zeit zu nehmen um das richtige Jahr anzugeben.

Selbstverständlich ist die gesamte Befragung anonym.
Ihre Fragen oder Anmerkungen nehmen wir sehr gern unter der E-Mail Adresse: innovation.diffusion@tuwien.ac.at entgegen.

* Erforderlich

Kommunikationsprozesse

1. **Führt Ihr Unternehmen Maßnahmen durch um die Anzahl an versendeten E-Mails zu reduzieren?** *
   Markieren Sie nur ein Oval.
   - ◯ Ja
   - ◯ Nein

2. **Wenn ja, seit welchem Jahr werden diese Maßnahmen durchgeführt?**
   _____
   Beispiel: 15. Dezember 2012

3. **Verwendet Ihr Unternehmen innerbetriebliche soziale Netzwerke (Enterprise Social Networks) für die interne Kommunikation?** *
   Markieren Sie nur ein Oval.
   - ◯ Ja
   - ◯ Nein

4. **Wenn ja, seit welchem Jahr verwendet Ihr Unternehmen Enterprise Social Networks?**
   _____
   Beispiel: 15. Dezember 2012

5. **Verwendet Ihr Unternehmen Instant Messenger für die interne Kommunikation?** *
   Markieren Sie nur ein Oval.
   - ◯ Ja
   - ◯ Nein

6. **Wenn ja, seit welchem Jahr verwendet Ihr Unternehmen Instant Messenger für die interne Kommunikation?**
   _____
   Beispiel: 15. Dezember 2012

7. **Wenn ja, welche Instant Messenger verwendet Ihr Unternehmen?**

Papierloses Büro

8. **Führt Ihr Unternehmen Maßnahmen durch um die Anzahl an auf Papier ausgedruckten Dokumenten zu reduzieren?** *
   Markieren Sie nur ein Oval.
   - ◯ Ja
   - ◯ Nein

9. **Wenn ja, seit welchem Jahr führt Ihr Unternehmen diese Maßnahmen durch?**
   Beispiel: 15. Dezember 2012

10. **Verwenden Sie in Ihrem Unternehmen E-Mail Signaturen, die den Leser der E-Mail dazu auffordern die Nachricht nicht auszudrucken. Beispielsweise: "Denken Sie an die Umwelt bevor Sie diese Nachricht ausdrucken."** *
    Markieren Sie nur ein Oval.
    - ◯ Ja
    - ◯ Nein

11. **Wenn ja, seit welchem Jahr werden solche E-Mail Signaturen verwendet?**
    Beispiel: 15. Dezember 2012

Integrierte Prozesse

12. **Verwendet Ihr Unternehmen Enterprise Ressource Planning (ERP) Systeme?** *
    Markieren Sie nur ein Oval.
    - ◯ Ja
    - ◯ Nein

13. **Wenn ja, seit welchem Jahr werden ERP Systeme in Ihrem Unternehmen verwendet?**
    Beispiel: 15. Dezember 2012

14. **Wenn ja, welches ERP System verwendet Ihr Unternehmen?**

15. **Verwendet Ihr Unternehmen Custom Relationship Management (CRM) Systeme?** *
    Markieren Sie nur ein Oval.
    - ◯ Ja
    - ◯ Nein

16. **Wenn ja, seit welchem Jahr werden CRM Systeme in Ihrem Unternehmen verwendet?**
    Beispiel: 15. Dezember 2012

17. **Wenn ja, welches CRM System verwendet Ihr Unternehmen?**

18. **Verwendet Ihr Unternehmen Cloud basierte Dokumentenablage Tools?** *
Markieren Sie nur ein Oval.

- Ja
- Nein

19. **Wenn ja, seit welchem Jahr werden Cloud basierte Dokumentenablage Tools in Ihrem Unternehmen verwendet?**

Beispiel: 15. Dezember 2012

20. **Wenn ja, welche Cloud basierten Dokumentablage Tools verwendet Ihr Unternehmen?**

Innerbetrieblicher Wissenstransfer

21. **Verwendet Ihr Unternehmen Wiki-Seiten um Firmenbezogenes Wissen aufzuzeichnen und intern zu verbreiten?** *
Markieren Sie nur ein Oval.

- Ja
- Nein

22. **Wenn ja, seit welchem Jahr werden Wiki-Seiten in Ihrem Unternehmen verwendet?**

Beispiel: 15. Dezember 2012

23. **Verwendet Ihr Unternehmen Softwarelösungen, außer Wiki-Seiten, um Firmenbezogenes Wissen aufzuzeichnen und intern zu verbreiten?** *
Markieren Sie nur ein Oval.

- Ja
- Nein

24. **Wenn ja, seit welchem Jahr?**

Beispiel: 15. Dezember 2012

Flexibilität

25. **Bietet Ihr Unternehmen seinen Mitarbeitern an mindestens einen Tag pro Woche von Zuhause aus zu arbeiten?** *
Markieren Sie nur ein Oval.

- Ja
- Nein

26. **Wenn ja, seit welchem Jahr bietet Ihr Unternehmen dies an?**

Beispiel: 15. Dezember 2012

27. **Gibt es in dem Büro Ihres Unternehmens so genannte "Shared Desk Offices"? Dies sind Büros in denen es keine fixierten Sitzplätze gibt.** *

Markieren Sie nur ein Oval.

- Ja
- Nein

28. **Wenn ja, seit welchem Jahr gibt es "Shared Desk Offices" in Ihrem Unternehmen?**

Beispiel: 15. Dezember 2012

Fragebogen abgeschlossen

Vielen Dank, dass Sie sich Zeit genommen haben und an der Befragung teilgenommen haben.

Datenerhebung der Verbreitung von Building Information Modeling in österreichischen Planungsbüros.

Vielen Dank, dass Sie sich die Zeit nehmen um an unserer kurzen Umfrage teilzunehmen!
Diese Datenerhebung wird im Rahmen eines Forschungsprojekts der Technischen Universität Wien durchgeführt. Diese beschäftigt sich mit der Verbreitung von Building Information Modeling (kurz BIM) in österreichischen Planungsbüros.

Selbstverständlich ist die gesamte Befragung anonym.
Ihre Fragen oder Anmerkungen nehmen wir sehr gern unter der E-Mail Adresse Innovation.Diffusion@tuwien.ac.at entgegen.

* Erforderlich

Datenerhebung der Verbreitung von Building Information Modeling in österreichischen Planungsbüros.

1. **Verwenden Sie BIM im Unternehmen?** *
   Markieren Sie nur ein Oval.

   ◯ Ja
   ◯ Nein

2. **Falls ja, seit wann verwenden Sie ca. BIM? (Die Angabe des Jahres und des Quartals genügt.)**

   _____
   Beispiel: 15. Dezember 2012

3. **Falls ja, in welchem Umfang verwenden Sie BIM?**
   Markieren Sie nur ein Oval.

   ◯ BIM-Softwareprodukte werden als Insellösung zum Lösen einer spezifischen Aufgabe eingesetzt (little BIM)
   ◯ Durchgängige Nutzung von digitalen Gebäudemodellen über verschiedene Disziplinen und Lebenszyklusphasen (big BIM).

4. **Falls Sie BIM einsetzen oder planen es einzusetzen, was ist der Hauptgrund der dafür spricht?**

   _____
   _____
   _____
   _____
   _____

5. **Falls Sie BIM nicht einsetzen oder planen es nicht einzusetzen, was ist der Hauptgrund der dagegen spricht?**

6. **Ist in Zukunft eine Einbindung oder ein verstärkter Einsatz von BIM in Ihrem Unternehmen geplant?** *
   Markieren Sie nur ein Oval.

   - Ja
   - Nein
   - Vielleicht

Fragebogen abgeschlossen

Vielen Dank, dass Sie sich Zeit genommen haben und an der Befragung teilgenommen haben.