Trends in Virtual Project Management:
Using Web-based Collaboration Tools to Create Additional Value

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Thesis mentors:
Dr. Stacie Petter
University of Nebraska at Omaha, USA
Dr. Christian Vohradsky
Management Center Innsbruck, Austria

Author:
Simon Thomas Schöpf
0610174035

August 8th, 2010

Simon Thomas Schöpf

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[1] www.marshallplan.at
[2] www.dvt.at

1 Introduction

Today's workplace is not what it used to be a few decades ago – it has become increasingly flexible and mobile and will be even more so in the near future. Companies hiring only homogenous, local personnel are rare; growing globalization and internationalization are triggers for a dispersed, heterogeneous workforce. Organizational forms shift and increasingly work is accomplished in projects, allowing companies to become more agile. However, this development is only possible with the help of proper technology. The explosive rise of the Internet within the past two decades[3] enabled completely new forms of collaboration. It is now common to have colleagues situated in different time zones work while you are sleeping. Having coworkers from different regions requires the ability to deal with diverse cultures and habits. Obviously, managing a project under such increasingly complex circumstances becomes even more challenging.

With this development, the domain of virtual project management (VPM) emerged. Virtual projects are projects in which the members are geographically dispersed; virtual projects are already seen as an essential component of modern organizations (Zigurs, Khazanchi, & Mametjanov, 2007). The field of VPM seeks to describe how to successfully manage such projects. In today's fast-paced world, appropriate tools are vital to manage and synchronize the flow of information. A variety of specialized tools for project management exist to support the team leader and participants. A very recent trend in this field is the development of web-based collaboration tools, going hand in hand with the much-cited "Web 2.0" phenomenon. This thesis will examine this trend, pointing out strengths and weaknesses while elaborating how to successfully use such tools and predict future directions.

The author's interest in those areas and a discussion with leading experts in the field of VPM led to the research questions of, "*How can web-based collaboration tools create additional value and complement task-oriented project management tools within IT projects?"* and, *"In what stages of an IT project do social technologies prove to be most effective and appropriate?"* These research questions are relevant because those business trends of using virtual (i.e., dispersed) teams for project management are already utilized in countless organizations worldwide; however, research on when it is most efficient to use different collaboration tools has not yet been explored (Donker & Blumberg, 2008). Moreover, the practical relevance of the topic is useful to unveil information and knowledge that can be applied within organizations.

[3] From 16 million users in 1995 to 1800 million users in 2010. For details, compare http://www.internetworldstats.com/emarketing.htm, accessed May 9th, 2010.

Figure 1 provides a short overview for the thesis. Following this introduction, chapter two (2 Literature Review) will provide a thorough discussion of the literature and cover background information about (virtual) project management and collaboration technologies. Next, in section three (see 3 Research Methodology), the fundamentals of the research methodology will be explained. A theoretical overview of commonly used research methods within the information systems (IS) field will be given, followed by a concrete description and justification of the design and methods used for this thesis. Section four (see 4 Results and Discussion) will present, reflect upon, and discuss the empirical findings. The last section (see 5 Limitations, Future Directions) will point out limitations of this study, draw implications for business uses, and also predict future directions. All references used (see 6 References) as well as additional material (see 7 Appendices) will be listed.

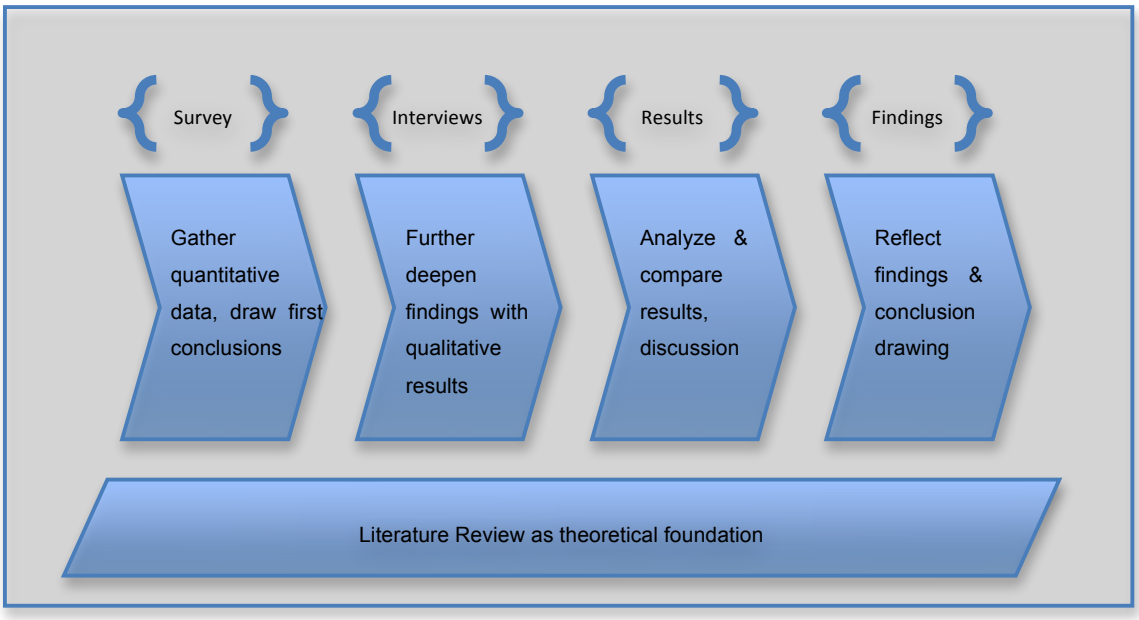

Figure 1. Thesis Overview

This thesis evolved out of the author's cooperation with scholars in both Management Center Innsbruck[4], Austria, and the University of Nebraska at Omaha[5], USA. Since the content includes virtual environments and global collaboration, writing this thesis on two continents was a fruitful and rewarding experience. Both universities, moreover, specialize in the areas covered; hence, the preconditions for conducting research were ideal and access to valuable resources trouble-free.

[4] www.mci.edu
[5] www.unomaha.edu

2 Literature Review

2.1 Traditional Project Management

In the literature review section, a thorough look on the current literature is provided. First, to fully understand the complexity of virtual project management, the necessary basics of traditional project management will be discussed and the required terms defined. Different approaches to project management will be introduced, including the description of the project management process groups. Then, the current paradigm shift towards managing projects in a more collaborative and virtual environment will be examined, which leads to a discussion about the needed technology for this development. Within this discussion, the terms of virtuality, virtual teams and knowledge management are discussed. Finally, the essential key findings will be reviewed and summarized. Because this thesis has a focus on collaboration techniques, the emphasis will be on the technology rather than on the management level.

2.1.1 Projects and Project Management

Throughout the current literature, it is commonly agreed that projects have become increasingly important during the last few decades and are now often used in managing a business. The management of projects is viewed as “a means to track and organize a project” (Curlee, 2008, p. 83) and is seen as “vital to the survival of many organizations” (Chen, Romano, & Nunamaker, 2003, p. 1303). There are a variety of definitions for projects and for project management, but no standard definition (Chen, Romano, et al., 2003; Gareis, 2006). A popular and well-known definition is given from the non-profit organization Project Management Institute (PMI) (2008) in their “Project Management Body of Knowledge” (PMBOK®): “A project is a temporary endeavor undertaken to create a unique product, service, or result” (p. 5). However, what all definitions of projects and project management have in common is that projects have a clear start- and end point (meaning they are temporary) and the output is to be a unique service or product (Chen, Romano, et al., 2003; Litke, 2005). Uniqueness is important because for the manufacturing process of identical products, a project structure would be inefficient. Litke (2005) also points out that projects, although they are unique, almost always have certain conditions in common. This is an important and necessary requirement for enabling a learning-by-experience process, enabling the organization to benefit in future projects. Additionally, projects have clear goals, limited resources, and a specific process structure (Litke, 2005). According to Gareis (2006), projects can also be seen as a social system, a construct, or a temporary organization. The latter is, particularly in Europe,

commonly agreed upon (Huemann, 2008) and embodies the thought that projects, just as common organizations, have a specific identity; thus, a project can be seen as a temporary organization with an emphasis on the start- and end processes (Gareis, 2006). However, this seems to conflict with the view of the PMBOK® Guide (2008) which mentioned that projects cannot operate as a closed system and only exist within an organization, needing input information and delivering capabilities. To summarize and point out the differences: a project can either be seen as temporarily organization and social system (Gareis, 2006) or as an unique task with a clear start and end point (Project Management Institute, 2008). For this thesis, the latter definition is sufficient and is used.

Khazanchi and Zigurs (2007b) mentioned that projects are "inherently collaborative activities and their management includes the design and execution of appropriate collaboration and communication processes" (p. 2). Gareis (2006) views PM as a process embodying the sub processes of project start, continuous project coordination, project controlling and project closing. As for project management (PM), we will also use the definition given in the PMBOK®, which stated that:

> *"Project management is application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. This application of knowledge requires the effective management of appropriate processes." (Project Management Institute, 2008, p. 37)*

A process is defined as a "set of interrelated actions and activities performed to achieve a specified product, result, or service" (Project Management Institute, 2008, p. 37). The PMBOK® Guide mentions 42 main processes which can be further grouped into five categories, named process groups. These five process groups are:

- Initiation
- Planning
- Executing
- Monitoring and Controlling
- Closing

Those five process groups (also known as Project Management Process Groups - see Figure 2 for an illustration) are important for this thesis and will be discussed in greater detail below.

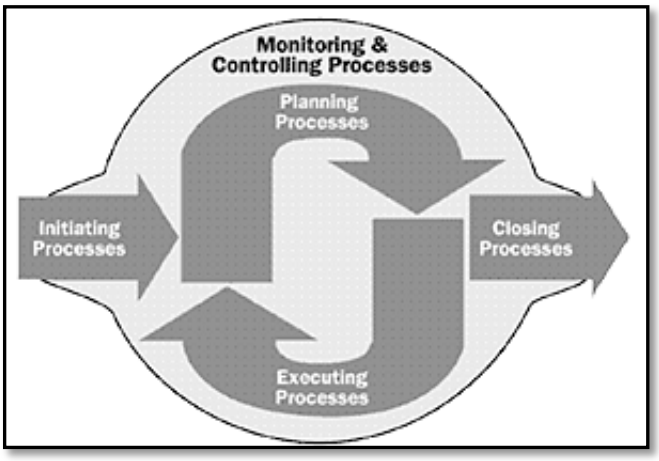

Figure 2. Project Management Process Groups (Project Management Institute, 2008, p. 40)

2.1.1.1 Traditional Approach

There are numerous approaches to project management. For project oriented companies, it is important to carefully choose a fitting approach and stick with it. Approaches can be either self-developed within the company (often, best practices are used) or taken from an established framework. Some examples would include the already mentioned PMBOK® Guide from the Project Management Institute (PMI), Extreme Project Management, ICB[6] from the International Project Management Association (IPMA) or PRINCE2[7] from the UK Central Computer and Telecommunication Agency. PRINCE2 was developed and is especially popular for managing IT and technical projects and separates the processes from the project stages.

The PMBOK® Guide identifies standards for project management processes. The five process groups shown in Figure 2 are overlapping activities that occur throughout the project (compare Figure 3 for an illustration). Also, they are independent of industry focus or application areas. The PMBOK® Guide explicitly mentions that process groups are not to be mistaken for project phases. A project consists of one or more project phases. If a project has more than one phase (e.g., design, build, test, etc.), all five process groups would normally be repeated for each phase. Phases can be both sequential (i.e., a phase can only start once the previous phase is completed) and overlapping (i.e., a phase can start prior to completion of the previous one) (Project Management Institute, 2008).

[6] International Competence Baseline
[7] Projects in Controlled Environments

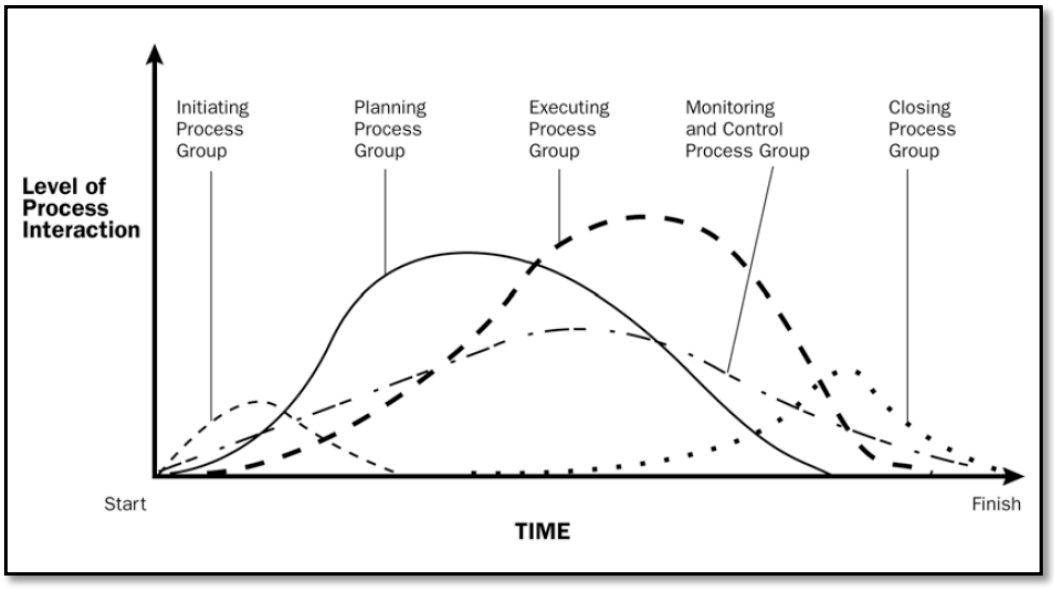

Figure 3. Process Groups Interact in a Phase or Project (Project Management Institute, 2008)

Initiating is the first process group and the start to every project or phase. This process obtains authorization to start the project or phase. It also consists of developing the standards for the other process groups, which are necessary for the successful completion of a project. Numerous activities such as defining the authority, responsibility, and accountability of the project team as well as establishing boundaries of the scope of the project are documented in the project charter (Lewis, 2006). The charter formally approves the project and defines what needs to be done to meet the requirements of the customer. Especially important in the project charter is the statement of a clear, complete, measureable, and feasible definition of the project goal (Hobel & Schütte, 2010), the development of a common language, and understanding the "big picture".

One of the major causes for project failure is due to poor performance in the next process group, *planning* (Lewis 2006). Planning is often viewed as a waste of time, with teams wanting to start working right away (Lewis 2006). This behavior occurs due to time pressure commonly faced in projects (Gareis 2006). In reality, a solid plan is especially important when it comes to controlling the project. A good project plan is required to refine the objectives, establish the scope and define the course of action for the project (Project Management Institute, 2008). Commonly plans change as the project progresses, and thus, the planning process group often accompanies the execution process group. Poor planning results in unrealistic project goals and role definitions, inadequate and non-binding project plans as well as unclear arrangements (Gareis, 2006). Controls need to be put in place to make sure that the end product meets the specifications of the project charter, the quality standards, and stays within budget and time constraints. Often, a kickoff event is held to officially start things off and extensively inform all project members.

Within the *execution* process group, the actual work is being done to implement the project plan (Lewis, 2006), coordinate people and resources, and to complete the product or service. Tasks are assigned and completed, and the project plan becomes increasingly detailed. The progress should constantly and consistently be monitored and controlled to recognize variances quickly so corrective action can be taken (*monitoring and controlling* process group). Frequent milestones with clearly defined results allow for assessment of the project's progress. Also, monitoring the work being completed and comparing the progress with the planned level of work informs the team if they are behind or ahead of schedule. Variances should be critically observed and the consequences predicted to effectively initiate countermeasures if needed. Motivation, clearly defined tasks, common esteem and a respectful handling of conflicts are all indicators of successful information and communication when executing the project (Hobel & Schütte, 2010).

The *closing* process group is the last process group, which formally works toward project acceptance and closure. It verifies that the defined processes are completed within all process groups (Project Management Institute, 2008). The client accepts the result and the project team can be disbanded. It is also important to preserve gathered experiences and conduct a lessons-learned session before closing the project (Lewis, 2006). The team reflects the evolvement of the project and discusses findings as well as documents experiences, insights and improvements (Hobel & Schütte, 2010), which enables good knowledge management. Should a project be closed without reaching the project goals, it is considered terminated. However, this option is often taboo in larger projects, and considered, if ever, too late (Hobel & Schütte, 2010).

2.1.1.2 Project Typology

Every project is unique, and there are many different types of projects. As not every project is suitable to be conducted as a virtual project, different perspectives of project typologies are presented. Chen, Romano, et al. (2003), based on Whittaker (2000), identified three types of projects: (1) manual, (2) machine, and (3) mind. *Manual projects*, as the name suggests, are accomplished by using manual labor. Examples are found in the construction industry and the "manager" has an easy job controlling the team by watching them work. *Machine projects* use technology and are more complex than manual projects. Specialization and skills of the workers increase and higher task interdependence is in place. Thus, coordination becomes more complex and important. *Mind projects* are the most complex form within this typology and the focus of our attention. The capital for this type of project is the "mind" rather than the "hand." Examples include software development or graphic design. The output is the result of information and thinking, which is not always tangible. Thus, the progress of the project can no longer be monitored by observation; explicit communication, concerted collaboration, and

information sharing among team members are strongly needed (Chen, Romano, et al., 2003). When it comes to virtual projects, mind projects are to one in place; to meet the requirements named, Chen, Romano, et al. (2003) proposed a collaborative PM approach (see 2.2.1.7).

Litke (2005) proposed another way to differentiate projects by considering complexity and innovation (see Table 1). Thereby, four different types of projects are identified: standard projects, development projects, pioneer projects and high-potential projects. The most complex projects are, of course, the pioneer projects facing both high degrees of complexity and high innovation. The higher the degree of innovation, the higher the risk of the project; best practices are only rarely available (Gareis, 2006). At the same time, those projects are most likely to be conducted as virtual projects. High degrees of innovation and complexity require particular skills and expertise and thus, access to global talent can be of the utmost importance for project success.

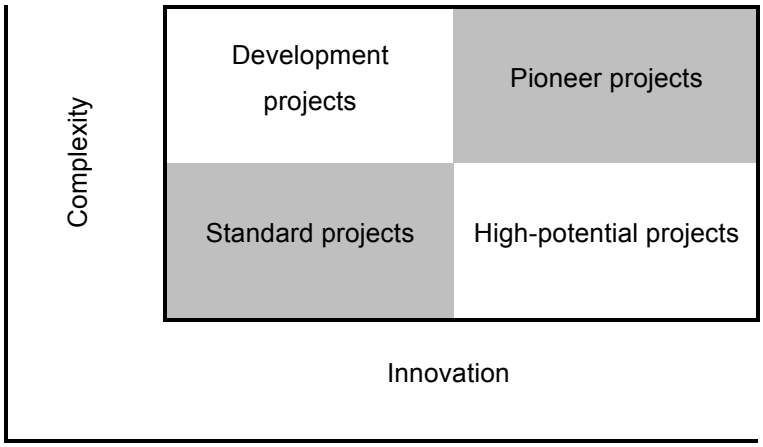

Table 1. Project Types (adapted from Litke, 2005)

For virtual projects, Khazanchi and Zigurs (2005) proposed a separate typology, to be discussed in 2.2.1.6. Although before discussing it, the necessary conditions for the area of virtual project management need to be clarified. The term “virtuality” can be found all over this thesis. Hence, it makes sense to clarify its meaning in the following sections.

2.2 Virtual Project Management

Due to business and technical forces, the domain of project management (PM) experienced significant changes over the last years. The fundamentals of PM as it had been developed have changed over the last decade (Evaristo & van Fenema (1999). Ten years later, this development within PM continues as methods and tools become more sophisticated and well developed. Evaristo & van Fenema (1999) named several factors for this development. The primary trigger, however, is information and communication technology, which enables effective global teamwork. Increased globalization and internationalization of organizations as well as the increased development of information technology (IT) have significant consequences for companies (Krejci, 2009). Due to information technology, the needed support for the development of new organizational forms is now available (Powell, Piccoli, & Ives, 2004). Romano, Chen, and Nunamaker (2002) underlined this observation by stating that during the last three decades, "the revolutionary change to PM is the computerized PM" (p. 7). However, this development was still focused on automation and featured a single-project perspective. Romano et al. (2002) further predict that "the next big change of PM will be collaboration" (p. 7), the focus of attention for this thesis. Increasingly globalized markets force companies to integrate global managerial and business processes. This has influenced corporations to use global sourcing with increasing frequency (i.e., obtaining goods and services from a global market across geopolitical boundaries) for their benefit (e.g., Krejci, 2009; Romano, et al., 2002). Furthermore, a project's cycle time can be reduced by using time zone differences to the advantage. Lastly, research and development (R&D) can be organized around globally distributed centers of excellence. These factors have led to the new discipline of virtual project management, which differs from traditional project management (and a traditional project) known as the management of a single project in a single location (see Evaristo & van Fenema, 1999; Romano, et al., 2002). Due to the increasing number of distributed projects (i.e., projects conducted in more than one location) in virtual environments, the PM paradigm began to change (Chen, Romano, et al., 2003).

2.2.1 Virtuality & Virtual Teams

According to Zigurs et al. (2007), *virtuality* can be defined in various ways, but the common denominator is dispersion. Virtuality is defined as:

> *"The extent to which project members are dispersed geographically and on other dimensions and rely on information and communication technologies for carrying out team processes and achieving project goals." (Zigurs, et al., 2007, p. 2)*

The greater the dispersion (e.g., geographical, time, cultural), the greater the degree of virtuality, which impacts the complexity of a project. Having the needed technical environment and infrastructure at hand, new organizational forms could emerge. Virtual teams represent one such form, having the potential to revolutionize the workplace and provide organizations with new levels of flexibility and responsiveness (Powell, et al., 2004). However, a virtual team was not a phenomenon that was planned methodically. Rather, virtual teams developed because the supporting technology became available (Bergiel, Bergiel, & Balsmeier, 2008; Kankanhalli, Tan, & Wei, 2007) and as the technology grew in viability and popularity (Powell, et al., 2004). Besides improved technology, increasing globalization was a driver towards the emergence of virtual structures within organizations (Kankanhalli, et al., 2007). The global economy is getting increasingly complex and competitive, forcing companies to find new ways to do successful business. According to Samson & Draft (2003), teams are the primary unit of performance and employees are widely agreed to be the most valuable asset of any organization. Using the opportunities that increased globalization provides, employees can now be hired worldwide and many companies would like to take advantage of the pool of global talent (Bergiel, et al., 2008).

2.2.1.1 Virtual Teams

But what makes a team virtual? First, we need to differentiate between teams operating in a traditional environment, to which we will refer as traditional teams from now on, and virtual teams. Traditional teams consist of members working together in the same location, thus having easy access to face-to-face communication, which is their primary channel of communication. (Powell, et al., 2004). For virtual teams, many definitions exist, but we define virtual teams "as groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks" (Powell, et al., 2004, p. 7). This means that all team members are strongly dependent on technology and are working toward common goals. Zigurs (2003) argues that "virtual teams come in many flavors, and 'virtuality' as a characteristic can be defined on many dimensions" (p. 339), where we already defined virtuality as at least geographically dispersed and dependent on IT (Khazanchi & Zigurs, 2005; Zigurs, et al., 2007). Furthermore, Zigurs (2003) and Khazanchi & Zigurs (2006) suggested that we should think of a team as existing on a continuum of virtuality and the more dimensions (e.g., time, location, culture, technology) or aspects on which the team is dispersed, the more virtual it is. Katzy, Evaristo and Zigurs (2000) also argued that the greater the dispersion, the more virtual an entity is. This view implies that there is no strict border between when to consider a team virtual, but rather that different levels of virtuality exist.

Features of virtual teams, besides their reliance on technology, are their flexible composition, their often short-lived time span and their ability to traverse traditional organizational boundaries and time constraints (Powell, et al., 2004). They allow people to communicate across borders without having to leave their offices and embrace the idea for companies to become more agile and globally competitive (Bergiel, et al., 2008). Other advantages to virtual teams are the promise of increased flexibility and responsiveness, reduced travel time and cost, the building of diverse teams, reduced discrimination, and improved resource utilization (Bergiel, et al., 2008). Of course, there are also downsides to virtual teams and obstacles that have to be dealt with which include multiple time zones, language, and different approaches to conflict resolution (Bergiel, et al., 2008). Zigurs (2003) stated that "the more virtual a team becomes, the more complex are the issues it must address to function effectively" (p. 339). To master those barriers, Bergiel et al. (2008) identified the following key factors of success for virtual teams: high levels of trust, clear communication, strong leadership, and appropriate levels of technology (p. 100). Those factors are discussed in more detail below.

2.2.1.2 Key Success Factors

Trust is often called the foundation of all successful relationships (e.g. Bergiel, et al., 2008) and considered a key issue for the success of virtual teams (Zigurs, 2003). Due to their nature, people within a virtual team can only rarely, if ever, meet personally. It is therefore important to know that all people in a team can be relied upon and that team members are able to complete their work (Bergiel, et al., 2008). Virtual teams often have only a limited time span and thus, trust must develop quickly (Powell, et al., 2004). The current literature agrees[8] to the fact that initial face-to-face meetings between team members' leads to increased trust. (Powell, et al., 2004; Zigurs, 2003). Even adding a "personal touch" such as a picture or video helps to associate a name with a face and is considered a benefit (Bergiel, et al., 2008). Virtual teams also experience the so-called "swift trust" paradigm where, due to their limited time, team members just assume that the others are trustworthy which helps in sharing ideas and perspectives early on (Powell, et al., 2004; Zigurs, 2003).

Communication is another vital ingredient for successful virtual teams. According to Anderson et al. (2007), effective use of communication, especially during the early stages of the team's development, plays an equally important role in gaining and maintaining trust. In this context, it is very important for team members to exchange information and to excel as active communicators (Bergiel, et al., 2008). However, there are various challenges to communication in virtual teams: nonverbal communication is usually missing, time delays in sending feedback occur, and misinterpretation of written text arise frequently (Powell, et al., 2004).

[8] Contradicting with that view, Carte and Chidambaram (2004) suggest that for diverse groups, it may be better to first use technology and only in later stages use face-to-face interactions.

Communication is also closely interconnected with technology because geographically dispersed team members are only able to communicate through technology, which tends to restrict the communication process due to a limited set of communication cues (Powell, et al., 2004). Technology filters information sources like mimics, gestures, body language, pitch, and pauses. Table 2 provides a graphical overview of those filters. The grey areas indicate that the certain type of information is available for the corresponding technique (e.g., instant messaging relies on both words and a dialog). Each team members' ability to master the medium in place is crucial for virtual team success.

	Words	Dialog	Voice	Body language	Context, surrounding
Face-to-face meeting					
Video conference					
Telephone					
Instant messaging					
E-mail					

Table 2. Filters in Virtual Communication (adapted from Krejci, 2009)

Technology is at the heart of any virtual team. In essence, "technology is simply described as a tool that requires human input" (Bergiel, et al., 2008, p. 103) and has the potential to fail if insufficient consideration is given to the user's perspective. Ongoing developments will provide potential for dramatic changes in how team members communicate and should be adapted in an evolutionary way to communicate effectively (Zigurs, 2003).

Finally, *leadership* differs from traditional teams in that "virtual teams are often characterized by high levels of autonomy rather than direct control" (Zigurs, 2003, p. 342) and thus becomes more of a collective effort that is distributed between team members. Powell et al. (2004) also states that leadership in an virtual environment needs to be more flexible and willing to let others take the lead when necessary. Characteristics that make a successful leader in traditional teams such as personal traits, open communication, or physical attendance are missing in a virtual environment. Virtual team leaders should provide training on participation in virtual teams, conduct team-building exercises, establish standards for communication, structure the process, and nurture self-leadership (Zigurs, 2003). Furthermore, choosing the right individuals suitable for virtual team work is considered absolutely crucial (Krejci, 2009).

2.2.1.3 Limitations

With all the advantages virtual teams offer, one also has to be aware of the drawbacks that can be encountered (see Bergiel, et al., 2008, p. 106). Donker and Blumberg (2008) stated that virtual teams are often less effective and their work capacities are limited due to the fact that the team members are dispersed and cannot achieve their maximum work effectiveness. Furthermore, choosing the wrong personal can also hinder the success. People in virtual teams need to be able to master the needed technologies appropriately and must possess the ability to communicate clearly and unequivocally (Krejci, 2009). However, project managers are often limited with their choice of personal and do not get the people they may want and need. This often results in the usage of inappropriate personal for virtual team positions, which again hinders success. Proper training can provide possible a solution to this problem but is also often considered an unnecessary expense and outside the budget (Krejci, 2009). Psychological challenges can also occur, as not all persons are suitable to work with reduced social contact. For virtual teams, a high degree of independence and reliability, intrinsic work motivation, and emotional stability are needed. Due to the geographical dispersion, isolation will occur, and it will be harder for the employee to receive help in case of problems. Also, it will be harder for the teammates to discover personal struggles of an individual. To encounter this problem, work is often defined and broken down into smaller tasks that are easier to complete. However, this practice can lead to the loss of a general overview for the project and the results will seem increasingly abstract (Krejci, 2009).

One should be aware that virtual teams are not a good solution for every organization. Virtual teams may not fit into the given operational environment or meet the given needs. As Powell et al. (2004) stated: “Virtual teams […] cannot be implemented on faith and they do not represent an organizational panacea.” Another common mistake regarding virtual teams is the management. Virtual teams are often formed and managed using traditional project management paradigms (Donker & Blumberg, 2008). Often, tight schedules force virtual teams to focus on the temporary goals instead of the group development, which leads to an emphasis on mainly factual instead of social or emotional topics (Krejci, 2009), impacting the success of the group. However, if we understand the relationship between the physical world and the e-world of virtual teams, consequently:

> *“The use of appropriate technology, combined with the input of creative employees, is certainly redesigning the ways in which organizations compete globally.” (Bergiel, et al., 2008, p. 107)*

Having the terms virtuality and virtual teams defined, we now discuss trends in virtual project management. The following sections talk about the currently happening paradigm change away from a traditional project management approach toward a more virtual one. An overview as well as a framework of this newly emerging research area will also be given.

2.2.1.4 Project Management Paradigm Change

According to Chen et al. (2003), "current and future PM will be more concerned with project process, explicit communication, and efficient and effective information sharing among contributors" as well as "high levels of collaboration" (p. 1303). Or, in other words, project management will become an inherently collaborative activity (Khazanchi & Zigurs, 2007b; Romano, et al., 2002). Chen et al. (2006a) stated that the "project landscape has changed dramatically during the past decade" (p. 1). Virtual or distributed projects were identified as a new business phenomenon (Chen, Romano, et al., 2003). They are increasingly important for today's modern companies striving for access to global resources and talent (Zigurs, et al., 2007). Also, the business landscape has undergone a major change in the past decade, due to shortened time to market, changing labor costs and international mergers (Evaristo & van Fenema, 1999).

In the past, project managers acted like decision makers and information keepers. Projects were conducted with a top down view and as a result, ordinary project members didn't have much influence (Chen, Romano, et al., 2003). When shifting projects into a global and virtual environment, much more flexibility is needed. Chen et al. (2003) identified three major challenges for VPM: (1) collaboration, (2) knowledge management, and (3) work processes. Again, strong emphasis is put on the high needs of collaboration for a successful outcome. To state a definition, we will from now on refer to a virtual project as

> *"A project in which team members are dispersed geographically and potentially on other dimensions, and are working together to accomplish a specific task under time and resource constraints." (Zigurs, et al., 2007, p. 1)*

The current literature also agrees that management principles for virtual projects differ greatly and cannot be compared to those in place for traditional projects due to the fact that team members have to rely on IT tools to collaborate (e.g., Chen, et al., 2006a; Nidiffer & Dolan, 2005). To effectively study and understand the special needs for virtual projects, Zigurs et al. (2007) developed a practical framework which will be discussed in the next section.

2.2.1.5 VPM Framework

The developed framework from Zigurs et al. (2007) describes a classic input-process-output approach, illustrates the main areas of importance for virtual environments and gives us a good opportunity to clearly define the focused research areas for this thesis.

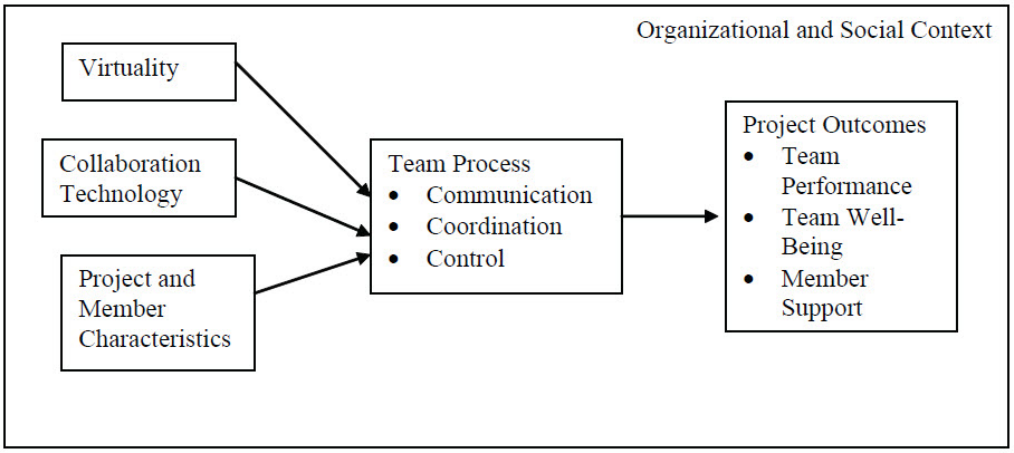

Figure 4. Framework for the Study of Virtual Projects (Zigurs, et al., 2007, p. 2)

The three boxes on the left side of Figure 4 describe the input factors, the middle box the process and the right side illustrating the outcomes. Everything is surrounded by the *organizational and social context*. This refers to the fact that every action within virtual project management is influenced by the organizational characteristics of the given company, and, in a broader sense, also by governmental and environmental issues.

The three ***input factors*** are namely (1) virtuality, (2) collaboration technology, and (3) project and member characteristics. Virtuality was already defined above as "the extent to which project members are dispersed geographically and on other dimensions and rely on information and communication technologies for carrying out team processes and achieving project goals" (Zigurs, et al., 2007, p. 2). The explicit notice of technology is because of the tremendous importance it plays within virtual teams. *Collaboration technology* will be the focus of attention for this thesis and thus will be discussed in more detail below. For now, it is sufficient to be aware that without it, effective communication and process structuring won't be feasible. The third major input factor is *project and member characteristics*. These characteristics define the nature of the project and are influenced greatly by the domain in which the project is conducted (e.g., construction, software development) and the extent of globalization as well as project complexity, risk, and scope (Zigurs, et al., 2007). Project complexity is affected by the project's size and the knowledge, cultural, or language differences within the team. Risk comes in many different categories and varies from phase to phase. Scope is simply the extent of duration, innovation, and breadth of the project (Zigurs, et al., 2007).

Three ***team process*** factors are identified as essential for the success of a virtual project: (1) communication, (2) coordination, and (3) control (Zigurs, et al., 2007). One can find those factors consistently throughout the current literature (for full explanation, see Khazanchi & Zigurs, 2006) which emphasizes their importance. *Communication*, especially, is seen as "in all its form essential to achieving effective control and coordination" (Khazanchi & Zigurs,

2006, p. 28) and "regardless of the type of project, communication was mentioned time and time again as a fundamental necessity" (Khazanchi & Zigurs, 2006, p. 44). We define communication as "the process through which people convey meaning to one another through the exchange of messages and information to carry out project activities" (Zigurs, et al., 2007, p. 3). *Coordination* is required to combine all available resources (e.g., people, technology) in a way that a successful outcome of the given task is achieved; it is a broad-ranging concept requiring actions related to tasks, members, norms, and time (Zigurs, Evaristo, & Katzy, 2001). The final issue is *control*, which is the process of monitoring and measuring project activities to anticipate and manage variances from project plans and organizational goals (Project Management Institute, 2008). Control in virtual projects has specific challenges, like establishing standards, communicating progress or structuring team interaction (Khazanchi and Zigurs, 2006).

The ***project outcome*** factors seek to accomplish more than just simply completing the task. A successful project also creates a sense of commitment for the team members and a feeling that they have contributed to the team (Zigurs, et al., 2007). Again, there are three subcategories: (1) *team performance* simply measures if the task gets done, (2) *team well-being* focuses on the relationships within the team and (3*) member support*, which describes the relationship of a single individual towards the team (Zigurs, et al., 2007). Further research findings related to team outcomes include: managers of virtual teams must allow time for adaptation to technology and towards the team, effectiveness is not only achieved due to technology but much rather demands a focus on human aspects and finally, team cohesion and process satisfaction must be seen as dynamic factors that develop over time (Zigurs, et al., 2007).

This framework provided a good holistic overview for the study of virtual projects. With regards to the research question, the input factor of collaboration technology will be the focus of attention for this thesis. However, since all other factors are of equal importance for project success, they also demand attention.

2.2.1.6 Project Typology for Virtual Projects

As argued, virtual projects differ from traditional projects in a number of ways. Khazanchi and Zigurs (2005) proposed a project typology adapted to the special needs of virtual project management. In their approach, they focused on the essential differences between virtual and traditional projects and used the dimensions of communication, coordination, control, and virtuality as a foundation. They came up with three different types of virtual projects: (1) lean projects, (2) hybrid projects, and (3) extreme projects.

Lean projects have low complexity, narrow scope, and relatively low risk (Khazanchi & Zigurs, 2005). Often, such projects are in-house activities or developments. They are usually conducted by small established, experienced teams; team members know one another and do not have to socialize to come together as a team. The goals and requirements are clearly set and resources allocated. Thus, such projects tend to be easily subdivided into smaller parts that can be achieved by using stable and known methodologies in a relatively short time span. Repeatable practices and well-established processes are used and the management approach focuses on control at all stages. As far as technology is concerned, an emphasis should be placed supporting task performance (Khazanchi & Zigurs, 2005).

Extreme projects, as their name suggests, are the most complex type of virtual projects. They are generally mission-critical, have a broad scope, and a high risk. Intense activity from numerous people who have not previously worked together is required. Physical contact and face-to-face meetings can be rare when a lot of the team's members are dispersed; communication, therefore, is the focus of management for extreme projects. It is important to develop a shared understanding and a strong agreement on the business case and goals with all stakeholders. The supporting technology needs to maintain high levels of communication and support the sharing of context and understanding. Tools capable of meeting these needs are rich context communication tools, which include video conferencing or web-based project management portals.

Hybrid projects are situated between lean and extreme projects and thus, have characteristics from both of them. They are defined as having varying levels of complexity, scope, and risk (Khazanchi & Zigurs, 2005). Teams are often constructed from members within the organization as well as from outside workers; some colleagues will already be familiar with each other, others will have to establish rapport first. However, there is a thread that such team members lack mutual project knowledge and might underperform. Eventual differences are moderated by team members where a high level of trust is already in place. Such projects are a mix of in-house and outsourced development and characterized by a systematic approach to development. The management approach focuses on coordination. This is especially important because members who are already familiar with each other will continue to work together in a way they are already used to; the new and dispersed colleagues, on the other hand, need to be properly coordinated to fit the team "in an environment that mixes the known with the relatively unknown" (Khazanchi & Zigurs, 2005, p. 28). Not only the management, but also the technology in place needs to support coordination. Examples of supporting technology would include knowledge management tools and virtual collaboration systems (Khazanchi & Zigurs, 2005).

2.2.1.7 Collaborative Project Management Approach

The VPM framework recognizes collaboration technology as a major input factor for virtual project management. Hence, we examine the collaborative PM approach by Chen, Romano, and Nunamaker (2006a), which focuses on the technology-component part of PM. This framework was developed because Chen et al. found that "distributed projects impose higher demands for more effective PM, which in turn call for more research and education into PM" (Chen, Romano, et al., 2003, p. 1306) and they wanted to provide guidance to direct this future research. This framework focuses on collaborative PM technologies and discusses four major components that PM software should incorporate. Hence, the framework is important for this thesis and will provide first steps toward understanding how collaboration technology can support PM. To achieve this, they grouped major PM technology functions into four types: (1) basic PM support, (2) knowledge management, (3) process management, and (4) communication and collaboration support (Chen, et al., 2006a).

Basic PM support talks about vital software features like resource-, time-, and cost management, scheduling, status tracking, and reporting. It is considered essential for the management of all kinds of projects (Chen, Romano, et al., 2003) and likely to increase the project managers' awareness of project related activities. Those features also help to make accurate decisions and estimate project progress (Chen, et al., 2006a).

In a virtual project, managers experience a change in their position and role compared to traditional projects (Chen, Romano, et al., 2003). They now have to act more like a coordinator instead of an information keeper. Whittaker (2000) proposed the idea of a flat "network view" where project members share information and files as well as decision-making power. Chen et al. (2003) also underlined that information flows in all directions.

Knowledge management is especially important for virtual projects. Compared to traditional projects, they face a reduced amount of communication, time lags, and elimination of non-verbal cues. Thus, misunderstandings of project information is more likely (Chen, Romano, et al., 2003). It is therefore important to install a project repository that allows timely access to current and accurate information as well as to increase project awareness by capturing key processes. The successful implementation of knowledge management will allow the knowledge to be visible and manageable and thus to be useful for more than one person, particularly if employees leave the project or company. Chen et al. (2006a) identified four components to facilitate information sharing: (1) A project dictionary where methodology and terms should be defined. (2) Business rules and policies where team members can explicitly specify those rules and standards. (3) Project context information, which means that project relevant information (e.g., time, budget) needs to be documented and shared. (4) Comprehensive knowledge capture to capture all project relevant information for later reuse.

Although critical for project success, *process management* is often reduced to only manage project inputs and outputs; the process remains a "black box" in that team members just know that something went wrong, but not what went wrong (Chen, Romano, et al., 2003). Process management is implied after the project begins and aims to ensure that everything is moving toward the goal efficiently and effectively, coordinate the team effort, and examine the progress against the plan (Chen, et al., 2006a). Its purpose is to provide a systematic way of workflows throughout the project instead of ad-hoc working. Especially important for virtual projects, project process needs also to be managed at the operational level (e.g., enforce deadlines for tasks, identify problems and take actions to address those) instead of just at a higher level (Chen, et al., 2006a). The VPM process, with its three components communication, coordination and control (Zigurs, et al., 2007), is especially important in virtual projects and must be tracked at a fine level to increase process visibility (Chen, Romano, et al., 2003).

Communication and collaboration support is a critical factor in VPM because most of the work is done in teams (Chen, Romano, et al., 2003). Holpp (1999) supports this thought: "No skill is more critical to the overall success of a team than the ability of its members to conduct focused, effective meetings" (p. 109). In virtual projects, most meetings are held virtually and thus depend on technology. Collaboration software should therefore support meetings, group decision-making and communication in synchronous and asynchronous mode as well as "allow participants to engage in divergent thinking (e.g., idea generation and issue exploration) and convergent thinking (e.g., idea organization and consensus polling)" (Chen, et al., 2006a, p. 7).

Those four principles should serve as a foundation for effective project management software. However, Chen et al. (2003) have not found a single PM system that provided support for all of the components. Nonetheless, more years have passed and PM software has become more sophisticated. An overview of selected products is provided in section 2.3. Prior to that discussion, however, we will have a closer look on one of those four principles, namely knowledge management. This area promises to be especially valuable for this thesis since it is considered a vital part of a collaborative environment. When work gets accomplished in projects, team member fluctuation will be high because certain individuals will only be needed for certain tasks. That said it is all the more important to preserve knowledge for reuse in future projects.

2.2.2 Knowledge Management

2.2.2.1 Introduction

Liessmann (2009) stated that knowledge can't be managed. He justifies this statement by arguing that knowledge is not something that can be stored in a database. Knowledge cannot be consumed either, but only be achieved through the effort of thinking. However, companies can offer tools and techniques to foster the exchange and interconnection of the knowledge of their team members. Knowledge itself can be defined as meaningful information that is put into a particular context (Tuomi, 1999). Knowledge management is known as "the process of acquiring, creating, sharing, and using knowledge" (Katzy, et al., 2000).

Knowledge management has received a lot of attention in research and business in the last decade. Understandably organizations strive to reuse gained knowledge and become more effective for future work. Petter and Vaishnavi (2008) emphasized this view explicitly for software development and developed the so-called Experience Exchange model for facilitating the reuse of experiences in a narrative form. Within virtual projects, knowledge becomes more specialized and fragmented and the sharing of knowledge is especially important in virtual teams and even affects the success of the project (Qureshi, Min, & Vogel, 2006). Katzy et al. (2000) argue that projects are the prevalent form of knowledge-intensive efforts within organizations and are popular, for example, within consulting, innovation, and research and development. As discussed above, projects have a limited lifetime, which has the advantage of creating high flexibility and bringing together diverse members. Knowledge, on the other hand, is the complete opposite: it should stay around as long as it is usable, which is usually far beyond the life of a project; also, knowledge emerges in stable social and organizational contexts (Katzy, et al., 2000). Bridging those two complementary components is a challenging endeavor.

2.2.2.2 Knowledge Management Framework

Knowledge is created during the project. Projects are goal-oriented and often operate in diverse socio-cultural and organizational contexts. Thus, "projects create the necessity to manage knowledge across time and in a multi-context setting" (Katzy, et al., 2000, p. 2). The challenge is that knowledge transfer is expected to occur within the process and with no explicit time scheduled for knowledge transfer. Knowledge needs to be available for (1) other projects (i.e., across-project transferability) as well as for (2) future projects (i.e., across-time transferability) (Katzy, et al., 2000). The following framework (see Figure 5) considers knowledge management in the context of virtual projects.

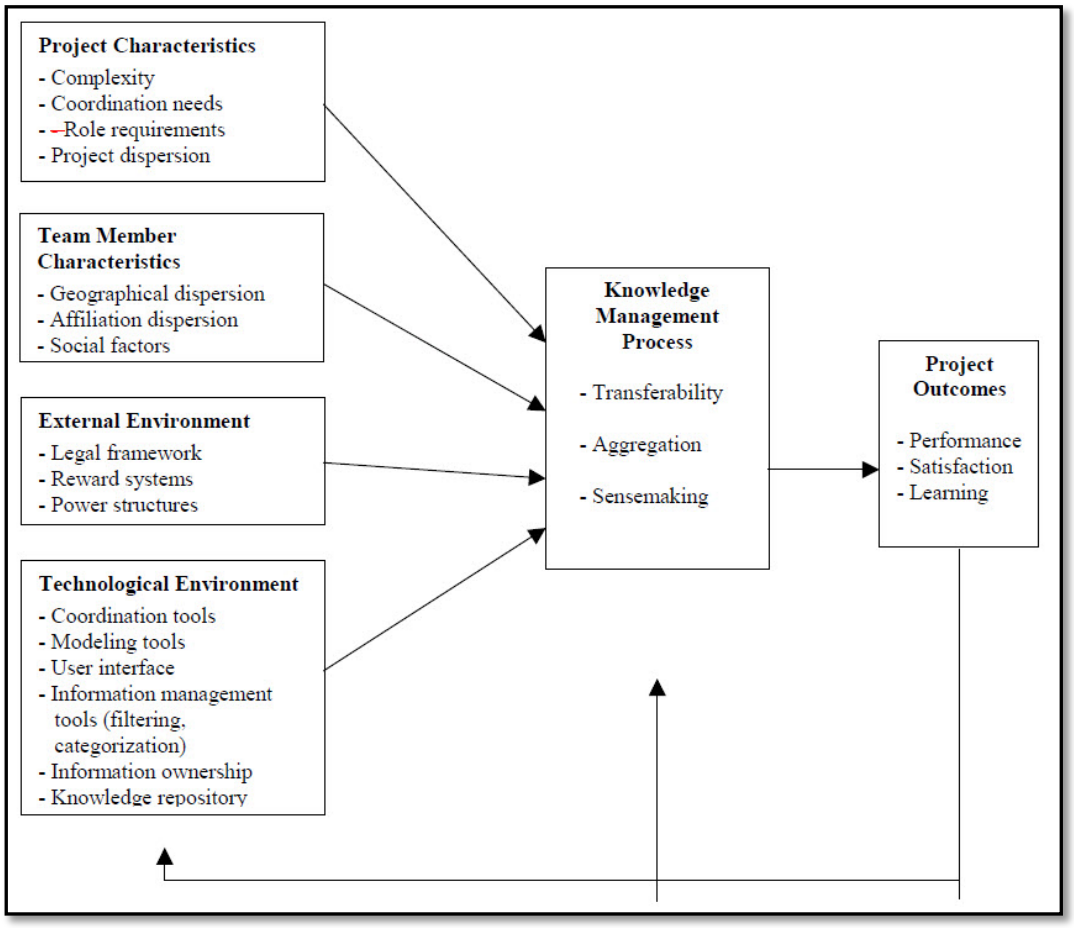

Figure 5. KM Framework in VPM (adapted from Katzy, et al., 2000, p. 4)

There are four *input factors* that influence the knowledge management process: (1) project characteristics, (2) team member characteristics, (3) the external environment, and (4) the technological environment. Of interest for this thesis is the technological environment with its subcategories coordination and information management tools (Katzy, et al., 2000).

The *knowledge management process* itself has to be seen as an ongoing process, which subdivides into three important points. First, *transferability* describes the means of exchanging knowledge across projects as well as across time. Different types of knowledge occur; often, tacit knowledge is developed within the workplace. Schindler and Eppler (2003) point out that software project managers often tend to harvest and not to share their knowledge with one another, thus preventing this knowledge from being used. Furthermore, knowledge is often lost when the project is finished or team members leave the team (Schindler & Eppler, 2003). Experience and knowledge are lost unless they are documented (Hansen, Nohria, & Tierney, 1999). Yet this knowledge is of great value if shared with others and the reused within the organization. However, tacit knowledge is often based on learning by doing, making mistakes and experiences and thus not easily tangible (Katzy, et al., 2000). Nonaka and Takeuichi (1995) describe the conversion from tacit towards explicit knowledge

(called *externalization*) and argue that it is triggered by dialogue or collective reflection. Furthermore, externalization is the key to creating new knowledge; Nonaka and Takeuichi (1995) suggested the use of metaphors, analogy and models to accomplish this process.

Second, the capacity for *aggregation* is important because knowledge needs to be constantly built upon. Therefore, it has to be presented in an obvious way that is relevant and fitting for the given task. The form in which it is presented to the end-user is also decisive as well as connectors and links between ideas are important (Katzy, et al., 2000). Third, *sensemaking* suggests the idea of rather thinking in terms of meaning instead of problems. This concept also stresses the importance of using metaphors in making knowledge explicit.

According to Chen, Nunamaker, Romano, and Briggs (2003), a KM tool can help managing those different forms of knowledge and conversion activities. Team members use collaboration technology to finally meet their goals and the *project outcomes*. In the framework, feedback loops are also included. They suggest that, as mentioned, the knowledge management process profits from the experiences and mistakes gathered in the project outcome. Also, the process may change when the inputs do so (i.e., when the used staff or the technology changes). To summarize, KM is an important part of each collaborative environment and awareness has to be given to the different forms of knowledge that exist. If all the factors involved are considered appropriately, better performance, satisfaction, and learning can be achieved and contribute toward project success.

2.3 Collaboration Technology

A variety of tools and systems are available to support collaboration among teams with features like communication tools, file sharing, and documentation capabilities. However, such tools are not a panacea to get the task done. Technology has to be chosen wisely, keeping in account the nature of the project, the task, and the people involved. The collaborative culture of an organization is even more important than the software choice itself (Sawyer, 2004). Although many technological advances are widely available, many teams still rely on the lowest common denominator, namely e-mail (Zigurs & Khazanchi, 2008).

But why is that so? What measures have to be taken to encourage team members to use the best technology to fit their needs? What are the factors that make people use the technology provided? To find answers to these questions, the next section proceeds as follows. First, a discussion of task-technology-fit models will explain the need to match technology characteristics to task characteristics. After that, the technology acceptance model will explain why people use certain technologies. Then, a more specific discussion of collaboration technologies in virtual project management follows, first introducing two frameworks to provide an

overview and then proceeding with a discussion of recent trends. Finally, a specific collaboration technologies used in virtual projects is presented.

Collaboration is defined as a "joint effort toward achieving a mutual goal" (Chen, et al., 2006a, p. 4). There are, however, different levels of collaboration that can be presented hierarchically; Nunamaker, Romano, and Briggs (2001) discussed three of them: (1) *Collected work* is simply the sum of individual efforts, collaboration and communication are minimal to nonexistent. (2) *Coordinated work*, on the other hand, depends on teamwork and the timely receipt of deliverables from others. Hence, the ability to coordinate efforts and manage activity dependencies as well as more structured processes and specific milestones are important. Finally, (3) *concerted work* requires the highest amount of task and process structure, because individual performance is directly and immediately influenced by the performance of all team members. Work is conducted simultaneously and must be synchronized, which requires constant communication.

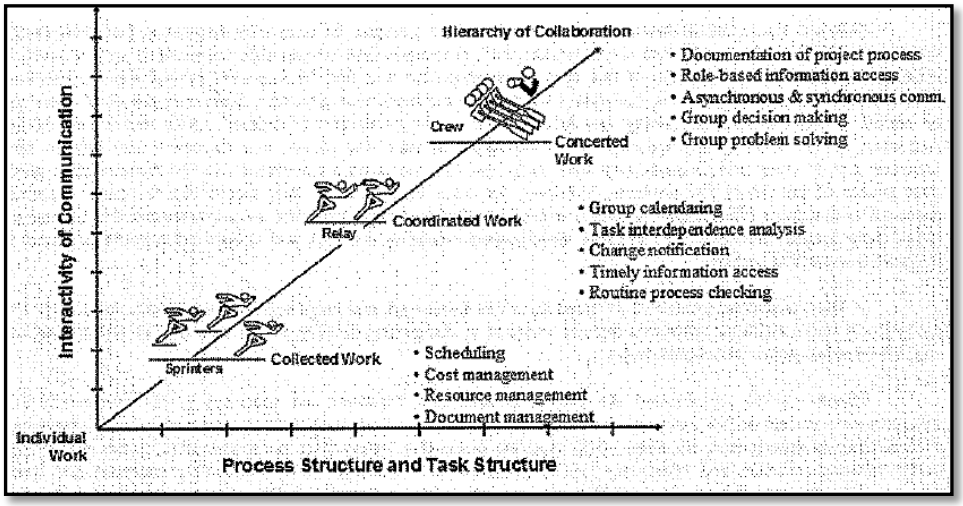

Figure 6. Level of Collaboration and PM Functions (Nunamaker, et al., 2001)

Figure 6 illustrates those three levels of collaboration and lists necessary project management functions for each level. The higher the level of collaboration, the higher the interactivity of communication, and the higher the process and task structure. To support these collaboration activities, technology is often used, particularly in virtual environments. Task-technology fit and technology acceptance helps in explaining why people may adopt or choose not to adopt collaboration technologies to support their work.

2.3.1 Task-Technology Fit

Considerable research has also been conducted regarding the principle of task-technology fit (TTF). Basically, this stream of research posits that an appropriate matching of task characteristics to technology characteristics will eventually lead to increased performance (Becker, Carte, & Chidambaram, 2006). Zigurs and Khazanchi (2008) presented an overview of selected existing models (see Table 3) and, building upon those as well as on the concept of patterns, they came up with a new view on task-technology fit. This model will be discussed in more detail below.

Theory	Key Constructs	Relationships	Source Reference
Media Richness Theory (MRT)	Uncertainty, Equivocality, Media richness	Media richness characteristics (feedback, multiple cues, language variety, and personal focus) determine how well a medium processes equivocal information and thus facilitates understanding.	(Daft, Lengel, & Trevino, 1986); (Daft, Lengel, & Trevino, 1987)
Channel Expansion Theory (CET)	Perceptions of media channel richness, Experiential factors	Experiential factors (channel experience, communication partner experience) affect perception of media channel; the greater the experience, the richer the channel is perceived to be.	(Carlson & Zmud, 1999)
Adaptive Structuration Theory (AST)	Structural features, Spirit, Appropriation process	Variations in structural features (rules and resources) and spirit, along with contextual contingencies, encourage different forms of social interaction; new structures emerge during appropriation process, which is also affected by group's internal system.	(DeSanctis & Poole, 1994)
Task-Technology Fit Theory (TTF)	Task type, Technology dimensions, Fit profile	Different task types based on complexity (simple, problem, decision, judgment, fuzzy) are best matched with differing levels of technology dimensions (communication support, process structuring, information processing) in a set of ideal fit profiles.	(Zigurs & Buckland, 1998); (Zigurs, Buckland, Connolly, & Wilson, 1999)
Fit-Appropriation Model (FAM)	Task type, Technology structures, Fit profile, Appropriation	Task type (generation, choice, combination) and technology capabilities (communication, information processing) must have good fit (ideal profiles), but appropriation support (e.g., guidance, facilitation, training) must also be provided.	(Dennis, Wixom, & Vandenberg, 2001)

Table 3. Selected Theories of Task-Technology Fit (adapted from Zigurs & Khazanchi, 2008)

2.3.1.1 A Patterns View on Task-Technology Fit

Table 3 provided an overview of some selected theories of TTF. They all have in common that they try to guide the way to explain how a tool should best fit a given problem. Or, in other words, "the group's use of collaboration technologies can be facilitated by a fit between the task characteristics and the capabilities of the CT [i.e., collaboration technology]" (Carte & Chidambaram, 2004, p. 467). However, the theories listed above are all based on a classic approach of "defining separate constructs and establishing relationships among them on the basis of specific characteristics or types" (Zigurs & Khazanchi, 2008, p. 9). Zigurs and Khazanchi argued that such a taxonomic approach is not sufficient to describe the task-technology fit encountered in a virtual environment. We have already defined the nature of virtual teams (see 2.2.1.1) as at least geographically dispersed. This complex and shifting context requires a more holistic approach compared to classic (i.e., non-dispersed) environments; such an approach can be found using the theory of patterns.

Khazanchi and Zigurs (2005, 2006, 2007a, 2007b) promoted their ideas of using pattern theory in virtual projects and furthermore adapted this approach to use it for task-technology fit models (2008). Pattern theory was first described by Alexander (1965) and has its roots in the domain of architecture. The ideas were later converted to the discipline of software engineering and used for an object-oriented approach in the 1990's (Gamma, Helm, Johnson, & Vlissides, 1994). In essence, the concept of patterns is based on making sense of complex behavior by discovering certain regularities in such behavior (Khazanchi & Zigurs, 2006). Khazanchi & Zigurs (2006) furthermore illustrated patterns as "means of providing holistic, 'abstractions of experiences' that are profound in some way, and can be implemented to solve problems in a specific context" (p. 30). A formal pattern is composed of three parts: a specific context, a problem, and a solution. The problem is a set of forces that occur repeatedly within that context. In the solution, the forces are tried to be arranged so that they can resolve themselves (Zigurs & Khazanchi, 2008). Zigurs and Khazanchi (2008) defined patterns in terms of task-technology fit as:

> *"Representations of specific management and team member practices that contribute to the effectiveness or ineffectiveness of virtual teams. These practices would include individual behaviors, processes, technology, and tools." (p. 10)*

This approach allows to first think of a solution and the collaboration needs and then to make sure that these needs are met by the technology. Thereby, those technical capabilities are embedded in a narrative form (e.g., description of the problem) and easy to comprehend and apply (Zigurs & Khazanchi, 2008). Refer to Table 4 for an example.

Manage Shared Understanding	
Content	Team members do not feel that they are a unified whole. People feel they are working independently rather than together.
Problem	How do you create synergy in your team and a shared understanding of project goals?
Solution	Use face-to-face or video conferencing to introduce and socialize team members at the inception of a project. Communicate clearly and often on project goals and individuals' roles in the project. Create a culture that encourages sharing of issues, sharing of all project-related information, discussion of solutions, and flexibility to accept differences.

Table 4. Pattern Example (adapted from Zigurs & Khazanchi, 2008, p. 11)

To match a certain task with an appropriate technology is important because it is likely to improve team performance. Besides task-technology characteristics, social influence and user experience can also impact a group's technology choice (Becker, et al., 2006). To summarize, TTF theory helps to comprehend how to best match technology capabilities with the tasks that teams need to fulfill. A pattern view on TTF promises to be particularly relevant in the contexts of virtual environments and thus, should be considered to select the best technology support for collaboration.

2.3.2 Technology Adoption

2.3.2.1 Introduction & History

Technology adoption helps to understand why some people adopt a certain technology and why others do not. Technology acceptance is a mature stream of information systems research (Venkatesh, Davis, & Morris, 2007), and was introduced in two papers (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) that are frequently cited (some 6800 and 4000 citations[9]) in both IS research and other disciplines (Venkatesh, et al., 2007). Since the original technology acceptance model (TAM) was developed, TAM has progressed continually with new external variables and adaptations of the model in changing environments.

2.3.2.2 Technology Acceptance Model

The technology acceptance model was adapted from the Theory of Reasoned Action (TRA), which is drawn from social psychology. TRA is one of the most fundamental theories of human behavior (see Fishbein & Ajzen, 1975). TAM is considered a powerful and influential theory to describing an individual's acceptance of an information system (Lee, Kozar, &

[9] Numbers received from *Google Scholar* (http://scholar.google.com) in January 2010

Larsen, 2003). According to Davis (1989) and Davis et al. (1989), there are two major variables that predict an individual's IS acceptance:

(1) Perceived Usefulness

(2) Perceived Ease of Use

These two constructs are "hypothesized to be fundamental determinants of user acceptance of information technology" (Adams, Nelson, & Todd, 1992, p. 227). *Perceived usefulness* is "the prospective user's subjective probability that using a specific application system will increase his or her job performance" whereas *perceived ease of use* "refers to the degree to which the prospective user expects the target system to be free of effort" (Davis, et al., 1989, p. 985). Venkatesh and Bala (2008) pointed out that within TAM, the effect of external variables, such as design characteristics, on behavioral intention are mediated by both perceived ease of use and perceived usefulness. They also stated that "TAM consistently explains about 40% of the variance in individuals intention to use an IT and actual usage" (p. 276).

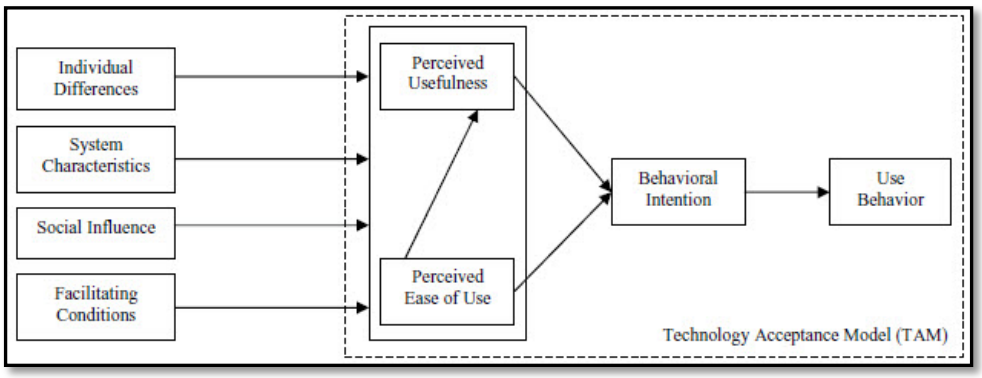

Figure 7. Theoretical TAM Framework (Venkatesh & Bala, 2008)

Figure 7 illustrates a simplified version of the technology acceptance model (within the broken line) and additionally, four different types of determinants of perceived usefulness and perceived ease of use (on the left side). As Davis (1989) stated in his original work,

> *"It should be emphasized that perceived usefulness and ease of use are people's subjective appraisal of performance and effort, respectively, and do not necessarily reflect objective reality." (p. 335)*

Those factors have been identified over years of intensive research to influence the user behavior. Now that those general terms are clarified, more specific collaboration technology used for virtual teamwork can be investigated.

2.3.3 Collaboration Technology in VPM

Collaboration technology is one of the three major input factors presented within the VPM framework (see 2.2.1.5 VPM Framework). Zigurs et al. (2007) recognized the ability of capturing variability in technology features as the major challenge in defining collaboration technology. Furthermore, as implied by TTF, it is necessary that the appropriate technology is provided to support tasks related to communication, structuring the team process, and information exchange. Qureshi, Min, and Vogel (2006) lamented that

> *"Most tools and techniques for project management focus on on-site, long term relationships and sourcing strategies at a time when inter-organizational relationships are becoming more dynamic and geographically dispersed." (p. 55)*

Projects are increasingly flexible, short-termed, and globally dispersed. Teams are often composed of diverse members with varying skills and backgrounds. Nevertheless, they need to work together effectively to meet project goals on schedule; often, training time is short or missing at all. As Karpova et al. (2009) noted:

> *"Global team members are expected to quickly establish and maintain reciprocal relationship with people from various backgrounds, relying on computer-mediated communication only." (p. 49)*

Thus, teams have a strong need for tools that meet those new and flexible requirements and are intuitive and easy to use at the same time (consistent with TAM). Such tools are essential for supporting virtual projects (Qureshi, et al., 2006). In their collaborative project management approach (see 2.2.1.7 Collaborative Project Management Approach), Chen et al. (2003) restricted PM support systems to systems that facilitate the management of time, cost, task analysis, resource allocation, and status tracking; however, they did predict that "the trend is toward web-based PM systems that provide all basic PM support and also include more advanced features" (p. 1312). This thesis will examine this trend and will take a close look at recent developments in the area of web-based collaboration tools. After all,

> *"[…] The technology needs to create and support a social space in which coordination and task activities can occur – a 'where' for the virtual project that gives members a sense of place, even in the midst of the dynamic and volatile environment that characterizes virtual projects." (Zigurs, et al., 2001, p. 19)*

2.3.3.1 Collaborative Project Management Framework

The collaborative project management approach developed by Chen et al. (2006a) was already discussed in chapter 2.2.1.7. To summarize, four major components of a successful PM system were identified: (1) basic PM support, (2) knowledge management, (3) process management, and (4) communication and collaboration support. Building upon this ap-

proach, Chen et al. (2006a) further developed a framework for collaborative project management systems (see Figure 8).

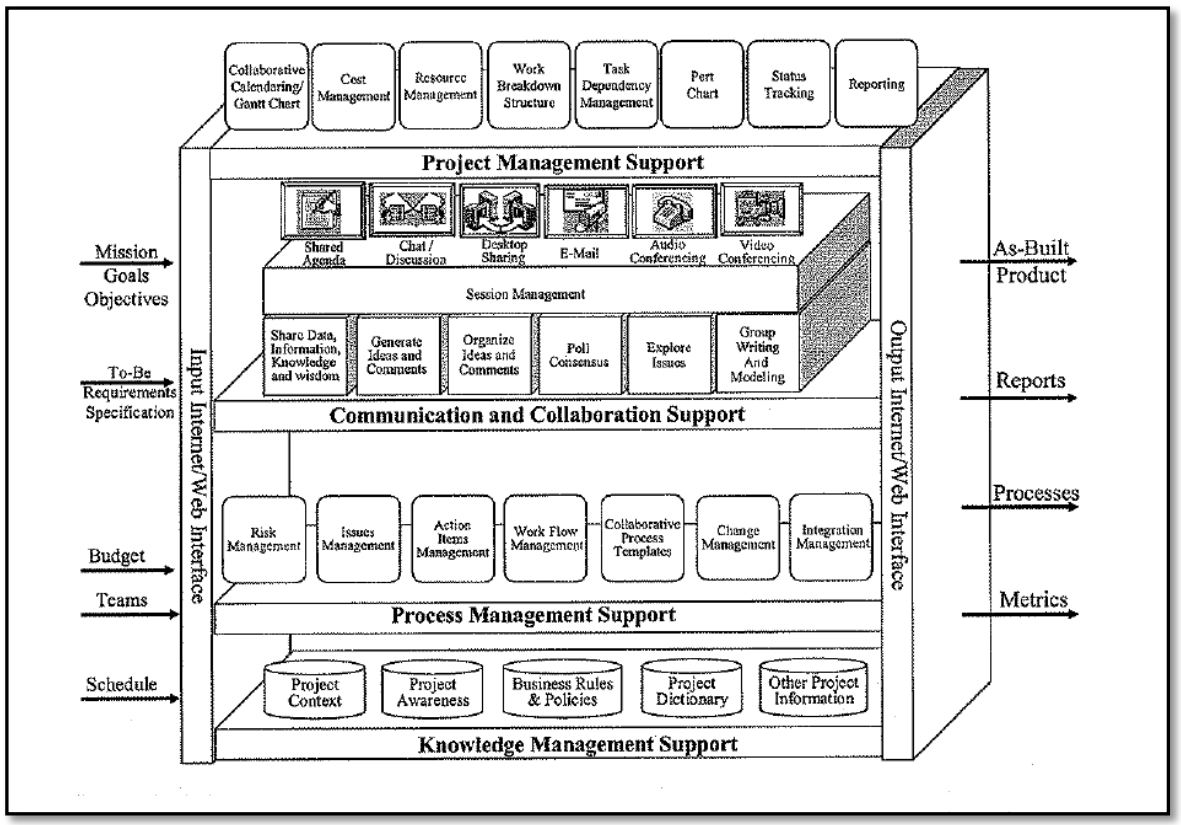

Figure 8. A Collaborative Project Management Framework (Chen, et al., 2006a, p. 10)

The framework shows all vital features that a system for collaborative project management needs to embody. It is important to state that the framework does not require a single tool to feature each of the components, but rather a collection of tools should represent all of the features. Section 2.3.4 will cover this issue in more detail. Discussing each function mentioned in the framework is beyond the scope of this thesis but for now, the framework provides a good high-level overview about the complexity of collaborative technologies.

2.3.3.2 Model of Electronic Collaboration Effects

Qureshi et al. (2006) analyzed virtual team interactions and identified three main categories of electronic collaboration within virtual teams, which include (1) communication, (2) coordination, and (3) adaptation (see Figure 9 for an illustration). Within each category, concepts and outputs were identified. The concepts, found on the left side of each box in Figure 9, lead to appropriate outputs, found on the right side. Each category is discussed in more detail below.

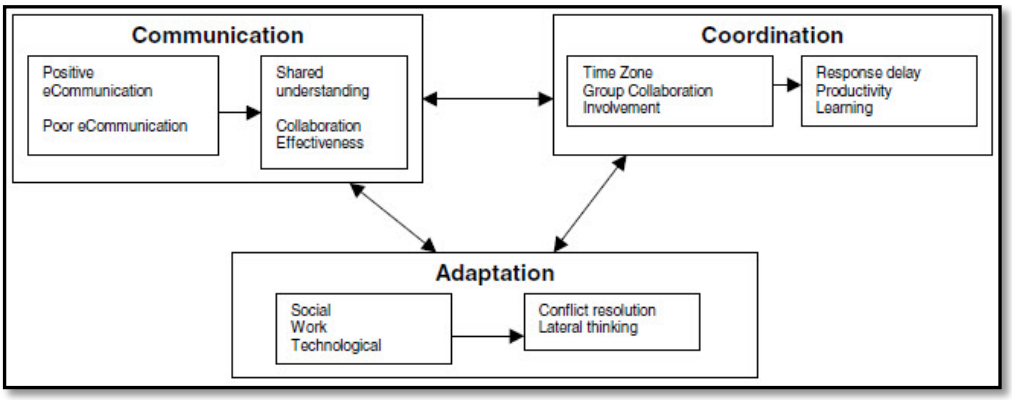

Figure 9. Model of Electronic Collaboration Effects (Qureshi, et al., 2006, p. 71)

Communication was identified as a major, or even *the* key, concept for the success of virtual teams throughout the literature. Qureshi et al. (2006) agreed with this view and further stated that effective communication means to understand, not simply to transport information. Khazanchi and Zigurs (2006) also shared this opinion by stating that communication is a way for people to convey meaning to one another. Due to the dispersion of virtual teams, team members rely heavily on information technology to communicate (Powell, et al., 2004). Not surprisingly, positive eCommunication led to shared understanding. Shared understanding is seen as "communication of different perspectives and exchange of information through which behaviors are modified and/or action is carried out" (Qureshi, et al., 2006). Negative eCommunication was also observed, which had a negative impact on the success of the project. However, those issues related more to problems with interpersonal communication rather than problems with the technology (Qureshi, et al., 2006). The second outcome of successful communication is effective collaboration; to achieve those two concepts, virtual teams need to be supported through collaborative processes and technology (Qureshi, et al., 2006).

Coordination is also a key component for virtual teams. It can be classified as a mechanism through which people and technology work together; Due to the time and cultural dispersion of global teams, coordination is a special challenge. The more dispersed the team members are (e.g., time zone difference), the more asynchronous the communication will be. Because real-time communication is often missing, delays in responses occur and problem-solving cycles are lengthened (Qureshi, et al., 2006). Another concept within coordination is group collaboration; it is seen as "the act of constructing relevant meanings that are shared by all parties involved to achieve congruent goals" (Qureshi, et al., 2006, p. 65) and the suggested outcome was productivity. The study found that productivity was achieved by planning ahead to work throughout the 24-hour cycle. The third concept related to coordination was involvement, which is a team member's ability to actively participate and interact in the project context. The linked outcome with involvement was learning, which is also seen as an essential ingredient for the production of successful products or services (Qureshi, et al., 2006). Fur-

thermore, the coordination of involvement and learning can be effectively achieved by using collaboration tools.

The third concept in the model of electronic collaboration effects is *adaptation*. It is defined as "the process by which members of a group learn to engage with themselves, the distributed work environment and the collaborative technologies with which they work" (Qureshi, et al., 2006, p. 67). Adaptation is especially important in a virtual environment because work practices usually differ significantly from accustomed ones. Adaptation appears in three main components: social, work, and technological, where technological seems to be most apparent. Social adaptation means to adapt to agreed patterns of interaction and rules within the group and leads directly to the outcome of conflict resolution. Work adaptation is the adaptation of technology to team member's own ways of working and is seen as essential for successful collaboration by enabling virtual teams to overcome cultural differences and provides a basis for open discussions (Qureshi, et al., 2006). The connected outcome is lateral thinking, the ability to adapt to new and unconventional ideas to solve problems. The study identified that adaption to technology as especially important. Also, the more flexible the technology is, the easier it is to adapt to it (Qureshi, et al., 2006).All team members need to learn how to use the technology provided to ensure effective teamwork.

To summarize, the three factors of communication, coordination, and adaptation are essential for virtual collaboration. The above framework is helpful to explain „why virtual teams function in the ways that they do and predict how distributed projects can be managed better" (Qureshi, et al., 2006, p. 74).

2.3.3.3 A Lean Approach

Another principle that has received a lot of attention recently is the concept of "Lean IT". The central thought is to eliminate everything that adds no value to the customer or service. Lean principles first emerged in the area of car manufacturing, namely within Toyota (see Poppendieck & Poppendieck, 2006). They were then adopted to the domain of software development by Poppendieck and Poppendieck (2006), who defined seven main lean principles (see Table 5 for a summary).

Lean Principles	
Eliminating waste	Everything that does not add value for the customer is considered waste and has to be eliminated (e.g., bureaucracy, unnecessary functionality)
Amplify learning	Different approaches and ideas should be tried and tests should be run as soon as possible and frequently

Decide as late as possible	Better decision can be made when based on facts and gathered knowledge; Therefore, to avoid uncertainty, decisions should be made as late as possible
Deliver as fast as possible	Fast releases lead to fast feedback which can be used to improve the learning and thus the product
Build integrity in	The customer needs to see all the different aspects of the system as a whole
Empower the team	Managers should listen to their experts instead of telling them what to do – also, things like motivation and a higher purposed need to be focused on instead of simple output
See the whole	All principles need to play together and interact as a whole

Table 5: Lean software principles (adapted from Poppendieck & Poppendieck, 2006)

From this paradigm, the terms of "Lean Services" (i.e., application of the lean concept to service operations) and "Lean IT" (i.e., application of the lean concept to development and management of IT products and services) evolved. The most important principle is the elimination of waste, or in other words, the reduction of unnecessary features or services that add no value to the customer. This leads to increased simplicity and thus to an increased ease of use and lower barriers of use. With such an approach, team members and customers can focus on the essential workflows. This is important because in today's workplace, IT is simply substantial to support core business processes and a prerequisite for companies that want to compete in the market. IT shifted away from simply supporting the back office towards delivering real customer value (e.g., for an online retail store, IT enables the customer to do everything from browsing the products to making the payment). That is, of course, especially true for IT companies and for those working with dispersed teams. Zigurs et al. (2007) supported that view by arguing:

> *"It seems that lean tools such as wikis (versus feature-rich groupware tools) may provide the flexibility and ownership that create an ideal circumstance for engendering improved communication, enhancing credibility of shared information, building trust, and developing a shared understanding of the project." (p. 4)*

To summarize, a recent trend for software is to get rid of unnecessary or rarely used functions (i.e., waste) and instead focus on the essential ones. The concept of Lean IT proves to be beneficial for VPM because an increased ease of use of IT systems will enable external or new team members to quickly adopt to work processes and develop a shared understanding of the project. Thus, increased simplicity can lead to an overall better performance. This is especially true for web-based platforms due to their browser-based nature. Such platforms are the state-of-the-art tool when it comes to virtual project management and global collaboration. A lot of cuts have to be made to adapt to this new environment, discussed below.

2.3.3.4 Web 2.0

No slogan has been hyped more and has been as present in the media as "Web 2.0". But what exactly is behind the name? "Web 2.0" was first coined by Darcy DiNucci back in 1999 in her article "Fragmented Future[10]", but it did not surface again until 2004 when O'Reilly Media hosted the first Web 2.0 conference (see Graham, 2005). However, the term does not stand for any technical innovation or update to the web; moreover, it describes a change in the way of *how* developers and users interact with the Internet. In earlier years, most web sites were a static presentation of information that could only be viewed. Web 2.0, on the other hand, suggests a strong involvement in actively influencing and editing the content or a web site (e.g., information sharing and collaborating). It could also be seen as a social and business phenomenon. Examples span a wide range from social-networking sites (e.g., Facebook[11]), video-sharing sites (e.g., YouTube[12]), blogs (see 2.3.4.5), wikis (see 2.3.4.6), or other services. The huge success and popularity of those web sites is unquestionable and can be illustrated by Facebook ranking second and YouTube ranking third of the "Top 500 Global Sites[13]" list by Alexa®, beaten only by the search engine Google. O'Reilly (2007) illustrates the concept as:

> *"[…] Web 2.0 doesn't have a hard boundary, but rather, a gravitational core. You can visualize Web 2.0 as a set of principles and practices that tie together a veritable solar system of sites that demonstrate some or all of those principles, at a varying distance from that core." (p. 18f)*

After the term was generally established, many companies claimed to incorporate "Web 2.0." But what principles hide behind this expression? A defining characteristic is to treat the users of the service as the biggest asset and even see them as co-developers. Almost every successful Web 2.0 application relies massively on user data and the monitoring of user behavior. That, of course, creates a massive amount of data that needs to be properly stored and managed in a database, which can be seen as another core competency of Web 2.0 companies (O'Reilly, 2007). Furthermore, a lot of Web 2.0 success stories enjoyed frequent further development from an (unpaid) user base. As O'Reilly (2007) states, "[…] the most successful web services are those that have been easiest to take in new directions unimagined by their creators" (p. 32f). This implies that the code needs to be either open to the public or easily access- or "hack"-able. The programming models used are lightweight and object oriented. Also, the services must be available on multiple platforms. Because web applications per se are available for every operating system, this is much rather important for mobile devices like

[10] http://www.cdinucci.com/Darcy2/articles/Print/Printarticle7.html, accessed January 20, 2010
[11] http://ww.facebook.com
[12] http://www.youtube.com
[13] See http://www.alexa.com/topsites, received January 21, 2010

smart phones, which are becoming more and more popular and embody the next big course of action for online services.

Another important term in this context is “Software as a Service” (SaaS). It basically describes the business model of licensing a software product to a customer on demand (i.e., for the time needed) for the use as a service. This is in contrast to the “traditional” software sales strategy where licenses are not sold for a certain period, but per user. Another important difference is that the software is hosted on the vendor’s web server rather than distributed to the customer. This model implies some interesting advantages, especially for small businesses that usually do not have a separate IT department. First of all, they can focus on their core competency instead of spending money for building up their own IT infrastructure. Also, cost transparency will be increased because the software has only to be paid for if actually used. On the other hand, common disadvantages include the strong dependence on the vendor (and the vendor’s hardware) and the outsourcing of data and corresponding legal issues. This is, of course, a serious concern, because with SaaS, the only connection to the vendor is the Internet line; should the vendor go bankrupt, the client company might as well. Despite those issues, according to Grohmann (2009), the use of SaaS in the business area has been growing constantly and rapidly within the last few years and is yet only at its starting point. Web-based collaboration tools for project management are frequently offered as a SaaS. Some selected technologies and specific tools that embody some or all of those principles are presented and discussed in the following section.

2.3.4 Overview of Collaboration Technology

> *“The careful choice of technology and its flexible and thoughtful use is a key contributor to distributed project success that is only beginning to be understood and warrants considerable extended research.” (Qureshi, et al., 2006, p. 73)*

Consistent with TTF, this quote emphasizes the importance of choosing the right tool for the right purpose. Donker and Blumberg (2008) addressed a similar problem as they believe that for a lack of efficiency within virtual projects,

> *“[...] Neither project management tools, nor collaborative software can be blamed alone. One very essential problem is that there is no connection between these areas. Today, numerous collaborative tools are available, but none of them are facing the lack of interfaces to affect processes, workflows and different phases of teamwork. Thus, it is not clear in which context these tools should be used.“ (Donker & Blumberg, 2008, p. 41)*

For example, within a single project, Microsoft Project could be used as a project management tool to schedule working times and deadlines; e-mail, instant messaging and telephone would be used for communication; and an online storage for file exchange between the team

members, could all be used as collaboration tools for the project. At this point, clear guidelines need to be communicated to prevent team members from misusing tools.

In the previous chapters of this literature review, basic findings, constructs, and models were discussed. The following sections now focus on concrete, web-based tools and technologies. Donker and Blumberg (2008) pointed out that "in almost all cases, work is coordinated using different project management tools" (p. 41). Along similar lines, Chen et al. (2006a) stated that "in practice, team members may need to use different systems for different functions to support their project activities" (p. 8). This underlines the assumption that there is no single or all-in-one solution, but rather a set of tools is being used. They further state that "the lack of effectiveness of virtual teams is based on insufficient interfaces between project management and collaborative tools" (p. 41). The following discussion is not intended to be exhaustive, and only selected tools are listed based on their qualities and relevance to this research.

Collaboration tools can be either classified as synchronous or asynchronous. Synchronous tools allow for immediate feedback from the communication partner, for example via telephone or instant messaging. Asynchronous tools, on the other hand, are characterized through a delay in their feedback. A classic example would be e-mail, where usually no immediate response occurs. With asynchronous communication, feedback time increases, but the advantage is that the other team member does not have to be online or available to receive the message. This is especially important in a setting where significant time zone differences occur.

An ongoing debate is whether information should be "push" or "pull" (Zigurs et al., 2007). The difference is that "push" tools automatically transfer information to the user while "pull" tools waits until the user explicitly retrieves that information. "Push" tools create a higher awareness because the user will receive the information as soon as it is available. On the other hand, such tools are more time consuming to manage and appropriate information needs to be filtered (e.g., e-mail) (Zigurs, et al., 2007). An example for a "pull" solution is a message board where a user logs in and then specifically decides which information he or she wants to access.

2.3.4.1 E-Mail

We have already noted that "e-mail is still widely used as the 'lowest common denominator,' even with all its shortcomings in the face of complex needs for communication, coordination and control" (Zigurs, et al., 2007, p. 4) and identified it as asynchronous. But often, the tool of choice is still simply e-mail (Hietikko & Rajaniemi, 2000; Zigurs & Khazanchi, 2008). This is understandable, because everybody in today's workplace is familiar with this sort of collaboration and, as long as an internet connection is in place, it is available everywhere, robust

and easy to use. However, a lot of disadvantages go hand in hand with this choice, too. For example, no central repository exists. Instead, unordered versions of documents are spread across team members and data transfer rates are unnecessarily high. Also, unwanted and unnecessary messages (spam mail) are a serious concern. Conlin (2005) quotes a study from the web-security provider Postini Inc.[14] that the amount of legitimate e-mail dropped to just 8% in 2005. The situation did not improve in the recent years. A study by anti-virus software company McAfee published in 2009[15] also showed that 92% of all e-mails sent are classified as spam mails (Bracco, 2009). Because of such statistics and according to Conlin (2005), more and more companies begin to change from e-mail to other software tools that function as real-time workspaces.

2.3.4.2 Document Management & Sharing

There is a rising trend towards putting the long-established office suits (e.g., Microsoft Office) onto the Web (often referred to as "Office 2.0"). Of course, those solutions offer only a fragment of the features because they operate in a web browser (e.g., Microsoft Internet Explorer or Mozilla Firefox). The main advantage of this is that no additional installation is needed and the files can be accessed from every computer with an Internet connection and a web browser and can thus be classified as a typical SaaS application. Furthermore, in contrast to "normal" office suites, those services (e.g., word processing, spreadsheets, and presentations) are often free, which makes them a considerable alternative for small companies as they become better developed. Moreover, most office suits offer functionality to read and write in the major office suite file formats (e.g., Microsoft Office, OpenOffice) and export to PDF, which makes integration possible. *Google Docs*[16] and *Zoho Office*[17] are two prominent examples of such online office suits. With Google Docs all services are provided for free, but Zoho also offers some premium features against payment, including a project management feature[18].

A major benefit of those online solutions is the easy collaboration and sharing with others, as all files stored on a server. Additional editors can be invited through e-mail and read or write permissions granted. In contrary to traditional office suits, people can collaborate in real-time and work on the same document or spreadsheet stored in a central location. This way, team members immediately see the work completed by other collaborators. Individuals are confident they are working on the latest version of the file. On the other hand, a major concern

[14] Acquired by Google, Inc. in 2007 and now known as "Google Postini Services"
[15] McAfee Threats Report: First Quarter 2009. Accessible at http://resources.mcafee.com/content/AvertReportQ109
[16] http://docs.google.com
[17] http:// zoho.com
[18] http://projects.zoho.com

with this approach is that all files are stored on a server outside the company and problems with data security and ownership of data may occur.

An example for effective file sharing is via the Internet is *Dropbox*[19]. The user gets up to 2 GB of free online storage and an application to quickly synchronize files and folders from the local operating system (available for Windows, Mac, and Linux). Similar to Google Docs and Zoho, users can be granted access to certain files or folders or made publically available. A version tracker is also included. This means that older versions of files can be restored at any time if important information should be lost.

2.3.4.3 Voice over IP / Instant Messaging

VoIP (i.e. Voice over IP) means nothing more than making phone calls using computer networks, relying on Internet standards. Computers, specialized phones (IP phones), and regular telephones using an adapter can all be part of the VoIP communication process. When using a computer, the user needs special software enabling VoIP calls. There is one application in particular that stands out and is widely spread: *Skype*[20].

Skype is a videoconference system that works via a peer-to-peer VoIP connection. It is downloadable for free and, as long as a headset and an Internet connection are available, a very cost-effective way to talk to people over long distances. Another big advantage is that conference calls can be arranged very easily, which is good for group discussions. As cited in Karpova et al. (2009), "Skype is free and easily available and super easy to use" (p. 47). If a web cam is in place, the video function can be very helpful for building early trust and connecting a face to the voice heard. The author experienced that first-hand when collaborating with geographically dispersed students on a common project; one feels much more connected to those students when a video-call takes place. Conversations about hobbies or common preferences emphasized this connection and the level of trust rose. Qureshi et al. (2006) came to the same finding when they concluded that,

> *"Although historically seen as 'noise' by some researches and businesses, theses non-task focused interactions play an important role in achieving team member trust and sustaining communication and involvement of distributed team members." (p. 72)*

This experience is in line with the much discussed importance of face-to-face conversations early in a project (e.g., see Bergiel, et al., 2008; Powell, et al., 2004).

Skype also offers an instant messaging function, which is commonly used. According to Alby (2008), instant messaging (IM) is one of the most used services on the Internet. IM (also

[19] http://www.dropbox.com
[20] http://www.skype.com

known as “online chat”) describes a collection of technologies featuring text-based, real-time communication process between two or more participants using computers, or increasingly, mobile devices. A software client or web service is needed to participate and users have a list of saved contacts (“friends list”). The main difference to e-mail is that those chats happen in real time, making them an efficient communication tool without delays. Often, additional features such as file transfers or video conferencing are offered. Software developers recognized this huge potential and developed so-called enterprise instant messaging (EIM) systems for business application. IBM included an EIM feature in its groupware Lotus Notes called “Sametime” and Microsoft did the same with their Exchange Server. Popular consumer IM software clients, besides Skype, include ICQ[21], Yahoo! Messenger[22], or Windows Live Messenger[23] and are, contrary to EIM clients, free of charge.

2.3.4.4 Groupware

Groupware aims to ease the collaboration effort of users working towards a common goal, or in other words “a major premise underlying groupware is the coordination of activities and people across time and space” (Orlikowski, 1992, p. 368). Often, the users are temporarily or geographically dispersed and the groupware tries to increase the group awareness. This means that a certain user will be informed and updated on what the other users of the system have accomplished. Common features include e-mail, calendars, contact and address management, file repository and to-do lists. Groupware has its origins in the early 1990s[24] when networks and technology became more capable and big companies faced the need for a software product to coordinate dispersed teams. IBM’s Lotus Notes appeared on the market as a major example of this category. An early definition that is still valid today was stated by Ellis, Gibbs, and Rain (1991), describing a groupware as a “computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment” (p. 40).

2.3.4.5 Blogs

A blog (a contraction of “web log”) is a web site which is regularly updated by an individual, usually providing information about a certain type of topic or material, using text, graphics, or videos. An important feature of many blogs is that users get the opportunity to comment on the posts and participate in discussions. Blogs can be a useful tool for internal communication as well as for external use (e.g., to publish a status report) (Hastings, 2009). Of course,

[21] http://www.icq.com
[22] http://messenger.yahoo.com
[23] http://windowslive.com/desktop/messenger
[24] Release 1.0 of Lotus Notes was shipped 1989. See http://www.ibm.com/developerworks/lotus/library/ls-NDHistory (accessed May 12, 2010) for a complete history

private web pages have been around since the Internet has been in place, but what made blogs such a huge success in recent years is in partly due to a technology called RSS (Really Simple Syndication[25]). It is used to publish entries of frequently updated web pages (e.g., blogs) in a standardized form. A user can easily subscribe to blogs of his or her choice on multiple platforms (e.g., smart phones or desktop computers). Another important characteristic of blogs is that they are interlinked; this way, the collective mass of active web users decides what's important (often referred to as "the wisdom of crowds"). A recent trend that became increasingly popular is micro-blogging, which features short messages of only 140 characters. The most famous representative for this kind of blog is Twitter[26].

2.3.4.6 Wikis

A wiki (Hawaiian for "fast") is a collaborative, interlinked web site where users can easily create, edit, and share content. Ward Cunningham, the creator of the first wiki software[27], defined a wiki as "the simplest online database that could possibly work" (2002). A wiki provides a space for collaborative group work, with an important feature that allows users to roll back to a previous version of the document (Hastings, 2009). Another crucial feature is that everybody, computer expert or not, is able to work with the system. This is often achieved by using a WYSIWYG-editor ("What You See Is What You Get"), where no coding skills are required to produce web content and functionality is reduced to the essential features. Zigurs et al. (2007) also emphasized the importance of such easy-to-use, lean tools that enable collaboration for all team members. Another advantage of wikis is that most of the underlying software is open source and free to use, meaning it can be downloaded, extended, and hosted on the company's own web server. With this technology, the discussion of the ownership of data is solved because it is stored within the IT structure of the firm. Wikis provide simple knowledge management because everyone is able to create content and share his or her ideas and experiences. Especially with the help of multimedia data like screenshots or video casts, valuable thoughts can be preserved and accessed in an effective way. The most popular publically available wiki is Wikipedia[28], a free online encyclopedia. It is based on a "radical experiment in trust" (O'Reilly, 2007, p. 23), the principal that any web user can add and edit any content. The experiment is unprecedented, and Wikipedia currently ranks sixth in the list of the "Top 500 Global Sites,[29]" serving as a knowledge repository for millions.

However, Miguel (2009) claimed in his article that wikis "came to represent the best of the true democratic, user-generated nature of the Web" Wikis have proven to be successful and

[25] Most commonly used, but not standardized expansion; also common: "Rich Site Summary"
[26] http://www.twitter.com
[27] WikiWikiWeb, http://c2.com/cgi/wiki
[28] http://www.wikipedia.org
[29] See http://www.alexa.com/topsites, received January 22, 2010

many companies implemented such platforms for knowledge sharing. Miguel (2009) also cites a manager talking about a "wiki mindset", a payback model where people now feel the need to share information for free. He concludes by stating that "wikis rely on editing and vetting for their credibility, while social networks are all about throwing caution to the winds and having a good time." But actually, social networks proved to be quite more than just an instrument for having fun.

2.3.4.7 Social Networks

The enormous success story of social networking sites, in particular Facebook, was already discussed above. Such sites are commonly affect private life and are separated from the workplace. According to Brensilber (2009), 40% of US companies have banned access to Facebook from the workplace. Stories of people getting fired because of improper activities viewed by their bosses or co-workers via social networking sites have also attracted quite some media attention lately. However, many flavors of social networking exist and some are solely business- and job-focused, a prominent example being LinkedIn[30]. But also other social networking sites offer a wide range of business uses, especially for geographically dispersed teams. They offer an opportunity to better get to know the team members and, in a way, compensate for missing face-to-face contact. Such a concentration on non-task focused activities can lead to an increased level of trust and a better team outcome. Third party applications developed to further extend the functionality of the site can be found. Some of those also offer specific functions for business uses like document sharing or message boards. Recently, a trend for implementing so-called "social networking" functions within other types of applications became visible. For example, users can suddenly change their profile picture and update their status message inside a wiki system.

2.3.4.8 Web-based Collaboration Tools

Some applications are no longer being installed locally but rather offered as a service on the Internet. This development was also decisive for the rise of web-based collaboration tools[31] with a focus on project management. Greater availability to broadband Internet access is a trigger causing barriers of adoption to fall (Sawyer, 2004). Moreover, "web-based project collaboration software has come of age" (Chen, et al., 2006a, p. 11) and pre-mature products have vanished from the market; "using web-based project collaboration system is on the rising trend" (Chen, et al., 2006a, p. 11).

[30] http://www.linkedin.com
[31] See http://www.1stwebdesigner.com/resources/best-project-management-collaboration-tools/ for an overview of popular project management collaboration tools. Accessed April 22, 2010

In their article, Donker and Blumberg (2008) identified three critical weaknesses of common project management tools: (1) results and outcomes of the project need to be transparent and visible for all project members. Presented results are often abstracted and thus, it is not clearly identified who has completed each task. (2) It is often unclear which tool should be used for which purpose, frequently resulting in inefficiency. (3) Project management tools that embody collaboration aspects only focus on conventional work processes and are insufficient for virtual collaboration. Using a new approach, web-based tools try to overcome those weaknesses. One example is Basecamp, a web-based project management tool developed by 37signals. It is distributed using the SaaS model (discussed in 2.3.3.4), meaning that the customer pays for a certain amount of users for a certain time. Monthly prices range from $24 to $149, and storage ranges from 5 GB to 75 GB[32]. No local installation is needed; all services are hosted by the vendor and accessed through a web browser. Also, a variety of third-party add-ons are available, including mobile usage. Basecamp is currently seen as the market leader in the area of web-based project management tools (Grohmann, 2009) with three million users. The vendor claims to offer all the needed functionality with at maximum level of simplicity. Hof (2005) also claims that the paradigm "keep it simple", in line with the discussion about Lean IT (see 2.3.3.3), is most important when it comes to web collaboration. To summarize and to justify the relevance of the research question:

> *"Since a project will differ in its stages and requirements during its lifecycle, different tools will be needed for supporting different kinds of tasks. There is a lack of research results on when to use which collaborative tool in which stage of a collaborative process. More, the effective configuration of such tools is not examined well, yet. Thus, no reliable recommendations about the effectiveness of collaborative tools can be made." (Donker & Blumberg, 2008, p. 42)*

2.4 Key Findings of the Literature Review

One of the key findings from the literature review was that diverse, virtual (i.e., at least geographically dispersed) teams have the ability to outperform their homogenous counterparts (see e.g., Bergiel, et al., 2008; Zigurs, et al., 2007) if managed properly. Trust was identified to be the most important key success factor (e.g., Zigurs, 2003) and vital communication is crucial (e.g., Powell, et al., 2004). However, virtual teams are no panacea for all business problems and can also prove to be less effective or even counterproductive (Donker & Blumberg, 2008; Krejci, 2009).

Given that technology is required to support virtual projects, it is crucial that the technology supports the needs of the team. TTF proposes that the use of IT can positively impact an individual or team's performance if the capabilities of the IT match the task requirements.

[32] See http://basecamphq.com/signup, accessed January 22, 2010

TAM postulates that perceived ease of use and perceived usefulness determine an individual's intention to use a system. Those two theories are to be considered when chosing a collaboration system for virtual project management.

The current paradigm change from the traditional project management approach toward a more dispersed, collaborative environment bares a lot of challenges and opportunities, especially within the IT sector, (Chen, Nunamaker, et al., 2003; Khazanchi & Zigurs, 2007b). It was also found that “the trend is toward web-based PM systems that provide all basic PM support and also include more advanced features” (Chen, Romano, et al., 2003, p. 1312) and teams working in such a dispersed setting are highly dependent on technology and tools (Qureshi, et al., 2006). However, it is common practice to use a set of collaboration tools instead of an all-in-one solution. Moreover, tool usage differs within the lifecycle of a project as it moves to different stages and “there is a lack of research results on when to use which collaborative tool in which stage of a collaborative process.“ (Donker & Blumberg, 2008, p. 42). This completes that literature review; the following chapters will present the empirical parts of this thesis.

3 Research Methodology

3.1 Introduction

After developing the theoretical fundamentals for this thesis in the literature review, this chapter introduces the research methodology used to investigate the research questions.

Basically, a combination of research methods were used. First, a questionnaire was selected to provide quantitative data to build upon and get an inside into current virtual project management practices. Finally, interviews with leading experts in the field of information systems and virtual project management were taken to further investigate in appropriate directions and to compensate for the shortcomings of the quantitative survey. Throughout both studies, the earlier literature review provided an understanding of the current state of the art for virtual project management and collaboration tool usage.

First, a general discussion about research methods in the discipline of information systems is presented. Then, the chosen research methods are focused on and viewed in greater detail. The empirical study strives to find appropriate answers to the research questions:

> *"How can web-based collaboration tools create additional value and complement task-oriented project management tools within IT projects?" and "In what stages of an IT project do social technologies prove to be most effective and appropriate?"*

3.2 Overview of Information Systems Research

3.2.1 Quantitative Methods

A popular and often-used categorization of research methodologies is the distinction between a qualitative and quantitative methodology. Q*uantitative research* methods emerged within the fields of natural sciences in order to identify causal relationships. Data collection is often achieved through experiments (Lu, 2007) or surveys; the key concept is, of course, quantity (i.e., collecting as much data as possible). Creswell (2003) described a survey as a means for providing quantitative descriptions of attitudes or opinions of a population by studying a sample of that population; an experiment, on the other hand, tries to study the impact of a treatment on an outcome. The data gathered can be precisely measured and are often in the form of numbers (i.e., where measurement is the process of turning data into those numbers) (Punch, 2005). But since data naturally does not always occur in a numeric

format, the researcher often imposes structure on the data. Also, procedures are often standardized to enable easy replication. Barbour (2008) noted that "quantitative research excels at identifying statistically significant relationships between variables." Such data is commonly analyzed sing statistics, tables, and charts.

Within the field of information systems, quantitative research is widely accepted and is often the preferred research methodology. By the turn of the millennium, alternative approaches – among them qualitative methods – became increasingly popular and accepted (Petter & Gallivan, 2010) and – in the IS literature – "numerous researchers have documented the slow and steady progression away from the pure dominance of positivist, quantitative research methods toward a broader array of epistemological and methodological approaches" (Petter & Gallivan, 2004, p. 4).

3.2.2 Qualitative Methods

On the other hand, *qualitative research* methods originally evolved in the area of social sciences to study social and cultural phenomena. There exist, of course, a number of different methods for qualitative research. A method is a specific technique or tool used to access or create data through different forms of interaction (Barbour, 2008; Silverman, 2005). The research methodology, on the other hand, being a "more general discussion about the assumptions underpinning different methods and the implications, challenges and limitations of choices for the process of conducting research and its ultimate products" (Barbour, 2008, p. 15), or, in other words, "a general approach to studying research topics" (Silverman, 2005, p. 109). Some specific methods listed by Barbour (2008) include interviews, observational fieldwork, focus groups, diaries, case study research or the critical incident technique. However, single methods can also be used in a different methodology, such as qualitative or quantitative (see Table 6 for examples). Qualitative data usually comes in form of words rather than numbers; those words, "especially organized into incidents or stories, have a concrete, vivid, meaningful flavor that often proves far more convincing to a reader" (Miles & Huberman, 1994, p. 1). However, due to their nature, such data are not immediately accessible for analysis, but require some sort of processing (e.g., a conducted interview needs to be transcribed and corrected). After that, qualitative methods can "provide an understanding of how official figures are created through social processes" (Barbour, 2008, p. 11). Miles and Huberman (1994, p. 9) gave an overview of a classic set of analytical methods, arranged in sequence:

- Affixing codes to a set of field notes drawn from observations or interviews
- Noting reflections or other remarks in the margins

- Sorting and sifting through these materials to identify similar phrases, relationships between variables, patterns, [...] and common sequences
- Isolating these patterns and processes [...] and taking them out to the field in the next wave of data collection
- Gradually elaborating a small set of generalizations that cover the consistencies discerned in the database
- Confronting those generalizations with a formalized body of knowledge in the form of constructs or theories

Barbour (2008) further stated that qualitative research answers very different questions from those addressed by quantitative research. Moreover, "quantitative data analysis has no greater or lesser importance than qualitative data analysis. Its use is entirely depended on fitness for purpose" (Cohen, Manion, & Morrison, 2007, p. 501). To conclude, Table 6 gives some examples of how the same methods can be used either quantitative or qualitative.

Method	Methodology	
	Quantitative research	Qualitative research
Observation	Preliminary work, e.g., prior to framing questionnaire	Fundamental to understanding another culture
Textural analysis	Content analysis, i.e., counting in terms of researchers' categories	Understanding participants' categories
Interviews	"Survey research": mainly fixed-choice questions to random samples	"Open-ended" questions to small samples
Transcripts	User infrequently to check the accuracy of interview records	Used to understand how participants organize their talk and body movements

Table 6. Different uses for methods (adapted from Silverman, 2001)

3.2.3 A Mixed Method Research Approach

3.2.3.1 Introduction

We have stated that both quantitative and qualitative methods are accepted research methodologies and part of the IS researcher's arsenal. This diversity is necessary to fully understand and explore phenomena within information systems, accepting that each method has its strength and weaknesses (Petter & Gallivan, 2010). So what about using both methods in a single research study? In their paper, Kaplan and Duchon (1988) stated that only one sole approach to information systems research is not sufficient to provide the needed richness of information. They go on and therefore argue that "mixing methods can also lead to new in-

sights and modes of analysis that are unlikely to occur if one method is used alone" and concluded that "combining qualitative and quantitative methods proved especially valuable" (Kaplan & Duchon, 1988, p. 582). Along similar lines, Petter and Gallivan (2010) stated that using both qualitative and quantitative methods would give researchers different "lenses" to understand and view the problem and increased the confidence of the data as well as for the interpretation. Mixed method research (MMR) uses at least one qualitative and one quantitative method for a study (Greene, Caracelli, & Graham, 1989). Petter and Gallivan (2010) extended this definition by adding that a study is only using mixed method research if both the qualitative and quantitative data is (1) collected, (2) presented, and (3) analyzed in the paper. For a clarification, they explained that numerous studies collect both types of dada, but sometimes fail to document the collection, analysis, and presentation of both types of data. This may be due to page limitations, journal policies or because of a stronger reliance on one data form.

Kaplan and Duchon (1988) emphasized the view of seeing "the need for a variety of approaches to the study of information systems" (p. 583) as their most important conclusion. Barbour (2008) and Creswell (2003) also shared this view by stating that mixing methods frequently results in a better understanding of the phenomenon as well as Mayring (2001), who considered a combination of research methods useful and necessary. Challenges of MMR include social factors (e.g., norms that tend to influence the researchers' choice of methods) and "philosophical differences" between researchers with different expertise (Petter & Gallivan, 2010). Also, terms are not used consistently and definitions vary across the literature (e.g., some view triangulation as a synonym for MMR while other state that it is just one of various approaches) (Petter & Gallivan, 2004). To conclude, Miles and Huberman (1994) stated that

> *"[…] Qualitative data can help the quantitative side of a study during design by aiding with conceptual development and instrumentation" and "[…] help by validating, interpreting, clarifying, and illustrating quantitative findings, as well as through strengthening and revising theory." (p. 41)*

3.2.3.2 Framework for Mixed Method Research

The advantages of mixed method research are known since thirty years, but have been largely ignored by a lot of disciplines, including IS (Petter & Gallivan, 2004). In their paper, Greene et al. (1989) classified five techniques for MMR design within the education evaluation literature. Fifteen year later, Petter and Gallivan (2004) adapted this model for the IS discipline, suggesting to add another dimension to those motives and introduced a framework for MMR (see Table 7). The five motives are triangulation, complementarity, development, expansion, and initiation, described in greater detail below.

		Approach		
		Sequential	Parallel	Independent
Purpose	Triangulation			
	Complementarity			
	Development			
	Initiation			
	Expansion			

Table 7. Framework for Mixed Method Research (adapted from Petter & Gallivan, 2004)

Triangulation seeks to "achieve convergence and corroboration of the results using both qualitative and quantitative methods" and "examine the same phenomenon under the same paradigm" (Petter & Gallivan, 2010, p. 4). In other words, triangulation means to collect and analyze different types of data to improve the accuracy of results. If those results turn out to match, convergent validity, the goal of triangulation, is achieved. There are different forms of how triangulation can be used, the strongest one implementing both qualitative and quantitative studies simultaneously and independently. However, this form is only rarely utilized, because conducting two studies means a huge additional effort.

Complementarity differs from triangulation because it aims to provide additional richness and detail to better understand a phenomenon (Greene, et al., 1989) instead of improving the accuracy. Petter and Gallivan (2004) acknowledged that for this approach, one study is usually dominant, and a lesser study is conducted to provide additional clarification (e.g., qualitative data may provide deeper insights into data gathered by a statistical analysis). Complementarity research can be conducted in two ways: sequentially or parallel. A sequentially approach describes two phases of research conducted in sequence where the findings of one phase feed the other. Parallel, on the other hand, means that both phases are conducted simultaneously, having interaction between the studies (Petter & Gallivan, 2004).

Another approach, *development*, aims to employ the "results from one method to inform the other method in terms of sampling, measurement, or implementation" (Petter & Gallivan, 2010, p. 4). This means that the results of a secondary study are used to shape the dominant study (e.g., interviews that help to create a questionnaire) (Greene, et al., 1989).

Initiation searches for "paradox and contradiction" (Petter & Gallivan, 2010, p. 4) in the results of the studies. In other words, divergent findings are thought to provide a new understanding of the phenomenon and hoped to provoke additional analysis. Noticeable is the differentiation to triangulation, which tries to do the opposite, namely searching for converging results.

The last technique mentioned is *expansion*, describing the use of mixed methods to expand the scope and breadth of a problem, motivated by a desire to provide a more comprehensive solution (Greene, et al., 1989). To ensure a broad understanding of the concept, different phenomena should be investigated.

The framework by Petter and Gallivan (2004) added another dimension to those techniques, suggesting thee approaches of mixed methods data collection and analysis: sequential, parallel, or independent. *Sequential* describes a different research method employed in each stage, one of those methods usually being more dominant than the other. *Parallel*, on the other hand, means that two or more studies are conducted simultaneously by separate researchers, but still allowing interaction between the parties. The last approach, *independent* research, is also conducted simultaneously, but not allowing interaction between the researchers during data collection or analysis.

In a very recent study, Petter and Gallivan (2010) conducted an extensive literature review of papers published in prominent MIS journals, identifying those papers using mixed method research and classifying them based on their framework described above. Their results: 48 papers from 1997 – 2009 were using MMR, using 1.3 motives on average per published study. Ranking number one was not surprisingly triangulation (22 motives), followed by complementarity (16) and development (12). Adding the new dimension of approach, "sequential triangulation" (16) was most popular, followed by "sequential development" (12) and "sequential complementarity" (8). To summarize, a sequential approach to mixed methods is by far the most popular one among IS researchers.

3.3 Research Design

Based on the discussion above, a mixed method research design featuring qualitative as well as quantitative methods was chosen for this thesis. To be more concrete, a "*sequential complementarity*" approach will be utilized. This means that the results obtained from one method will enrich and clarify the results of the second method. We also mentioned that one of those methods is usually dominant. For this thesis, a questionnaire was used to first gather quantitative data and after that, expert interviews were conducted for the qualitative part. The survey was the dominant, primary research method. This research design allowed a holistic view and a deeper understanding of the problem; or, as Miles and Huberman (1994) put it: "The questionnaire findings can be further deepened and tested systematically with the next round of qualitative work" (p. 41/42), in our case using qualitative interviews. The discussion below will illustrate and describe this chosen research design in more detail.

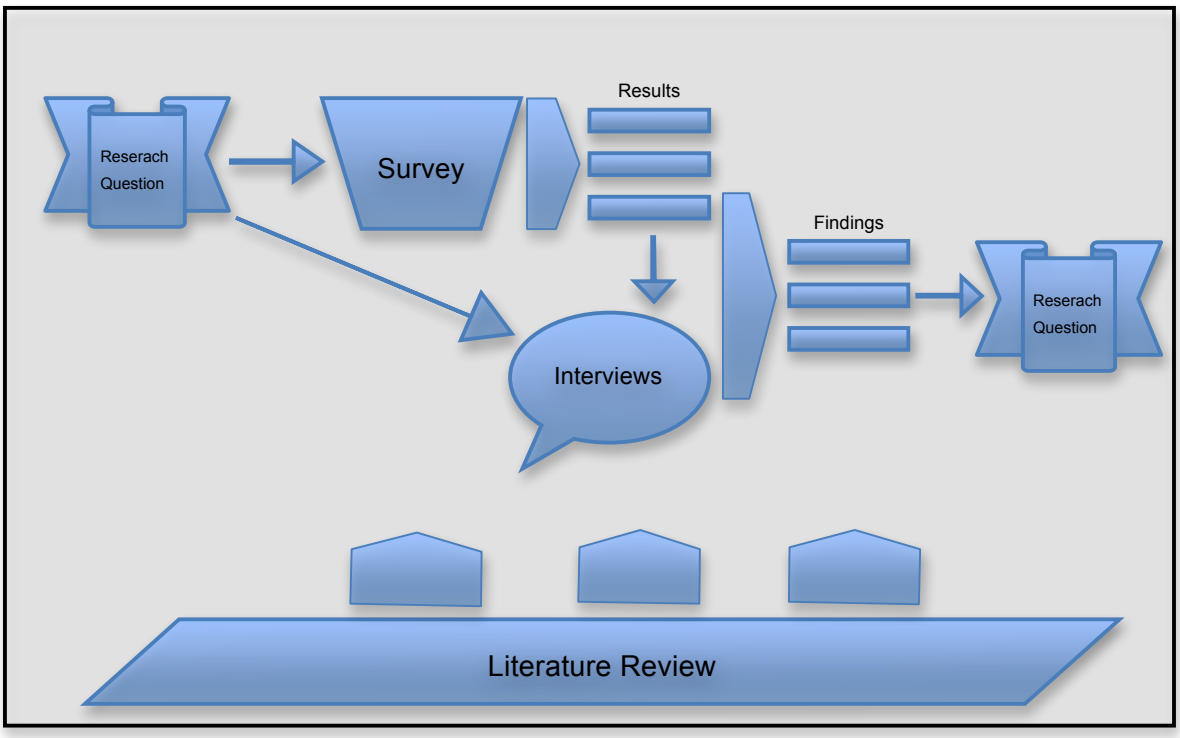

Figure 10. Thesis' Research Design

Figure 10 illustrates the used research design. After all, the thesis started out with the development of the research question described in an exposé. After the exposé was officially accepted by MCI, an extensive literature research covering topics like (virtual) project management, virtual teams and collaboration tools was started and the necessary knowledge gathered. Towards the end of the literature research, special topics needed for the empirical study were examined and notes for possible survey questions were made. Then, a questionnaire was designed and pre-tested before it was finally rolled out. During the data gathering process, which took two weeks' time, new findings were incorporated in the current literature review and thoughts about possible interview questions were developed. After that, the data from the quantitative questionnaire was analyzed and those results were specifically used to develop the interview questions. In this research, the survey is viewed as the primary empirical research method, and the interviews examined questions at a more detailed level and addressed open issues. This is in line with the findings about mixed method research as explained in 3.2.3.2. The results of the research studies were compared to the literature review to determine if the study results were consistent or conflicting with the literature. Key findings were then identified and considered in light of the research questions to determine if the questions could be answered based on the results.

3.4 Quantitative Questionnaire

3.4.1 Introduction

Questionnaires (or surveys) are a common method for gathering quantitative data within the IS field. A questionnaire can be either cross-sectional (i.e. data collected at a single point in time) or longitudinal (i.e. data collected over time). A questionnaire can be carried out in a variety of ways: via mail, interview (e.g., telephone or face-to-face), or self-administered (i.e., online). The latter became increasingly popular with the rise of the Internet because it is very easy to create and deliver online questionnaires. With online questionnaires, data is collected electronically (which is necessary for statistical analysis) and it can be shared to a larger number of potential respondents without any increase in costs. The downside is that the response rate of online questionnaires is lower because people can easily ignore the questionnaire. Furthermore, it is possible that individuals may not focus on the questions, leading to improper responses.

3.4.2 Quantitative Data Collection

For this thesis, a questionnaire was conducted to get a better understanding of current virtual project management practices. The goal was to discover how project managers currently perceive and work with web-based tools as well as to obtain insight on project management approaches. Questionnaires are easy to implement and allows each respondent to receive the same set of questions and the same limited choice of answers. Another reason to use a questionnaire for data collection is internationalization. The questions and answers can be translated to multiple languages, but the statistical analysis remains consistent since the data is numeric. This was important because the survey was conducted both in English and in German, allowing a broader audience to answer the survey. Furthermore, it would be possible to examine local and cultural differences, which may lead to interesting findings.

The survey was delivered in an online format, making the distribution and the analysis easier. LimeSurvey[33] was the tool of choice for a couple of reasons. First, it is open-source software and thus free of cost. Second, it was the only online survey tool found by the author that supported multi-language questions. Third, LimeSurvey is a widely used online survey tool and has a large supporting community. Last but not least, the appearance is completely customizable, including the incorporation of graphics, which allows the design to be more attractive and clearer, which can lead to a higher percentage of completed questionnaires.

[33] www.limesurvey.org

The study participants were project managers, employees working in projects, and individuals with experience with project management. Before beginning the research study, a pilot phase was conducted to pre-test the survey. Ten individuals were asked to give feedback on the survey for the English as well as for the German version. Based on this feedback, the questionnaire was reworked as necessary and finals adjustments were made. For the roll out, several project-based companies in Austria, ranging from 15 to 80 employees, were asked both verbally and via e-mail to complete the survey within a time span of two weeks. For the English-speaking region, a multinational software development company and several university-affiliated business partners were contacted. The English version of the questionnaire can be found in Appendix D.

3.4.3 Quantitative Data Analysis

Since an Internet-based survey approach was chosen, the data was already available in digital format and hence easy to process. LimeSurvey comfortably supports the export of its data into the SPSS[34] format. All quantitative data analysis was performed using SPSS version 18. Descriptive statistics "simply report what has been found" (Cohen, et al., 2007, p. 504), in contrast to the more complex inferential statistics, which seeks to make predictions and inferences. Researchers commonly prefer inferential statistics since they are more powerful, giving them opportunities like correlations, hypothesis testing, or difference testing. Sometimes however, "simple frequencies and descriptive statistics may speak for themselves" (Cohen, et al., 2007, p. 504) and proved to be sufficient for the course of this thesis. The results of the questionnaire are presented in section 4.1. After the data analysis process, qualitative interviews were conducted to complement these results.

3.5 Qualitative Interviews

3.5.1 Introduction

According to Lu (2007), the "use of qualitative techniques in IS research is widely accepted today and seen as enhancing the effectiveness of IS implementation in organisations [sic]" (p. 11). IS researchers are increasingly leveraging the potential of qualitative methods to obtain a better understanding of everyday problems. The strength of qualitative data lies within the ability to describe a very natural setting, focused on a specific case, embedded in its context. Another feature, as Miles and Huberman (1994) put it:

[34] www.spss.com

> *"[…] Their richness and holism, with strong potential for revealing complexity; such data provide 'thick descriptions' that are vivid, nested in a real context, and have a ring of truth that has strong impact on the reader." (p. 10)*

In other words, qualitative data is strong at displaying the complexity of „real-life" data. Interviews are probably the most common way to collect such data and can be structured (i.e., fixed set of questions) or open (i.e., open conversation). If only fixed-choice questions are asked (e.g., "Do you agree with XY?"), gathered data will be quantitative, whereas open-ended questions (e.g., "What is your opinion regarding XY?") provide qualitative data (see Table 6). For the purpose of this thesis, open-ended questions were asked to complement the quantitative data from the questionnaire. This approach was chosen because qualitative data is generally pragmatic and grounded in the lived experiences of people and can thus add a more practical perspective on the quantitative data. In other words, emphasis was put on complementing a theoretic perspective with complex real-life viewpoints.

3.5.2 Qualitative Data Collection

Before conducting the expert interviews, the CITI[35] training course was completed, and the research method, including a justification, had to be officially certified by an IRB[36]. The final IRB approval letter can be found in Appendix A.

Once certified, the interviews took place at the University of Nebraska at Omaha or in a location chosen by the interviewee (e.g., in a café). The predicted time for each interview was 20 to 25 minutes and the participants were asked for their approval to record the conversation. The interviews were conducted in a semi-structured fashion, meaning that a set of five main questions were asked to each respondent, including sub-questions depending on the participants' answers. Refer to Appendix B for the complete interview guide and questions.

Five interviews were conducted. As for selecting the participants, emphasis was put on selecting both researchers and people with actual practical experience in the field of project management. This was considered an important step to provide a holistic view on the topic. To cover the researcher's perspective, Ilze Zigurs, Stacie Petter, and Deepak Khazanchi from the University of Nebraska at Omaha were chosen as they represent leading experts in the field of project management. For a more practical view, Dorest Harvey and Justin Daharsh offered valuable insights from their work experiences as project managers.

Prior to the interviews, the participants were provided with the five primary interview questions to allow them to prepare. Furthermore, they received an information sheet containing

[35] Collaborative Institutional Training Initiative. For more information, see https://www.citiprogram.org
[36] Institutional Review Board of the University of Nebraska Mecial Center. For more information, see http://www.unmc.edu/irb

summarized information regarding the project process groups to establish a common standard for project process-related discussions.

3.5.3 Qualitative Data Analysis

Regarding the analysis of qualitative data, a variety of approaches exist. According to Miles and Huberman (1994), the analysis process for qualitative data involves three major steps: (1) *data reduction*, which refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in transcripts. Next is the (2) *data display*, where data is organized and compressed to draw conclusions. Finally, (3) *conclusion drawing and verification* describes interpreting the meaning of the gathered results and testing for their "confirmability" (i.e., their validity).

For this thesis, a systematic coding scheme was used (Miles & Huberman, 1994), because it is "by far the most common initial procedure" (Seale, 1999, p. 154) in qualitative data analysis. Some qualitative analysis methods are based on the generation of a certain set of categories, developed either before or during the data collection process. The data (e.g., text) is then classified in categories and compared afterwards. However, since the number of the conducted interviews for this thesis was small, the choice of analysis techniques is somewhat limited. An exceedingly systematic approach to analyze categories as quantitative data (e.g., count frequencies, calculate percentages) such as that proposed by Mayring (2001) is not practical. Due to the limited number of the interviews, it is more appropriate to use a *cross-case display* for exploring and describing the results. Cross-case analyses are widely used in social studies, such as management information systems, and can be used in a variety of ways. The basic idea is to rely on a framework to guide the analysis of multiple, qualitative case studies (e.g., interviews). According to Miles and Huberman (1994), using multiple cases increases generalizability and aims to see processes and outcomes across many cases. They furthermore argue that "a second, more fundamental reason for cross-case analysis is to deepen understanding and explanation" (p. 173). Such an analysis can be either *variable-oriented* (i.e., read the table vertically) or *case-oriented* (i.e., read across a row). A case-oriented approach is typically used with a limited number of cases, or in other words, "good at finding specific, concrete, historically-grounded patterns common to small sets of cases" (Miles & Huberman, 1994, p. 174).

For this thesis, the approach of a *partially ordered meta-matrix* was used, suitable for "bringing together basic information from several cases into one big chart in the 'stacking' style" (Miles & Huberman, 1994, p. 177). The five main questions of the interview will serve as variables. Additionally to the cross-case analysis and due to the newness of the research topic, the answers of the interviews will be treated and quoted as if they were literature. This

approach is used to shed light on previously uncovered areas as well as to validate already existing findings. For the results of the qualitative expert interviews, refer to section 4.2.

4 Results and Discussion

This section presents the results gained from the analysis of the empirical research conducted for this thesis. As argued above, the primary research method was a questionnaire, delivering mainly quantitative, but also some qualitative data from an open-ended question. Section 4.1 introduces the key findings of the survey. Building upon this data, various interviews with leading IS researchers and project managers were conducted to further validate and specify the results. The findings from those interviews can be found in section 4.2. This chapter concludes with a discussion of how those empirical findings can be combined to answer the research question and contribute back to the literature, which is explained in section 4.3.

4.1 Questionnaire Results

This section discusses the results of the questionnaire. The online survey was active from April 13th until April 30th, 2010. In total, 127 responses for this survey were obtained (114 full responses, 13 responses not completely filled out). Only fully completed surveys were included in the results, meaning the number of responses included in the analysis was 114. The complete questionnaire can be found in Appendix B.

4.1.1 Participant Demographics

As already mentioned, the survey was conducted in both English and German. Thus, it was possible to reach a broad audience from different nations. The majority or the questionnaires was answered by individuals from Austria, the USA, and Russia.

Where do you currently work and live?	Count	Percentage
Austria	70	61.40%
USA	20	17.54%
Russia	15	13.16%
Germany	4	3.51%
Other	3	2.63%

Table 8. Nationalities of Participants

The majority of the respondents were male, but this is common in many IT studies.

Your sex?	Count	Percentage
Male	86	76.79%
Female	25	22.32%

Table 9. Gender of Participants

Over 70% of the survey participants worked for an organization within the IT sector, followed by 12% for the service industry, and 10% for architecture and construction. As intended, most of the participants were managers or employees working on projects. Over one-third of the participants classified themselves as managers, suggesting that many respondents had reasonable experience with the domain under study.

What is your position within the company?	Count	Percentage
Employee	52	46.43%
Manager	41	36.61%
Student / Intern	14	12.50%
Trainee	4	3.57%

Table 10. Participants' Position within the Company

Regarding work experience, the results were split fairly evenly (see Figure 11). The respondents had a broad range of work experience (0 – 5 years to more than 20 years). The broad age range of respondents was ideal because individuals with less work experience are likely to be younger and thus may have a different view about web-based tools in general. Alternatively, individuals with twenty or more years of work experience may have a large amount of project management experience; however, they may be less amenable to changing their work practices to use web-based tools for project management.

Furthermore, 90% of the participants accomplish their work in project teams, mainly in medium-sized teams of 6-15 persons (41%) or small project teams with up to five persons (37.5%). This is consistent with the literature which suggests work in project teams is becoming more important and even a necessity in the current workplace (e.g. Chen, Romano, & Nunamaker, 2006b).

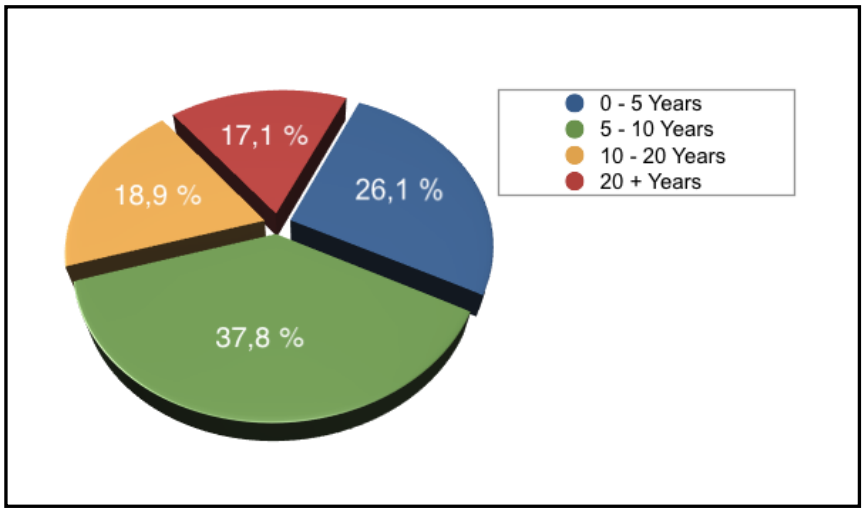

Figure 11. Work Experience of Participants

4.1.2 Web-based Collaboration Tools

One goal of the questionnaire examined how and how often social media („Web 2.0“) tools are currently used. Individuals were asked if they used wikis to obtain knowledge. It was expected that a majority of respondents would be users of wikis, particularly with the rise of Wikipedia (see 2.2.5.6 Wikis for details). Indeed, the survey revealed that only 2.63% did not use a wiki as a source of knowledge.

Do you use a wiki to obtain information and knowledge?	Count	Percentage
Yes, frequently	89	78.07%
Yes, rarely	22	19.30%
No	3	2.63%

Table 11. Wiki Usage of Participants

In terms of the number of respondents that contribute content to wikis, it was expected that the numbers would drop significantly. It is known[37] that almost half of the content of Wikipedia comes from a small group of people, of which 80% are male and 70% are under the age of 30[38]. More than half of the survey participants did contribute content to a wiki, with 18.4% stating that they contribute regularly (see Figure 7). This could be due to more companies using internal wiki systems for knowledge management (see 2.1.4 Knowledge Management and 2.2.5.6 Wikis for details) or documentation.

[37] see http://www.mndaily.com/2007/11/13/few-proud-wikipedia-authors, accessed online on April 30, 2010
[38] see http://bostonreview.net/BR34.6/morozov.php, accessed online on April 30, 2010

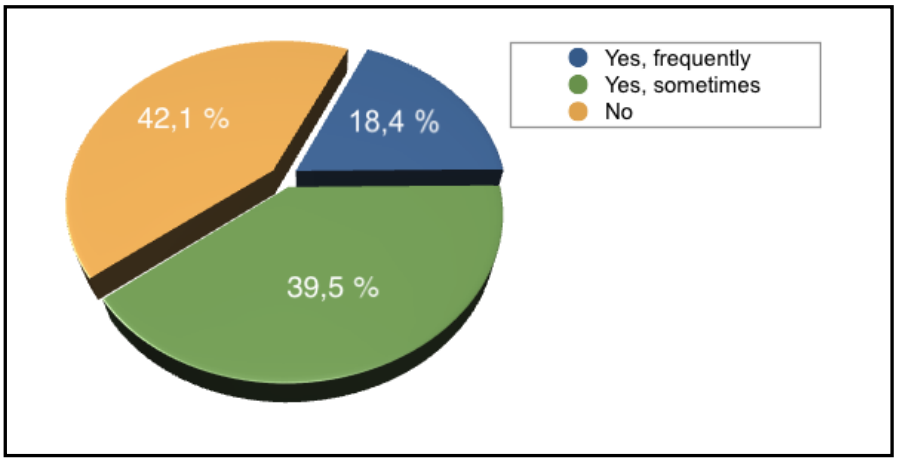

Figure 12. Wiki Contributions of Participants

Regarding the recent trend of social networks, three out of four participants had a profile on at least one social networking site, with almost half (47.37%) having multiple profiles. These figures confirm that social networks are widespread. Given that working professionals spend a considerable amount of time on social networking platforms, companies may want to consider how to use social networks to their advantage.

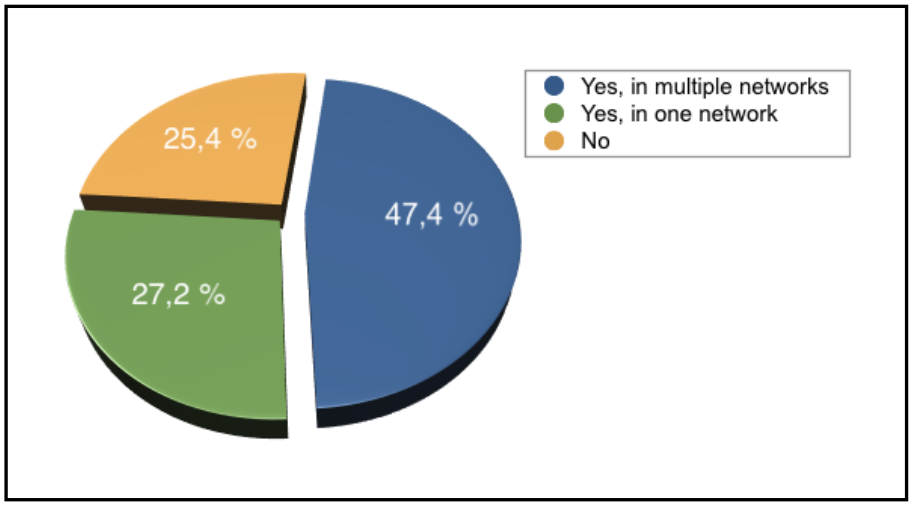

Figure 13. Social Network Usage of Participants

Another question of the survey asked for the respondent's opinion about open source software. The expected outcome was that a majority would consider this type of software useful, but also believed that a considerable portion of respondents (about one third) would find open source questionable for business uses, especially due to the lack of professional support. As it turned out, almost 95% of the participants had a positive opinion about open source products and viewed them as a possible alternative to commercial software (see Table 12 for details).

Do you consider Open-Source software as an attractive alternative to commercial products?	Count	Percentage
Yes, whenever possible	34	29.82%
Depends on the circumstances	75	65.79%
No	5	4.39%

Table 12. Participants' View on Open Source Software

Respondents were asked about data security and whether the participants considered it risky when documents are stored on servers outside the company (i.e., on the Internet). This question was important because this is mostly the case when using web-based collaboration tools. The hypothesis was that a large number (at least one third) of respondents would be skeptical and would prefer business documents to be stored on company-owned servers. The questionnaire confirmed this view in that approximately one-third of respondents wanted data stored on company-owned servers and two-thirds believed this decision was dependent upon the security guidelines of the service provider. Only four of the 114 participants had no concerns about data security (see Figure 14).

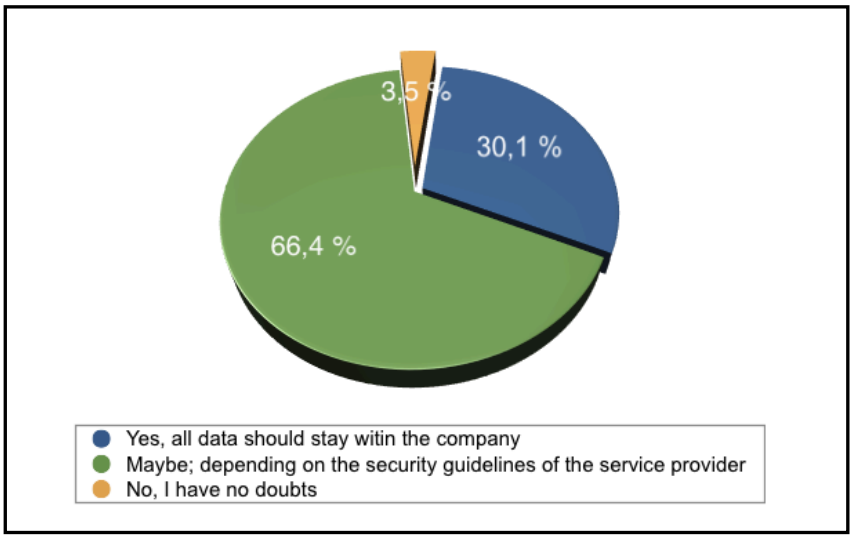

Figure 14. Participants' View on Data Security

Overall, the majority of the study participants are already using web-based technologies and tools regularly, but there still some doubt using these technologies in a business context.

4.1.2.1 Tools for Project Management

The second section of the questionnaire examined the business use of web-based technologies in the context of project management practices. In terms of the specific tools used in project management, e-mail is still the most commonly used tool. This is consistent with the

current literature (e.g. Zigurs & Khazanchi, 2008). Surprisingly, wikis ranked second and web-based collaboration tools third, with Microsoft Project, a widespread project management tools, ranked fourth (see Figure 15). The answers for „Other“ included Excel, Skype, Microsoft SharePoint, Instant Messaging, Citrix and custom-made solutions. It can be interpreted that a trend is definitely moving towards web-based tools and away from traditional locally installed software applications, such as Microsoft Project, or client-server applications, such as Lotus Notes.

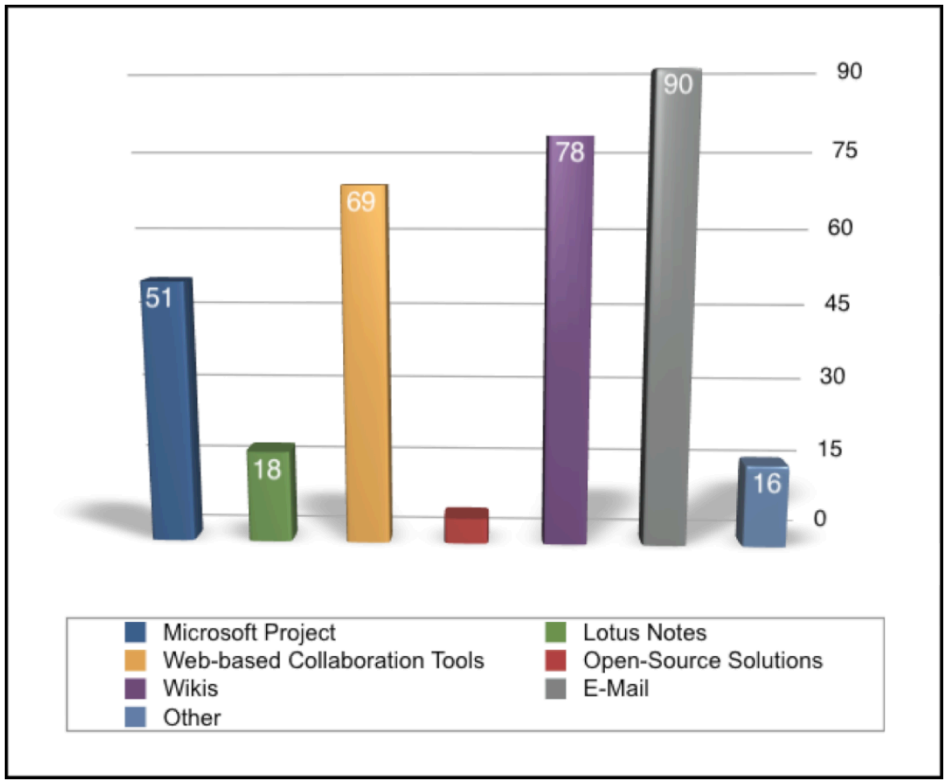

Figure 15. Tool Usage for Project Management

Respondents were asked about their frequency of use of various tools. The tools chosen are commonly used in offices within the IT sector. Table 12 shows the results.

	Never	*Yearly*	*Monthly*	*Weekly*	*Daily*
E-Mail	0.88 % (1)	0	0	0	98.25% (112)
Telephone	0.88% (1)	0	0.88% (1)	7.02% (8)	90.35% (103)
Fax	41.23% (47)	20.18% (23)	26.32% (30)	9.65% (11)	1.75% (5)
Instant Messaging	29.82% (34)	4.39% (5)	6.14% (7)	11.4% (13)	46.37% (54)
Office Suites	3.51% (4)	0.88% (1)	4.39% (5)	19.3% (22)	71.05% (81)
Online Office	53.51% (61)	5.26% (6)	7.89% (9)	20.18% (23)	12.28% (14)
Wikis	6.14% (7)	0.88% (1)	10.53% (12)	44.74% (51)	36.84% (42)
Web-based PM Software	30.7% (35)	1.75% (2)	7.89% (9)	14.04% (16)	44.74% (51)

Table 13. Frequency of Tool Usage

The exceptional findings are shaded for a better overview. The high scores for daily e-mail and telephone usage were expected. However, modern web-based technologies such as wikis, instant messaging, and web-based PM software had high levels of frequent usage, whereas fax as expected, is only used on a seldom basis.

When asked about the advantages of using web-based collaboration tools for project management, four answers were the most common: (1) More effective communication, (2) Simplified file-sharing, (3) Simplified collaboration with dispersed team members, and (4) All data is stored in one centralized place (no duplicates). Advantages mentioned in „Other“ included ease of installation and independence of a specific operating systems.

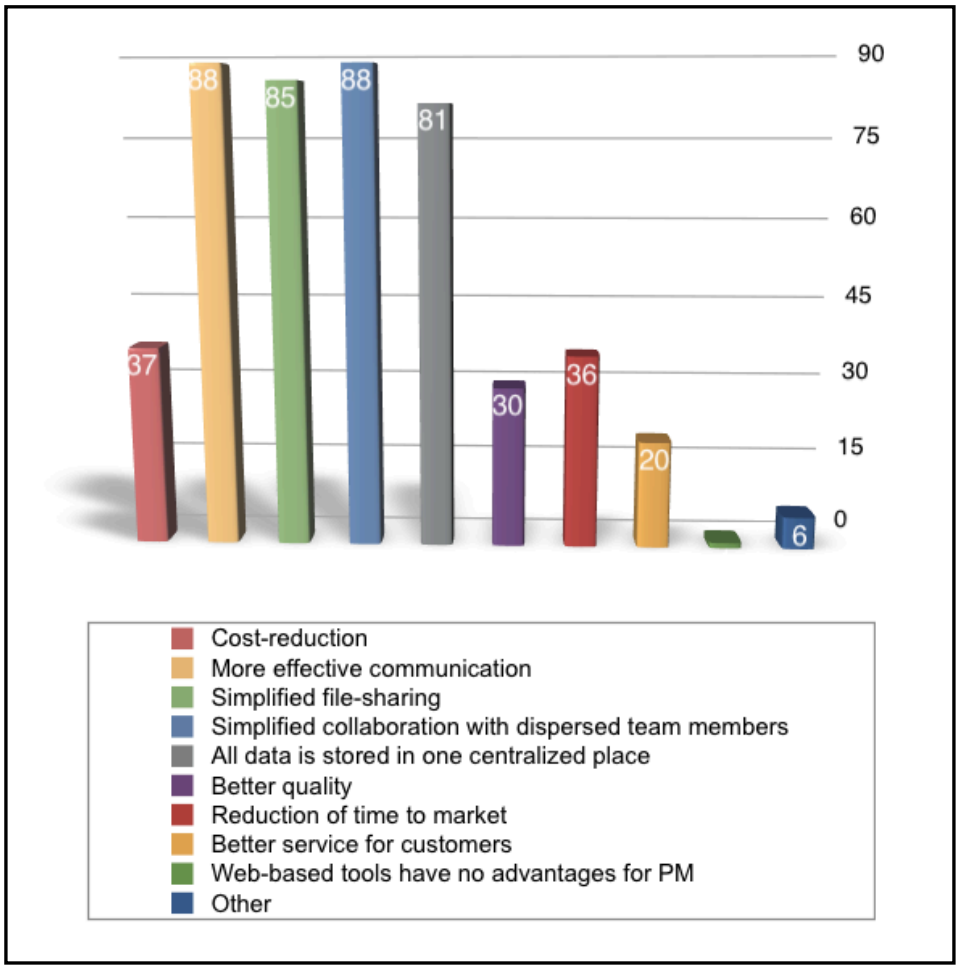

Figure 16. Advantages of Using Web-based Collaboration Tools for PM

4.1.3 Project Process Groups

To conduct a project, there are many processes, which are grouped into five process groups (see 2.1.1.1). One of the research questions seeks to discover whether social technologies prove especially useful for certain process groups and why. The survey respondents identified two process groups that could benefit from the incorporation of web-based technologies: (1) initiation and (2) planning (Figure 17).

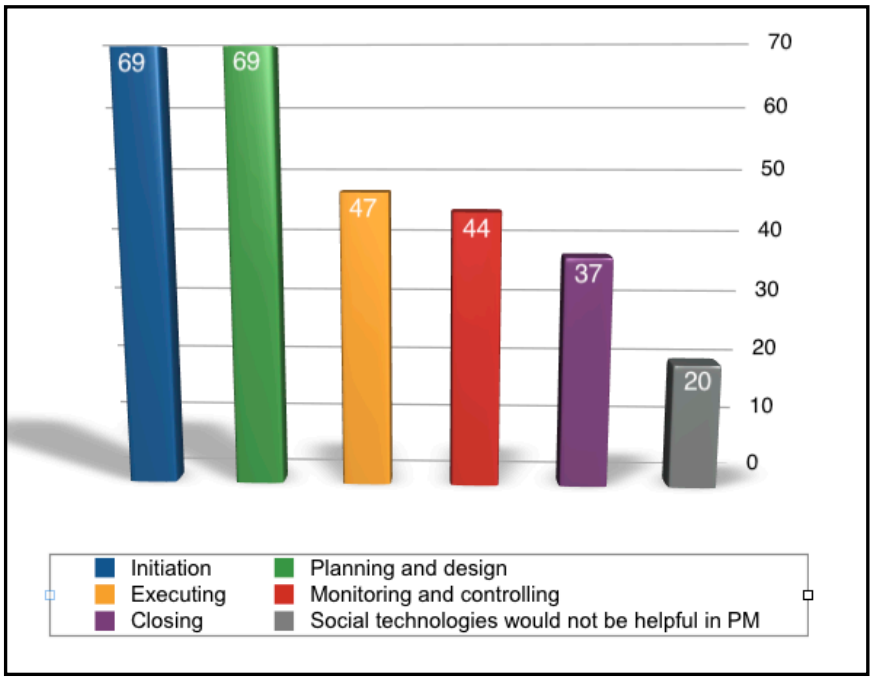

Figure 17. Usefulness of Social Technologies for PM Process Groups

The literature suggests that communication is an important factor for successful virtual teamwork. Therefore, one survey question asked if there were process groups in which the need for communication is especially intense. The process groups of initiating and planning were noted as having a strong need for communication (Figure 18). This finding is consistent with the literature implies that communication could be augmented by using social technologies.

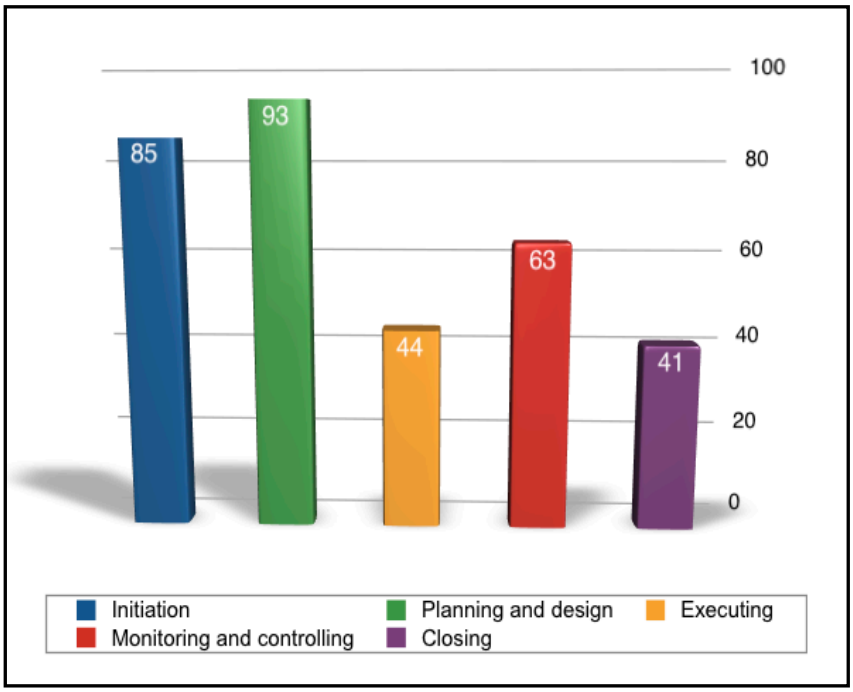

Figure 18. Process Groups with Especially Intense Communication Effort

When respondents were asked about the processes in which the internal coordination effort was more important, planning and executing were most often cited. Internal coordination refers to the logical organization of activities within a company. Those have to be communicated clearly and all staff members of all departments need to be aware of their roles and responsibilities.

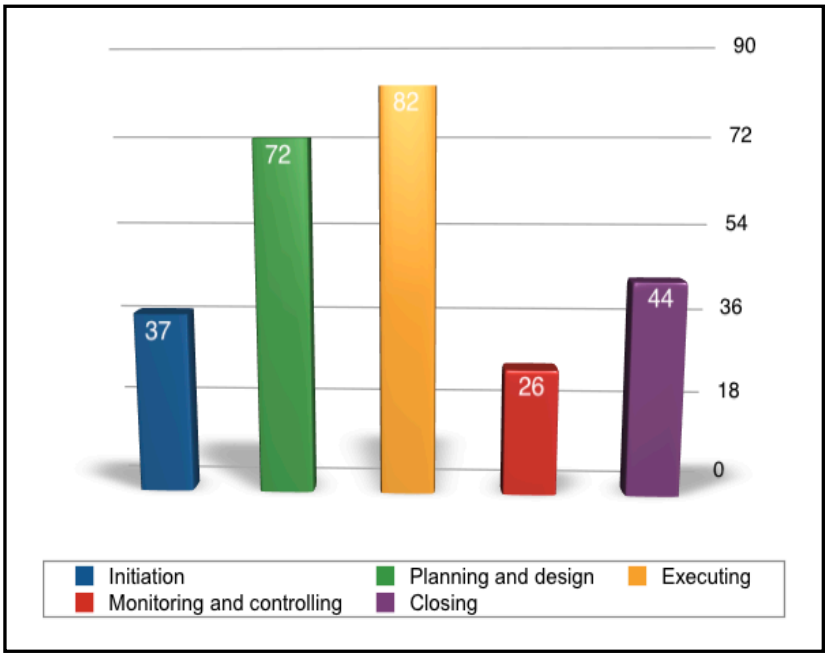

Figure 19. Internal Coordination Effort by Process Group

4.1.4 Open Question Results

One survey question allowed for open, qualitative responses. Respondents were not required to answer the question „By using 'Web 2.0' technologies for project management, what value (or detriment) would arise?" 31 respondents, or 27.19%, answered the question. The complete list of answers is available in Appendix E.

The qualitative data was analyzed using a coding scheme by categorizing the answers into frequently occurring keywords and then counting and ranking the codes. Consistent with Miles and Huberman (1994), codes were defined as "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study" (both p. 56). Note that the participants were invited to state positive as well as negative impacts of Web 2.0 technologies in project management. However, the positive arguments (29) outnumbered the negative comments (9).

Six themes or codes were identified in the discussion of the positive value of using Web 2.0 technology for project management. The ability to store project data in a single location, thus having an effective version control for all team members was identified ten times. This is consistent with the results in the quantitative portion of the survey, in which this benefit of Web 2.0 tools was identified as one of the most commonly identified benefits of social technologies in project management (refer back to Figure 16. Advantages of Using Web-based Collaboration Tools for PM). In the open-ended responses, flexibility was mentioned seven times, making it the second most important answer. The concept of flexibility not only includes time flexibility (i.e., flexible working hours), but also geographical flexibility (i.e., work from anywhere). Other codes identified in the open-ended responses include communication, visibility, connectivity, and ease of use. For an overview, refer to Table 14.

Rank	Keywords	Count
1	Single Place of Knowledge / Versioning	10
2	Flexibility	7
3	Communication	4
4	Visibility	3
4	Connectivity / Coordination of team members	3
6	Ease of Use	2
		29

Table 14. Added Values by Web 2.0 Technologies for PM

As for the negative impacts of using social technologies for project management, data security was the most commonly identified concern. Some also suggested that web-based systems may distract workers more easily, by encouraging “play” rather than work. Others were concerned that by using web-based systems, communication would suffer compared to oral conversation. Information overload and the loss of personal contact were additional concerns. For details, see Table 15.

Rank	Keywords	Count
1	Security	3
2	Distraction from Work	2
2	Communication Concerns	2
4	Loss of Personal Contact	1
4	Information Overload	1
		9

Table 15. Determinants by Web 2.0 Technologies for PM

Although the questionnaire provided insight to the research questions, more information was desired to better understand the use of Web 2.0 technologies by project managers. Therefore, experts were interviewed to shed light on the questionnaire findings.

4.2 Interview Results

This section explains the findings of a series of qualitative expert interviews. As mentioned, the interviews were conducted in the course of the chosen "*sequential complementarity*" research approach (refer to section 3.3 for a detailed explanation). The results of the interviews enrich and clarify the key findings of the survey data described above. To analyze the data, a *partially ordered meta-matrix* (see section 3.5) was used to compare and find common ground among the interviews. According to Miles and Huberman (1994), "meta-matrices are master charts assembling descriptive data from each of several cases in a standard format" (p. 178). This exercised aided in the search for patterns throughout the different interviews as well as to compare the findings with the quantitative survey data. The meta-matrix is shown in Table 16, where a plus ("+") in front of a statement suggests a generally positive statement about the use of web technologies in project management and a minus ("-") denotes a more negative assumption.

	Increasingly Internet-mediated work	Web 2.0 tools for business uses	Differences traditional / web-based tools	PM Stages for social technologies	Future directions for VPM
Ilze Zigurs (Researcher)	+ overcome barriers of distance / time / organizations + more diversity + better experience - trust - traditional mgmt carried to VPM	+ part of new workforce + social networking - blindly drifting into use	+ shared view / input +shared repository + more capability	+ initiating stage + planning stage - monitoring & controlling, executing: more classic	+ more use of VPM + 3D environments + mobile devices + moving into “the Cloud”
Stacie Petter (Researcher)	+ “follow the sun”, work 24h/day + access to global talent + flexibility in cost models - coordinate across time zones - decreased trust by not knowing people	+ lots of potential + feel part of a cohesive group + build rapport - needs to be part of day-to-day work processes	+ more collaboration + team members can report process + better information-spread	+ important during start of project + controlling phase to share ideas - executing: individual work	+ more VPM = inevitable + more electronic interaction + smarter tools - data security / data stored in “the Cloud”
Dorest Harvey (Project manager)	+ pick up speed + more productive - lose dialog, f2f - trust	+ rapport needed + right people for right task	+ quicker + faster +cheaper / affordable + more interaction	+ initial stages: broadcast mode + working: meeting without being present	+ tele-presence + multi-tasking - security
Deepak Khazanchi (Researcher)	+ leverage global talent + balance life- and work-style needs + cross-cultural experience + 24/7 work - not effective without synergy and right technology set - time zone challenges	+ flexibility + prestige + anecdotal KM + reduce bureaucracy - strong need for specific purpose	+ everything web-based + more shared repositories + flatten hierarchies	+ initial stages + brainstorming in planning	+ all in one platform + better and easier interfaces + agile project management + quality assurance + risk assessment
Justin Daharsh (Project manager)	+ evolving in real-time + repository for data - get everybody to use the SW the same way - follow certain guidelines	+ everyone can access same information + keeping track electronically - control	+ all information accessible instantaneously by all members + automatically keeps track of financial issues + automatic report creation	+ initiating stages + especially planning stage	+ web-based software + work from everywhere

Table 16. Partially Ordered Meta-Matrix for Interview Data

When asked about the consequences of an **increasingly Internet-mediated workplace**, "the ability to draw from the best of the best around the world" (Stacie Petter, Interview), or, as Deepak Khazanchi put it, that "you can find the talent that you need for your project, wherever it is, at a reasonable price", was identified as the most fundamental advantage. This is an interesting additional finding compared to the quantitative data, which mainly identified increased flexibility as well as simplified collaboration and file sharing as important. Furthermore, increased cultural diversity, which can prove helpful when it comes to dealing with global business partners, was also mentioned throughout the interviews.

Another benefit of the increasingly internet-mediated workplace is that it:

> *"[..] Helps you to tab into local knowledge and local customs, depending on what it is that you are doing. And when you can do it, 'follow the sun' works really well." (Stacie Petter, Interview)*

The "follow the sun" principle describes the ability to enhance the workday to 24 hours, taking advantage of time zone differences. However, Deepak Khazanchi pointed out that "even though to the fact that you can do 24/7 activities, the disadvantage is that you can do 24/7 activities", illustrating this point with an example that communication throughout time zones can be a major problem.

Strong emphasis was placed on "how important that communication is, that initial communication, and lots and lots of communication" (Ilze Zigurs, Interview). Moreover, the project is "evolving in real time" (Justin Daharsh, Interview), which requires keeping everyone on the same page and updated as things change during the project.

In terms of drawbacks for the internet-mediated workplace, the participants widely agreed that the issue of trust and building initial rapport is key for the success of virtual teams.

> *"I generally trust them [i.e., other team members], but I don't know if they always trust me because we have never met! Its hard to built rapport and [..] feel like you are really working with someone when really all I'm interacting with is a computer screen and e-mail." (Stacie Petter, Interview)*

Other concerns about the increasingly internet-mediated workforce is the skepticism that some employees may have. "Once you can get that buy-in and people don't feel like they are 'displaced by' and become comfortable with the technology, their productivity will go up; The more interaction, the better" (Dorest Harvey, Interview). Another potential challenge is that "it can be really hard to coordinate people across time zones" (Stacie Petter, Interview), thus proper communication and coordination are vital.

When it comes to **business uses for social collaboration technologies**, the consensus was that "they can be incredibly helpful" and "there could be a lot of potential for them" (Stacie Petter, Interview). The expert interviews uncovered the importance of "building things in,

making things explicit" (Ilze Zigurs, Interview). People have to be trained and guidelines must provided to improve the potential for success.

> *"Well, it is the importance of training project managers on the differences in virtual environments and really giving them advice rather than assuming they're just going to be able to start using all of these tools." (Ilze Zigurs, Interview)*

Furthermore, there was a general concern "that people seem to be sort of blindly drifting into their use rather than having a clear notion of what the benefit would be from a business perspective" (Ilze Zigurs, Interview) and that organizations commonly "just assume that if they put it out there, people will use and like it and everything will be great". Obviously, "it's more to it than that" (Stacie Petter, Interview); a specific purpose is needed: "Technology capabilities have to be used for a purpose, and a business purpose needs to be very clearly defined" (Deepak Khazanchi, Interview).

> *"You can have a great tool, but if there is nobody ready to use it, if there is no real process in place, if you don't know why you are using it and the user sees no value, it's not going to help you at all. There has to be a culture that promotes it, that encourages it, and a process that supports it." (Stacie Petter, Interview)*

Deepak Khazanchi mentioned that the ability of anonymously submitting ideas and comments often leads to a far better outcome than having the user's name attached. However, a problem that goes hand in hand with anonymity is that people can no longer be rewarded for their contributions. Incentives, Stacie Petter mentioned, are important to encourage individuals to contribute; managers cannot expect employees to spend extra time for documentation. The process of contributing knowledge needs to be part of the person's day-to-day routine. Especially since "people don't usually like to document or share things" (Stacie Petter, Interview). But when properly integrated into work processes, social technologies are utterly helpful when it comes to knowledge management, where "sharing anecdotal stories", also about failures, is considered most helpful (Deepak Khazanchi, Interview).

Another interesting point about the potential of business uses for social collaboration technologies is the technology's ability to reduce bureaucracy by giving more power to the individual.

> *"And what it [i.e., social media] does is it removes power-differences, so any power differential we might have. And that's a great way to allow bureaucracy to flatten, especially with technology." (Deepak Khazanchi, Interview)*

The expert interviews also revealed several **differences between traditional and web-based collaboration and project management tools** that were consistent with the open-ended question in the survey. Web-based tools help to make information "accessible instantaneously, and by large groups of people ... all those people who are involved with the project" (Justin Daharsh, Interview). Besides that, Stacie Petter mentioned that by using tradi-

tional project management tools, all communication has to run through the project manager, who then runs danger of "becoming essentially a secretary". By implementing a central collaborative platform, individual project members are given more autonomy and the opportunity to directly cooperate and obtain information from the right persons, hence the manager can focus on what he or she is there for: managing the project.

> *"Whereas the web-based collaboration tools are not only about having a shared view and shared input, but they also go beyond just traditional project management techniques and add that social component and—well, you know you can put them together any way you want. So there's more capability in web-based collaboration tools; There's also more potential for confusion." (Ilze Zigurs, Interview)*

This is consistent with the survey findings, which identified a single location for storing data and higher flexibility as advantages of web-based project management tools. Dorest Harvey summarized the main differences in three words: "quicker, faster, cheaper".

Another question during the interview asked **in what stage** of a project are web-based collaboration and social technologies most useful. Ilze Zigurs thought "definitely in the initiating stage, because that's where you're really getting everything; people are getting to know one another, you're trying to define the scope of the project", because "there's need for clarifying ambiguity; need for defining what it is we're talking about, then I think the social technologies can help". Deepak Khazanchi underlined that point by stating "that especially in the initial stages you need lot more collaboration." Stacie Petter offered a similar argument:

> *"I think it is going to be really important whenever you are starting up in the project and you are trying to get this initial buy-in from a lot of stakeholders and that aspect of initiation. There, I think these types of tools can be important, because they allow, you know, to kind of establishing rapport." (Stacie Petter, Interview)*

To summarize, the qualitative data confirms the quantitative findings, which also identified the early stages of 'initiation' and 'planning' as most adequate for the usage of social, web-based technologies, "because that's where collaboration and communication is most valuable" (Justin Daharsh, Interview). To underline this quote, the questionnaire showed that communication was considered most intense in the early stages of the project.

Other reasons to leverage web-based technology mainly focused on building rapport and cohesion among the team, to ensure "people are feeling like they are working as part of a group and they don't feel like they are alone, stuck doing the task that I'm supposed to be doing" (Stacie Petter, Interview).

Looking ahead, it was stated that "it seems obvious to me that there's no turning back [..]; we're going to have more and more use of virtual project management" (Ilze Zigurs, Interview) and, on the same line, "that there's going to be more virtual project management. I think it's inevitable" (Stacie Petter, Interview). And since:

> *"The world is shrinking, people are becoming more and more accustomed to interacting with people they have never met and only interacting electronically or in a virtual sense. So I think it's going to increase and that there is a lot that those tools have to accomplish. The processes and the tools need to work together. The more that the tool is separate to what the person is actually doing in the day-to-day work, the less likely the tool is going to be used." (Stacie Petter, Interview)*

"The generation that is coming out today, Generation X, Generation Y, they are so much more comfortable with technology than the Baby Boomers", meaning that the newer employees in the workforce have grown up with technology and also possess "more community focus, with this 'let's work together' focus" (Stacie Petter, Interview). The use of web-based tools for project management will continue in the future since "there are far more benefits than drawbacks with that sort of software and doing project management in such a style" (Justin Daharsh, Interview). Deepak Khazanchi focused the idea of merging project management and collaboration tools:

> *"I want to be able to put all of those capabilities into one platform! I want to be able to do collaboration, process management, workflow management, I want to do scheduling, all that on one platform." (Deepak Khazanchi, Interview)*

Technology can be used to develop a more risk and control-based view on project management. This will help project managers in identifying risks, learning how to control those risks, and further using those same optimized processes across all stages. That is, according to Deepak Khazanchi, "the way you set yourself off for success".

4.3 Discussion

A mixed method research approach was chosen to leverage the benefits of both quantitative and qualitative methods. The primary research method was a questionnaire, with over one hundred respondents from various countries. This questionnaire obtained information about project management and the use of web-based tools within their organizations. The results were then used to develop questions for expert interviews. The five interviews validated and expanded the findings of the questionnaire. The research approach proved to be valuable because the interviews delivered further insights and, moreover, helped to deepen the understanding of the topic.

The research question was split into two parts; the first part asked for how to create additional value using web-based collaboration tools for project management practices. The term 'additional value' was defined as an additive capability in section 4.3.1. The primary additive capabilities for web-based collaboration tools derived from the questionnaire data include:

- Electronic documentation, meaning that all communication is automatically sent and received in an electronic format and thus easy to archive

- Enhanced media capabilities, meaning that additional value can be provided by integrating image, video, or other forms of content
- Single source for data, meaning that a central repository enables all users to have access to the latest version of a document
- Coordination support, meaning that proper resource- and time-management systems are in place to track project scope
- No installed software is needed, meaning that all data can be accessed via a web-browser from any device connected to the Internet

The expert interviews findings are consistent with the above points. However, additional findings that did not surface in the questionnaire were also found. The interviews revealed the ability to leverage global talent. By using web-based collaboration tools, the company's workforce is no longer bound to a single or a few locations. Moreover, employees can be distributed worldwide and are still able to effectively work together by using a common platform. As a result, the working day can be increased to 24 hours by using time zone differences. However, the downside is that proper training is important since traditional project management practices must be adapted in such a new and complex setting. Additionally, processes must be in place to enable teams to work together efficiently and effectively. Trust, already described within the literature review, represents another commonly mentioned area of concern when it comes to virtual teams. But at the same time, social components like social networks or video conferencing were identified to be helpful when it comes to creating rapport and cohesion.

The second part of the research question focused on the question of when it is most appropriate to use social technologies during a project's life cycle. During the literature review, it was discovered that a variety of approaches exist regarding the management of a project. The most common approach in North America, developed by PMI (described in detail in section 2.1.1), was used for this investigation. The analysis of the quantitative survey showed a strong connection between the communication needs and the usefulness of social technologies. In the initiation and planning processes, not only are communication needs the most intense, but also the perceived usefulness of web-based technologies to support project management. The qualitative interviews confirmed and elaborated upon this finding. During the project's early stages, it is important to establish a common language, to clearly define project goals and key terms, and to assign tasks. Hence, strong communication needs exist, and in these processes of the project, rapport and trust are established. Social technologies can be valuable during the early stages of a project since they help people to come together and not just focus strictly on the task. This is especially important in a virtual setting where face-to-face communications are scarce or nonexistent. Web-based tools often help to compensate for that shortcoming and possess the ability to 'put a face to a name'. The expert

interviews furthermore revealed that web-based tool usage differs as the project progresses; for example, using a wiki for knowledge management will prove most helpful during the execution phase.

4.3.1 A Framework for Project Management Collaboration Technology Capabilities

Carte and Chidambaram (2004) developed an integrated model of ongoing team interaction, which described how the deployment of selected collaborative technology capabilities can leverage positive benefits while limiting negative impacts. An interesting fact about their framework is that they view collaborative technologies as "bundles of capabilities" that can both enhance and restrict communication. Time plays a key role in this model since it takes time to integrate collaborative technologies into group processes (Carte & Chidambaram, 2004).

The literature review already stated that a single technology or tool is not sufficient to satisfy all the needs for virtual project management (see 2.3.4); therefore, a collection of tools is required. Carte and Chidambaram (2004) also stated that collaboration technologies, while varying in their specific capabilities, can be viewed as a collection of systems that offer overlapping capabilities available to group members in a given context. Therefore, this framework is adapted for the project management context.

Within the framework, both reductive and additive capabilities are considered. A "*reductive capability*" is a feature of the technology that is considered inferior to traditional face-to-face communication (e.g., a loss in feedback time due to asynchronous communication). Alternatively, an "*additive capability*" enhances normal communication exchanges (e.g., an electronic trail or coordination support). Thus, an additive capability of a certain collaboration technology can be seen as an *additional value*.

The capabilities identified for this thesis are described in detail below. The specific collaboration technologies listed below were extracted from the questionnaire findings (4.1) and theoretically described in section 2.3.4. For an overview, see Table 16.

	Collaboration Technologies				
	E-Mail	Instant Messaging	Wikis	Groupware	Web-based PM Systems
Reductive Capabilities					
Asynchronous Communication	Yes	No	Yes	Yes (in most cases)	Yes (in most cases)
Visual Anonymity	High	Moderate (in most cases)	High (in most cases)	High	Moderate (in most cases)
Offline Availability	Yes (in most cases)	No	No (in most cases)	Yes	No (in most cases)
Additive Capabilities					
Documentation	Yes	No (in most cases)	Yes	Yes	Yes
Enhanced Capabilities	Image & File Transmission	One-on-one or group messaging	Versioning, group editing	Document Storage & Retrieval	Document repository, coordination
Single Source for Data	No	No	Yes	Yes	Yes
Coordination Support	No	No	No (in most cases)	Yes (in most cases)	Yes
No Installed SW Needed	Yes (in most cases)	No (in most cases)	Yes	No	Yes

Table 17. Bundles of Capabilities for Collaboration Technologies

4.3.1.1 Reductive Capabilities

The synchronicity of communication differs across collaboration technologies. While face-to-face communications or telephone calls are synchronous forms of communication, most collaboration technologies tend to be the opposite and are *asynchronous* (i.e., a given delay for a response). However, it was pointed out in the literature review that asynchronous communication is not necessarily a disadvantage; responses are often more sophisticated when individuals have time to think about their response. Furthermore, when working with team

members located in different time zones, asynchronous communication is sometimes a requirement to access the person during their work hours. An exception is instant messaging, in which the delay is so minimal that it can be viewed as equivalent to a telephone call, except that it features written instead of spoken words. Some web-based collaboration tools also have chat features that can be used in the same fashion.

Visual anonymity refers to the inability to connect a face with a certain message or comment. This is a reductive because many non-verbal cues (e.g., body language, expression) are removed from the conversation. Since most collaboration technologies rely on text-based communication, visual anonymity tends to be high. Some technologies do allow an individual to include an image beside the message, such as an emoticon. This feature is often used in instant messaging.

Offline availability describes whether or not data is accessible without an Internet connection. With e-mail, for example, already received e-mails and attachments may be available depending on the type of protocol used (POP3 vs. IMAP or web-access). If POP3 is used, a downloaded message will also be available without Internet access, but for web-access, this is a requirement. However, other tools, such as IM, are not available for use without an Internet connection. Some web-based tools do allow for offline access, but most of these tools require Internet connectivity. Therefore, it is seen as a reductive capability since the user is dependent on not only an Internet connection, but also the availability of the server that is storing the data.

4.3.1.2 Additive Capabilities

The primary advantage of using text-based communication is that it is *documentable*. A copy of all messages can be archived easily and might prove especially helpful in later project stages when the amount of documents and messages increases. Provided that there is an appropriate search mechanism, documents can be found and reviewed without difficulty.

Another important additive capability of collaboration technologies is the ability to *enrich communication* with other forms of media, such as images or video files. Since Internet bandwidth and storage capabilities increase steadily, these richer formats become increasingly available.

Single source for data refers to centralized storage for documents and data in which every project member can access. The primary advantage is that data can be easily found and everybody is automatically given access to the latest version of a document. However, not all collaboration tools support this feature.

Coordination support is especially important for project management. People and resources need to be organized and deadlines met. Web-based project management systems offer

features to support coordination, whereas simple e-mail or instant messaging lacks them. Examples of coordination support include cost- and time planning functionality and tend to be found only in groupware and web-based project management tools.

Another important feature identified is that web-based systems run, by their nature, in a web browser. This means that *no additional software* needs to be installed, and the project data can be accessed from nearly any device with an Internet connection. This increases flexibility and accessibility to data.

4.3.2 Summary of Findings

The current virtual project management literature did not consider the benefits of web-based collaboration tools and the rising trend of Web 2.0 phenomena as it relates to certain project processes. This research addresses this limitation in the literature. Overall, the research studies suggest that the changes triggered by a web-based collaboration may be more profound than the current literature suggests. Through the use of web-based technologies in project management, not only do work practices and employment opportunities change, but also organizational structures. Social technologies assign more power to the individual and by doing so, hierarchies become increasingly flattened. Direct, electronic communication can reduce bureaucracy. The adapted framework from Carte and Chidambaram (2004) helped to identify additive and reductive capabilities of collaboration technologies in general and web-based systems specifically. It was found that web-based systems offer, compared to other collaborative technologies (e.g., e-mail), profound advantages and opportunities for project management.

5 Limitations, Future Directions, and Conclusions

5.1 Limitations

For this thesis, several limitations apply. First of all, due to the newness of the chosen topic, no established or standard books for this area exist. Therefore, recently published journal articles, conference proceedings, and unpublished working papers were used as a foundation for this research. As a result of this, not all literature used has been fully peer-reviewed.

Furthermore, a single person conducted this research for the purpose of a diploma thesis; therefore, time and resources were limited. The sample size of the survey was above one hundred and also had respondents from several nations. The assumption is that the sample is broad enough to suggest some level of generalization across cultures and industries. Of course, a larger sample size would be needed to holistically cover the diversity of individuals using virtual project management practices. Admittedly, the sample size for the qualitative expert interviews was small. This was an intended feature of the research design because the interviews were viewed as the secondary research method with the goal of deepening the findings of the survey. However, if more resources and time had been available, additional expert interviews would have further improved the quality of the findings.

In the data analysis, the qualitative data was analyzed using a cross-case analysis. In this approach, data was compared using common codes, which is a data-reduction technique. This implies that some information may have been lost during the process.

The selected tools and techniques for virtual collaboration provide a good overview of the status quo, but do not necessarily represent all tools available on the market. Hence, some project management tools may have not been discussed in the literature review, questionnaire, or interviews. The goal was to identify classes of well-known and popular tools to begin a discussion on the topic.

Due to the fact that a single researcher conducted this study, the possibility of bias towards a certain technology exists. This thesis is limited in scope should be viewed as a student's first steps in conducting research within the information systems field.

5.2 Future Directions

A clear trend toward an increasingly collaborative environment has been identified throughout the research process. In modern organizations, the days where project managers acted as information keepers and communication hubs are over. Today, project members can have the ability to directly report task outcomes to a transparent, web-based platform, making information instantaneously accessible for stakeholders allowing team members to better understand the status of the project. Organizational hierarchies are becoming increasingly flattened, partly due to social technologies giving more power to the individual and making communication more open and transparent. Hence, as this trend continues to evolve, project management tools will need to become increasingly collaborative; or, the other way around, collaboration tools will need to incorporate more support for project management. The two domains of project management tools and collaboration tools, which were too long considered separate, will need to merge. A platform combining all necessary capabilities is desirable. As teams become more global, software tools will need to become smarter. As an example, individuals can already take advantage of software that allows team members to communicate in their native language over the web, while the software translates the text into each person's language.

Other predicted developments include the increasing use of mobile devices (e.g., smart phones) to collaborate. This goes hand in hand with a rising demand for flexibility, being able to work not only from an office, but also in contexts independent of time and location. This is likely to boost forward even more as Generation Y ("digital natives") enter the workforce. This younger generate has grown up with technology, such as the Internet and mobile phones, and regularly integrate web-based tools in their daily life. This group may believe it is perfectly natural to be online 24/7; in other words: "Everyone is living in 'The Cloud'" (Ilze Zigurs, Interview).

Another area of focus mentioned during the research process, beyond this thesis, is the use of three-dimensional (3D) environments for virtual project management. Due to increased IT capabilities such as bandwidth, such approaches are becoming more popular. These 3D environments allow for a more immersive and natural user experience. Other emerging technologies, such as tele-presence systems, will add face-to-face communication characteristics to virtual teams. With these classes of technology, video and audio create the feeling that all project members are in the same room whereas in reality, they can be thousands of miles apart. These newer tools can affect how virtual projects are managed and controlled.

5.3 Conclusions

Virtual project management is a discipline embodying the potential of connecting globally dispersed talents to achieve common project success. The available research confirms that this is a challenging goal. Factors like time difference, diverse cultures, or the lack of face-to-face presence result in increased complexity for the management of virtual teams. However, if one is able to overcome these obstacles, results are promising. The empirical research underlined the assumption that the demand for VPM is steadily increasing, it even "seems obvious [..] that there's no turning back" (Ilze Zigurs, Interview). Cost reduction, access to global talent, increased demand for flexibility, as well as flattened hierarchies were named as major triggers for this development. Yet, this progression to virtual projects is dependent upon the capabilities of information and communication technologies. Due to the rise of the nearly omnipresent Internet, a recent trend toward using web-based collaboration tools for project management developed.

The research has shown that there is, although desirable, no single tool that is able to unite all of the craved collaboration and project management needs. Hence, in almost all cases, a combination of different tools and techniques is being used to compensate for this shortcoming. Therefore, the research questions investigated in the course of this thesis aimed to shed light on the yet unresolved issues of (1) *how* to use web-based collaboration tools to create additional value and (2) *when* is it ideal to implement these tools during a project's life cycle.

The answer regarding the first part of the question is twofold: First of all, during the process of this thesis, it proved reasonable to increase the level of abstraction toward talking of "collaboration techniques" instead of specific "tools". This is because similar tools will share certain collaboration techniques and will always be temporary; new tools are developed almost daily as others become outdated. It is the capabilities of these tools that matter. From this viewpoint, the research identified coordination support, a single source for data, electronic documentation, enhanced media capabilities, and the ability to not required additional software as the primary added values of web-based tools. Second, it is of utmost importance to have strong processes in place, supporting the usage of collaboration tools and social technologies. Both researchers and project managers agree that the tools must be embedded in the day-to-day work processes or otherwise, the technologies will not used effectively. The findings from both the literature and research align with the fact that initiating trust is vital for any successful virtual team. Also, a big challenge still remaining is the adoption of management practices to a virtual environment. Providing proper training, which is often and mistakenly considered a waste of time and money, can tackle this issue. However, if implemented thoughtfully, web-based collaboration tools provide potential for supporting virtual project management.

The literature review as well as the empirical studies revealed that collaboration and communication requirements differ during a project's life cycle. This thesis examined the existing research gap of when to most effectively implement web-based collaboration techniques. Combining both quantitative survey data and qualitative interviews, the results were unambiguous. The early stages, namely initiation and planning, proved to be most in need for strong communication and thus, social technologies were agreed to provide the most value. Reasons include the desire for creating initial rapport and cohesion among the team members but also frequent communication with project stakeholders. Moreover, tool usage differs as the project progresses: during the early stages, social networks will help to connect people and create rapport while blogs or wikis help to foster knowledge management and documentation during later stages.

Despite the limitations, this thesis in addition makes a valuable contribution regarding a practical implementation of topics related to virtual project management. The literature review aimed to provide a holistic overview of the areas of virtual project management and collaboration techniques, summarizing the main concepts and clearly defining key terms.

This thesis should be seen as a convenient starting point for future research projects related to the practice of virtual project management. For that reason, this work was published under a Creative Commons license (see ·); a step to make sharing and distribution of ideas uncomplicated. The literature review as well as the empirical study has shown that the demand for virtual project management and virtual teams will rise inexorably. The author therefore hopes that the relevance of this research area is being recognized and that he could spark at least some of his readers' curiosity for this intriguing and emerging field.

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7 Appendices

Appendix A. IRB Approval Letter i

Appendix B. Interview Guide ii

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Appendix A IRB Approval Letter

University of Nebraska Medical Center

NEBRASKA'S HEALTH SCIENCE CENTER

Office of Regulatory Affairs (ORA)
Institutional Review Board (IRB)

May 27, 2010

Simon Schoepf
PKI
UNO - VIA COURIER

IRB#: 298-10-EX

TITLE OF PROTOCOL: Trends in Virtual Project Management: Using Web-based Collaboration Tools to Crate Additional Value

Dear Mr. Schoepf:

The Office of Regulatory Affairs (ORA) has reviewed your application for Exempt Educational, Behavioral, and Social Science Research on the above-titled research project. According to the information provided, this project is exempt under 45 CFR 46:101b, category 2. You are therefore authorized to begin the research.

It is understood this project will be conducted in full accordance with all applicable HRPP Policies. It is also understood that the ORA will be immediately notified of any proposed changes that may affect the exempt status of your research project.

Please be advised that this research has a maximum **approval period of 5 years** from the original date of approval and release. If this study continues beyond the five year approval period, the project must be resubmitted in order to maintain an active approval status.

Sincerely,

Ernest D. Prentice, Ph.D.
Executive Chair, IRB

EDP/gdk

Academic and Research Services Building 3000 / 987830 Nebraska Medical Center / Omaha, NE 68198-7830
402-559-6463 / FAX: 402-559-3300 / Email: irbora@unmc.edu / http://www.unmc.edu/irb

Appendix B Interview Guide

Method: Personal interviews

Duration: 20 to 25 minutes

Type: Semi-structured, qualitative interviews

Number of main questions: 5

Question 1: Based on your experience, what are the main benefits and drawbacks of increasingly Internet-mediated and dispersed project teams?

Question 2: What is your opinion about using Web 2.0 tools like wikis, blogs, or social networks for business purposes? What values as well as drawbacks to you see for using these tools in virtual project teams?

> **Question 2.1**: Do you personally contribute to a wiki for business purposes? Why or why not?

Question 3: Where do you see the most influential differences between traditional project management software tools and web-based collaboration tools?

Question 4: Collaboration and communication needs differ depending on the current stage of the project's life cycle. In which stage(s) of a project do you identify the most (or least) value for social technologies?

> **Question 4.1**: In your opinion, how do those chancing requirements influence tool usage during a project's life cycle?

Question 5: Looking ahead, where do you see the future of virtual project management and the tools used to support virtual project management?

> **Question 5.1**: Do you have concerns regarding data security for project data, for example business documents or e-mails, if increasingly more data is stored "in the Cloud"?
>
> **Question 5.2**: Can you imagine that web-based collaboration tools have the ability to become a standard business tool and replace conventional, locally installed software in the future?

Appendix C Interview Transcripts

Interview with Ilze Zigurs, PhD

Position: Department Chair, Information Systems and Quantitative Analysis; Mutual of Omaha Distinguished Chair of Information Science & Technology

Organization: University of Nebraska at Omaha

Address: 6001 Dodge Street, PKI 284E, Omaha, NE 68182-0116 USA

Phone: +1 (402) 554 3182

Email: izigurs@unomaha.edu

Duration: 22 minutes

Type: Personal interview

Date: May 24th, 2010

Place: PKI, University of Nebraska at Omaha

Schoepf: Based on your personal experiences, what are the main benefits and drawbacks of increasingly intermediated and dispersed project teams?

Zigurs: Okay, the um…you know it's interesting to say—to ask it in that way what the main benefits are because, you know, those are fairly obvious. They bring together people from places that you otherwise might not be able to. So you overcome the typical barriers of geography, and time, and organizational affiliation, and everything else—all those barriers. You overcome all of those and you're able to put the right people together for the right task. So, you may get more diversity, you may get a better bunch of expertise and so on. Um, but you know, these sorts of things are just—this is the way we do things now [laughs]. We have to do it that way, so we can't do, you know, sort of this classic cost-benefit analysis. That's just the way the world works. But drawbacks wise, I think there are, again, there are some fairly obvious drawbacks. Um…where it may be harder with a team of people who don't know one another to kind of achieve that trust, but I think the more interesting drawbacks, you see a lot of sort of pretty traditional drawbacks in the literature, but the more interesting drawbacks, I think, are kind of the more hidden ones. This idea, the more subtle ones, and one of them I think is that people have a lot of unsurfaced assumptions about virtual teamwork and dis-

persed internet mediated work. I think their main—they don't reflect, I think, on [phone rings] what they're getting into when they get started on it. They carry their knowledge of traditional teams, such as it is, into these new environments, and they assume that the new environments are going to be the same and that they can operate the same in those new environments. And so I think that there are some real traps that they can fall into. You know, and everyone reads these checklists of well, "What do you have to do for our team to work correctly?" Well, you have to communicate, you have to be really organized, you all have to have agreement about what the process is going to be and so on. But people, I think, do not appreciate just how important that communication is, that initial communication, and lots and lots of communication. And they don't appreciate how important this structure is, and so assuming that they don't, you know, that they can just keep doing what they're doing and that they're going to know how to do it, I think is one of the biggest drawbacks.

Schoepf: And this communication you were talking about also involves non-business conversation—eh, communications like for example…

Zigurs: Oh, social communication.

Schoepf: … exactly, just to socialize and establish trust, I assume?

Zigurs: Right. Right. Exactly. Yeah, exactly. And that's probably harder to do, you know, in the literature you see that classic differentiation between the task-related communication and then the social building, and the team-building communication. And people usually, just like you and I did when you came into the room and sat down here, you know, we just kind of talked for a little while before we said, "Okay, let's get started on this task now," and it's not as…unless you build that in to a virtual environment, that typically is not going to happen. So that makes the whole structure thing even more important, and building things in, making things explicit.

Schoepf: For this "making things explicit," is there a certain example you could name?

Zigurs: Um…well the, well the time spent on team building for example. That as a virtual team you should put that in, put that into a schedule, put that into the team workspace. Or, sometimes, making explicit what the expectations are, or making explicit what everyone's

norms are within the group. Or even simple things like national holidays, or regional holidays that other members of the group might not know about where people would not be expected to have an instant response [snaps fingers].

Schoepf: So there should be a central place for those kinds of announcements?

Zigurs: Yes, yep.

Schoepf: What is your opinion about using Web 2.0 tools, for example wikis, blogs, or social networks for business purposes. Because a lot of those uses are kind of private related, but when it comes to businesses, business uses, what values and, again, maybe drawbacks do you see with using those tools?

Zigurs: I think that this is a really interesting question and it's been fascinating to me how business has adopted these. And it seems like a situation where people are saying—well, you know, they don't seem to be adopting them from the perspective of, "Oh we have a very clear-cut business reason why we want to do this." Instead they almost seem to feel like it's inevitable. Right? That the Millennial Generation or whatever we're calling the new generation is so hooked into these tools that they're just going to take them to the workplace and they're going to use them in the workplace and so, you know, business is like, "Well, this is it," you know, "we have to use these!" So the value, certainly the value of the tools is all about that—the social networking. Well one value, I guess, really relates to these tools are definitely part and parcel of the new workforce, the Millennial Generation. So having this as part of your workplace and the tools that you use in the workplace is a nice familiar environment for people and will, you know, so it looks like you're in the 21st Century at least. So that's good. The drawback may go to what I just said, that people seem to be sort of blindly drifting into their use rather than having a clear notion of what the benefit would be from a business perspective. And there's also such a proliferation of all these different social-networking sites that it's not obvious, you know, how can people possibly have enough time to keep track of everything that's going on on all the different sites? And which tool is best for what kind of activity, for what kind of team and so on.

Schoepf: Mm, I see. Do you, for example, personally contribute to a wiki?

Zigurs: I'm not very good at it [chuckles]. I was, well, last year I was sort of in charge of a wiki, uh… but it's died back. You know what I mean? And I'm not doing too much with it anymore. I've used blogs in…for one of my classes. We're using Facebook, and…uh…in our…when our, we have Norwegian and Indian students coming to visit and we use Facebook to kind of keep connected on that. So yeah, I use these tools.

Schoepf: Okay, and where do you see the most influential differences between those traditional project management tools and merely web based collaboration platforms?

Zigurs: Yep, the traditional tools, of course, have been very much about, kind of, the single user. You know where you have the old notion of Microsoft Project, or whatever big complex project management tool you have. You know, you have the project manager using this tool to keep track of everything that's going on. Whereas the web-based collaboration tools are not only about having a shared view and shared input, but they also go beyond just traditional project management techniques and add that social component and—well, you know you can put them together any way you want. So there's more capability in web-based collaboration tools; there's also more potential for confusion. But definitely the biggest difference is this idea of the shared view; that it's a community space, and that it's a shared responsibility rather than a single person's responsibility.

Schoepf: And obviously it's not, um, not good to just use such systems for each and every kind of project. So I've read a recent article which stated that there is, of course, a learning curve until you get into those tools. And so very short-term projects are not that good for such tools, so they might be used for long-term—longer-term projects because then it makes sense for people to establish some routines and go on with the work.

Zigurs: Yep, absolutely.

Schoepf: Okay, let's come to the next question. So collaboration and communication needs differ depending on which state the project is in its life cycle. In which stages of a project do you identify the most or least value for such social technology?

Zigurs: The social technologies, yeah.

Schoepf: Can they differ from stage to stage?

Zigurs: Yeah, I mean definitely in the initiating stage, because that's where you're really getting everything; people are getting to know one another, you're trying to define the scope of the project. You know, this very—this is very, yeah [chuckles] the whole PMI thing is so task oriented. That it's, you know, very bare bones when it comes to the human side. And so initiating, you know, always…it's uh…doesn't really speak to the social side. But I would think in initiating, when we're really trying to agree on, "What are the boundaries?" There may be a lot of conflict; there may be a lot of communication, and it would help to have that. And that goes over into planning as well, but as you…you know, executing, I don't think, and monitoring and controlling perhaps less so. I mean these phases: executing, monitoring, and controlling are much more classic. All about the task and keeping track of who the resources are and how long, you know, and all the Gantt charts and everything else. But in closing as well, you know, you might have some community celebration and so on. Maybe more in the early phases and then in the closing phases.

Schoepf: Okay, so that's related to, let's say the communication needs where, like, there's more communication ongoing.

Zigurs: Yeah, I think so. More communication, particularly in the early phases where it may be more ambiguous, right? Because if there's need for clarifying ambiguity; need for defining what it is we're talking about, then I think the social technologies can help.

Schoepf: Okay. So, let's head onto the next question and it's about looking ahead. And where do you see the future of virtual project management and especially the tools being used in this environment?

Zigurs: Well, it seems obvious to me that there's no turning back [laughs]. That we're just gonna have more and more tools; we're going to have more and more use of virtual project management. More and more kind of ad hoc and…and adaptive sorts of environments, and teams forming and reforming as they need to form and reform, and reassignment of resources. So tools, I think…um…you know, of course based on the sort of work that we've been doing in virtual worlds. I mean, that's one direction is to have more of a 3D environ-

ment, more of an immersive environment. And another direction is mobile devices, right? To have more of these tools available on mobile devices. So, I think those are two kinds of interesting developments.

Schoepf: So the "3D" idea is that you'll just feel in a more natural environment…

Zigurs: Yes, yes.

Schoepf: …than just on a webpage for example?

Zigurs: Yeah, there's more of a social presence. There's more of a feeling that you're…uh…natural in some ways but unnatural in others [laughs]

Schoepf: [Laughs] It's true.

Zigurs: Yeah, but a feeling—I mean but it's useful for these early phases where people kind of want to get to know one another a little bit more. And there may also be some useful training things that can be done in virtual environments.

Schoepf: Uh hm. And do you think that the development is definitely a tool that's web based tools, just because of the connections getting easier for dispersed teams…

Zigurs: Yes.

Schoepf: …and away from, like, locally installed tools?

Zigurs: Yeah, yeah I think so. Yeah, no I think so—absolutely. Everyone is living in "the Cloud".

Schoepf: [Chuckles] And speaking of which, do you have concerns about data security with more and more information stored on the internet or "in the Cloud?"

Zigurs: Yeah, no. Very much so. Uh…and…uh, yeah it's interesting that you should mention that because we were talking about that in a different context just this morning. This university has gone over to Google for mail, Gmail, for mail for our students and we're planning on going over to Gmail for our faculty maybe in a year's time. But one of our colleagues in the security area was telling us that some universities have already started to go away from it because of their concerns about that and about, you know, this data—these messages being stored forever, you know, on these servers in "the cloud." And yes…that is something to be very concerned about.

Schoepf: Is there anything you'd like to add to this interview?

Zigurs: I think that one of the things that is so important—I guess I would go back to sort of what I started with, is the importance of training project managers on the differences in virtual environments and really giving them advice rather than assuming they're just going to be able to start using all of these tools; really giving them a deep understanding of the different capabilities of the tools and what might be most appropriate under what kinds of circumstances. So I think there's a huge role still for teaching people how to be members of virtual teams and virtual projects.

Schoepf: And I think it's also important that maybe not everyone is suitable for working in such an environment.

Zigurs: Yes.

Schoepf: And such people just shouldn't, because they'll just hold back the team.

Zigurs: Yeah, yeah. I think that's right. Yeah. That's absolutely right so making choices, you know, when they do those little resource assignments in Microsoft Project. Now you have yet another dimension on which you have to assign members [chuckles].

Schoepf: Yeah [chuckles]. Thank you very much for the interview.

Zigurs: You’re welcome.

Interview with Stacie Petter, PhD

Position: Assistant Professor, Information Systems and Quantitative Analysis

Organization: University of Nebraska at Omaha

Address: 6001 Dodge Street, PKI 173B, Omaha, NE 68182, USA

Phone: +1 (402) 554-2077

Email: spetter@mail.unomaha.edu

Duration: 18 minutes

Type: Personal interview

Date: June 2nd, 2010

Place: PKI, University of Nebraska at Omaha

Schoepf: Based on your experience, what are the main benefits of increasingly Internet-mediated project teams?

Petter: I think the largest benefit is the ability to draw from the best of the best around the world. You are not confined to „who's the best in one location?" its "who's the best, no matter where you are". Also, it allows for a lot of flexibility because you have flexibility in cost models, for example people in Omaha do not have to paid as much as people in New York City and you might have comparable experience for a cheaper price. So it gives you some flexibility there, it also helps you to tab into local knowledge and local customs, depending on what it is that you are doing. And when you can do it, "follow the sun" works really well. The fact that you can have basically people working for 24 hours a day. Now, the drawback is, not everybody can do "follow the sun" very well. Now, that's obvious, that's than the down side, its connection and communication, it can be really hard to coordinate people across time zones. I'm working on a project with people right now, from here and from Australia. And that's a pain, because for us to be able to talk, I have to be able to talk at 7 or 8 o'clock at night and its 10 o'clock in the morning for them; we are not really online doing the same thing at the same time zones of the day, so we have a hard time communicating and coordinating, and so if there is a lot of geographic dispersion, its just with time zones that makes it even harder to communicate and coordinate. I also think that there are issues with trust, that are easy to come up in those virtual setting, because I am working with people I have never worked with before, I don't know them, if I saw them on the street, I don't know who they are.

I generally trust them, but I don't know if they always trust me [chuckles] because we have never met! Its hard to built rapport and [..] feel like you are really working with someone when really all I'm interacting with is a computer screen and email. I'm interacting with a computer, not a person. So I think that can lead to lower morale, it can affect the productivity and can just affect the trust and cohesion of the team.

Schoepf: Do you think that face-to-face meeting would be helpful to increase this level of trust?

Petter: I think at least one face-to-face meeting, depending on how long the project is. If it's over a long period of time, like multiple month and years, you may need multiple face-to-face meetings. But I think at least an initial kick-off meeting, whether you meet at a conference or at a side of the company somewhere, I think it can be really helpful. But its not always feasible, I mean sometimes you just cant do it. But I think sometimes it can help.

Schoepf: Regarding time zones, what's your experience with asynchronous communication, because this type will be used more often?

Petter: Right. Right. I think that asynchronous communication is certainly an option but sometimes, it can be slow. So if I send an email at 10 am, he's not gonna get it if he is in Australia until like about 6 pm, and by then I'm eating dinner and winding down from the day, he sends me an email and for him, 1 o'clock his time, that's when I'm sleeping; it just slows things down, even though we do have the ability to talk asynchronously, something that should maybe take, you know, if we could have a quick phone call, we could have it resolved in a few minutes or if we were at the same time zone, we might get it resolved in the same day, and now it drags out to two or three days, just because of the time lag of when we are actually physically online, when we're checking email.

Schoepf: Let's head on to the next question. What is your opinion about using Web 2.0 tools like wikis, blogs, social networks for business purposes? Most of the time those kind of tools are connected with private usage.

Petter: I think they can be incredibly helpful. I think there is a lot of … there could be a lot of potential for them. I don't think that most businesses have found out how to tab into that po-

tential yet. They just assume that if they put it out there, people will use and like it and everything will be great. It's more to it than that. You can't just say we have Facebook in our company and then its gonna work. There has to be a more concerned effort, but I think that there is a lot of potential for those types of tools.

Schoepf: Could you name some specific measures for companies to make those tools work.

Petter: Well I think part of it is, ehhm, they have to know why they are actually using the tool. So if they are trying to use a social networking tool, is it to try to initiate more rapport in the team and so people do feel like they are part in a cohesive group or network, I think then yes, there could be a lot of benefit and use to it. It's there for a specific purpose, its not "we're just going to throw it out there and see what happens". You encourage people according to that purpose of "that's our way to build rapport". If you have a wiki or a blog, usually the intent there is to capture knowledge. There has to be some incentives, it has to be part of the person's work process. If you are just expecting people to go about their normal day to day business and then spend some extra time documenting things on a wiki or blog, they are probably not going to do it. People don't usually like to document or share things. Especially work-related things, thing that aren't „fun" [chuckles]. So I think you have to make it part of their job, it has to be integrated into their process of "this is my day-to-day job, this is what I do, this is how I do my job". To do my job, I have to search it for information, I have to use the information and I have to put it out there. Its not just about only getting information on the wiki or the blog, you want people to actually go out there and use it. And when I know I have a problem, thinking "I'm gonna go check the wiki", not "I'm gonna go call up my fiend" and ask them for advice. I mean, you want to make sure people actually use the information that's being put on there.

Schoepf: On those same lines, do you personally contribute to a wiki and if to, what's the motivation behind it?

Petter: I do not! I don't contribute to wikis or blogs. I'm on Facebook, but I never update it [chuckles], never really online. Because for me, its not integrated in any of my processes. I used blogs in one of my classes this past semester, and I had my students to do weakly blogs, and I only posted on the blog a couple of times. But I made it part of their process and then I read their blogs, I consumed their blogs, but I didn't post it myself.

Schoepf: Where do you see the most influential differences between traditional project management software and newer, web-based collaboration tools?

Petter: Well I think the real benefit with some of the newer, web-based tools is this collaboration. The fact that you are able to get people to working together. Uhhm, its … in some way, there is two parts of this coin. Part of it is, now you're able to get more information from those people actually working on the project, you are able to better communicate and coordinate with them, but it also gives those individual project members more autonomy. They are able to share back to the project manager, update themselves through the tool, "I completed this task", so they update the project plan. Its not them calling the project manger: "Hi, I completed the task today" and then the project manager becoming essentially a secretary. They are actually able to manage the project and not just record the task. So, in some way it creates more of a self autonomy, where people are able to do more on their own, but also by doing that, there is now more interaction and communication between team members and the project manager, because they are both having some ownership of that's going on in the project.

Schoepf: During a project's life cycle, the need for communication and collaboration will differ from stage to stage. Can you identify some stages where it's more relevant to use social technologies than other stages?

Petter: I think it is going to be really important whenever you are starting up in the project and you are trying to get this initial buy-in from a lot of stakeholders and that aspect of initiation. There, I think these types of tools can be important, because they allow, you know, to kind of establish rapport; everyone is coming on board, establishing the scope of the project, the success, the objectives, the rules and responsibilities. You are getting a large group of people involved to do that. Then it kind of flows into phases or aspects that are more autonomous, like, certain types of planning can be done alone and it doesn't necessarily need a lot of collaboration. You might need some inputs in types of estimates, but it doesn't need, say, this large degree of collaboration or social networking to accomplish the goal. But I think once you get into executing, you know, a person on the team runs into a problem, or the project manager is trying to figure out if the project's going off course and how to bring it back and looking for ideas. Especially in the controlling phase, I think where there could be a lot of value in having those types of technologies, because it can bring people together to share ideas and brainstorming on how to keep the project on track.

Schoepf: Regarding those tools and technologies, is there a difference for using certain tools for certain phases?

Petter: Yes. I think, for example social networking, those type of tool would become really important in earlier stages, where you are trying to build rapport. To me, that's really the real value of a social networking technology. It can come in and try to build some cohesion in a team and people are feeling like they are working as part of a group and they don't feel like they are alone, stuck doing the task that I'm supposed to be doing. To draw a larger picture, that can help in the earlier phases. As you are going more into execution and closing, I think more knowledge-capturing sources like wikis and blogs can be really helpful in those types of environments, because you can really identify "here are problems I'm having along the way", "here are ways how I solved them", and other people can leverage that as they are running into problems. I think tools like SharePoint, or more web-based project management tools where people can update their tasks and projects on tasks, I think that's helpful in monitoring and controlling. Then, the project manager is no longer the secretary, the individuals who are doing the actual work are saying: "Okey, here's what I've done today and it's completed". So yes, I think that there's different tools that can provide different kinds of values to different phases.

Schoepf: Let's head on to the final question: If you look ahead, where to you see the future of virtual project management and, especially, the tools being used?

Petter: I think that there's going to be more virtual project management. I think it's inevitable. The world is shrinking. People are becoming more and more accustomed to interacting with people they have never met and only interacting electronically or in a virtual sense. So I think it's going to increase and that there is a lot that those tools have to accomplish. The processes and the tools need to work together. The more that the tool is separate to what the person is actually doing in the day-to-day work, the less likely the tool's going to be used. So if, for example, I have a social networking site, and that's where I go to update the project plan, I also see the social networking site that might help to establish trust and rapport and it just becomes part of what I do. But if this is something separate that I have to do, in addition to my day-to-day activities, I'm not gonna use it. And that's why I don't get on wikis or blogs. I don't have to in my day-to-day work, and I have plenty of other things I can do with my time, so I'm not going to do that on my own motivation; I don't see the value in doing it. But if it

were part of my process in what I do in my day-to-day activities, than I would use it. So I think that those two things would have to be tightly coupled, to create a strong synergy between the tool, supporting project management activities.

I also think that our tools are getting smarter. And I say that in a couple of ways: One is that, you know, now we have things like Google Wave, that can translate as we chat. So, I've talked to students where English is not their first language and they felt very uncomfortable talking on the phone with some other students; So I've suggested "Use Google Wave!", you can type in your native language and it will translate it for you into English for the other person that you're talking to, so I think our tools are getting smarter and I think those types of things can be embedded into project management tools. And even more specific, to project management, our tools can get smarter in terms of helping provide better estimates of how long tasks are going to take, because people are going to enter information on the web, online, its going to be captured and stored electronically. Then we can mine that data, we can do something with this data in order to come up with better estimates and better predict future project, based on that information. So, uhm, I think that's a good thing. I think that the concern that some people have and that I'm hearing from, students for example that are in the area, is concern about "The Cloud" and having too much information about projects stored off-site. You know, is it something they want to contain locally in their company or do they want to put in on "The Cloud" and trust a Microsoft SharePoint server that's online. And how far online do they really want to go and how easy or susceptible is their company? Should that data be breached? If its an important project of your company that you are working on the virtual project, then that's a concern, you don't want people to know how far along you are in the project or what you've learned along the way and there are thing that you want to keep private. So I see that also being, uuhm, kind of a concern or something that's going to impact the future of how the tools are used in VPM.

Schoepf: Recently, I stumbled upon an interesting article which stated that's not mainly the tools, but more likely the collaborative culture influences outcomes.

Petter: Yes, right. I definitely agree with that. And I think some of that is going to … the generation that is coming out today, Generation X, Generation Y, they are so much more comfortable with technology than the Baby Boomers. There is a study which I found really interesting, which was about three years ago, where seven-year olds were investigated. And seven-year olds don't view technology as a separate thing, its just something that has always existed, they just view is as part of themselves. They don't really think of a cell phone as a separate device, you just have one and you don't even think of it as anything else. It's just

something that you have. So the tools become less of an issue as long as they are embedded in our day-to-day activities, and I think part of that is culture, too. So, the organizational culture, the society culture in terms of how they view technology and how its used to support processes, how they view collaboration. And this is definitely a generation that is focused on collaboration and working with others, whether it be through online gaming, through Twitter, through all the different tools and technologies that are available now. A lot of people in society are growing up with this kind of more community focus, with this "lets work together" focus, uhhm, I think some of that does change with age [chuckles]. Its not necessarily that everything is unique to that generation, I had certain parallels in my generation, but I think its not necessarily the tools that matters, its how you use the tool. And that's kind of that first point of that. That has to be really strong in order to add a lot of value to the firm. You can have a great tool, but if there is nobody ready to use it, if there is no real process in place, if you don't know why you are using it and the user sees no value, it's not going to help you at all. There has to be a culture that promotes it, that encourages it and a process that supports it.

Schoepf: Is there anything you would like to add to the interview?

Petter: I don't think so. I think that covers it!

Schoepf: Okay, thank you very much for your time!

Petter: You are welcome.

Interview with Dorest Harvey, MBA

Position: Executive in Residence

Organization: University of Nebraska at Omaha

Address: 6001 Dodge Street, PKI 173A, Omaha, NE 68182, USA

Phone: +1 (402) 554-3161

Email: dorestharvey@mail.unomaha.edu

Duration: 17 minutes

Type: Personal interview

Date: June 2nd, 2010

Place: PKI, University of Nebraska at Omaha

Schoepf: Based on your experiences, what are the main benefits and drawbacks of increasingly Internet-mediated work and project teams?

Harvey: A problem is that you lose certain things in a dialog using technical means, for example the dialog, the face-to-face, etcetera. However, you pick up a lot of speed and based upon what the context is, then the Internet-mediated can be much more productive. It's a hybrid model, because I've read through your questions and that's when I really said „I'm really on a hybrid model here". Because you need some face-to-face, so that you get to know the people, and then after that, once you establish the trust, then you are good to go. And those tools provide a way to speed the thing up.

Schoepf: So you think that an initial face-to-face meeting would be helpful to gain trust?

Harvey: Yea, I've been in some, in both corporate and government situation where we've done that; you do an initial face-to-face and then you do the electronic means, whatever that is. And it's much more successful after you have establish at least a rapport; If its not trust, you get a rapport that you establish, by people saying "Oh yea, I know you, you're from Phoenix, okay!"

Schoepf: But what about if those people are highly geographically dispersed, for example some of them being situated in Australia?

Harvey: See, I don't think that matters. I'm making the assumption that the project is funded at a level where there is an initial face-to-face. Now, I have not participated but I would be delighted to do so in these Cisco presence type of meetings. I think we are going to see that [tabs on table] take the place to some extend to the face-to-face. That's because it establishes the same thing. It gives you the body language and all this other stuff and the dialog. And they have come a long way with that. And John Chambers is betting Cisco on that right now, right? [laughs] So we should have that available here but we don't have it yet; but we would have the capability.

Schoepf: What is your opinion of using Web 2.0 tools like wikis and blogs for business purposes since those tools are mainly related to private issues?

Harvey: Yea, sometimes you have issues with that. But I think there is value to that if it is focused on a topic project-based. People will tend to contribute to that based upon the same thing of a rapport [tabs table] and they provide meaningful, sub sensitive input to the process. People are going to ignore the same way people would sit in a meeting and not participate if they did not have anything to offer. So that goes back to the issue of having the right people at the right problem, right? So if you select them right, this is the Jack Welch GE thing, how did he make run GE so well? Get the right people and the rest is easy. They will communicate and figure the problem out. So that would be the assumption I would make. That you have the right people; they are all interested, they are all motivated and focused. Given that, those tools work well, I have seen that in numerous examples. Values, drawbacks, same things, the initial face-to-face, but once you establish rapport at a minimum, trust at a max, you can use these tools.

Schoepf: You also mentioned processes. Do you think its important to provide structured processes when using such tools?

Harvey: I think from a project management standpoint, if you are a project manager, leader to that, the first thing you do is to provide the project beginning and end, overview, you know, you can name those mission, vision, values; what are the things we are going to do? Once

you get buy-in from the participants on that, you are going to have much more success from whatever tools that you use, and you gain increased productivity from the automated tool-sets, the electronics, the Web 2.0, the interaction. Because you enable interaction to take place on a more regular, a more systematic basis.

Schoepf: You already talked about project phases. Communication and collaboration needs will differ from phase to phase within a projects life cycle. Where do you think social technologies can prove the most value?

Harvey: Well, initially there is a lot of the broadcast mode, form the project manager assigning responsibilities etcetera. So you will gain some value there, but you will gain more once an understanding of what the goals and the objectives are. People will work more interactively with those tools than they could without them. In other words, you don't have to set up the meeting, you can do it through IM or through a blog or a wiki at any time, any place. So you can do that asynchronously as oppose to having everyone in one place at one time. I think that's the real benefit. We did some things early at American Express back in the late 80's early 90's on group system software and we found that to be true even back then, before you had all the other Internet tools, you could lay that on top of it. Once you establish the means and the needs and the goals, people can interact. If they are so motivated and comfortable with the tools.

Schoepf: So you are saying that those tools are especially helpful during the day-to-day activities?

Harvey: Yea. But there is also another set of tools for the initial brainstorming, problem-solving etcetera. But once everybody is in line for the direction and understands what the mission is, they can interact more quickly with electronic tools.

Schoepf: Where do you see the most influential differences between traditional project management tools and web-based tools or collaboration platforms?

Harvey: It's quicker, faster, cheaper. All in those terms, from an implementation kind of standpoint, with the web tools are more in vogue because you can afford them, right? They provide more interaction, hopefully will get you better results, it won't get you into the [..] the

argumentative or whatever phase because then the communication would stop; again, it's an alignment issue from the beginning. So I think that that would be one of the differences.

Schoepf: Looking ahead, what do you think the future of virtual project management, especially with regards to the tool usage, will look like?

Harvey: Well, I think it's going to be the telepresence with all those tools all embodies in that. We used to talk about those things called "wearable's". And there will be some form of that. To where now, you can almost have … of course I hate to say it, because we now have legislation relative to not using texting while driving, but people to tend to be able to multitask. And so this will give you the opportunity to do that, if you have the capability to be in the room, doing something else. And today, we are all attending those "webenars" etcetera. You can be doing this, doing that, interacting when you need to and so on. There will be much more of that. I've read a couple of years ago that somewhere the IT, the service workforce or whatever the hell we are these days, we are interrupt-driven. And the .. the time on-task is in a few short minutes. You probably know a lot more about that than I do. So you can take these few short minutes of interacting, doing this, doing that, being over here, texting someone etcetera. You can do that. Again, project focused, with pre-signals in mind.

Schoepf: Do you think then that there is a trend toward a single system embodying those characteristics?

Harvey: Nono, distributed or distributive; depending upon your view on the world. All of this stuff will come in these type modes. Now, will there be more important, centralized data-sinks or data-repositories? Yea, for the successful companies or organizations, that will be true. We are seeing that. I see that at the work I do here, at the state of Nebraska, I see it in the military, I see it all over the corporate world; once you can get that buy-in and people don't feel like they are "displaced by" and become comfortable with the technology, their productivity will go up; the more interaction, the better.

Schoepf: Do you have concerns about data security if more and more data is stored in the Cloud?

Harvey: [laughts] Well, sure! Yea, and you see that every day and somebody has got one of these [grabs phone] and telling you something you don't care about. But depending upon what the topic was, if you were a competitive whatever, that's a real issue. But that .. well, the technology is secondary to whether people understand, and maybe they try to multitask too much in too many different areas. So you have to consider the location, consider the course. Things you wouldn't do, well, we are seeing that on Facebook now; there are things that you would not tell the world, but people are putting it on Facebook, what the hell is up with that? [laughts] Well, they don't get it! But once you get it … and not necessarily control it, but of course they will add their own controls to that. You have to consider the folks around you. But in a focused business sense, in a focused environment, that would be appropriate.

Schoepf: Do you wish anything to add to the interview?

Harvey: No, I would look forward hearing your results and see how I line up with other folks. It would also be interesting if you see some differences internationally, although I suspect in a global marketplace today, there will be less rather than more.

Schoepf: That is to expect. Well, thank you for this interview!

Harvey: You are welcome, that's it! Send the retainer to my secretary [laughts].

Interview with Deepak Khazanchi, PhD

Position: Professor of Information Systems & Quantitative Analysis, Associate Dean for Academic Affairs

Organization: University of Nebraska at Omaha

Address: 6001 Dodge Street, PKI 172C, Omaha, NE 68182, USA

Phone: +1 (402) 554-2029

Email: khazanchi@unomaha.edu

Duration: 27 minutes

Type: Personal interview

Date: June 9th, 2010

Place: Scotts Conference Center, University of Nebraska at Omaha

Schöpf: Based on your experiences, what are the main benefits as well as drawbacks of increasingly Internet-mediated project work and project teams?

Khazanchi: I guess the most critical benefits are the usual; you know, you can leverage talent, wherever it is. In my view, globally dispersed teams bring one fundamental thing to the table, and that is this: you can find the talent that you need for your project, wherever it is, at a *reasonable* price. So those are elements in my view for successful teams. And then, the other part is, you can bring together intellectual parts from different parts of the organization. You can allow people to balance their life- and work-style needs. You know, if you have a person that has to take care of their children, they can stay at home and still work full-time; if a person is disabled, they can still operate and do the things they need to do if they have the talent. Right? And the same thing is true with cross-cultural members of the team. So when they can participate at their own time, asynchronously or synchronously, and (..) put effort in the team. So that's I would say broadly the most beneficial. I think that companies look at productivity benefits and cost efficiency as another reason, but I think those only happen if you have synergy across the team. So to create that, you have to create an environment where every member is appreciated for what they can bring to the table. The other things are cost efficiency and productivity are of course important for companies. But they will come if everything else is in place. So those are the benefits. I mean the challenges clearly understanding how to work with culturally dispersed members and also members who have differ-

ent needs in the team, lifestyle needs, if you have, like we said, family or work issues that require to operate out of different locations. And then, (..) the other challenges of course are finding the right set of technologies that support interaction between team members. So that's a big challenge; Companies tend to just choose technologies without thinking through what kind of features they need to support the needs that they have. So if you have an insurance company, they are more process-oriented, you need support in the team to help the process, and shared process management. If you have a software company, you have process but you have also a lot of insuring work that can be broken up into parts and send to different people. The other part is that you can also create sub-groups that are intercultural. So, instead of just saying "Indians are going to do our sourcing and Americans are going to do that design", what you have to do in my view to be more effective and more efficient for companies is to find a way to have an integrated group that goes across cultures and you have talent that can put together whether it is design or outsourcing of maintenance or software development. But it has to be based on abilities rather than just cost. I mean, right now, it is mostly based on cost, but in the future it will be more based on your capabilities. So that's a challenge still. And then of course, you know, time is a big issue. Even though to the fact that you can do 24/7 activities, the disadvantage is that you can do 24/7 activities. So if someone from the US needs to talk to someone in India, you have to actually do it in the night because it's 12h time difference. So that really is a big problem.

Schöpf: You already mentioned to find the right set of technology. In recent years, social technologies like wikis or blogs became more popular. What is your opinion about using such tools for business purposes, since they are mostly used for private issues? Do you think that they can be helpful in business settings?

Khazanchi: Yea I think so. Ilze [Zigurs] and I have this concept we call "bundle of capabilities". So you have to have a bundle of technology capabilities to allow people to be flexible. I just recently wrote a paper on how to retain global IT talent. What are the main challenges of retaining global IT talent? And one of the interviews we did with a local CIO of a global company, he said he allows his employees to use social media, so that a) it gives them prestige, they can use the leading technology, so it actually is a benefit. So if I'm doing well in the company, I'll give you access to social technologies, you can use that. And b), you can use it for communication between people. And so by restricting it, it doesn't really change anything because employees still use it. So you need specific measures. So instead of not allowing users social media at work, they have their own social media versions. So they have created in-house versions that they use for communicating between the employees by themselves

and then customers. So they are using it for just issue-solving and handling problems over Facebook. They have a Facebook page. So I think that you can use social media, again its just like any other technology. Technology capabilities have to be used for a purpose, and a business purpose needs to be very clearly defined. And if the only thing you are going to do is e-mail, then why would you need anything else? So, it depends on what you want to do, for example someone wants to have a branding strategy that will help them to be identified by the next generation of employees they might have. Right? So, they want to use social media to make sure that people are aware of who this company is and what they do because they want to hire you [points], ultimately. You work for them, and if you don't see them on Facebook or Twitter, they will say you are not a real company, right? So, to that extend, companies will invest in it, but I don't think right now companies don't spend too much effort in social technology as it relates to business. But I think there are benefits, you can use private groups, private messaging to inform and also collect anonymous input on corporate issues, government issues and also troubleshooting. Mutual of Omaha, for example, uses instant messaging for support, for IT support. So you can get an IM if you are part of this network. But that's all secure and internal; So, they are using versions of social media but in their own way. You can use social media like blogs and wikis for knowledge management and I think that's a big deal. And you are working with Stacie [Petter], so Stacie has done that and I think that is not used enough. Sharing stories rather than sharing "if you do this, do X, if you do X, do Y", rule-based knowledge management. Sharing anecdotal stories that would actually help other people. Also, sharing stories about failures would help you to become better managers, because you would not do that. So I think if you can do it anonymously, it will help. It also helps you reduce bureaucracy by having social media available to you employees. So like the military here, they have implemented a blogging environment for their internal use, and initially they have implemented it by stating of who you really were when you posted something. Result: no one used it. Of course, the guy on the field is not going to say something against the general, because it is a very hierarchical organization in the military. You have to do military service, right? You can't just say something to your superior. But when the new general command here in Omaha decided that it will allow people to submit anonymous commentary, they can submit ideas, solutions, comments, so suddenly it has become a very well used media. And what it does is it removes power-differences, so any power differential we might have. And that's a great way to allow bureaucracy to flatten, especially with technology.

Schöpf: I think giving more authority to the individuals is a very important idea.

Khazanchi: Exactly, power to the individual. Of course, we will never have this fully in the private sector, [laughs], if one be like Europe, right, everyone is equal. Its not gonna happen, because the private sector is completely based on competition and is value-driven. They have to make money and be efficient. So that means that some people have to make decisions and so there will be hierarchies, whether people want to call it that or not, I mean Apple says they are a matrix, but actually I don't think they are; they are not actually flat. So if you think of Google, everyone is an equal person, but not really! Sergey Brin has more money than everyone else, right? So the thing is that you are equal and technology can help flatten that, at least in terms of the differential that exists in generating ideas and solutions. But there is a downside: I can't reward you for your ideas because I don't know who you are if its anonymous. So there is no incentive in some sense for people to create ideas and solutions if their names are not attached to it. So that's a challenge.

Schöpf: A recent trends in project management has been to used web-based collaboration platforms to coordinate and communicate. What do you think the main differences to normal project management tools are?

Khazanchi: I think that now, there are no 'normal' project management tools. Everything is web-based! If you look at the Microsoft products [.. people greeting Deepak], you can deliver it by web. So the traditional tools are also available as web-based tools. Of course I think that there are collaboration tools; Collaboration tools over the web are not … in our research at least, Ilze and I found that global companies don't tend to use much collaboration tools for process stuff. They only use it for communication, for example conference calls or skypeing. They don't really use it for work processes. So I think that I changing as technology is becoming better, people are more able to use shared repositories like Google Docs. So that is happening. I think there is still a long way to go in terms of the design of the technologies. I don't think its there yet, its not very easy to use. We have used Hardle and all those different technologies, but its not easy to use. I would like to have all the capabilities on one technology. I want to be able to do multi-point video conference, communicate with people in real time, asynchronously, I want to be able to do asynchronous interviews, for example put a questions, get an answer, like a blog kind of thing which is actually more of a focus group, but its virtual [smiles]. I want to be able to put all of those capabilities into one platform! I want to be able to do collaboration, process management, workflow management, I want to do scheduling, all that on one platform.

Schöpf: Do you think that's realistic in the near future to combine all those capabilities into one platform?

Khazanchi: It is, it is! I think it is possible. And Groove started that. So Groove has little applet, little work-flow applets, they have these tabs. And each of those tabs are in the same architecture. And so they started it but it did not really success very well because Microsoft bought them. It has now become part of the Microsoft platform. But I think you need an independent kind of provider. Lot of technology companies are moving towards that, especially in our work, again in the 3D environments Ilze and I worked on, that capability needs to be incorporated into collaboration tools, its not there yet. None of the collaboration tools have them. There are some experimental ones, but they are not good and sophisticated enough. If you can bring all these great simulation games and Wii-type games and those joysticks, why can't we incorporate those kind of design features into collaboration? So I think the interface needs to change, the hardware, it has to be more comfortable; you are using iPhone [picks recorder up]; why can't we design interfaces that are like that? You have wireless connectivity, I should be able to sit on the beach and be part of a meeting [chuckles].

Schöpf: That'd be the dream, yes. Lets head on to the next question; communication and collaboration needs differ within the lifecycle of a project. Do you think that social technologies provide more value to certain stages?

Khazanchi: Like I said, if you have a collection of tools that are integrated in one platform, then you can choose the capabilities. I'd say that there are differences, for example planning requires more brainstorming whereas execution requires more monitoring and scheduling. If you have all those tools in one environment, then you can obviously choose the ones that are more suited. But I would say that each of those stages requires more of one or the other. But clearly, communication is common to all of those, you have to have communication. Controlling, you need to have more tools that allow you to keep track of project then. You know, like a project management software. Yea, I think depending upon all of (..) I guess project management tools in general have good scheduling and so on. I'd say that especially in the initial stages you need lot more collaboration, like brainstorming, collection of ideas, requirements definition and so on. That's more emphasis on the brainstorming side of things.

Schöpf: Lets head on to the last question which looks a little bit ahead. Where do you think that the future of virtual project management is heading? You mentioned an integrated platform, but besides that, do you think of anything else?

Khazanchi: I think that this idea of agile project management. And, of course, quality assurance is another area. Project management assurance is a concept I have created, actually I have a paper on this PMA, and the idea is that we need to have project management assurance activities to the whole cycle, the whole process. What people do is they take the initial requirements and they look at the success factors and then say, okay, we've reached them in schedule or out of schedule; but what we are proposing and what the future holds is assessment of risk in each stage and you need to identifying controls for managing the risk before you even start. So for each stage you would have risks and controls, and then these risks and controls will have to be managed and they have to be audited. So my proposal in this paper is, and I can send it to you if you want, it's the idea of assuring project management and that includes risk management, includes quality insurance, but assuring it from a risk perspective; so that ultimately, you have those outcomes that you want, on time, on schedule. Those things are easier to measure, but the problem is by looking at just that, every stage, you don't really set yourself off for success. The way you set yourself off for success in my view is that you identify risks, identify how you control those risks and then use that process all the way. So if the risks are not mitigated after the first stage, you go back and adjust so that you know that won't be a problem in the next stage. So, what we have done is we have categorized risks in each of those stages. And we can tell you what kind of controls are needed. So we are calling this whole process the "project management assurance". So I think even in distributed project management this would be a model in the future. That it will be more risk- and control-based, more accounting kind of view, then it will be traditional schedule, budget and stuff. So you need technology to also support that kind of process.

Schöpf: Sounds very interesting, I'd be keen to read this paper. Thank you for the interview!

Khazanchi: Sure, we will do that. You're welcome.

Interview with Justin Daharsh

Position: Project Manager

Organization: FireGuard, Inc.

Address: 4404 South 76 Circle, 68127 Omaha, NE

Phone: +1 (402) 898 2236

Email: justin.daharsh@fireguardusa.com

Duration: 19 minutes

Type: Personal interview

Date: June 13, 2010

Place: Library, University of Nebraska at Omaha

Schoepf: Based on your experiences, what are the main benefits as well as drawbacks of the increasingly Internet-mediated work and project teams?

Daharsh: Well, I'll start with the drawbacks. One of the biggest drawbacks is to get everybody to use the softwares the same way, because initially people are going to use the softwares however it benefits them best. But that doesn't benefit the team very well because everybody's using it in such a different way that it's hard to keep track of the means by which the project is produced in the end. So, employee A does his way of creating a project schedule, employee B does it different, C is different and so on and so forth. Sure it's efficient for each one of them independently, but once you're trying to actually produce the project as a team it just creates problems. Additionally, it's really hard to get everyone to follow one one set of guidelines on how to use it because you're taking away their independence and creativity by limiting them and saying that this is the way the project should flow and this is the way you should use the software to make the project flow that way. Going into benefits though—the biggest benefit I've found with internet based project management software is that as the project is evolving, it's evolving in real time. So using employee A,B, and C again, as they're each independently doing work on the project, their project can be seen by eachother simultaneously as they're all working on it. So in an eight-hour workday, when each one of them is working on it independently at their own computer in their own office, they can access eachothers' work and see the project evolve without actually having to discuss with eachother what they're doing (more or less). Like, „What have you done today for the past

two hours? I need to know so I can formulate what I'm going to do next." So they can kind of see it growing organically almost.

Schoepf: What is your opinion about using Web2.0 tools like wikis or social networks for business purposes, since they are usually used for private purposes? Do you think there is a value those tools can create for being used within a business?

Daharsh: Yeah, I do. I personally haven't used social networking tools, *per se*, in the business setting, but the software I use in the current company I work for is a web-based project management software. It has a component to it where notes for any individual project are recorded and updated as the project itself evolves. The benefit that I've found to this is that as the project goes through different phases, people can access the same information for that project and update it accordingly when they see fit. So the initial phase of a project, when the project is captured, there are certain bits of information that are pertinent to the project and to whichever individuals are acting in that project. As that project evolves, it goes to construction and to whatever the next phases are. Those notes either need to be eliminated or updated—new notes added and so on ad so forth. This can be done very efficiently when everyone has access. The only problem is that it allows people to put in whatever notes they want to put in. So it's hard to put a control in there and make sure people are putting the right information in and not eliminating information that is pertinent, but that they don't understand. So an employee can get in there and eliminate some information because that employee doesn't know why that information was there and didn't see value in it. But another employee does know why it's there and does know the value of it, so there are problems in that. I suppose strong communication is the answer to that, but, again, it creates problems. Though the overall benefit of having a way to keep track of updated information efficiently; there's a big benefit there with that sort of software.

Schoepf: Where do you see the main differences between traditional project management tools and this newer web-based approach?

Daharsh: The biggest difference I see is the fact as the project grows and changes, the information is accessible instantaneously, and by large groups of people ... all those people who are involved with the project. A company I used to work for who didn't have an Internet based project management software had a project management software that was created by the company and it was on the company's server and everybody basically had their own

software, more or less. It was the same, but everybody used it differently so for the most part, it was all different. So these projects which required design teams, and project managers, and estimators, and service technicians, and all these different people were using the same software, more or less, on the same projects but using it differently all the time. The information that was pertinent to these projects didn't correlate very well because people would put information that was contradictory to other peoples' information because they couldn't see each others' work. As the projects would come to a close, it was a mess because the information wasn't sorted in an organized fashion. It was at the whim of whoever was using it at any given time. So to keep track of where the project was tracking financially, or how the labor force was doing as far as efficiency is concerned...these sorts of things were very hard to read without a whole lot of research into the details that were in each project file. Whereas with the web-based project management software, everybody sees the same thing at the same time. So everybody knows where the project is at at a time, and they know exactly what each other knows because they're all seeing the same thing. The other big benefit of it, at least with the software that I'm using, it keeps track of the financials, and where the labor is at for a project, and how many hours are being put into the project, and so on and so forth. It prints out reports for us that can tell us all that information as opposed to somebody actually having to calculate it.

Schoepf: Research identified that communication and collaboration needs will differ depending on which stage the project is in. Do you think there are differences using those web-based tools? Are there more values in certain stages of a project, where they could prove to be more helpful than in others?

Daharsh: Absolutely. I have quite a bit of experience with both types of software, Internet based and more traditional based, and with both companies there was a similar system with how a project goes from beginning to end. Where there's an initial estimating phase, and then there's going to be a kick-off project management phase which would be like the planning phase, and then there's going to be a design phase, then an execution phase, and then at the end of that phase, a closeout phase. The company I used to work for which didn't have the Internet based, there were certainly problems with communication in the initial phases as far as the design and project management phases because the project manager always had to be present to communicate to the design team, or to the executing the work, and so on. Whereas with an Internet based software, you could communicate through that so information can be given to the design team or to the labor force via the web. Rather than having to be in person, or making phone calls, or sending e-mails or anything like that and this informa-

tion is accessible by the entire project management team. So everybody knows where everyone's at rather than just the designer knowing where the designer's at, along with the project manager. Also, the president of the company knows where they are at, the admin knows where they're at, the labor force knows where they're at, so everybody is on the same page. So I suppose the most value I find in Internet based project management software would certainly be in the conception phase—planning and design. Because that's where collaboration and communication is most valuable. Because you have a whole slew of different people who have different ideas of what this project is, and how it needs to evolve, and make its way to completion. And everyone has to make sure that this is done in an agreeable fashion. To have this sort of software, to communicate with it, has proven to be very valuable, especially where I'm working now where I'm communicating to the upper management team as well as the labor force simultaneously when I use the software to say, „Hey technician A, you're going to have to be at this job doing these sorts of things on such and such day." Well then upper management sees that as well and knows, „Hey, technician A is going to be here doing this, which means that this part of the project is complete and we're ready for the next phase of the project." And if they see it and they say, „I don't agree with that, this project's not ready to move on to that phase, or, technician A shouldn't be the one on that project," they can communicate that too me foregoing the fact that maybe that wouldn't have even known about it otherwise.

Schoepf: Let's look a little bit ahead. Where do you see the future of project management heading?

Daharsh: Well I'd certainly say that the future of project management will initially go to a web-based project management software. There are far more benefits than drawbacks with that sort of software and doing project management in such a style. The old fashioned companies that are still doing the traditional forms of project management are falling behind because it's a cost and a burden because it takes more labor hours, more people hours, to complete a project because of the fact that people have to be present in front of other people to communicate details of the project. Whereas with the web-based software they can do it from anywhere; they don't have to be present.

Schoepf: Do you see a concern regarding data security if all the data is stored online instead of on everyone's computer?

Daharsh: There's data security issues that I could see coming from within the company, because if everyone has access to it everyone can make modifications and change it. People can hide their mistakes in it as well. In that sense I see security issues, but in the sense that other companies or competitors might be able to access your files and your records—I can only say this based on assumption—but I would assume that security tools for these sorts of software are evolved enough and smart enough that they don't allow it.

Schoepf: Is there anything else you would add to this topic?

Daharsh: I don't think so, I think we've gone over everything.

Schoepf: Thanks for your time and the interview!

Daharsh: Alright!

Appendix D Questionnaire (en)

Collaboration Tools

1 [wiki1] Do you use a wiki to obtain information and knowledge? *

Please choose only one of the following:

- Yes, frequently
- Yes, rarely
- No

e.g. Wikipedia or company-intern wiki

2 [wiki2] Do you contribute actively to a wiki? *

Please choose only one of the following:

- Yes, frequently
- Yes, sometimes
- No

e.g. for documentation, knowledge management

3 [soc-net] Do you have a profile in a social network? *

Please choose only one of the following:

- Yes, in multiple networks
- Yes, in one network
- No

e.g. Facebook, Twitter, Buzz

4 [op-source] Do you consider Open-Source software as an attractive alternative to commercial products? *

Please choose only one of the following:

- Yes, whenever possible
- Depends on the circumstances
- No

Collaboration Tools 2

5 [security] Data security: Do you consider it risky when documents (e.g. e-mail) are stored on servers outside the company ("on the Internet")? *

Please choose only one of the following:

- Yes, all data should stay within the company
- Maybe; depending on the security guidelines of the service provider
- No, I have no doubts

6 [tools-pm] Which tools are used to support project management in your company? *

Please choose all that apply:

- Microsoft Project
- Lotus Notes
- Web-based tools or platforms (e.g. JIRA, Basecamp, Loop, 5PM, Zoho)
- Open-Source solutions (e.g. OpenProj, GanttProject)
- Wikis
- E-Mail
- Other:

7 [tools] On average, how often do you use each of the following tools during work? *

Please choose the appropriate response for each item:

	never	yearly	monthly	weekly	daily
E-Mail					
Telephone					
Fax					
Instant Messaging (e.g. Skype, ICQ, MSN)					
Office Suite (e.g. Microsoft Office, Open Office)					

never yearly monthly weekly daily

Online Office (e.g. Google Docs)

Wiki

Web-based Project management software (e.g. JIRA, Basecamp, Loop, 5PM, Zoho)

Project Management

8 [adv-tools] Using web-based tools for project management, which advantages do you see? *

Please choose all that apply:

- Cost-reduction
- More effective communication
- Simplified file-sharing
- Simplified collaboration with dispersed team members
- All data is stored in one centralized place (no duplicates)
- Better quality
- Reduction of time to market
- Better service for customers
- Web-based tools have no advantages for project management
- Other:

9 [phase-1] In which project phases could social technologies prove to be especially helpful? *

Please choose all that apply:

- Initiation phase
- Planning and design
- Executing
- Monitoring and controlling
- Closing
- Social technologies would not be helpful in project management
- e.g. file-sharing, social networks, chats

Project Management 2

10 [phase-comm] In which project phases is the need of communication with customers especially intense? *

Please choose all that apply:

- Initiation phase
- Planning and design
- Executing
- Monitoring and controlling
- Closing

e.g. customer involvement, frequent feedback, ...

11 [phase-coor] In which project phases is the internal coordination effort especially intense? *

Please choose all that apply:

- Initiation phase
- Planning and design
- Executing
- Monitoring and controlling
- Closing

e.g. resource-allocation, task-distribution

12 [value] By using 'Web 2.0' technologies for project management, what value (or detriment) would arise?

Please write your answer here:

e.g. wikis, social networks, document-sharing, ...

General Information

13 [sex] Your sex? *

Please choose only one of the following:

- Female

- Male

14 [nation] Where do you currently work and live? *

Please choose only one of the following:

- Austria
- Germany
- USA
- Russia
- Other

15 [job] How many years of work experience do you have? *

Please choose only one of the following:

- 0 - 5
- 5 - 10
- 10 - 20
- 20 +

16 [funk] What is your position within the company? *

Please choose only one of the following:

- Manager
- Employee
- Student / Intern
- Trainee

17 [gr-pt] What is the size of your current project team? *

Please choose only one of the following:

- Small (up to 5 persons)
- Intermediate (6 to 15 persons)
- Big (more than 15 persons)
- I don't work in a project team

Should you work in multiple project teams, please select an average

18 [time] Do you work with team members located in different time zones? *

Please choose only one of the following:

- No
- Yes, small time difference (< 3h)
- Yes, medium time difference (3h - 6h)
- Yes, big time difference (> 6h)

19 [branche] In which field does your company operate? *

Please choose only one of the following:

- IT
- Architecture / Construction
- Service industry
- Other

Appendix E Qualitative Questionnaire Results

- bessere Vernetzung aller Teammitglieder *(better connection with team members)*
- highly flexible workplaces
- flexible working hours
- Flexible and easy data gathering, single place of knowledge. Comes at cost of neccessity to keep everybody organized by forcing them to contribute, but when the process is started, team can pretty much keep it up.
- wiki, project management, support
- Better coordination & visibility.
- Sharing of up to date documentation and information from a single repository will assure that everyone has access to the correct project information (contract documents, project plans, specifications, issues logs, etc)
- As a project manager, I have used both web based and private project management softwares. The benefit I found with web based software was that internal communication with regard to project status was very effective. Progect life cycle could be viewed, al
- zentrale Datenhaltung *(centralized data)*
- I dont see the valve
- zentralisierte datenhaltung *(centralized data)*
- Nutzen:- Dokumenten-Sharing: mehrere Personen können auf ein Dokument zugreifen und gemeinsam daran arbeiten --> spart Zeit und somit Geld- durch die Interaktivität von Web 2.0-Technologien kann das kreative Potenzial der Projektmitglieder besser genutz (document sharing)
- Verbesserte Kommunikation.Projektdetails und Projektfortschritt in Echtzeit den Projektteilnehmern zugänglich machen. *(increased communication)*
- no duplicates for document versions
- Datenschutz *(data security)*
- Mehrwert: bessere Kommunikation Nachteil: ev. Informationsüberflutung *(+ better communication, - too much information)*
- Flexibilität, Erreichbarkeit (*flexibility, availability)*
- global availibility, access with only browser
- Wikis, document sharing
- Senkung der Kollaborationskosten- Verkürzung der Informations-Durchlaufzeiten- Homogene Informationsdichte
- einfache Handhabung *(cost cuttings for collaboration)*
- Der persönliche Kontakt zum Kunden sollte nicht verloren gehen. *(don't lose personal contact)*
- Z.B. Lastenheft (und auch Benutzerhandbuch) im via WIKI an einer Stelle vorhanden und änderbar *(document repository)*
- manche Mitarbeiter sind es nicht gewöhnt *(new to some employees)*
- einfach zugängliche und gemeinsame Plattform der Projektdokumentation von der 1. Analysephase bis zun Projektabschluss inkl. der Anwenderdokumentation. nicht geeignet für vertrauliche bzw. geheime Dokumentationen *(simple access to common platform, not acceptable for confidential documents)*
- Ablenkung größerzu viel \"spielereien\" möglichbesprechungen oft sinnvoller, als alles zu versuchen online abzuwickeln *(distraction)*
- Ablenkung, zuviel privates Surfen *(distraction)*
- Direkter, unkomplizierter Kontakt mit dem Kunden und unter den Projektmitarbeitern, wenn auf professionelles Kommunikationsniveau geachtet wird. Bei zu saloppem Umgang mit dem Medium wirkt die Kommunikation schnell schlampig und erzeugt ein unprofessionel *(direct contact to customer)*
- alle Informationen an einem Platz für alle Teammitglieder zugänglich *(document repository)*
- Überblick
- Gesprächskultur nimmt ab, reale Kommunikatuion oftmals wesentlich zielführender *(decreased communication culture)*

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