Computer Supported Cooperative Work (2012) 21:317–356
DOI 10.1007/s10606-012-9159-1

Exploring Appropriation of Enterprise Wikis:
A Multiple-Case Study

Alexander Stocker[1], Alexander Richter[2], Patrick Hoefler[3] & Klaus Tochtermann[4]
[1]*DIGITAL - Institute for Information and Communication Technologies, JOANNEUM RESEARCH, Steyrergasse 17-19 8010 Graz, Austria (Phone: +43-316-8762611; Fax: +43-316-8761403; E-mail: alexander.stocker@joanneum.at);* [2]*, Bundeswehr University, Werner-Heisenberg-Weg 39, Neubiberg 85577, Germany;* [3]*, Know-Center, Inffeldgasse 21a, Graz 8010, Austria;* [4]*, German National Library of Economics (ZBW) – Leibniz Information Centre for Economics, Düsternbrooker Weg 120 24105 Kiel, Germany*

Abstract. The purpose of this paper is to provide both application-oriented researchers and practitioners with detailed insights into conception, implementation, and utilization of intra-organizational wikis to support knowledge management and group work. Firstly, we report on three case studies and describe how wikis have been appropriated in the context of a concrete practice. Our study reveals that the wikis have been used as Knowledge Base, Encyclopedia and Support Base, respectively. We present the identified practices as a result of the wiki appropriation process and argue that due to their open and flexible nature these wikis have been appropriated according to the users' needs. Our contribution helps to understand how platforms support working practices that have not been supported by groupware before, or at least not in the same way. Secondly, three detailed implementation reports uncover many aspects of wiki projects, e.g., different viewpoints of managers and users, an investigation of other sources containing business-relevant information, and perceived obstacles to wiki projects. In this context, our study generates a series of lessons learned for people who intend to implement wikis in their own organizations, including the awareness of usage potential, the need for additional managerial support, and clear communication strategies to promote wiki usage.

Key words: knowledge management, knowledge sharing, social software, wiki, enterprise wiki, web 2.0

1. Introduction

Wikis, Weblogs, Social Networking Services, and other types of social software have been quite successful on the Web in the last few years. Wikipedia, Facebook, MySpace, Youtube, and many more have formed participative environments, allowing anyone to create, share, and modify content in an easy and intuitive way – even users with very limited technical expertise. Platforms such as these have steadily lowered the barrier for knowledge sharing on the Web, and nowadays provide rich sources for knowledge acquisition. The term 'Web 2.0' was coined by Tim O'Reilly and Dale Dougherty in 2005. The Web 2.0 can be summarized as architecture of

participation where users become producers of content, data sources can be mixed up, and lightweight services from the Web substitute installed software on desktop PCs (O'Reilly 2005). In a nutshell, Web 2.0 is the evolution of a new dynamic user-centred Web (often called "me-centricity": see e.g. Koch 2008) with social features.

More and more companies realize that the knowledge of their employees is a valuable strategic resource for being successful on the market (Drucker 1992). In many definitions of knowledge management, knowledge is bound to people or extracted from experts and made available in specially designed systems, which can be called knowledge-based systems (Mayer 2004). The term management then denotes the support of those knowledge-based systems in storing, administering, updating and retrieving of knowledge (Mayer 2004). Knowledge management is the managerial approach to handle the asset 'knowledge' within an organization. However, scientists and practitioners have different views on how knowledge can and should be managed in the enterprise, most notably because of the interdisciplinary nature of the term knowledge and its varying definitions. In recent years, the term has been extensively used without sufficient differentiation from the term information (Meyer and Sugiyama 2007). But knowledge should not be seen as a valuable asset in itself. It can only generate added value when shared and applied in activities, tasks and projects, i.e., it has to be taken into action. Therefore the facilitation of knowledge sharing represents one of the major challenges of knowledge management and is a vital component of knowledge management in action (Strohmaier et al. 2007).

Motivated by their observations of knowledge sharing on the Web, enterprises have slowly begun to acknowledge the value of Web 2.0 principles and technologies. The adoption of the Web 2.0 was supposed to lead to manifold business advantages for various application domains (e.g. Bughin and Manyika 2007). The increasing convergence of Web 2.0 and organizational knowledge management has recently been studied in detail: Levy (2009) argued that the Web 2.0 shares a lot of principles and attributes with knowledge management. Further publications have discussed the potential of Web 2.0 technologies to empower knowledge workers (Schneckenberg 2009) and investigated key determinants of knowledge sharing and collaboration enabled by Web 2.0 technologies (Paroutis and Saleh 2009). Insights on the ability of the Web 2.0 to harness and manage personal knowledge are provided by Razmerita et al. (2008), who question whether the Web 2.0 can reconcile the conflicting interests of managing organizational knowledge with personal objectives.

Computers are and have always been a medium for communication and cooperation (Licklider and Taylor 1968). However, the support of collaboration is not only about providing appropriate tools and technologies but also about shaping socio-technical systems consisting of people, technology, organizations, and tasks (Pasmore et al. 1982). As in the field of knowledge management, the consensus is that human, technological and organizational aspects need to be well

balanced (e.g., Savage 1996; Hlupic et al. 2002). The close relationship between knowledge management/organizational memory and computer-supported collaborative working (CSCW) has been extensively discussed before (e.g., Greif 1998; Ackerman and Halverson 1998; Ackerman and Halverson 2000). As CSCW is about understanding collaboration and shaping socio-technical systems for supporting this collaboration (Koch 2008), the emergence of social software – including wikis, weblogs, and social networking services– is assumed to be a major step in the right direction, as a plethora of highly useable collaboration tools has emerged.

In the last few years organizations have been striving for mature Web 2.0 technologies and applications, most notably in the form of wikis and weblogs. While weblogs may serve as a new medium for corporate communication (Kosonen et al. 2007; Efimova and Grudin 2007; Stocker et al. 2008), wikis facilitate the collaborative creation of content in the enterprise (Grace 2009; Hasan and Pfaff 2006; Watson and Harper 2008). Wikis may form suitable platforms to support identification, acquisition, development, distribution, preservation, and use of knowledge within the enterprise, which are the 'knowledge management building blocks' of Probst et al. (2000). As most of the organizational knowledge resides in people's heads, collaborative conversational knowledge management tools including wikis may help to widen the bottleneck of knowledge acquisition (Wagner 2006). Besides wikis and traditional weblogs, two further applications are currently gaining importance: social networking services (DiMicco et al. 2008; Richter and Koch 2008; Richter and Riemer 2009) and microblogging services (Riemer and Richter 2010; Zhang et al. 2010; Barnes et al. 2010; Mueller and Stocker 2011).

To fully exploit the huge potential of the Web 2.0 for knowledge management and collaboration support, managers need to understand and master the emerging field of tension between the fundamental principle of the Web 2.0, which is the self-organization of its users, and the prevailing hierarchical organizational structures in enterprises. Hence, adopting Web 2.0 platforms in corporate intranets to support the collaboration of employees is very different from operating platforms on the Web (Jahnke 2009). Academia has to offer companies guidance, describing how others have successfully adopted Web 2.0 platforms to facilitate knowledge sharing. To improve knowledge sharing support with the help of information technology, the adopted tools must be embedded in the social networks (Huysman and Wulf 2006) and brought into a social context.

With our paper, we aim to provide application-oriented researchers and practitioners interested in case studies with detailed insights into conception, implementation, and utilization of three enterprise wikis. To achieve our research goals, we carried out semi-structured interviews with all managers in charge of these wikis as well as online surveys of knowledge workers who were supposed to benefit from using them.

In this introduction we have provided an overview of concepts including Web 2.0, Computer Supported Collaborative Work (CSCW), and Knowledge Management. The rest of the paper is structured as follows:

- Section 2 introduces the concept of appropriation and elaborates on openness of use as a key feature of social software that also justifies the need for our study.
- Section 3 explores relevant related work, i.e., research that has already investigated the appropriation of enterprise wikis.
- Section 4 defines our research goals and illustrates our chosen research design. It further points out the limitations of our research.
- Section 5 presents a detailed description of the wiki usage practices (i.e., how a platform is appropriated in the context of a corporate practice and how it is connected to a concrete goal). It covers the presentation of qualitative data from all three cases by looking at the perspective of the managers and gives a cross-case analysis.
- Section 6 continues with a detailed description of the degree of adoption, presenting and interpreting quantitative data gained from surveying knowledge workers.
- Section 7 presents a discussion of the results as well as our interpretation, and finally Section 8 concludes the paper.

2. Appropriation and usage

Due to diversifying business processes and more individual work practices and the resulting decentralization of organizational structures, the scope for decision-making of knowledge workers is continuously broadening. The importance of prescriptive rules of individual and cooperative forms of work – e.g., role descriptions and process models – is decreasing, and aspects like organizational culture and context are gaining importance (Orlikowski and Iacono 2000). As a direct result it has become a central challenge to deal with the differentiation of specific work practices instead of designing according to abstract descriptions of the formal organization (see Brynjolfsson and Hitt 1998; Barley and Kunda 2001). Social practices cannot simply be changed at will due to their embodiment and routinization. Hence, the discipline of information systems (of which CSCW and Web 2.0 research can be seen as part) has to face a huge repertoire of practices in organizations of different industries to gain an understanding of the possibilities for change in the context of the introduction of IT artifacts (Orlikowski and Iacono 2000; Wulf and Jarke 2004).

For the design and use of collaboration systems (being a part of information systems research) considerations about appropriation play a central role. In the context of our study, appropriation shall be defined as "the way in which technologies are adopted, adapted and incorporated into working practice. […] Appropriation relies on flexibility in both practice and technology, and in particular, flexibility in the way in which the technology can be mapped onto user needs" (Dourish 2003, 5). According to Dourish, CSCW has typically explored questions concerning appropriation from a social perspective, e.g.,

in Orlikowski's studies of the adoption of Lotus Notes (where she observed patterns of mutual adaptation of work practice and technology) (Orlikowski 1992, 1995) and in Grudin and Palen's work on calendar systems (Grudin 1988; Grudin and Palen 1995).

To explain appropriation phenomena, there are several appropriate theoretical concepts such as the concept of situated actions (Suchman 1987), the concept of the boundary object (Star and Griesemer 1989) or Activity Theory (Kuutti 1996).[1] Arguably most influential is the concept of the structuration of technology, with the most relevant works from De Sanctis and Poole and from Orlikowski (Poole and De Sanctis 1989; Poole and De Sanctis 1992; Orlikowski 1992).

Both are based on Giddens' framework of structuration in which structure is understood as a generic concept that is manifested in the structural properties of social systems. Structure constrains but at the same time also enables social action. Furthermore, social structures sustain action, but they are also transformed through action (Giddens 1979, 1984).

Both approaches can be very helpful to further conceptualize appropriation: Poole and De Sanctis (1989) argue that technology constitutes a specific form of structure. Structure is the outcome as well as the mediator of human action, but does not determine action directly and rather has to be appropriated by the users. In her later publications, Orlikowski goes a step further and argues that the action of users "enacts emergent structures through recurrent interaction with the technology at hand" (Orlikowski 2000, 407). Thus, the distinguishing feature in the adaptation of Giddens' framework by De Sanctis and Poole and by Orlikowski's later work concerns the question whether structure is "embodied in technology, or whether it is a phenomenon that emerges from using technology" (Stevens 2009, 17). This is an ongoing discussion and in this paper we do not want to engage with this fundamental question. Therefore in the following and in the context of our study we rather argue from the second, i.e., the point of view of Orlikowski's later work (Orlikowski 2000).

Dourish (2003, 5) also notes that appropriation "might also simply involve making use of the technology for purposes beyond those for which it was originally designed, or to serve new ends". Representing a similar opinion, Pipek (2005, 30) suggests that the term appropriation "stresses the option of the appropriator to go beyond the rules and ideas that have been originally associated with the thing that is being appropriated. With regard to technologies, this stresses the options of technology users to go beyond the intentions that technology designers associated with a technology or a technological artifact". Consequently, we could say that structure can also emerge when users make sense of the (use of the) artifact. In this context, Pipek and Wulf (2009) propose infrastructuring as an "integrated perspective to overcome the traditional distinction between IT design and IT adoption" and describe a methodological approach that acknowledges organizational IT as work infrastructure and supports the successful establishment

of information system usage. A work infrastructure can be defined as "a shared, evolving, heterogeneous installed base of IT capabilities among a set of user communities based on open and/or standardized interfaces" (Hanseth and Lyytinnen 2004, 208). Whereas infrastructuring considers the versatility of software, i.e., the fact that users can modify and appropriate different parts of the technology in ways unforeseen by technology designers, there are also examples of software whereby (the structure) of the artefact does not lend itself to a particular form of usage. This means also that the software in general is not associated with a typical usage.

Riemer recognizes this fact and identifies it as the phenomenon of 'Nutzungsoffenheit'. In fact, Nutzungsoffenheit is an essential characteristic of many collaboration technologies (and especially of social software). Riemer defines Nutzungsoffenheit 'as a form of openness, whereby the technology and its set of features do not precipitate its forms of usage (…) Nutzungsoffenheit means that the true nature and potential of such technologies only manifests itself when people make sense of and incorporate them in their day-to-day work routines'. (Riemer et al. 2009, 186). Whereas Riemer has opted to stay with the German term, we think that 'openness of use' might be a quite close translation. Riemer argues that collaborative technologies cannot be understood as bundles of features, but have to be perceived as technologies in use (Riemer et al. 2007) and that the platforms need to be appropriated by their users in a particular context, thereby becoming part of different practices (Riemer and Richter 2010). In this case, structure only emerges when users make sense of their platforms (e.g., the wikis).

For corporate social networking and enterprise microblogging, Riemer and Richter show that 'Nutzungsoffenheit' especially applies to social software (Richter and Riemer 2009; Riemer and Richter 2010). They point out as an example that whereas these platforms lead to rather hedonistic behaviour in the private context ("the big chatter of Twitter"), the nearly identical piece of software has been appropriated in a useful, focused and sensible way in corporate contexts. This means that the users need to explore and figure out how they can use the assumed big potential of social software. If there is no experience with the same type of social software, Nutzungsoffenheit implies that it is hard to predict how a platform will be appropriated.

To return to the setting of our study, there is no one and only way to use a wiki, but there are manifold ways: A wiki may be used within a project to collaboratively edit the project proposal or to facilitate knowledge sharing between support employees, but it may also be used to arrange a meeting and to document the meeting minutes. Following Riemer's argumentation, to show the highest potential of enterprise wiki usage possible, it is important to be aware of diverse potential ways to use a wiki. In our three case studies, we describe how the platform has been (or can be) appropriated in the context of a concrete practice and is connected to a concrete goal. As argued above, how a platform is

used depends on the particular context. Thus, our cases only suggest ways in which the platform can be appropriated by its users, i.e., to become part of different practices. Therefore, in many cases managers try to figure out a suitable and business-relevant use case before rolling out a particular piece of social software, and later on actively promote this usage towards the employees (Richter and Stocker 2011).

However, as we will show in the next section, studies examining appropriation and concrete working practices are quite limited.

3. Corporate wiki appropriation and usage

Our literature review revealed that very little has yet been reported about wiki appropriation and usage. Most of the reviewed wiki publications, as summarized in Table 1, do not explicitly take the perspective of the knowledge worker into account, as they are not gathering and assessing empirical data by surveying or observing employees. Whenever scientific publications have researched the

Table 1. Reviewed studies on enterprise wikis.

Authors	Investigated case(s)	Collected Data	Type of Study
Chau and Maurer (2005)	Medium sized software organization (Empolis)	Observations	Exploratory Case study/Poster Paper
Majchrzak et al. (2006)	Corporate wiki users across the globe	Online survey of 168 corporate wiki users	Survey/ Conference Paper
Buffa (2006)	ILOG Company University of Nice: Computer Science Department	Access to wiki, visited meetings, interviews with more than 20 employees Interviews with 17 students and 5 teachers	Case Study
McAfee (2006); McAfee and Sjoman (2006)	Investment Bank Dresdner Kleinwort Wasserstein	Interviews	Case Study
Hasan and Pfaff (2006)	Organizational case of wiki rejection	Interviews with management	Case Study
Wagner and Majchrzak (2007)	Three cases of organizations	Interviews with site creators	Multiple-Case Study
White and Lutters (2007)	7 enterprises	Semi-structured telephone interviews with employees	Interviews
Danis and Singer (2008)	Globally distributed 900-member research organization	40 interviews, analyses of logs, additional 20 interviews	Case Study
Farrell et al. (2008)	Large organization (IBM)	Studies of applications	Case Study
Happel and Treitz (2008)	Six cases (3 very large, 2 medium, 1 small)	6 qualitative interviews	Survey
Blaschke and Stein (2008)	Leading innovation agency in Europe	Wiki-database dump	Comparative data analysis
Grace (2009)	Three case studies (Mapa, eBay, Ingenta)	Desktop research	Position paper
Trkman and Trkman (2009)	Slovenian company (software department)	Semi-structured interview with project leader, survey of 21 users, usage statistics	Longitudinal Case Study
Arazy et al. (2009)	Large organization (IBM)	Online survey of 919 users Interviews with central administration unit	Case Study
Holtzblatt et al. (2010)	Not-for-profit organization (MITRE Corporation)	Unstructured open-ended interviews with 26 users	Case Study

behaviour of users, the respective usage of the wiki was not comprehensively outlined.

The following fifteen scientific papers, presented in chronological order, describe empirical studies on enterprise wikis. User interviews and surveys were the most frequently used data collection technologies. We highlight their most interesting findings as well as the connection of their conducted research to ours.

Chau and Maurer (2005) presented an exploratory case study on the use of a self-organized, wiki-based experience repository used for sharing content for problem solving and expertise location. By observing users, they found that a newly introduced wiki was primarily used to exchange ideas on technical problems. However, usage, success factors, motivation, and benefits were not researched in detail.

Surveying 168 corporate wiki users from different enterprises, Majchrzak et al. (2006) found that enterprise wikis enhanced reputation, made work easier and helped the organization to improve its processes. The examined wikis were adopted to support a variety of tasks and used by various departments. These wikis particularly contributed to improve workflows, increase collaboration efficiency and knowledge reuse, and identify new business opportunities. This paper provides very useful information regarding corporate wiki usage, focusing on wiki contributors and their experiences, but wiki usage itself is not presented, as the surveyed people came from many different organizations.

Buffa (2006) presented a lot of experiences gained while investigating the intranet wiki of the French company ILOG and provided detailed insights on its implementation. Buffa showed that collaborative tools including the wiki facilitated knowledge sharing and creativity in the enterprise. Setting up a wiki required help from a 'local guru' due to the technical skills required for installation and maintenance. This paper tackles manifold wiki issues but does not provide any empirical data on wiki usage and motivation from the perspective of employees.

McAfee investigated the use of wikis and other types of social software in the investment bank Dresdner Kleinwort Wasserstein and discussed the ability of wikis to replace email for certain tasks, thereby reducing information overload within the enterprise (McAfee 2006; McAfee and Sjoman 2006). McAfee argued that wikis are capable of making both the knowledge work and its output more visible and transparent. This paper highlights the vast potential of wikis but does not assess any empirical data from the perspective of the knowledge workers.

Hasan and Pfaff (2006) investigated a single case of wiki rejection, discussing challenges and opportunities when adopting a wiki to manage corporate knowledge. They identified managerial concerns, which dealt with an emerging conflict caused by the flattening of organizational hierarchies due to the innovative wiki approach. Secondly, they identified social concerns, which dealt with the wiki's openness to vandalism, missing recognition for authorship, and the poor means of quality assurance for the information in wikis. The description

of this wiki-rejection case helps to better understand potential obstacles that might prevent the successful appropriation of wikis.

Wagner and Majchrzak (2007) described three cases of organizations that used wikis to foster customer-centricity and enabled customers to access and change an organization's web presence. Their research focused on external wikis and revealed six characteristics which affect customer engagement by drawing parallels with studies of the open source software movement. Though this paper is very valuable reading, its findings may not be applicable to intra-organizational wikis.

White and Lutters (2007) presented preliminary findings from semi-structured interviews regarding the implementation of wikis in the workplace. This paper highlighted aspects of successful wikis including article creation, managerial support, technical knowledge, and trust, but unfortunately the researchers did not go into detail on any aspect.

Danis and Singer (2008) conducted a longitudinal single-case study of a research wiki deployed in a globally distributed 900-member research organization. They found that wiki articles eventually resulted in a greater transparency on the knowledge of employees. This paper does not intensively provide much empirical data on motivation, usage, benefits and obstacles from the perspective of the employees.

Farrell et al. (2008) studied the use of wikis and other social software within IBM and argued that a participatory Web can finally lead to a 'socially resilient enterprise' where social software can be used to spread reputation, strengthen weak ties, enable cross-organizational communication and share work products. This paper provides vast knowledge on the use of social software at IBM but does not explicitly refer to wiki usage, benefits and obstacles from a knowledge workers' perspective.

Happel and Treitz (2008) analyzed wiki proliferation, i.e., certain problems coming along with wikis, including redundant or outdated content, based on six exploratory interviews with managers in charge of the wikis. Their work focuses on wiki problem patterns, including content, access and structure and their practical implications where inaccuracy of content was most frequent. This study provided us with many insights on obstacles preventing the appropriation of enterprise wikis but did not describe the wiki usage from which the investigated obstacles had been derived.

Blaschke and Stein (2008) presented an in-depth case study of a corporate wiki, investigating the emerging network structures when wikis are adopted. The research approach they took built on the notion that organizations are networks of communication and wikis are perceived as two-layer networks of actors and documents. The paper provided a lot of quantitative data and graphic visualizations depicting the wiki usage, but does not include empirical evaluations.

Grace (2009) reviewed the appropriation and usage of wikis in three organizations and developed a framework based on the conducted analysis to

provide insights into what enticed organizations to select wikis as a knowledge sharing tool. This paper reviews existing cases from the literature and develops a wiki selection and implementation framework based upon this review. However, it does not include any empirical research on usage and motivation.

Trkman and Trkman (2009) investigated a longitudinal case of wiki implementation within a department of a Slovenian company. They applied the Delone and McLean model for information system success (Delone and McLean 1992), analyzing the three constructs information quality, system quality and service quality. Interestingly, the authors argue that the main challenges and success factors with enterprise wikis remain the same as with earlier technical solutions.

Arazy et al. (2009) conducted an in-depth empirical study of wikis at IBM where there was a large user base of early adopters. This very comprehensive study showed that users at IBM perceive enterprise wikis to be highly valuable, in terms of impact on their job and organizational benefits. Arazy et al. (2009) revealed that enjoyment is the main motivation for corporate wiki participation in the early period. This finding may indicate that corporate wikis might require a defined wiki usage, an issue that we discuss at the end of our paper.

Holtzblatt et al. (2010) explored factors that affect the use of wikis to support the dissemination of knowledge in the enterprise, discovering two major factors: a reluctance to share specific information, and a heavy reliance on other, non-wiki tools. Staff were not always willing to share specific information company wide and people did not want to learn another tool. This paper enabled us to learn much about potential wiki obstacles preventing successful wiki appropriation.

4. Research design

Our research problem can be defined as follows: As we showed before, the appropriation of corporate wikis has rarely been analyzed in academic literature, and the benefits from enterprise wikis are just in the early stages of being systematically explored. The existing and reviewed studies provide a first step towards understanding corporate wiki usage. However, we still do not fully understand processes, context, and phenomena in regard to the appropriation of wikis in the enterprise (Danis and Singer 2008; Arazy et al. 2009). Specifically, the studies do not sufficiently explain the appropriation process, i.e., they do not describe how a wiki has been (or can be) appropriated in the context of a concrete practice and how the wiki is connected to a concrete goal.

Since we were especially interested in gaining knowledge on wiki appropriation and usage, we built a multiple-case study of three Austrian enterprises that had chosen to adopt wikis. A multiple-case study approach (Eisenhardt 1989; Miles and Huberman 1984) seemed very fruitful to us, given the fact that we aimed to identify common patterns and differences across all three cases to investigate wiki appropriation and usage. Table 2 summarizes the main

Table 2. Descriptive data of examined industry cases.

	Case Alpha	Case Beta	Case Gamma
	'The Support Base'	'The Encyclopedia'	'The Knowledge Base'
Industry	Microelectronics	Engineering Services	IT Services
Number of employees	~2900	~250	~750
Scope of the wiki	Design Centre	Whole enterprise	Whole enterprise
Potential wiki users	~200	~250	~750
Actual wiki users	80	180	100
Years installed	>1.5	>2	>2
Purpose of the wiki	Support for researchers and developers	Internal Encyclopedia for information technology and workflows	Internal knowledge base for all employees
Target group of the wiki	Support, R&D	All departments, primarily technicians	All departments

characteristics of our three case companies *Alpha*, *Beta*, and *Gamma*. All three cases had completed the roll-out of their wikis at least one and a half years before we conducted our research.

Through our research we wanted to investigate *how* and *why* enterprises used a wiki and with *what* results. As we aimed to better understand the wiki appropriation, we thoroughly explored the initial situation before the wiki was selected, investigated the wiki implementation phase, and took a close look at the achieved results in terms of usage and generated benefits from two different perspectives, managerial and non-managerial. The three case study reports are important for making the wiki usage and the degree of adoption transparent to researchers.

Table 2 presents an overview of the selected case studies. These case studies share many commonalities, but they also show differences. All three case studies have at least 1.5 years of experience with enterprise wikis, all are settled in Austria (which makes them culturally comparable), and in all cases, there are explicitly named managers in charge of the wikis. However, the three cases differ in size (number of total employees, number of potential wiki users), industry, target group of the wiki, and the purpose of the wiki.

We outlined the following research questions: How and why do enterprises provide a wiki to support employees in their daily business and with what results – i.e., what do we learn about appropriation and usage from a manager perspective? Building on this question, we were further interested in finding out which motivation drove non-managerial employees to utilize enterprise wikis, what individual and organizational benefits were generated by enterprise wikis, and which success factors determined successful enterprise wikis – i.e., learning about the appropriation process. In our study, we assess both quantitative and qualitative data in order to increase its validity, following the requirements as described by the literature on case study research (Yin 2003; Eisenhardt 1989). We applied two data collection techniques:

In the first step, we conducted semi-structured interviews with all available managers, i.e., all persons being in charge of the enterprise wikis and/or having the task to implement them. We asked them 40 questions about their perceived degree of organizational suffering (i.e., the reason for a new technological

solution), their particular wiki implementation strategy, and the perceived impacts. Regarding the perceived impact, we differentiate between individual and organizational impacts, according to the Delone and McLean model for information systems success (Delone and McLean 1992). Each interview lasted between 2 and 3 hours. The data from the interviews was collected by the interviewing scientist. Managers were given enough leeway to digress from one particular question and share their experiences gained from the wiki projects. In all three cases, managers were the responsible authorities who felt the demand for the enterprise wikis and who took over the non-technical administration, i.e., the community building. They were also heavy users of the wikis.

The qualitative empirical results were documented in three case study reports and sent back to the interviewees to comment upon and to ensure that all details were interpreted correctly, positively contributing to construct validity (Yin 2003). These three reports enabled us to learn much about the wiki usage which was supposed to benefit the organization from the perspective of the managers. Table 3.

In the second phase, we concentrated on investigating knowledge sharing from a non-managerial employee's perspective. We expected to learn from a user study on the 'actual' degree of adoption, since key facts regarding the profile of corporate wiki users, their time spent on wikis, and their motivational factors are not well researched at the moment (Arazy et al. 2009). The overlaps between interview questions and survey questions are intended. However, our survey questions were much more focused on the parameters of wiki usage and value gain, motivational aspects, perceived benefits, and obstacles, while our interview questions were intended to enable us to give a detailed description of the particular wiki usage.

We surveyed in total 113 non-managerial employees who – as the potential beneficiaries – utilized wikis in their daily business. All users with an active wiki account received an email sent by the interviewed managers including an invitation to contribute to the user survey. The survey questionnaire included 17 questions on reading and writing behaviour, (knowledge) work practices, motivation for reading and editing wiki articles, and perceived benefits and

Table 3. Collected data from examined industry cases.

	Case Alpha	Case Beta	Case Gamma
	'The Support Base'	'The Encyclopedia'	'The Knowledge Base'
Interviewed managers	Responsible support department manager Quality manager	Responsible department manager Project managers (members of wiki core team)	Project manager (member of personnel department) Responsible personnel manager
Addressed knowledge workers in survey	80 (registered wiki users)	48 (wiki users currently not involved in customer projects)	100 (registered wiki users)
Surveyed knowledge workers	43	22	48
Surveyed 'non-adopters'	–	–	6
Assembled case study report	yes	yes	yes

obstacles. In one case of relatively low wiki appropriation, we were allowed to seek additional qualitative information from 6 'non-adopters' by email. The user surveys enabled us to explore the degree of adoption and compare it with the viewpoints of the managers.

Analyzing the quantitative data from the user survey, we extended the case study reports from the managerial interviews and elaborated them with the data from the user survey. The three 20-page case study reports we assembled aimed at guiding the managers to derive strategies for optimizing their wiki utilization. These reports enabled us to learn more about the concrete appropriation of the wiki from the perspective of the users and may provide the participating enterprises with ideas to further improve their wikis. Unfortunately, we never discussed these reports in detail with the managers.

Limitations of the conducted research relate to the methodology used (case-study research), the number of cases investigated, the types of cases, the instruments used for data collection, and the collected data itself.

It is well known that case studies provide no basis for statistical generalization (Yin 2003) but for analytical generalizations discussed as key findings. We investigated three cases of wiki appropriation, using two different sources of evidence: manager interviews (to investigate the wiki usage) and online surveys of non-managerial employees (to investigate the degree of adoption). Our three cases differed from each other in particular aspects, including industry, wiki usage, and defined goals of the wiki. Another limitation of our study is the risk that the collected data does not represent the entire wiki user population in our three cases.

A further limitation deals with the instruments used for data collection: Due to confidentiality, we were not allowed to conduct ethnographical studies, oral interviews of knowledge workers, explorations of the wiki content, and explorations of wiki log-files, which would have provided additional insights for us. Our sources of data were limited to interviews of managerial experts and user surveys. Future research in enterprise wikis should include additional sources of evidence. Furthermore, we deem it fruitful for research in Enterprise 2.0 in general to conduct longitudinal studies observing how wiki appropriation evolves and user habits change over time.

Finally, we treated wikis as a generic type of application for collaboration and knowledge management with functionality comparable to MediaWiki, the system that Wikipedia is based on. Current (commercial) wiki software may contain additional functionality such as social networking (similar to Facebook) or microblogging (similar to Twitter), which may affect enterprises differently, but was not within the scope of our study.

5. Wiki appropriation (manager interviews)

The case description in this section presents a manager's perspective. The data was collected during semi-structured interviews with persons in charge of the

enterprise wikis – the managers. Each case study presented in subsections 5.1, 5.2, and 5.3 consists of a comprehensive presentation of the appropriation process, i.e., the initial situation, the wiki implementation and the results of the appropriation. Additionally, we include the perceived success factors from the perspective of the interviewed managers, as the wiki projects have been claimed, at least in some parts, to be successful by all interviewed managers. Subsection 5.4 presents a cross-case analysis combining the data from the manager interviews highlighting the identified wiki usage. Table 4 presents a summary of the wiki usage of all three cases.

5.1. Case alpha: 'the support base'

The investigated enterprise in Case *Alpha* is the Austrian subsidiary of a large-scale multinational group, developing highly innovative technical parts for the automotive industry as well as industrial electronics. We examined an internal wiki-based solution implemented by the local support department. This wiki was aimed to foster knowledge transfer within the support department and on the entire site, which employs about 200 employees.

5.2. Initial situation

The employees of the enterprise, mainly researchers and developers, were spread across three different buildings and twelve floors. As research projects dealt with

Table 4. Wiki usage (summary).

	Case Alpha	Case Beta	Case Gamma
	'The Support Base'	'The Encyclopedia'	'The Knowledge Base'
Initial situation	Lacking knowledge transfer in R&D support department	Lacking knowledge documentation and learning	Lacking repository for certain types of information
Wiki goal	Establish centralized and lively knowledge base for tool-specific and methodical support knowledge	Document and share technical and administrative knowledge	Establish a centralized electronic knowledge base for certain business-relevant topics
Wiki implementation	Wiki for the R&D support staff (*MediaWiki*)	Wiki for technical and administrative staff (*Perspective-Wiki*)	Wiki for all employees (*JSP-Wiki*)
Wiki results	Raised efficiency and effectiveness of support Enabled simpler search and retrieval of problem descriptions	Facilitated technical knowledge sharing Better exploitation of phases of low workload for learning and knowledge acquisition	Improved collection and documentation of certain types of information
Perceived wiki success factors	Provide sufficient wiki articles right from start Roll out wikis on broader employee base Acquire convinced users motivating others to participate likewise	Have a dedicated and optimistic wiki team Corporate culture privileging open communication Management commitment and attention	Acquire first-movers motivating others to participate Roll out with sufficient wiki articles Perform intensive internal marketing activities

confidential information and material, each project team had to work physically disconnected from each other in order to limit the diffusion of knowledge. An internal support department assisted researchers and developers, providing guidance for all technical and methodical issues (IT support, similar to a distributed help-desk). Each member of this support department was assigned to one particular project team. Decentralized working environments caused restricted knowledge sharing within the support department, as face-to-face meetings were limited, resulting in heavy email traffic and continuous 'reinventions of the wheel'.

A 'Web 2.0 type database' was considered to collect all the support-based lessons that had already been learned within the conducted research and development projects. The support department required a centralized electronic solution to facilitate knowledge sharing and to raise the interconnectedness of its members. The support department's manager expected a wiki to be the most suitable platform, referring to the wiki-typical simplicity, known user acceptance as observed from Wikipedia, its special functionality and platform independence, and last but not least the wiki principles, allowing anybody to read and quickly edit articles. The software chosen for this project was 'MediaWiki', mainly because of its popularity and proven scalability.

5.3. Implementation approach

The wiki was introduced top-down by the support department's manager, who directly reported to the local site manager. This approach gave the project the necessary managerial commitment. As experience with MediaWiki was internally available, no external consultants were assigned to this project. Being aware of the wiki-typical standardized functionality, no formal requirement engineering process was performed.

The structure of the wiki had been eagerly discussed in internal group meetings, but no strict definitions for terms and categories were chosen. Wiki articles were supposed to be created bottom-up, particularly by the members of the support department. To assure immediate wiki adoption, some relevant articles were migrated from existing repositories. The knowledge inside the wiki was organized by tasks and topics. Categories were used for better structuring of the articles. When documenting knowledge, employees were asked to avoid building structures with many hierarchies in order to keep complexity in the wiki as low as possible. Every employee had to be logged in by providing his/her real name, and anonymous editing was prohibited. As a further restriction, only administrators were allowed to delete articles.

Multifaceted activities had been conducted to raise awareness and acceptance of the wiki: Official introductions within periodical meetings, personal presentations detailing goals and benefits of the wiki, and as invitations of corporate opinion leaders to participate in the wiki and stimulate their colleagues played crucial roles in the communication strategy.

5.4. Situation after 1.5 years of wiki usage

Approximately 500 wiki articles, periodically read by around 80 employees, 15 of them highly involved in editing, had been created in one and a half years. Based on a current server log, the wiki had been accessed more than 130,000 times since its rollout, and wiki articles had been edited more than 10,000 times in total.

Because of the personal assistance they received from the support staff via face-to-face meetings, phone calls and emails, researchers and developers felt no need to use the wiki directly. They even requested support employees to document ideas on behalf of them, stating objections including 'wiki-usage is very time-consuming', 'wiki is too complicated', 'I am too lazy', 'I can directly ask somebody from support', or 'I lack time'.

Adopting a wiki generated many benefits for the enterprise: A major benefit was related to the new built-in full text search, allowing quick guidance for emerging problems. Employees were also provided with many useful solutions for potential problems in a way which enabled them to immediately adopt it in their current projects. As an organizational benefit, the wiki increased the transparency of the support knowledge and the respective knowledge holders. Furthermore, the wiki ensured easy and out-of-the-box access to knowledge without requiring any special authorization. To sum up, increased efficiency and effectiveness in the support was the most important return from the usage of a wiki.

5.5. Summary of the wiki usage

In this case, the manager of the support department had become aware of a business-relevant problem: lacking knowledge transfer causing support inefficiency. Because researchers and developers are spread across different buildings and floors and separated from each other, knowledge sharing is limited. He was highly fascinated by the idea of a wiki as a tool to facilitate knowledge sharing inside the support department. He had a more or less clear vision of how such a wiki should be used by the support employees and how their use of it is connected to their business challenges, providing excellent tool-specific and methodical support. In the course of time, he became aware that not only the support employees themselves will benefit greatly from the wiki, but also the actual beneficiaries of their support, researchers and developers. To increase wiki adoption, he presented the wiki to all kinds of people in any location, always communicating goals and possible benefits.

Although the wiki was primarily intended to stimulate and foster knowledge sharing among the members of the support department, it soon became clear that researchers and developers could also benefit greatly from using the wiki. However, while the support departments' employees have been eagerly using the wiki since its implementation, researchers and developers still hesitate to join

them in action. The wiki facilitated open access to knowledge on tool-specific and methodical support. Applying this knowledge in the workplace, researchers and developers were able to focus their creative potential on the design of products. Although the wiki was especially based on the requirements of the support department and primarily intended to benefit the support employees, researchers and developers at the local site were also able to edit articles.

5.6. Lessons learned from the managers' perspective

The following success factors were explicitly claimed by the interviewed managers and represent their points of view:

- "A sufficient number of articles must exist right from start to accept the wiki as a useful knowledge base."
- "The rollout of a wiki has to occur on a broad user base, requiring a handful of dedicated users who stimulate others in face-to-face talks."
- "The 'built-in' simplicity of a wiki is a minimum requirement rather than a success factor."

5.7. Case beta: 'the encyclopedia'

The investigated enterprise in case *Beta* is the Austrian subsidiary of a worldwide engineering group with a staff of about 250 people delivering multifaceted engineering services. We examined an internal wiki that had been implemented by a two-person core team responsible for knowledge management in the company. The wiki was primarily intended to support technical project staff in knowledge documentation and learning, but was intended also to provide a central knowledge base for the administrative staff.

5.8. Initial situation

As the enterprise was lacking an intranet, documents and templates were stored in complex hierarchical folders on a file server or, even worse, not centrally accessible at all. These shortcomings limited the ability of technical employees to efficiently document and share their project-specific technical knowledge. In day-to-day business, technical employees periodically returned to the headquarters after finishing their customer projects to reflect on their achievements and to prepare for upcoming tasks. Due to the lack of a central knowledge base, much knowledge 'flowed' through the enterprise during this preparation phase.

After a manager had observed a successful wiki implementation at a customer's site, he came to the conclusion that such a tool could be advantageous for project staff to 'explicate, codify and share' knowledge. A wiki would enable the technical project staff to develop a corporate encyclopedia for all project-relevant technical knowledge. The main goal of the introduced wiki was therefore

to document all relevant technical knowledge, emerging from customer projects, for example, for further projects. Additionally, the wiki should document all process-relevant knowledge to support the administrative staff.

5.9. Implementation approach

'Perspective' (www.high-beyond.com) was chosen as the wiki software: Simple 'what you see is what you get' editing of articles, integrated file management and document search, support for attachments, and Microsoft Active Directory integration were stated as the main reasons. The wiki had been implemented without any external help by the two members of the wiki core team, consisting of a technician and a sales representative. To begin with, wiki structures and properties were conceptualized in lively discussions with employees from various departments. To assure transparency, all wiki users were automatically logged in with their real names, thereby prohibiting any anonymous editing. While the implementation of the wiki had followed a top-down strategy driven by a department manager, articles were to be created bottom-up in a rather self-organized way.

The wiki was divided into two sections: The first one was dedicated to represent all the knowledge of the technical staff, based on an enterprise-wide saying that 'all technical and organizational knowledge unable to be found via Google in less than two minutes should be documented'. Wiki articles were interlinked with documents and other files from the file server. The second section dealt with administrative issues and covered various forms, templates and process descriptions. While the core team manually edited quite a number of wiki articles for the administrative staff, only marginal content was collected before the wiki rollout to support technicians.

5.10. Situation after 2 years of wiki usage

The wiki basically served as a solution for knowledge transfer, documentation, and sharing. All 250 employees were able to both read and edit the majority of wiki articles. Some sections, including administrative and project spaces, had access restrictions. About 180 employees utilized the technical knowledge, consisting of more than 500 articles. Approximately 20 employees used the wiki after returning to the headquarters from customer projects, as access to the wiki from outside the enterprise was not possible. From studying server log files, the wiki core team learned that on average 15 wiki articles were updated each day. 20 technicians used the wiki very intensively and created many articles, thereby assuring a lively wiki with up-to-date technical knowledge.

The technical section had been co-developed by the staff and was structured similarly to an encyclopedia: In the beginning, some of the employees documented articles on a particular topic or technology based on their personal

interests in the topic. However, they soon realized the potential value of making their personal knowledge internally available for professional use. After a while, the wiki reflected all the technical competencies of the enterprise. As an organizational benefit, project managers had found a new way to select appropriate staff for future projects: They studied wiki articles with project-relevant topics to become aware of the employees' competences. It is worth mentioning that editorial efforts within the technical section were minimal, only dealing with reassignment of articles to the proper categories.

While the technical section was perceived to be very successful, the administrative section was the problem child: Although several project marketing activities had been conducted to point out the various advantages of the wiki, the administrative staff hesitated to use it. The majority of the non-technical articles were created by one former wiki core team member who had already left the enterprise. After his exit, the up-to-dateness of the administrative wiki articles continuously declined, rendering most of them useless.

Observing benefits from and obstacles to wiki utilization, the core team found that technical staff were more willing to bear the additional workload triggered by the wiki. Non-technical staff always complained about the lower comfort of the wiki compared to their more familiar office tools. Moreover, the technical staff perceived a much higher individual value gain from the wiki, most notably because of the faster and more structured access to project-relevant technical knowledge. Articles within the technical section not only afforded access to textual content but also acted as a guide to software tools located on the file server.

As a major organizational benefit, the wiki simplified collaboration amongst (technical) employees. The technical staff were encouraged to use their idle capacities for sharing knowledge. One huge obstacle accompanying the wiki adoption was the fact that employees only recognized the value of the wiki after having used it intensively. Unfortunately, communicating this very special aspect of social software to employees prior to implementation is extremely challenging. Any successful appropriation of a portal like a wiki must be accompanied by a change in employee behaviour. Therefore, a lot of management attention is required when wikis are rolled out.

5.11. Summary of the wiki usage

In this case, the enterprise was lacking an editorial intranet and documents and templates were mostly not centrally accessible. This circumstance hindered knowledge sharing during and after customer projects. One of the company's managers had observed a wiki at a customer's site. This manager judged such a tool to be very advantageous to be implemented in his own enterprise as it would enable key technical employees to develop an encyclopedia-like repository for technical project relevant knowledge. A two member wiki core team was

responsible for the implementation of a wiki. However, wiki structures and properties emerged bottom-up, caused by the lively discussions amongst employees.

In the initial phase a personal interest in the topic was the main driver for employees to use the wiki. But the majority of employees soon realized the potential value of making their knowledge available to all colleagues and to project managers. The wiki acts like a map of the employee's competences. As a result of this, project staff can be and are commonly selected according to the content of their articles. Technicians report a high individual value gain, mostly because of faster and more structured access to project-relevant technical knowledge. Hence technical employees use the wikis intensively during phases of low workload to document and share what they have learned in their projects.

5.12. Lessons learned from the managers' perspective

The following success factors were explicitly claimed by the interviewed managers and represent their points of view:

- "Wikis require a dedicated and very enthusiastic core team that has reasonable time for editorial work."
- "Wikis require a corporate culture facilitating open communication and knowledge sharing."
- "Management commitment and attention are a must-have: An enterprise-wide wiki must not be the initiative of a single person or department."
- "The intended wiki users have to be closely involved in the conception and implementation right from the start."

5.13. Case gamma: 'the knowledge base'

The investigated enterprise in case *Gamma* is a major Austrian IT service provider employing more than 750 people. We examined an internal wiki implemented by a 10-person group responsible for knowledge management. The wiki was intended to serve as an electronic knowledge base by analogy with Wikipedia and to support all employees by providing stable and long-term knowledge that is only infrequently needed by employees.

5.14. Initial situation

Since the founding of the enterprise, a plethora of internal databases containing partly redundant knowledge had emerged. Many opinions were voiced demanding a more centralized approach. A managerial representative of a 10-person group, responsible for knowledge management within the enterprise, took up the idea of deploying a knowledge management tool based on the principles of Web 2.0 to draw on user-generated content. This group was very much attracted

by wikis and the philosophy of allowing anybody to contribute voluntarily to a central database in a self-organized way.

The aim of the project was the development of a centralized electronic knowledge base that should involve all employees in the content creation process. This company-wide encyclopedia should contain a precisely defined set of topics and articles as well as the most prevalent abbreviations and designations for products and services used in daily business. Such knowledge was not yet available in a centralized enterprise-wide platform. The wiki should only capture long-term knowledge intended to be accessed by anyone within the company.

5.15. Implementation approach

'JSP-Wiki' (www.jspWiki.org) was chosen as the wiki software because expert knowledge about the system was already internally available. The wiki was introduced without any external consultancy, but some implementation support was provided by an affiliate company. The wiki project team consisted of four members of the 10-person group responsible for knowledge management. The project team designed the initial structure of the wiki and provided some content. They strictly defined what kind of knowledge was allowed to be captured in the wiki, e.g., basic information about customers, projects, technology, and expertise, as well as information about the enterprise and the knowledge management group. The wiki contained glossaries, frequently used terms, project names and explanations, descriptions of the departments, customer names, and abbreviations. Meeting minutes, project-relevant knowledge, knowledge related to interpersonal communication, news, and specific reports were not intended to be part of the wiki, as parallelisms between the wiki and the existing intranet had to be avoided.

The wiki rollout was accompanied by multifaceted communication efforts. Intranet articles, flyers, and news tickers were disseminated internally to facilitate the acceptance of the wiki amongst employees. The wiki project was also formally approved by the company management.

5.16. Situation after 2 years of wiki usage

Employees could be divided into three groups based on their frequency of usage: The ten 'power-users', mainly senior management and the knowledge management group, made very frequent use of the wiki. The second group, which was larger in number, perceived the wiki as a valuable tool but argued that its appropriation requires a lot of personal initiative. Therefore, they rarely read wiki articles and almost never edited any of them. The third group, the 'non-adopters', consisted of even more employees who did not take advantage of the wiki at all.

In the beginning, the project team perceived the wiki to run like clockwork without much active and professional promotion. However, they soon learned

that the majority of employees lacked confidence in operating such a tool. Though many wiki users found the knowledge in the wiki very helpful for their daily business, hardly any of them edited articles at all. They were hampered by the challenging operation, most notably caused by the uncomfortable editor and the obscure wiki syntax. However, after surveying 'non-adopters' in the course of our research, we uncovered far more and different aspects slowing down the success of the wiki: 'Non-adopters' argued that most of the articles were of little relevance for their day-to-day work. They were not aware of any added value generated by the wiki. Furthermore, they perceived the goal of the wiki as too broad and the content as too unspecific.

Though the corporate culture was perceived to be very participative, employees perceived many obstacles to editing wiki content, most notably the lack of anonymity and the complexity of operation compared to using desktop applications. However, as an organizational benefit, the wiki increased the transparency of the knowledge. Collecting and documenting information seemed to work satisfactorily at least from the perspective of the knowledge management group. However, for the portal pages, only few articles had in fact been edited collaboratively.

5.17. Summary of the wiki usage

In this case, a plethora of internal databases with partially redundant knowledge had emerged and many opinions for a more centralized approach were voiced. A manager of a 10-person group responsible for knowledge management was attracted by the wiki idea and launched the implementation of a wiki as an answer to these voices. The wiki should form a user-generated repository for basic information on customers, projects, technology, the enterprise and the knowledge group. The wiki roll-out was accompanied by intranet articles, flyers, news tickers and more to communicate the wiki and its goals to the employees.

The degree of adoption largely varies: There are so far only very few people who intensively use it, mainly senior management and the knowledge group. The majority of employees claim that wikis require a lot of personal initiative, and they lack confidence in operating it or do not know what they should do with it and how it is linked to their daily work assignments. Though the wiki increases transparency on knowledge and the corporate culture is perceived to be participative, many employees were not successfully attracted to adopt the wiki.

5.18. Lessons learned from the managers' perspective

The following success factors were explicitly claimed by the interviewed managers and represent their points of view:

- "A successful wiki implementation requires 'early adopters' to stimulate others to participate."

- "A wiki has to be rolled out with sufficient articles in order for employees to accept it."
- "Even though being a social medium, a wiki requires intensive internal communication support."
- "Wiki users must perceive the value of a wiki for their daily work right from the beginning."

5.19. Cross-case analysis of wiki appropriation and usage

In this subsection, we compare our three cases against each other, listing both commonalities and differences. Table 4 is the respective summary, outlining initial situation, goal, implementation, results and success factors for each particular case – and the summarized wiki usage. Interviews with the managers in charge enabled us to become aware of and better understand the wiki usage.

In all three cases, the need for a new solution (wiki) was diagnosed by a managerial employee, who was one of our interviewed persons. The wiki-typical simplicity in collectively editing articles as observed from Wikipedia and the notion of the huge growth of Wikipedia were the main reasons for implementing wikis. Hence, the motivation towards implementing a wiki was not driven by the potential beneficiaries (employees). Concerning the process of implementation, no external consultants were involved and no formal requirements engineering was done. The managerial employees were aware of more or less defined ways of wiki usage, before rolling out the wikis in all three cases.

During the investigation of the initial situation, we learned that only the manager in case *Alpha* was able to articulate a concrete business problem – lacking knowledge transfer in the R&D Support department, resulting in lower service quality. But the managers in *Beta* and *Gamma* argued knowledge-based problems – the lack of an appropriate platform for knowledge documentation and learning in *Beta,* and the lack of a platform for documentation of certain types of information in *Gamma*. Additionally, goals, as defined by the interviewed managers, differ across all three cases: The wiki in *Alpha* is focused on a rather more concrete business goal and target group than the wikis in *Beta* and *Gamma*.

During the study, it became apparent that the stated wiki goals were knowledge-based (e.g., to establish a knowledge base to support, document and share technical knowledge, establish a centralized knowledge base), rather than business-oriented (e.g., to increase support efficiency by x%, increase employee satisfaction by x%, …). As such, it is very challenging to assess the wikis in terms of success. The managers most notably argued very general benefits ranging from raised efficiency of support to improved collection and documentation of certain types of information. In all three cases, the wiki was said to have increased the transparency on knowledge and knowledge holders.

Our three cases have various commonalities: All of them featured open access to the wiki and allowed every employee to read and edit wiki content, except in case

Beta, where the administrative section had an access protection. All wikis had been initially filled with articles to make them more attractive to the employees before the roll-out. While the wikis were all implemented top-down, article creation was driven by the beneficiaries. This approach led to various employee-centric challenges: In all three cases non-technical employees perceived much higher barriers to using the wiki, complaining about lower comfort and additional workload. Contrariwise, technicians perceived a much higher value gain from using the wiki. Internal marketing activities were conducted by the managers to motivate employees in sharing knowledge, including personal presentations in departments, invitation-to-participate emails, wiki flyers, and more – to promote the wiki usage.

From their particular viewpoints, the managers perceived their wiki projects to be successful to some extent. However, the stated success factors were very subjective. It became apparent that wikis have to be initially filled with sufficient content before their roll-out takes place to make them more useful and useable. Managers deemed it crucial to personally motivate employees to adopt wikis in business, as potential wiki benefits may remain very ambiguous for early adopters. Therefore all three cases performed more or less intensive internal marketing activities to explain both the goals and potential benefits to the users to promote the wiki usage and to increase wiki popularity and adoption.

While case *Beta* lacked an editorial intranet and as such lacked an appropriate portal infrastructure for knowledge sharing, *Alpha* and *Gamma* were equipped with one. Information in the wiki differed from information on the intranet across all three cases. One of the managers in *Beta* explicitly mentioned a huge stumbling block for rolling out wikis in the enterprise: The potential value gain from a wiki will only be recognized after employees intensively use it. And this property of wikis requires a lot of management attention. Though managers in *Alpha* and *Gamma* did not explicitly mention this fact, their reactions created the impression that they were aware of it.

6. The degree of adoption (knowledge worker survey)

The facts presented in the previous subsections represent the viewpoints of the managers. However, we wanted to also shed light on the perspective of the knowledge workers and so conducted a user survey including the most relevant aspects of wiki appropriation. Surveying 113 non-managerial employees from all three cases, we were able to generate additional findings beyond the manager interviews conducted. In this section, we present selected results of this survey, focusing on aspects including

- reading and writing behaviour
- type and frequency of wiki contribution, (further) sources of business-relevant information,
- reasons to use the wiki,
- individual motivation to read and edit wiki articles,

- individual and collective benefits,
- perceived obstacles to wiki appropriation.

We used a four-point scale across all questions, as we did not want to allow our respondents to vote indifferently, except for question one, where a five-point scale was chosen to find out more about the degree of adoption. The following tables show both mean and variance of the investigated aspects for all three cases to make the degree of adoption transparent across the three cases. Additional information about the managers' perception of the wiki usage can be found in the previous subsections. Figures 1 and 2

6.1. Reading and editing behaviour

As most of the previous research has studied wikis in the public domain focusing on Wikipedia, only little is known about their concrete usage in corporate settings (Arazy et al. 2009; Hasan and Pfaff 2006) and many key questions still remain unanswered, e.g., how often on average do employees read or edit wiki articles. Table 5 shows how often **wiki articles are read and edited** across the three cases.

The lower overall editing behaviour in *Alpha and Gamma* as compared to *Beta* can be explained when taking into account how the wiki is used. The particular strength of *Beta* is the successful development of a lively enterprise-wide Encyclopedia which was driven by technical employees and accompanied by some management support. Furthermore, we found that employees who frequently read wiki articles also account for regular edits. That particular property of enterprise wikis may explain why wiki adoption increases in time. However, we expect the same argument to hold for other types of social software in the enterprise in general.

6.2. Type and frequency of wiki contributions

Surveying **type and frequency of wiki contributions**, our study revealed that 'minor edits of existing wiki articles' and 'creation of new articles' prevailed. 'Correcting grammar' and 'spelling', 'reverting articles' by using the revision

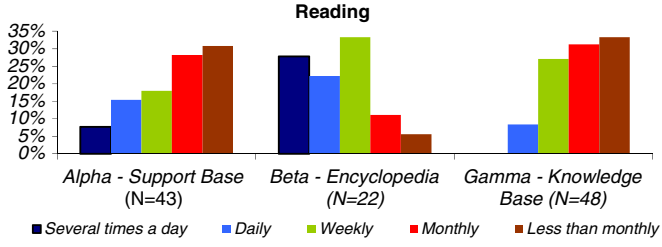

Figure 1. Wiki reading behaviour.

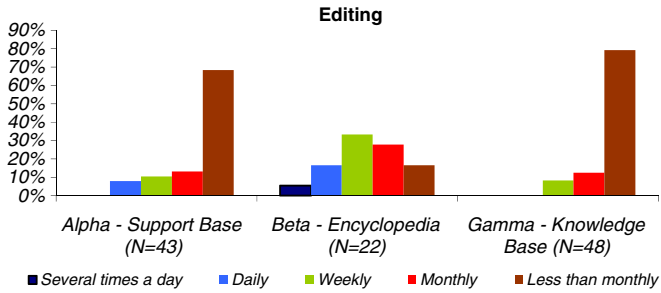

Figure 2. Wiki editing behaviour.

history, 'restructuring articles', and 'commenting on articles' were clearly outnumbered. The tracking and revision feature – a basic functionality of wikis – seemed to attract almost no attention across all three cases. However, the scientific literature (Grace 2009) stresses the importance of this functionality. Again the study showed that *Beta* is the liveliest wiki, as technicians intensively added content to existing Encyclopedia articles. The addressed target group in *Alpha* explains the lower mean compared to *Beta*, as the majority of *Alpha*'s staff were not involved in content creation. Table 6 presents an overview of type and frequency of wiki contributions.

In most organizations, a wiki may not be the only source of business-relevant information. However, a wiki may compete with other types of media for different tasks. Holtzblatt et al. (2010) even found that a heavy reliance on other tools besides wikis is a factor that really affects the use of wikis in the enterprise. We therefore argue that it is important to explore other sources of business relevant information when measuring the appropriation of enterprise wikis. Surveying enterprise-wide **sources of business-relevant information**, non-managerial employees of *Alpha* and *Beta* perceived the wiki as such a source. In *Gamma* the wiki knowledge seemed to bypass the demands of information seekers or was not perceived to be very useful in the day-to-day business. The responsible manager described the wiki as a repository for certain types of knowledge, but it seems this knowledge is not perceived to be relevant by the

Table 5. Basic wiki tasks.

		Alpha (N=43)		Beta (N=22)		Gamma (N=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
How often do you perform the following basic tasks in the Wiki?							
1) Several times a day	Read articles	3.21	1.80	2.36	1.19	3.90	0.95
(2) Daily	Edit Articles	4.24	0.97	3.27	1.26	4.71	0.38
(3) Weekly							
(4) Monthly							
(5) Less than monthly							

Table 6. Type and frequency of wiki contributions.

		Alpha (*N*=43)		Beta (*N*=22)		Gamma (*N*=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
How often do you perform the following tasks in the Wiki? Add content to existing articles							
	Add content to existing articles	2.91	1.54	1.82	0.73	3.04	0.76
(1) Often	Comment on articles	3.79	0.23	3.55	0.35	3.71	0.21
(2) Sometimes	Create new articles	3.00	1.21	2.50	0.74	3.08	0.89
(3) Rarely	Correct conten	3.12	0.89	2.82	0.63	3.21	0.64
(4) Never	Correct grammar and spelling	3.50	0.56	3.14	0.60	3.48	0.55
	Rewrite paragraphs	3.47	0.50	3.00	0.67	3.50	0.55
	Restructure articles	3.41	0.73	3.05	0.62	3.63	0.41
	Revert articles using the history	3.65	0.36	3.73	0.30	3.69	0.47
	Modify articles after face-to-face talks	3.09	0.81	2.64	0.53	3.52	0.43

employees. Interestingly, employees of *Beta* seemed to strongly prefer archives and portals (including the 'Web', 'document management', and 'file server') to channels (including 'phone', 'email' and 'face-to-face conversation'). In *Alpha* and *Gamma,* traditional media, (including 'email' and 'phone') still prevailed as the primary source for business-relevant information. Table 7 presents the employees' attitude towards sources of business-relevant information.

6.3. Reasons to use the wiki

Employees partially shared different motivations for reading wiki articles compared to what has been previously reported in the scientific literature (McAfee 2006; Grace 2009; Arazy et al. 2009). Key motivational factors in the scientific literature include direct benefits, social pressure, learning new skills, and enjoyment. Across all three cases, 'finding business-relevant information', 'facilitating individual work', and 'observing what is happening within the enterprise' were the highest ranked **reasons to use the wiki**. Finding business-relevant information and facilitating one's work are both expressions of direct benefits. Our study revealed

Table 7. Sources of business-relevant information.

		Alpha (*N*=43)		Beta (*N*=22)		Gamma (*N*=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
Where do you retrieve information relevant for your work?							
	Wiki	2.06	0.78	1.82	0.82	2.77	0.69
(1) Often	Document Management/File-Server	1.82	0.51	1.64	0.53	1.58	0.55
(2) Sometimes	Web	2.06	1.03	1.59	0.82	2.13	1.05
(3) Rarely	Email	1.47	0.44	1.95	1.00	1.27	0.33
(4) Never	Messaging	3.21	1.20	3.59	0.35	2.98	1.08
	Telephone	1.47	0.44	2.45	0.74	1.63	0.62
	Formal face-to-face Meetings	1.76	0.49	2.00	0.67	1.67	0.65
	Informal face-to-face Meetings	1.59	0.37	1.91	1.04	1.56	0.59

that wiki usage was not greatly stimulated by employees trying to 'counteract their daily information overload' resulting from email and face-to-face meetings, though such aspects were mentioned in the respective literature (McAfee 2006). Furthermore, and contrary to the literature (McAfee 2006), 'sharing private information' seemed to play a minor role across all three cases, although it may be useful to quickly get in practice with a new medium in an informal manner. Table 8 presents the main reasons for non-managerial employees to use the wiki.

Knowledge management researchers have investigated both motivational aspects and barriers to actively sharing knowledge (Cabrera et al. 2006; Cabrera and Cabrera 2002; Ardichvili et al. 2003; Wasko and Faraj 2005). Past research has shown that the effectiveness of knowledge transfer instruments strongly depends on their situational context, on the stakeholders involved and on their acceptance, motivation and goals (Strohmaier et al. 2007). Many of these findings can be replicated to enterprise wikis, as our study revealed. The main **motives** for non-managerial employees to actively **participate in content creation** in our three cases were their 'perceived high value of own contributions' for others (perceived self-efficacy), their 'expectation of receiving individual benefits' when sharing knowledge (individual benefit maximization), and the 'stimulation of their colleagues' to also create content (reciprocity). Our study revealed that reciprocity of knowledge sharing (Davenport and Prusack 1998) and perceived self-efficacy (Cabrera and Cabrera 2002) are important motives when using wikis for sharing knowledge in the enterprise, too. Therefore, one way to increase the perceived efficacy of wiki contributions would be to establish mechanisms by which employees instantly receive feedback whenever colleagues use their contributions. However, no such mechanisms to visualize how often a wiki article had been accessed or voted for had been implemented in our three cases. Table 9 presents the main motives for non-managerial employees to participate in content creation.

The information systems literature offers a range of models which determine factors influencing appropriation and success of a new technology. The

Table 8. Main reasons to use the wiki.

		Alpha (N=43)		Beta (N=22)		Gamma (N=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
For which purposes do you use the Wiki?							
	Find business-relevant information	1.97	0.94	1.86	0.69	2.92	0.67
(1) Agree	Communicate on business-relevant topics	3.44	0.62	2.86	0.98	3.54	0.42
(2) Agree slightly	Share private issues	3.97	0.03	3.86	0.22	3.92	0.08
(3) Disagree slightly	Inform colleagues about own work	2.59	1.28	2.18	1.20	2.67	0.91
(4) Disagree	Facilitate own work	2.21	1.2	1.77	0.28	3.06	0.78
	Observe what happens in the organization	3.29	0.64	2.27	0.78	3.00	0.68
	Get fewer emails	3.29	0.82	3.32	0.99	3.52	0.43
	Write fewer emails	3.12	1.14	3.18	1.30	3.35	0.66
	Participate at less face-to-face meetings	3.65	0.42	3.45	0.74	3.58	0.33

Table 9. Motives to participate in content creation.

		Alpha (*N*=43)		Beta (*N*=22)		Gamma (*N*=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
What do you expect when you add content to the Wiki?							
	Get an individual benefit	2.10	1.09	1.86	0.79	2.71	1.02
(1) Agree	Respond to requests of colleagues	2.16	1.03	1.91	0.37	2.54	1.02
(2) Agree slightly	Motivate colleagues to participate	2.05	0.85	2.09	0.85	2.52	1.45
(3) Disagree slightly	Reciprocate for useful Wiki information	2.62	1.05	2.36	1.00	2.88	1.05
(4) Disagree	Raise professional reputation	2.57	1.16	2.55	1.12	3.21	0.76
	Own contribution is valuable for others	1.76	0.89	1.77	0.47	2.38	1.18
	Receive an equivalent from colleagues	3.55	0.37	3.00	1.05	3.54	0.38
	Respond to requests of senior management	3.24	0.59	2.36	0.91	3.21	0.93

Technology Acceptance Model (Davis 1989) introduces 'perceived ease of use' and 'perceived usefulness' as the two fundamental determinants for user acceptance. The Information Systems Success Model (Delone and McLean 1992; Delone and McLean 2003) lists three factors – information quality, system quality and service quality – influencing the success of information systems. Both models can be applied to the domain of wikis. Raeth et al. (2009) have introduced criteria for assessing the success of an enterprise's wiki building on the information systems success model. For instance, they suggest measuring 'improved professional status' and 'improved productivity' from an individual perspective and 'increased productivity' and 'knowledge sharing' from an organizational perspective. We intended to measure these as well as some additional aspects including the impact of wikis on 'social status', 'facilitation of individual work', and 'improved processes', 'improved collaboration', and 'idea generation' from an organizational perspective.

6.4. Perceived individual value

Wikis may yield multifaceted types of individual benefits: Surveyed on their **perceived individual value** (cf. Delone and McLean 1992) gained from wiki usage, non-managerial employees in *Alpha* and *Beta* mentioned that the wiki had to some extent helped them to 'perform their business tasks more quickly' by 'facilitating their knowledge work'. Only some employees were able to 'raise their social and professional status', e.g., by gaining visibility in their enterprise through editing wiki articles. We assume that possible social changes, for example, a perceived higher social or professional status, will require a longer period of time to happen. However, our three cases were experimenting with wikis for between 1.5 and 2 years initially.

Currently there are only a few studies in the literature that empirically measure wiki success. Arazy et al. (2009) have investigated the impact of wikis on an employee's job at three different proficiency levels. Interestingly, the measured

impact on the job was perceived to be much higher by employees surveyed by Arazy et al. (2009) compared to what our study revealed: The higher the proficiency level of an employee, the higher the perceived motivation and benefits.

Our user survey revealed that *Gamma's* non-managerial employees perceived comparably lower benefits through the wiki, a fact that we also learned during our interviews with the managers in charge. Table 10 presents the individual value that non-managerial employees perceived.

6.5. Perceived collective value

As a knowledge management system (Alavi and Leidner 2001), wikis are also supposed to generate multiple types of organizational benefits, depending on how they are used. Surveyed on **perceived collective value** (cf. Delone and McLean 1992) for the team and organization, non-managerial employees noticed an 'improvement of intra-organizational knowledge transfer' and a 'boost in organizational work performance' in *Alpha* and *Beta*. In *Beta,* the wiki also led to 'improved collaboration', while *Gamma's* wiki only generated marginal advantages, which can be explained by the lower acceptance rate. The results of the survey corroborate the interviews with the managers. During the interpretation of the measured aspects, we learned that the managers in charge perceived greater wiki benefits than non-managerial knowledge workers.

Arazy et al. (2009) have recently published research on the organizational impact of enterprise wikis: In their study employees perceived the organizational impact to be higher than the individual impact. We were basically able to replicate this finding, as organizational impact was perceived to be slightly higher than the individual impact in our three cases. This circumstance may be interpreted by referring to the knowledge sharing dilemma (Cabrera and Cabrera 2002). Table 11 presents the collective value that non-managerial employees perceived.

Table 10. Perceived individual value.

		Alpha (N=43)		Beta (N=22)		Gamma (N=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
In which aspects has the Wiki helped you?							
	Raised social status	3.44	0.68	3.05	1.00	3.60	0.37
(1) Agree	Raised professional status	2.97	1.18	2.59	0.92	3.40	0.67
(2) Agree slightly	Facilitated own work	2.18	1.24	1.77	0.56	2.98	0.83
(3) Disagree slightly	Increased effectiveness	2.71	1.18	2.18	0.63	3.23	0.65
(4) Disagree	Increased efficiency	2.44	1.47	2.05	0.81	3.13	0.66

Table 11. Perceived collective value.

		Alpha (N=43)		Beta (N=22)		Gamma (N=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
In which aspects has the Wiki helped your team/organization?							
	Improved processes	2.35	0.96	1.91	0.47	3.13	0.66
1) Agree	Improved collaboration	2.65	0.66	1.59	0.25	3.02	0.87
2) Agree slightly	Improved knowledge sharing	1.76	0.61	1.36	0.24	2.52	0.85
3) Disagree slightly	Generated ideas for new projects	2.76	0.85	2.36	0.81	3.27	0.67
4) Disagree	Increased effectiveness	2.44	1.10	1.95	0.43	3.17	0.74
	Increased efficiency	2.21	1.08	2.05	0.62	3.15	0.64

6.6. Perceived obstacles

As presented by the interviewed managers, employees perceived manifold barriers and obstacles to using wikis. However, the scientific literature has so far not comprehensively listed obstacles for users adopting and using a wiki. Our interviewed managers mentioned a series of obstacles during their interviews, e.g., the complicated wiki syntax or the potential conflict with other sources of information. Surveyed on their **perceived obstacles,** non-managerial employees identified aspects including 'few employees editing wiki articles', 'low number of wiki articles', and 'time-consuming editing and retrieval efforts'. Interestingly, 'personal conflicts' between wiki editors regarding the content of an article and the 'transparency gained' from wikis in the enterprise were not considered to be major obstacles. 'Privacy aspects' seemed to play a minor role in the context of enterprise wikis. A fear of vandalism may also prevent the success of an enterprise wiki, as reported by Hasan and Pfaff (2006), but this was not perceived to be an obstacle across our three cases. In the case presented by Danis and Singer (2008), people were reluctant to modify others' content except in special circumstances, such as members of the same projects. Fears of vandalism were not reported in the case of Danis and Singer (2008) except in the studies by Majchrzak et al. (2006) and White and Lutters (2007). Table 12 presents wiki-obstacles as perceived by non-managerial employees.

Table 12. Perceived obstacles.

		Alpha (N=43)		Beta (N=22)		Gamma (N=48)	
		Mean	Variance	Mean	Variance	Mean	Variance
What are obstacles for successful Wiki adoption?							
	Retrieving knowledge is a huge effort	2.62	1.09	2.32	1.37	2.44	0.85
(1) Agree	Editing knowledge is a huge effort	2.29	0.88	2.14	1.17	2.13	0.62
(2) Agree slightly	Wiki contains too few articles	2.18	0.88	2.45	1.12	1.83	0.70
(3) Disagree slightly	Only certain employees are allowed to read	2.79	1.26	2.59	1.49	2.85	1.36
(4) Disagree	Only certain employees are allowed to edit	3.03	0.88	2.95	0.81	2.96	1.10
	Too few colleagues edit articles	2.00	0.67	2.05	0.52	1.81	0.54
	Wiki generates too much transparency	3.44	0.56	3.27	0.40	3.50	0.55
	Employees don't want their contents edited	2.82	1.18	3.09	0.75	2.83	0.87

7. Discussion

In the last two sections we explored the wiki appropriation and usage (covering the presentation of qualitative data from all three cases by looking at the perspective of the managers) and gave a detailed description of the degree of wiki adoption (presenting and interpreting quantitative data gained from surveying knowledge workers). In the following we consolidate our results and discuss our findings across the three cases to show implications for both academia and practice.

7.1. Wiki appropriation and usage

We have argued above that wikis, as open and flexible technologies, do not lend themselves to immediate forms of usage determined or prescribed by their features (i.e., a wiki in general is not associated with a typical usage). Termed 'Nutzungsoffenheit' above, this phenomenon implies that it is hard to predict how a platform (e.g., a wiki) will be appropriated. Rather, the platform needs to be appropriated through experimentation and sense-making by its users, a process that takes time and is also open-ended in the sense that its outcome is open, in that the emergence of particular ways of usage can only to a certain extent be foreseen. The potential of such platforms only manifests itself when people make sense of and incorporate them into their day-to-day work routines. Therefore it is helpful to be aware of diverse forms of wiki usage, to point out the highest possible potential of enterprise wiki usage.

In our study we presented three types of wiki appropriation and usage and explained them in detail.

- In case Alpha the wiki served as a support base with the aim of establishing a centralized and lively base for tool-specific and methodical support knowledge. From the manager's viewpoint, the wiki raised efficiency and effectiveness of support and it enabled simpler search and retrieval of problem descriptions. Support employees showed a much higher adoption degree than researchers and developers, who were the target group for the support (and the secondary targeted user group for the support wiki).
- In case Beta the wiki was used as an enterprise-wide encyclopedia with the goal of documenting and sharing project-relevant technical and administrative knowledge. From the manager's viewpoint, the wiki facilitated sharing of technical knowledge and allowed a better exploitation of phases of low workload for learning and knowledge acquisition. Project staff (most notably technicians) showed a much higher appropriation than administrative staff, who did not perceive the potential gain from the wiki.
- In case Gamma the wiki was used as a common knowledge base with the goal of capturing knowledge on customers, projects, technology, the enterprise and the knowledge group. From the manager's viewpoint, the

wiki improved collection and documentation of certain types of information. Senior management and the knowledge group show a much higher wiki appropriation than 'ordinary' employees.

We also explained that these three identified types of usage (support base, enterprise wide encyclopedia, and common knowledge base) may only suggest options on how wikis can or should be appropriated by their users to become part of their different practices. It is worth mentioning that the types of wiki usage were described by managers during interviews while wiki adoption was investigated in detail by surveying knowledge workers.

We assumed that wikis are usually implemented in the enterprise to reach a particular individual or organizational goal. From interviewing the responsible managers, we learned that the investigated wikis in fact fulfilled a knowledge-based goal (e.g., to increase transparency of support knowledge) rather than a business-orientated goal (e.g., to increase support efficiency by x%). Based on our study results, we expect that corporate wikis might be much more successful if they help to reach a defined business-oriented goal that is sufficiently relevant to the work assignments of employees. From our investigation (especially from the 'non-adopters') we derive that it is of importance for managers to understand *that* there is a business-oriented goal and *what* it is before implementing a wiki. Goal-oriented problem statements will have to include at least a description of the initial situation, the domain of application, the desired goals of the wiki, the targeted and the estimated benefits. If not properly defined and differentiated from other types of media used in the enterprise, we expect – building on our conducted research – that wikis may just be weakly adopted by knowledge workers.

A wiki may not be the only source of business-relevant information in the enterprise. We therefore deem it important to include all available sources of business-relevant information into the research, when analyzing the appropriation of enterprise wikis. During our user survey we learned that other sources of relevant information may be used heavily. A reported high usage of an enterprise wiki might be caused by a lack of other sources including intranet, central databases or fileservers. Whenever wikis are competing against other sources of business relevant information in the enterprise, wiki appropriation might be different.

7.2. The degree of wiki adoption

Surveying 113 non-managerial employees from all three cases, we focused on relevant adoption aspects including reading and writing behaviour, type and frequency of wiki contribution, individual and collective benefits, and perceived obstacles to wiki appropriation.

We want to stress that these results (or better: that this part of our results) have to be seen as closely connected to the usage: To correctly interpret the degree of

adoption in the enterprise, knowledge about the desired and factual usage is very important. During the analysis of the data from the managerial interviews we found that the degree of adoption was not always very transparent to the manager, neither were wiki goals and benefits always concretely described by him (alternatively the manager has communicated a more intensive wiki usage during the interviews). Based on our research we argue that any study on enterprise wikis has to describe the forms of wiki usage – a fact which has currently been underestimated in enterprise wiki research. We feel that interviews with employees in charge of wikis may serve as an appropriate instrument to initially explore the degree of adoption. And we learned that an enterprise wiki can be successful even if it is not utilized by the mass, as Case *Alpha* showed where the primary target group made heavy use of it and realized high individual benefits.

Since researchers usually are not granted access to usage statistics and usage data, we suggest them performing user surveys to compare the degree of adoption with the viewpoints of the managers on wiki usage and created benefits. Managers tend to overestimate quantitative wiki usage and a user survey with quantitative operational figures can help to better estimate the actual wiki usage.

In particular, investigating the perceived benefits played a major role for us: We learned that the interviewed managers perceived higher benefits from their wikis than non-managerial knowledge workers, a fact which was especially revealed by our survey of non-managerial users. From CSCW literature we know that system appropriation can be effected by a large number of factors including usability and suitability. One of the reasons why (classical) applications fail is the disparity between those who will benefit from an application and those who must do additional work to support it (Grudin 1988). However, taking the philosophy of Web 2.0 into account, the targeted corporate social software should generate benefits for all users (stake-holders), i.e., for both managerial and non-managerial employees. We expect that to serve as an important issue for further research on how social software differs from classical software in terms of appropriation and perceived benefits.

Our user survey shed light on the types of wiki benefits. Taking the explorations of Arazy et al. (2009) into account, we also expect that benefits from wiki usage will rise whenever an enterprise wiki evolves over a longer period of time. But achieving a very high degree of adoption may probably take more than 1.5 years. Taking time appears to be a property of social software in general, which largely depends on network effects. We therefore intend to continue our research on enterprise wikis, investigating how wiki usage and perceived wiki benefits will develop over time.

Exploring three different cases of enterprise wikis uncovered further findings for applied research in knowledge management to be generalized to other cases of enterprise wikis: Sufficient wiki articles must be provided right from the start as ‘too few wiki articles’ was mentioned as a major obstacle by non-managerial employees. While this is common knowledge in the research of virtual

communities (Nonnecke and Preece 2001), the necessity of seeding articles has been previously underestimated in enterprise wiki research. Our study revealed that aspects related to the wiki content were perceived as greater obstacles by non-managerial employees than aspects related to wiki privacy, which is a very interesting fact that has not been reported before by other researchers.

In all three cases, the need for a new solution was diagnosed by one of the interviewed managers, mentioning simplicity and observed success from Wikipedia as major factors. While wikis were introduced top-down with much managerial support in our cases, the creation of wiki articles was supposed to be done bottom-up across all three cases. We expect an accompanying wiki communication strategy and supporting activities of the senior management to play a crucial role in wiki success as mentioned by the interviewed managers. However, enterprise wikis do not necessarily have to be implemented top-down. For future research, we therefore suggest investigating archetypes of wiki appropriation and taking a closer look at the role of management.

8. Conclusion

In this paper, we presented a multiple case study involving three Austrian enterprises adopting internal wikis. Since related work on enterprise wikis, more specifically on corporate Wiki appropriation and usage, is still at a rather experimental level (e.g., Arazy et al. 2009), we expected to learn much from studying wiki usage (mainly from the interviews with managers in charge of the wiki projects) and the degree of wiki adoption (mainly from the surveyed wiki users).

To collect the required data for our research, we carried out seven in-depth semi-structured interviews with managers and surveyed 113 non-managerial knowledge workers. We comprehensively explored parameters which are linked to appropriation and usage, i.e., initial situation, goals, implementation, results and perceived success factors during our interviews. In a second step, we surveyed wiki users on aspects related to wiki appropriation, including type and frequency of wiki contribution, attitude towards (other) sources of business-relevant information, main reasons to read/edit content, perceived individual and collective benefits, and perceived obstacles.

The main contribution of our study is the explicit and detailed illustration and cross-case analysis of three examples of wiki appropriation and usage that help to understand how the wiki was used in the context of a concrete practice and how it is connected to a concrete goal. The awareness of these examples is one of several socio-technical design parameters we identified which can guide managers who intend to implement wikis in their own organizations.

To conclude, from our study we found that enterprise wikis, even in a very native form (i.e. MediaWiki with very basic wiki functionality), are capable of

generating benefits for users. In the near future, we expect to find wikis with additional functionality including microblogging and social networking in the enterprise. Furthermore, as knowledge workers will be increasingly equipped with mobile devices, new collaboration practices will emerge to be the subject of future investigation.

Acknowledgements

We would like to thank the anonymous reviewers, the companies who were part of our study and the colleagues who contributed to our study. Especially, we want to thank the editors of this special issue, Carla Simone, Volker Wulf and Mark Ackerman for their valuable feedback and their willingness to help us to improve our paper. Alexander Richter wants to thank Michael Koch and Kai Riemer for being great mentors.

Note

1. For a broader overview of these theories and a discussion see e.g. Stevens (2009).

References

Ackerman, M. S. and Halverson, C. (1998). Considering an organization's memory. *Proceedings of ACM 1998 Conference on Computer Supported Cooperative Work*, Seattle WA: ACM Press, pp.39–48.

Ackerman, M. S., & Halverson, C. (2000). Re-examining organizational memory. *Communications of the ACM, 43*(1), 58–63.

Alavi, M., & Leidner, D. (2001). Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly, 24*(1), 107–136.

Arazy, O., Gellatly, I., Soobaek, J., & Patterson, R. (2009). Wiki deployment in corporate settings. *IEEE Technology and Society Magazine, 28*(2), 57–64.

Ardichvili, A., Vaughn, P., & Wentling, T. (2003). Motivation and barriers to participation in virtual knowledge-sharing communities of practice. *Journal of Knowledge Management, 7* (1), 64–67.

Barley, S., & Kunda, G. (2001). Bringing work back in. *Organization Science, 12*(1), 76–95.

Barnes, S., Boehringer, M., Kurze, C. and Stietzel, J. (2010). Towards an understanding of social software: the case of Arinia. *Proceedings of 43 rd Hawaii International Conference on System Sciences*, Koloa, Kaunai, Hawai.

Blaschke, S. and Stein, K. (2008). Methods and measures for the analysis of corporate wikis. *Proceedings of the 58th Annual Conference of the International Communication Association (ICA)*, Montreal, Canada.

Brynjolfsson, E., & Hitt, L. M. (1998). Beyond the productivity paradox. *Communications of the ACM, 41*(8), 49–55.

Buffa, M. (2006). Intranet Wikis. *Proceedings of the Intraweb Workshop, World Wide Web Conference (WWW 2006)*, Edinburgh, Scotland.

Bughin, J. and Manyika, J. (2007). *How businesses are using Web 2.0: A McKinsey Global Survey.* McKinsey Research.

Cabrera, A., & Cabrera, E. (2002). Knowledge sharing dilemmas. *Organization Studies, 23*(5), 687–710.

Cabrera, A., Collins, W., & Salgado, J. (2006). Determinants of individual engagement in knowledge sharing. *International Journal of Human Resource Management, 17*(2), 245–264.

Chau, T. and Maurer, F. (2005). A case study of wiki-based experience repository at a medium-sized software company. *Proceedings of the 3rd International Conference on Knowledge Capture (K-CAP '05)*. New York: ACM Press, pp. 185–186.

Danis, C. and Singer, D. (2008). A Wiki instance in the enterprise: Opportunities, concerns and reality. *Proceedings of the ACM 2008 Conference on Computer Supported Cooperative Work*, San Diego, USA.

Davenport, T., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Cambridge, MA: Harvard Business School Press.

Davis, F. D. (1989). Perceived usefulness perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*, 319–340.

DeLone, W., & McLean, E. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60–95.

DeLone, W., & McLean, E. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4), 9–30.

DiMicco, J.M.; Millen, D.R.; Geyer, W.; Dugan, C.; Brownholtz, B.; Muller, M. (2008). Motivations for Social Networking at Work. *Proceedings of the 12th Conference on Computer Supported Cooperative Work*. ACM Press, New York.

Dourish, P. (2003). The appropriation of interactive technologies: Some lessons from placeless documents. *Computer Supported Cooperative Work (CSCW) - The Journal of Collaborative Computing, 12*(4), 465–490.

Drucker, P. F. (1992). *Managing for the future*. New York: Truman Talley Books/Dutton.

Efimova, L. and Grudin, J. (2007). Crossing boundaries: A case study of employee blogging. *Proceedings of the Fortieth Hawaii International Conference on System Sciences (HICSS-40)*, Los Alamitos: IEEE Press.

Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), 532–550.

Farrell, R., Kellogg, W. and Thomas, J. (2008). The participatory web and the socially resilient enterprise. IBM T.J. Watson Research Center, *Proceedings of the 12th Conference on Computer Supported Cooperative Work*, ACM Press, New York.

Giddens, A. (1979). *Central problems in Social Theory: Action, Structure and Contradiction in Social Analysis*. London: Macmillan.

Giddens, A. (1984). *The Constitution of society: Outline of the theory of structuration*. Cambridge: Polity.

Grace, T. (2009). Wikis as a knowledge management tool. *Journal of Knowledge Management, 13*(4), 64–74.

Greif, I. (1998). Everyone is talking about knowledge management. *Proceedings of ACM 1998 Conference on Computer Supported Cooperative Work*, Seattle, WA: ACM Press, pp. 405-406.

Grudin, J. (1988). Why CSCW applications fail: Problems in the design and evaluation of organizational interfaces. *Proceedings of ACM Conference on Computer-Supported Cooperative Work*. New York: ACM, pp. 65-84.

Grudin, J. and Palen, L. (1995). Why groupware succeeds: Discretion or mandate. *Proceedings of European Conference on Computer-Supported Cooperative Work*, Dordrecht: Kluwer.

Hanseth, O. and Lytinnen, K. (2004). Theorizing about the design of information infra-structures: Design kernel theories and principles, sprouts. *Working Papers on Information Systems*, vol. 4, no. 12.

Happel, H. and Treitz, M. (2008). Proliferation in enterprise wikis. *Proceedings of the 8th International Conference on the Design of Cooperative Systems,* Carry-le-Rouet.

Hasan, F. and Pfaff, C. (2006). The Wiki: an environment to revolutionise employees' interaction with corporate knowledge. *Proceedings of the 18th Australia Conference on Computer-Human Interaction*: Design: Activities, Artefacts and Environments, Sydney, Australia.

Hlupic, V., Pouloudi, A., & Rzevski, G. (2002). Towards an integrated approach to knowledge management: 'Hard', 'soft' and 'abstract' issues. *Knowledge and Process Management, 9*(2), 90–102.

Holtzblatt, L., Damianos, L. and Weiss, D. (2010). Factors impeding wiki use in the enterprise: A case study. *Proceedings of CHI 2010*, ACM Press.

Huysman, M., & Wulf, V. (2006). IT to support knowledge sharing in communities: Towards a social capital analysis. *Journal on Information Technology (JIT), 21*(1), 40–51.

Jahnke, I. (2009). Socio-technical communities: From informal to formal. In B. Whitworth (ed): *Handbook of research on socio-technical design and social networking systems*. IGI Global Publisher, pp. 763–778.

Koch, M. (2008). CSCW and Enterprise 2.0: Towards an integrative perspective. *Proceedings of the 21st Bled Conference eCollaboration: Overcoming Boundaries through Multi-Channel Interaction*, Bled, Slovenia.

Kosonen, M., Henttonen, K., & Ellonen, H.-K. (2007). Weblogs and internal communication in a corporate environment: a case from the ICT industry. *International Journal of Knowledge and Learning, 3*(4–5), 437–449.

Kuutti, K. (1996). Activity Theory as a potential framework for human-computer interaction research. In B. Nardi (Ed.), *Context and Consciousness: Activity Theory and Human Computer Interaction* (pp. 17–44). Cambridge, MA: MIT Press.

Levy, M. (2009). Web 2.0 implications on knowledge management. *Journal of Knowledge Management, 13*(1), 120–134.

Licklider, J. C. R., & Taylor, R. (1968). The computer as a communication device. *Science and Technology, 76*, 21–31.

Majchrzak, A., Wagner, C. and Yates, D. (2006). Corporate wiki users: Results of a survey. *Proceedings of the 2006 International Symposium on Wikis*, ACM Press, New York,

Mayer, R. (2004). *Knowledge management systems: Information and Communication Technologies for Knowledge Management*. Berlin: Springer.

McAfee, A. (2006). Enterprise 2.0. The dawn of emergent collaboration. *MIT Sloan Management Review, 47*(3), 21–28.

McAfee, A and Sjoman, A. (2006). Wikis at Dresdner Kleinwort Wasserstein. (Case No. 606074). Boston, *Harvard Business School Case Studies*.

Meyer, B., & Sugiyama, K. (2007). The concept of knowledge in KM: a dimensional model. *Journal of Knowledge Management, 11*(1), 17–35.

Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A sourcebook of new methods*. Thousand Oaks, CA: Sage Publications.

Mueller, J., & Stocker, A. (2011). Enterprise microblogging for advanced knowledge sharing. The References@BT Case Study. *Journal of Universal Computer Science, 17*(4), 532–547.

Nonnecke, B. and Preece, J. (2001). Why lurkers lurk. *Proceedings of American Conference on Information Systems (AMCIS 2001)*, Boston.

O'Reilly, T. (2005). *What is Web 2.0: Design patterns and business models for the next generation of software*, O'Reilly Media.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science - Focused Issue: Management of Technology, 3*, 398–427.

Orlikowski, W. J. (1995). Evolving with notes: Organizational change around groupware technology. *Working Paper 186, Center for Coordination Science*. Cambridge, MA: MIT Press.

Orlikowski, W. J. (2000). Using technology and constituting structure: A practise lens for studying technology in organizations. *Organization Science, 11*(4), 404–428.

Orlikowski, W. J., & Iacono, S. (2000). The truth is not out there: An enacted view of the digital economy. In E. Brynjolfsson & B. Kahin (Eds.), *Understanding the digital economy: Data, tools, and research*. Cambridge, MA: MIT Press.

Paroutis, S., & Saleh, A. (2009). Determinants of knowledge sharing using Web 2.0 technologies. *Journal of Knowledge Management, 13*(4), 52–63.

Pasmore, W., Francis, C., Haldeman, J., & Shani, A. (1982). Sociotechnical systems: A North American reflection on empirical studies in the seventies. *Human Relations, 35*, 1179–1204.

Pipek, V. (2005). *From tailoring to appropriation support: Negotiating groupware usage*. Ph.D. thesis. Faculty of Science, Department of Information Processing Science (ACTA UNIVERSITATIS OULUENSIS A 430), University of Oulu, Oulu, Finland, 246 p.

Pipek, V. and Wulf, V. (2009). Infrastructuring: Towards an integrated perspective on the design and use of information technology. *Journal of the Association of Information Systems (JAIS)*, vol. 10, no. 5, Article 1.

Poole, M. S., & De Sanctis, G. (1989). Use of group decision support systems as an appropriation process. *Proceedings of the Twenty-Second Annual Hawaii International Conference, 4*, 149–157.

Poole, M. S., & De Sanctis, G. (1992). Microlevel structuration in computer-supported group decision making. *Human Communications Research, 19*, 5–49.

Probst, G., Raub, S., & Romhardt, K. (2000). *Managing knowledge –building blocks for success*. New York: John Wiley.

Raeth, P., Smolnik, S., Urbach, N. and Zimmer, C. (2009). Towards assessing the success of social software in corporate environments. *Proceedings of 15th American Conference on Information Systems*, San Francisco.

Razmerita, L., Kirchner, K., & Sudzina, F. (2008). Personal knowledge management. The role of Web 2.0 tools for managing knowledge at individual and organizational levels. *Online Information Review, 33*(6), 1021–1039.

Richter, A. and Koch, M. (2008). Functions of social networking services. *Proceedings of the 8th International Conference on the Design of Cooperative Systems,* Carry-le-Rouet.

Richter, A. and Riemer, K. (2009). Corporate social networking sites – modes of use and appropriation through co-evolution. *Proceedings of the 20th Australasian Conference on Information Systems*, Melbourne.

Richter, A. and Stocker, A. (2011). Exploration & promotion: Einführungsstrategien von Corporate Social Software. *Proceedings of 10th International Conference Wirtschaftsinformatik (WI 2011)*, Zürich.

Riemer, K. and Richter, A. (2010). Tweet inside: Microblogging in a corporate context. *Proceedings of the 23rd Bled eConference 2010 – "eTrust: Implications for the Individual, Enterprises and Society"*, Bled, Slovenia.

Riemer, K., Froessler, F. and Klein, S. (2007). Real time communication – modes of use in distributed teams. *Proceedings of 15th European Conference on Information Systems (ECIS)*, St. Gallen, Switzerland.

Riemer, K., Steinfield, C., & Vogel, D. (2009). eCollaboration: On the nature and emergence of communication and collaboration technologies. *Electronic Markets, 19*(1), 181–88.

Savage, C. M. (1996). *Fifth generation management: Co-creating through virtual enterprising, dynamic teaming, and knowledge networking*. Oxford: Butterworth-Heinemann.

Schneckenberg, D. (2009). Web 2.0 and the empowerment of the knowledge worker. *Journal of Knowledge Management, 13*(6), 509–520.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39. *Social Studies of Science, 19*(3), 387–420.

Stevens, G. (2009*). Understanding and designing appropriation infrastructures: Artifacts as boundary objects in the continuous software development*. Ph.D. thesis, University of Siegen.

Stocker, A., Strohmaier, M., & Tochtermann, K. (2008). Studying knowledge transfer with weblogs in small and medium enterprises: An exploratory case study. *Journal of Scalable Computing: Practice and Experience, 9*(4), 243–258.

Strohmaier, M., Yu, E., Horkoff, J., Aranda, J. and Easterbrook, S. (2007). Analyzing knowledge transfer effectiveness – An agent-oriented approach. *Proceedings of the 40th Hawaii International Conference on System Sciences (HICSS-40 2007)*, January 3-9, IEEE Computer Society, Hawaii, USA.

Suchman, L. (1987). *Plans and situated actions: The problem of human-machine communication.* Cambridge University Press.

Trkman, M., & Trkman, P. (2009). A Wiki as intranet: a critical analysis using the Delone and McLean model. *Online Information Review, 33*(6), 1087–1102.

Wagner, C. (2006). Breaking the knowledge acquisition bottleneck through conversational knowledge management. *Information Resources Management Journal, 19*(1), 70–83.

Wagner, C., & Majchrzak, A. (2007). Enabling customer-centricity using wikis and the wiki way. *Journal of Management Information Systems, 23*(3), 17–43.

Wasko, M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly, 29*(1), 35–57.

Watson, K. and Harper, C. (2008). *Supporting knowledge creation – using wikis for group collaboration*. Research Bulletin, Issue 3, Boulder, CO: EDUCAUSE Center for Applied Research.

White, K. and Lutters, W. (2007). Midweight collaborative remembering: wikis in the workplace. *Proceedings of the 2007 Symposium on Computer Human Interaction for the Management of Information Technology*, ACM, New York.

Wulf, V., & Jarke, M. (2004). The economics of end user development. *Communications of the ACM (CACM), 47*(9), 41–42.

Yin, R. (2003). *Case study research: design and methods*. Thousand Oaks: Sage Publications.

Zhang, J., Qu, Y., Cody, J. and Wu, Y. (2010). A case study of micro-blogging in the enterprise: Use, value, and related issues. *Proceedings of CHI 2010.* ACM Press.