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Te Kura Tiaki, Whakawhiti Kōrero

Personal Knowledge Management

An analysis of benefits and challenges of using
Web 2.0 technologies at the individual level

MMIM592

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Executive Summary

This research investigates the benefits and challenges of using Web 2.0 technologies (Wikis, Blogs, Facebook, Twitter, etc.) for personal knowledge management (PKM). It focuses on the challenges and benefits of using these technologies at the individual level to find out how realization of the key benefits and mitigation of challenges can improve personal performance in software engineering companies. This research also investigates the influence of PKM skills proposed by Dorsey (2000) in realising benefits and minimising challenges.

Methods of data collection involved semi-structured interviews with three middle level managers and three software developers from four multinational software engineering companies. Qualitative research methods were used for analysing data. To explore benefits and challenges of using Web 2.0 technologies for PKM, a general inductive analysis strategy (Thomas, 2006) was used. This approach helped the researcher to derive concepts and themes which emerged from the raw data. Analysis also drew on and extended Dorsey's PKM skill model (2000) to identify which benefits and challenges of using Web 2.0 technologies can be addressed by PKM skills.

Results from this study highlighted three important benefits of using Web 2.0 technologies for PKM: *improved time saving, improved collaboration, and improved communication across hierarchical barriers*. *Ease of use of technologies* and *ease of organising information* were found to be enablers of the technologies for effective management of personal knowledge. Results also showed four important challenges of using Web 2.0 tools for PKM: *inaccurate and inappropriate information, lack of participation, lack of knowledge about the nature of technologies, and security sensitive*. Findings of this study highlighted the importance of PKM skills to realise benefits of Web 2.0 technologies and minimise their challenges.

The benefits and challenges of using Web 2.0 technologies have direct impact on individual performances. If employees are aware of these challenges, and have appropriate PKM skills, they will be able to improve their individual performances. The researcher suggests an extension of the Dorsey's PKM skill model (2000). Furthermore, in order to enable better understanding about the impact of PKM skills on individual performances using Web 2.0 tools a tentative model is proposed at the end of the study, which needs to be further explored in future studies.

Key Words: PKM skills, Knowledge management, Web 2.0, Enterprise 2.0

Preface

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Chapter 1. Introduction

Unlike Organizational knowledge management, which is to facilitate access to and retrieval of content with special emphasis on the accessibility of knowledge at organizations (Alavi and Leidner, 2001), personal knowledge management (PKM) is about the self effectiveness of individuals to create value for themselves and be more valuable to their organization (Nonaka et al., 2006). It is concerned with how people can become knowledge workers (Pauleen, 2009). The value of studying PKM is to support individuals to better manage their knowledge processes, collaborate around information and exchange their knowledge with others (Frاند and Hixon, 1999; Truch, 2001; Agnihotri et al., 2008; Razmerita et al., 2009). Nonaka et al., (2006) highlight the importance of individual knowledge workers in organisations, and address individual knowledge workers as the main knowledge creators in organisations.

“Organizational knowledge creation is the process of making available and amplifying knowledge created by individuals as well as crystallizing and connecting it to an organization’s knowledge system”. (Nonaka et al., 2006, p. 1179)

Web 2.0 tools have changed the way individual workers interact with each other. Many studies have been done during last few years, highlighting the importance of Web 2.0 technologies for improving knowledge management in organisations (Agnihotri et al., 2008; Paroutis and Al Saleh, 2009; Pachler and Daly, 2009; Razmerita et al., 2009; Balim and Dogerlioglu, 2011). These technologies help employees to organise, retrieve, and analyse information more easily, and because of the ability of these technologies for instant publishing (Schneckenberg, 2009), employees are able to become both users and publisher at the same time. However, researchers argue that there are many challenges associated with using Web 2.0 technologies (Paroutis and Al Saleh, 2009; Razmerita et al., 2009; Balim and Dogerlioglu, 2011). Security issues, existing inaccurate and inappropriate information, and lack of participation are some of the challenges of using Web 2.0 technologies. Razmerita et al., (2009) argue that Web 2.0 can also have a disruptive impact and employees can spend a lot of time using these tools, which can lead to a loss of productivity.

This research investigates the benefits and challenges of using Web 2.0 technologies (Wikis, Blogs, Facebook, Twitter, etc.) for managing personal knowledge. It focuses on using these

technologies at the individual level to find out how they can improve personal performances in software engineering companies. This research also investigates the impact of PKM skills proposed by Dorsey (2000) on realising benefits and minimising challenges of using Web 2.0 technologies at the personal level. Dorsey (2000), and Avery et al. (2001) emphasise the importance of using these skills for both problem solving and appropriate use of technologies, rather than problem definition.

Although there are many studies that identify the benefits and challenges of Web 2.0 technologies at the organisational level, (Paroutis and Al Saleh, 2009; Pachler and Daly, 2009; Razmerita et al., 2009; Balim and Dogerlioglu, 2011), to date, there is little holistic research that explores the challenges and benefits of using Web 2.0 tools at the individual level. In addition, it appears that no research has been done to explore what PKM skills employees need to manage their knowledge when using these technologies, and which challenges and benefits of using Web 2.0 technologies can be addressed by these skills. Therefore, the motivation for doing this research was to answer the following questions;

1. *What are the benefits and challenges of using Web 2.0 technologies for PKM?*
2. *What are the technological enablers of Web 2.0 technologies?*
3. *What PKM skills can enable the realisation of the benefits and help in the reduction of challenges?*

This research begins by presenting a literature review. It then presents the methodology used for analysing data. Thirdly, it presents findings of the research which describes participants' views about the benefits and challenges of using Web 2.0 technologies and PKM skills they needed to manage their knowledge. Fourthly, it presents deeper discussion and suggestions that would have potentially help employees to realise the benefits of Web 2.0 technologies and minimize challenges of these technologies at the individual level. Finally it shows implications for future research.

Chapter 2. Literature Review

The purpose of this chapter is to review relevant literature including previous studies about the use of Web 2.0 technologies for Personal knowledge management (PKM) in organizations. After a brief overview of literature about knowledge management, this chapter will explore potential benefits and challenges of Web 2.0 technologies for personal knowledge management in organisations based on findings from previous studies. The chapter will then use the PKM skills model from Dorsey (2000) to consider which challenges or benefits of using Web 2.0 technologies can be addressed by PKM skills.

2.1. Knowledge Management Strategies

Knowledge has become the most important strategic asset in organisations and is seen as being a crucial resource to help achieve sustainable competitive advantage (Davenport and Prusak, 1998; Paroutis and Al Saleh, 2009). Realising the importance and value of knowledge sharing between employees, many organizations have invested a large amount of money, time and effort in knowledge management systems (McNamee et al., 2010).

Knowledge has been explained as consisting of two broad dimensions; explicit and tacit (Polanyi, 1966; Nonaka et al., 2000; Howells, 1996). Explicit knowledge refers to more tangible knowledge that can be captured and expressed in a systematic language and can be shared in the form of data, diagrams, tables, and manuals and so on (Nonaka et al., 2000). In contrast tacit knowledge is in the mind of workers and cannot be easily articulated. Jeremy Howells defines it as “*non-codified, disembodied know how that is acquired via the informal take-up of learned behaviour and procedures*” (Howells, 1996, p. 92). The concept of tacit knowledge appeared for the first time in a book by Michael Polanyi (1966), called ‘*The Tacit Dimension*’. Polanyi argues that individuals know more than they can tell.

Some authors identify two broad approaches to Knowledge Management Strategy; codification and personalisation (Hansen et al., 1999; Greiner et al., 2007). Companies may adopt one or both of these strategies to manage their tacit and explicit knowledge. The codification strategy aims to capture and store explicit knowledge, where it can be accessed and used at any time by employees, while the primary aim of the personalisation strategy is to develop and transfer tacit

knowledge through direct person to person contacts (Hansen et al., 1999; Parise, 2009). In the personalisation strategy the purpose of using *information and communication technologies* (ICT) is to connect employees to each other and facilitate better communication and knowledge sharing between them. The focus of this research is relevant to both codification and personalisation strategies. The research aims to explore the benefits and challenges of using Web 2.0 technologies both for sharing tacit knowledge between individual employees, and also to retrieve, organize and evaluate explicit knowledge.

2.2. Knowledge Sharing

Knowledge sharing has been recognised as a key process area in knowledge management, as it provides a link between the level of individual knowledge workers, where knowledge resides and organisations, where knowledge achieves its economic and competitive value (Hendriks, 1999). The Employee knowledge sharing is defined as “*the ability of employees to share their work-related experience, expertise, know-how, and contextual information with other employees through informal and formal interactions within or across teams or work units*” (Kim & Lee, 2006, p. 371) .

Over the past three decades, awareness of the importance of spreading tacit and explicit knowledge among employees has persuaded organisations to use different information and communication technologies such as email, ERP, CRM, etc. (Hendriks, 1999) to facilitate knowledge sharing between peers in organisations. Hendriks (1999) suggests that these technologies can enhance knowledge sharing as they can lower temporal and spatial barriers between knowledge workers by improving access to information and knowledge. However, traditional technologies lack the social context surrounding both the content and the source of information (Parise, 2009). Traditional knowledge management systems have focused on capturing and storing explicit knowledge. Alavi and Tiwana (2002) identified several limitations of traditional knowledge management systems; (1) constraints on transitive memory, (2) insufficient mutual understanding, (3) failure in sharing and retaining contextual knowledge, and (4) inflexibility of organisational ties. They argue that these limitations reduce the knowledge integration in organisations. However, Burley et al. (2009) argue that emerging Web 2.0 technologies have the ability to overcome these limitations by supporting knowledge sharing and free-flowing information exchange between employees.

2.3. PKM skill model

The notion of PKM was coined by Frand and Hixon (1999). They introduced PKM as “*a conceptual framework to organize and integrate information that we, as individuals, feel is important, so that it becomes part of our personal knowledge base*”. PKM is not all about self-promotion (Agnihotri and Troutt, 2008), but as Truch (2001) explained, PKM is about self-effectiveness and making people more valuable to the organisation that they are working in and consequently, it will create more value for individual employees. According to Razmerita et al. (2009) personal knowledge management (PKM) represents the sub-domain of knowledge management that focused on individual knowledge process. The value of studying PKM is to support individuals to better manage their knowledge processes, collaborate around information and exchange their knowledge with others (Frand and Hixon, 1999; Truch, 2001; Agnihotri et al., 2008; Razmerita et al., 2009). Nonaka et al. (2006) highlight the importance of individual knowledge workers in organisations and managing their knowledge because individuals are the main knowledge creators in organisations and managing their knowledge can create value for both individuals and organisations. In this study, the scope of PKM is referring to PKM in the organizational context and use of PKM by individuals for their personal life is excluded.

Dorsey (2000) suggests that individuals need to have PKM skills to be able to make better decisions and solve their problems easier. Dorsey (2000); Avery et al., (2001); Hayams (2000); and Agnihotri and Troutt (2008) are among few researchers who have highlighted the significance of PKM skills for managing personal knowledge, problem solving and decision making. Avery et al. (2001) argues that these skills support problem solving, rather than simply defining problems. There are seven PKM skills in the proposed PKM framework by Dorsey (2000). PKM skills are: (1) Retrieving information, (2) Evaluating information, (3) Organising information, (4) Collaborating around information, (5) Analysing information, (6) Presenting information, (7) Securing information.

The reason for choosing this framework by Dorsey (2000) is that the researcher believes that individuals are more likely to benefit from technologies, and minimise the challenges of using technologies if they optimise these skills properly. It is obvious that all barriers and challenges of using technologies cannot be solved by PKM skills, because some of challenges are out of the control of employees. However, some of the important challenges of using technologies may

occur because they are not used skilfully by individual employees. Therefore, the most important focus of this research is to examine which of these challenges and benefits (with respect to the use of Web 2.0 tools) can be addressed by PKM skills.

Agnihotri and Troutt (2008) suggest that the only way employees can exercise PKM optimally is when technology tools are used skilfully. *“The optimal utilization of technology tools will depend on how well knowledge workers and other users assimilate the PKM skills and technology in their KM behaviours”* (Agnihotri and Troutt, p. 339). Furthermore, adopting new technologies is not enough for managing employee’s knowledge, but individual employees also need to have appropriate PKM skills that will allow them to retrieve, process, filter, structure, store, secure and share knowledge (Jefferson, 2006).

2.4. Web 2.0 tools and benefits for PKM

The term Web 2.0 was firstly coined in 2004 by Dale Dougherty, Vice President of O’Reilly Media Inc during a conference about the future of Web (O’Reilly, 2005). Web 2.0 refers to the second generation of web applications such as Social Networking Sites, Social Bookmarking, Blogs, Wikis, Yammer, RSS feeds, etc. Schneckenberg (2009) argues that Web 2.0 technologies are not only a new generation of technologies but a paradigm shift in which users are accessing the internet for collective creation of knowledge. One of the important benefit of these tools is their capability to improve communication and collaboration in organisations, between employees and also with other external parties like customers and suppliers (Paroutis and Al Saleh, 2009; Pachler and Daly, 2009). While traditional knowledge management systems have focused on capturing and storing explicit knowledge, new web-based technologies are more people-centric technologies which focus on capturing and sharing tacit knowledge as well as explicit knowledge in a connected environment (Hazlett et al., 2005).

Unlike traditional technologies, which lack the social context surrounding both the content and the source of information (Parise, 2009), these technologies facilitate a more socially connected web. People are able to communicate, participate, collaborate, add or edit information, and make educational transactions more possible than any other time (Paroutis and Al Saleh, 2009; Pachler and Daly, 2009). Since the day of its invention in 2004, Web 2.0 has rapidly gained popularity in business and society.

Web 2.0 technologies have been seen as leading to faster innovation in organisations and making innovations richer because these tools have the potential for involving individual employees in the innovation ecosystem (Ribiere and Tuggle, 2009). Adequate integration of Web 2.0 applications by employees can accelerate innovation and entail economic benefits ranging from optimising to higher degrees of innovation and quality (Benlian and Hess, 2008).

Web 2.0 tools have changed the way individual workers interact with each other. These tools also allow users to become both users and publisher at the same time because of the ability of Web 2.0 instant publishing technologies (Schneckenberg, 2009). Social networking applications, Blogs, and Wikis are among the most popular applications that could facilitate knowledge sharing between employees.

2.5. Enterprise 2.0 (Web 2.0 in organizations)

The term Enterprise 2.0 (E2.0) refers to the use of Web 2.0 tools for organizations. “*Enterprise 2.0 are new digital platforms for generating, sharing and refining information that are already popular on the internet, where they are collectively labelled Web 2.0*” (McAfee, 2006, p. 23). McAfee used the term E2.0 to focus only on those media whose organizations and individual employees can use in order to make the output of their knowledge workers more visible. Enterprise 2.0 tools are more business oriented and the most popular of them are Wikis, Blogs, Yammer, Micro-blogging, RSS feeds, social bookmarking, and social networking.

In the last few years, E2.0 technologies have massively entered to the organizations’ knowledge environment. In a survey of over 619 business technology professionals in April 2011, Wolfe (2011) identified that 68% of organizations have adopted at least one E2.0 application and the rest of them are either rolling or testing these technologies. However, this research uses the term Web 2.0 generally because participants of this study may use these technologies out of their work environment for managing their personal knowledge. Several important Web 2.0 technologies and the way they are used are defined as follows;

Social Networking: Social Networking sites are central points on the web for personal knowledge sharing (Razmerita et al., 2009). These web sites are used by both public and corporate users. “*Social networking sites have become central points on the web for sharing personal information and socializing online*” (Razmerita et al., 2009, p. 1027). The most popular

social networking web site is Facebook with more than one billion active Users by October 2012 (Protalinski, 2012). LinkedIn, Tweeter and MySpace are the other most popular social networking web sites.

Blogs: According to Balim and Dogerlioglu (2011), blogs are personal corporate oriented diaries that organisations can use in order to enhance communication, collaboration and knowledge sharing among the employees, and can even be shared with external partners.

Wikis: Wikis allow users to add new content, edit available content, and share it with other people (Levy, 2007). These tools are seen as very useful tools to retrieve and organise information (Avery et al., 2001). At the business level, Wikis are also among the most popular application for internal knowledge sharing.

RSS (Really Simple Syndication): RSS is a web feed which is used for adding new data and information about the company on the company's website. "*The usage of this protocol in the organizations enables employees to be notified about new information about the company*" (Baliim and Dogerlioglu, 2011, p. 203).

Social Bookmarking: These applications provide a simple way for employees to share bookmarks of internet resources (Razmerita et al., 2009). Social bookmarking applications help employees classify their resources, in order to have easy access to them in future. The most famous examples of these applications are *Delicious.com* and *Heystack.com*.

Yammer: This application is similar to social networking tools like Facebook but has been designed for using in companies for knowledge sharing purposes. In recent years, Yammer has been adopted by many organisations. While some of organisations are afraid of using Social Networking tools because of security challenges, Yammer is seen as being a useful alternate for these technologies inside organisations.

The following table highlights the important benefits of using Web 2.0 technologies at the individual level which have been identified in the existing literature. This table shows that a few researchers have studied the usefulness of these technologies for knowledge management.

Benefits	Sources
Improving communication	Paroutis and Al Saleh (2009); Pachler and Daly (2009); Razmerita et al. (2009)
Improving collaboration	Balim and Dogerlioglu(2011); Razmerita et al. (2009)
Improving knowledge sharing	Burley et al. (2009); Schneckenberg (2009)
Increasing innovation	Ribiere and Tuggle (2009); Benlian and Hess (2008)
Creating and codifying information	Razmerita et al. (2009); Chui et al. (2009)
Organising information	Razmerita et al. (2009); Avery et al. (2001); Tredinnick (2006)

Table 1. Summary of Web 2.0 Benefits and sources for PKM

2.6. Challenges of using Web 2.0 tools for PKM

Lack of executive support in applying Web 2.0 tools is an important factor that may prevent employees from using these tools. Paroutis and Al Saleh (2009) highlight the role of management in introducing Web 2.0 in organisations and argue that top management need to take an active leadership role in introducing Web 2.0 technologies, explaining and communicating their benefits and articulating how these technologies fit into the organisation's knowledge management strategy.

Finding accurate and relevant in Web 2.0 tools is another important concern of knowledge workers. Anderson and Mohan (2011) argue that difficulty in finding necessary information through Web 2.0 platforms is a challenge in front of employees who are using these technologies. In addition, finding reliable information on Web 2.0 technologies is hard and time consuming for employees. Furthermore some managers are concerned that their employees may spend too much time in using these tools for personal purposes (Kaplan and Haenlein, 2010; Razmerita et al., 2009). Razmerita et al. (2009) argue that Web 2.0 can also have a disruptive impact, and employees can spend a lot of time with these tools which can lead to a loss of productivity.

Privacy concern and information leaking is another important challenge in front of employees who are using Web 2.0 tools. Anderson and Mohan (2011) identify privacy concern as one of the important challenges that make employees reluctant to use these tools. They find that people are

concerned about sharing their personal information with colleagues or outside of their organisational boundary.

Resistance of employees to adopt Web 2.0 tools is one of the main barriers in implementing Web 2.0 in organisations. In a survey in 2009 about adoption of Web 2.0 tools, it was declared that the most important barrier for adopting Web 2.0 tools was culture. Resistance to change was considered as the main cultural challenges by respondents (Wylie, 2009). Balim and Dogerlioglu (2011, p. 202) argue that “*content control is the most important resistance reason related to the usage of Web based systems for communication and information sharing activities*”.

Lack of knowledge about the benefits and usability of Web 2.0 tools in organisations is also an important challenge. Paroutis and Al Saleh (2009) argue that the lack of knowledge about tools, unawareness or cynicism about the value that these tools could provide, and also lack of organisational or management support are the most important barriers for adopting Web 2.0 tools by organizations and individual employees. Furthermore, due to the existing varieties of Web 2.0 technologies available on the Web, some companies don’t know which application is appropriate for their organisation. The following table shows the key challenges identified in the literature regarding using Web 2.0 technologies at the individual level.

Challenge	Source
Privacy concerns	Anderson and Mohan (2011)
Resistance to change	Wylie (2009); Balim and Dogerlioglu (2011)
Lack of knowledge about the nature of Web 2.0 Technologies	Chui et al. (2009); Paroutis and Al Saleh (2009)
Lack of executive support	Paroutis and Al Saleh (2009)
Content control	Balim and Dogerlioglu (2011)
Difficulty to find accurate information	Anderson and Mohan (2011)
Time control	Kaplan and Haenlein (2012); Razmerita et al. (2009)
Lack of motivation	Paroutis and Al Saleh (2009)

Table 2. Summary of Web 2.0 Challenges for personal knowledge management

2.7. PKM skills and Web 2.0 tools

As mentioned earlier, there are several Web 2.0 technologies which can support PKM. Each tool has its own features and has been designed for a specific purpose. According to Razmerita et al. *“PKM on Web 2.0 is achieved by a set of tools that allow people to create, codify, organize and share knowledge, but also to socialize, extend personal networks, collaborate on organizing knowledge and create new knowledge”* (Razmerita et al., 2009, p. 1022).

Adopting these technologies will not necessarily bring success to the companies or individual employees, but the way these technologies are used is more important. As Agnihotri and Troutt (2008, p. 332) stated *“the focus should be on how these tools and techniques facilitate the process of finding solutions for knowledge workers’ needs”*. Agnihotri and Troutt (2008) have proposed three dimensions of PKM skills- tools fit and argue that knowledge workers should apprise their skills and tools by using these three dimensions;

1. *Quality of Information-* for the proper interpretation and transformation of information retrieved information must be correct.
2. *Accessibility of information-* access to new information and saved knowledge must be easy.
3. *Ease of use of tools-* using tools must be easy.

Agnihotri and Troutt (2008) also highlighted the importance of user context and believe that at the individual level, context is very important for the effective creation and utilisation of knowledge. They argue that *“it is clear that an individual’s PKM skills and tools will predict their fit, however, this relationship will be sensitive to the user’s context”* (Agnihotri and Troutt, 2008, p. 337).

As it was mentioned earlier, some authors suggest that adopting technologies will be effective if users are armed with PKM skills. Harmonising technologies with PKM skills can bring individuals and organisations long term benefits. Agnihotri and Troutt (2008, p. 338) identified that *“if technology tools will address the concerns of the user exercising PKM skills, it is highly probable that the perceived utility will be positively affected and there will be great improvement in terms of utilization of these PKM skills and tools”*. Furthermore, they argue that utilisation of PKM skills and tools will lead to a positive knowledge impact.

2.8. Literature review summary

The reviewed literature highlights the importance of PKM for improving individual performance. It also identified the important benefits and challenges of using Web 2.0 tools at the individual level. PKM skills model proposed by Dorsey (2000) is applied to find out how these skills can enable realising the benefits of Web 2.0 tools and reduce challenges of using these technologies. Reviewing existing literature revealed that there have been a few studies that identify benefit and challenges of using Web 2.0 technologies at the personal level, and to date no research has been done to examine which benefits and challenges of using Web 2.0 technologies can be addressed by PKM skills. Furthermore, the PKM skills model has not been applied in the context of Web 2.0.

Chapter3. Methodology

This chapter begins by explaining the approach that will frame the research. Then it will describe the participants and ethical considerations. Thirdly, data collection strategies will be explained with regard to the research questions. Finally, the data analysis procedure will be explained in detail.

3.1. Research method

Researchers use different approaches in qualitative research for studying information system in organisations. Orlikowski and Baroudi (1991), and Myers, (1997) suggest three philosophical assumptions for studying information technology in organisations; positivist, interpretive and critical. In contrast to the positivist approach, which is to understand objective or factual account of events and situations, Orlikowski and Baroudi (1991) argue that the interpretive approach assumes that people create and associate their own subjective meaning of the world around them. Hennink et al. (2011) identify that the interpretive paradigm has three distinguishing aspects; firstly it is to understand people lived experience from their own perspective, which is known as subjective experience. Secondly, in the interpretive approach reality is socially constructed when people's experiences are within social, cultural, historical or personal contexts and finally, unlike positivist approach, which only concentrates on available facts, the interpretive approach recognises that people experiences are subjective and they can have multiple perspectives on reality.

According to the above definitions, the researcher decided to frame this research within the interpretive paradigm, as it considered as the most appropriate approach for this study. This approach helps the researcher to explore and interpret the subjective meaningful experiences of individual employees who are using different Web 2.0 technologies based on the social and cultural context that they are working in. Klein and Myers (2000) suggest the interpretive paradigm as a most suitable method for studying information system in organisations because it can help the information system researcher to understand employees' actions and thought in an organization's context, and can produce a comprehensive understanding of information system phenomena.

To answer research questions raised by this study, qualitative research method within the interpretive tradition is considered to be the most appropriate research method. Qualitative research allows the researcher to investigate issues and challenges of a phenomenon from the view point of study participants, and to understand their meanings and interpretations to events or objects (Hennink et al., 2011; Myers, 1997). As one of the aims of this research is to explore challenges and benefits of using Web2.0 technologies from the viewpoint of participants, qualitative research method is seen as being the most suitable method for this research.

Qualitative research is also considered as the best approach if people want to examine a subject in depth, especially when the topic is new, and there is not much formerly published research on that topic (Myers, 2008). As understanding the usefulness of Web 2.0 technologies for personal knowledge management purposes in organisations is relatively new, and there are only a small amount of previously published studies available about this topic, qualitative research method is an appropriate approach for this study. Qualitative research gives the researcher the chance to focus on smaller samples, and to ask questions that are impossible to put into numbers (Bogdan and Biklen, 1998).

3.2. A description of participants and ethical considerations

Participants of this study were six professional employees from four multinational software engineering companies. The participants included three software developers and three middle level managers, all with more than five years experience of working at high profile multinational companies. The selection was performed through two different levels of employees at these organisations in order to avoid group biases (Myers, 2008), and get comprehensive knowledge about different benefits and challenges of using Web 2.0 technologies from the viewpoint of two different hierarchical levels.

Ideally this research should have happened in three companies with two interviewees from each company. However before starting the interviews, one of the participants resigned, and another participant from the fourth company was involved in this research. Table 3 shows an overview of participant selection.

In accordance with the Victoria University Human Ethics process, all interviewees were provided with a 'participant information sheet', prior to the beginning of interview. The

participant information sheet described the purpose of research, and assured participants of the confidentiality of their data. It also described participant’s right to withdraw from the research before the commencement of analysing the data. With the permission of interviewees, 45 minutes interviews were recorded using a digital voice recorder. On the day of interview, a signed consent form was also obtained before the interview took place.

Company A	Interviewee A and B (software developers)
Company B	Interviewee C (middle level manager)
Company C	Interviewee D and F (middle level managers)
Company D	Interviewee E (software developer)

Table 3. Participant selection process

3.3. Data Collection

Data collection was carried out via face-to-face semi-structured interview. Semi structured interviews help researchers to develop a comprehensive understanding of the topic. “*Semi-structured interview enjoys its popularity because it is flexible, accessible and intelligible and, more important, capable of disclosing important and often hidden facets of human and organizational behaviour*”. (Sandy and Dumay, 2011, p. 246). As the interviews occurred only once, semi- structured interviews were chosen to help the researcher to discuss issues around the topic in more detail, and disclose important and mostly hidden facts of participants’ behaviours. Semi-structured interviews also helped to explore detailed components from the viewpoints of interviewees.

All participants were asked the same set of 10 open ended questions, and some follow up questions. The follow up questions arose following the participants’ answers to main questions in order to draw out their experiences and attitude. After transcribing interviews, for the sake of increasing trustworthiness and credibility of data (Denzin and Lincoln, 1998), texts were sent to participants so they could check their transcripts and return them to me with any changes. Two of participants were also telephoned to ask for clarification about some of their comments that were difficult to understand. Participant checking is a good way to check the validity of the data. Participant checking happens at the end of interviews when the researcher provides a report, and sends it to participants to revisit it in light of their judgment. (Richards, 2009, p. 149).

3.4. Data Analysis

According to Thomas (2006), deductive analysis refers to data analysis that examines whether data is consistent with previous theories, frameworks, and hypotheses which has been investigated by prior researchers. On the other hand, inductive analysis refers to a systematic approach which allows a researcher to develop a theoretical account which is grounded in empirical observations and raw data (Strauss and Corbin, 1998; Martin and Turner, 1986).

The researcher used both deductive and inductive strategies for analysing data. Hennink et al. (2011, p. 210) indicate that “*qualitative data analysis involves the interplay between induction and deduction*”. They argue that if researchers only consider deductive strategy for data analysis, they may miss issues and facts raised by participants that may point to new processes, explanations and behaviours that were not considered by researcher.

To explore benefits and challenges of using Web 2.0 technologies for personal knowledge management, a general inductive strategy approach was used. Data were inductively coded using an inductive coding process technique described by Thomas (2006). After organising raw data in a common format, themes and categories were developed from multiple readings of the raw data. The key themes and words were then displayed in a table. This process helped the researcher to draw the conclusions from different themes. According to Miles and Huberman (1984), displaying data is very useful to identify emerging themes and to discover themes that need further verification from interview participants. After displaying the data three participants were asked to verify several unclear themes by email.

To address the second question of this research, a combination of deductive and inductive strategies were applied. Deductive strategy was applied based on the categories of PKM skills described in literature review, by Dorsey (2000). This strategy was used in order to explore which challenges and benefits of using Web 2.0 technologies at the personal level can be addressed or minimized by PKM skills. Inductive strategy was also applied to interpret raw data to identify and explore new categories about new PKM skills.

Chapter 4. Empirical Findings

The purpose of this section is to present findings about participants' views about the key benefits and challenges of using Web 2.0 technologies for managing their personal knowledge and to explore how PKM skills may address these benefits and challenges. The study identified three key benefits, *improved time saving, improved collaboration, and improved communication across hierarchical barriers*, and four challenges, *inaccurate and inappropriate information, lack of participation, lack of knowledge about the nature of technologies, security sensitivity*. In addition two technological enablers were found to have facilitated the realisation of benefits and mitigation of challenges, *ease of use of technologies and ease of organising information*.

Six of Dorsey's seven PKM Skills were identified that contributed to reducing challenges and facilitating the realisation of benefits, *retrieving information, evaluating information, organizing information, collaborating around information, presenting information, securing information*. In addition, two further PKM skills were identified that contributed to reducing challenges of using Web 2.0 technologies: *creating and updating information, and time control*. Figure one shows the overview of findings of this study which will be discussed in more detail in the following two chapters.

This chapter is organised as follows: first, a description of the technologies which were used in the four multinational software engineering companies where participants worked is presented. Second, the benefits of using Web 2.0 technologies for personal knowledge management and their impacts on individual performance are described. Third, the participant's experiences about the existing challenges of using Web 2.0 technologies and their impacts on individual performance are outlined. After each benefit and challenge, the PKM skills which could address that specific benefit or challenge are described.

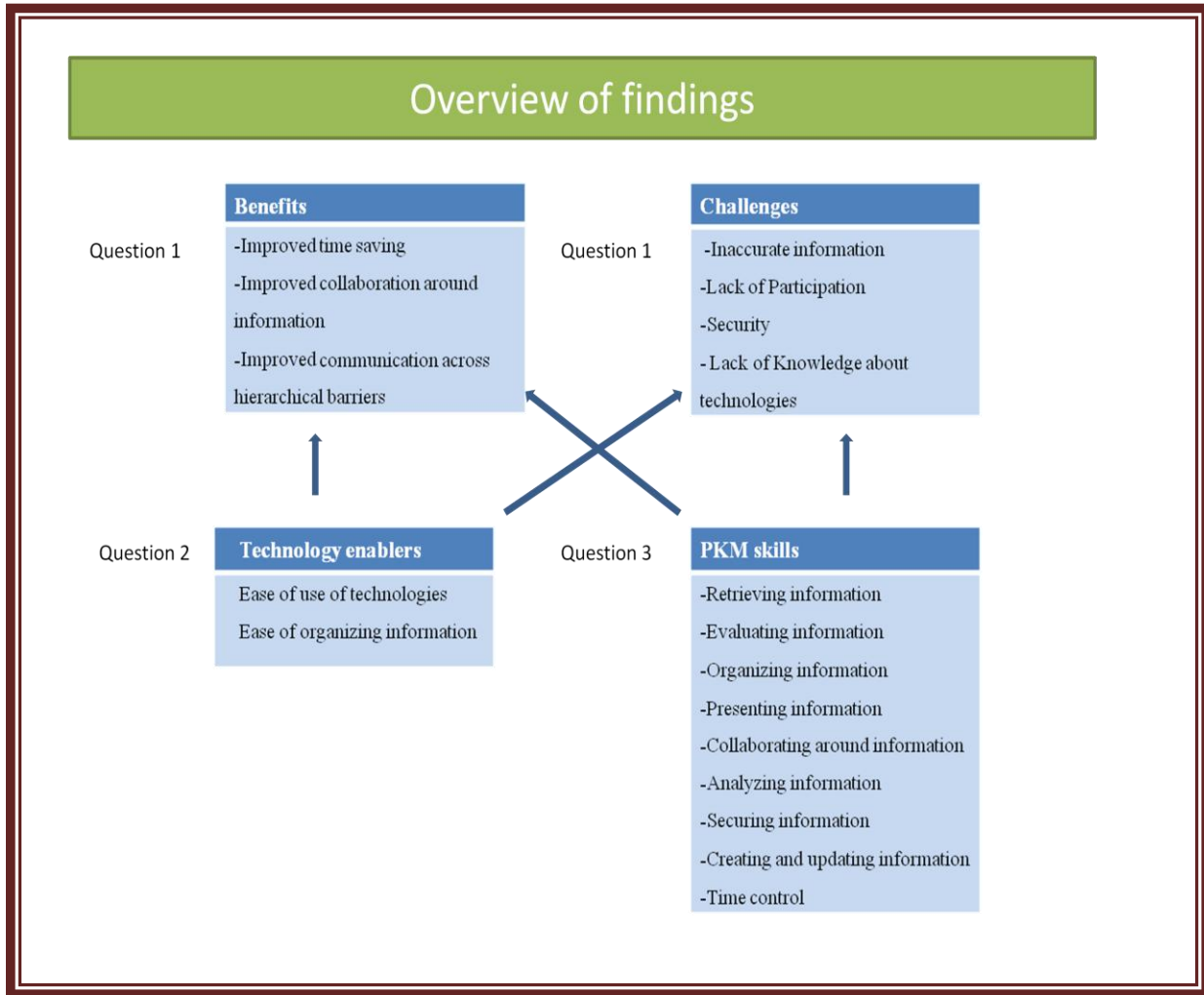


Figure 1. Overview of findings

4.1. Nature of Use of technologies

The Table below shows what Web 2.0 tools were being used by employees in the four multinational software engineering companies where participants worked. Companies used Web 2.0 tools based on their requirements. Larger companies used a broader range of these tools for various purposes. Internal tools, such as Wiki and Yammer, were used for collaboration and knowledge sharing between employees. External tools like Facebook, LinkedIn and Twitter were used to communicate with customers, and make them aware of what was happening in their companies.

Wiki was one of the internal Web 2.0 tools that was heavily used in all four companies. All participants considered Wiki as the most important and reliable tool for internal collaboration

and knowledge sharing. Employees highlighted that sharing information using external technologies, especially Twitter, Facebook and LinkedIn may be more real time and immediate, but because of the public access, they were limited to using such tools for peer to peer non-official knowledge sharing. One of the middle level managers (an online community manager) stated that her organisation didn't allow employees to use social networking tools, because they are open to the public and she considered that as the main reason to encourage employees to share their knowledge only using internal Web 2.0 technologies like Wiki and Yammer.

Social technologies [public technologies] are not appropriate for sharing information with staff, because they have got a public element, so we wouldn't use them to share information from one colleague to another. That is why we turned to tools like Yammer. (Interviewee D, middle level manager)

Among external and public tools, LinkedIn was considered as the most reliable tool for personal use. Five out of six of participants used LinkedIn to be connected to other mostly professional friends. One of the middle level managers stated; *“Actually more and more people are using LinkedIn to get in touch with each other to see who they can go to about a particular topic”*. Therefore, both internal and external Web 2.0 technologies were addressed as valuable tools for managing personal knowledge.

People in different roles used different tools to perform their internal tasks. This suggests that they are valuable as PKM tools. The way in which tools were used depended also on employees' position and organisational rank. For example, software developers argued that they were only allowed to use certain tools which they needed and were related to their job, while middle level managers had access to a larger range of these tools. This is shown in the table 4. In this regard, one of the middle level managers stated:

“Facebook and Twitter are mainly used by our public relations office, Blogs are heavily used by the top executive to keep business up to date and Wikis are heavily used by different teams to share information [internally]”. (Interviewee C, middle level manager)

Interviewees	Internal Tools			Public Tools					
	Wiki	Yammer	Flowr	Blog	Twitter	LinkedIn	Facebook	Forum	Google+
Interviewee A (Software Developer, Company A)	✓		✓			✓			
Interviewee B (Software Developer, Company A)	✓		✓			✓			
Interviewee C (Middle Manager, Company B)	✓			✓	✓		✓	✓	
Interviewee D (Middle Manager, Company C)	✓	✓		✓	✓	✓	✓		✓
Interviewee E (Software Developer, Company D)	✓					✓	✓		
Interviewee F (Middle Manager, Company C)	✓	✓		✓	✓	✓	✓		✓

Table 4. Web 2.0 tools used in software engineering companies.

4.2. Benefits, enablers and relevant PKM skills

This section describes participants' views about the benefits of Web 2.0 technologies and enablers of these technologies for managing personal knowledge. Three key benefits of using Web 2.0 technologies were found: *improved time saving*, *improved collaboration*, and *improved communication across hierarchical barriers*. In addition two factors, *Ease of use of technologies* and *ease of organizing information* were found to be the enablers of the benefits of using Web 2.0 technologies. Table 5 summaries benefits and enablers of using Web 2.0 technologies for PKM and demonstrates their impacts on personal performances. Web 2.0 technologies were found to have direct impact on individual performances such as, easy access to information and knowledge, better collaboration around information, better communication with colleagues and manager, better knowledge sharing and easier organisation of information.

To answer the second question of this research, the seven PKM skills proposed by Dorsey (2000) were employed to examine interview data, with the aim of indentifying which challenges or benefits of using Web 2.0 technologies can be addressed if these technologies are used skilfully. The seven PKM skills were found to impact on the performances of individual employees who are using Web 2.0 technologies at their work. Avery et al. (2001) and Dorsey (2000) stated that PKM skills are necessary for solving problems and helping people to realise the benefits of technologies.

Furthermore, two new skills also emerged from the inductive analysis of raw data. Analyzing data revealed that one of the important challenges of using Web 2.0 technologies is lack of participation. Therefore, employees need to be able to participate in these technologies and be able to create and update information. Therefore, *creating and updating information*, was identified as the first inductive PKM skills. Another challenge that persuaded the researcher to propose a new skill to the seven PKM skills proposed by Dorsey (2000) is the fact that participation in a wide range of Web 2.0 technologies requires appropriate time management and time control. Therefore, *time control* was added as another new PKM skill that individual employees need to have to be able to overcome challenges and realise the benefits of these technologies.

Participants didn't directly talk about PKM skills and there were few comments about needs of PKM skills from interviewees, because they thought Web 2.0 technologies' capabilities minimised need to some of these PKM skills. Participants relied extensively on technologies and their benefits for improving their performance. For example, when some of the participants were asked about their knowledge to retrieve or organise information, some of them argued that using Web 2.0 tools had minimized the importance of these skills, because these days even an inexperienced employee knows how to retrieve or organise information. While participants sometimes attributed benefits to the technologies itself, deeper analysis of data revealed that PKM skills were important for minimising some of the challenges and realising some of the benefits of using Web 2.0 tools. *Existing literature also support the importance of these skills for problem solving and appropriate use of technologies* (Dorsey, 2000; Avery et al., 2001; Agnihotri and Troutt, 2008).

Findings of this research show that three benefits, *improved time saving*, *improved collaboration* and *improved communication across hierarchical barriers*, can be facilitated by PKM skills. After each benefit, the relevant and required PKM skills will be described broadly. The relationship between PKM skills and benefits of Web 2.0 technologies are shown in the Table 5.

		Impact on Individual performance	Interviewees' comments		PKM Skills
			Software Developers	Middle Managers	
Benefits	Improved time saving	Easy access to information and openness nature of Web 2.0 tools help employees to save time and improve their individual performance.	<i>We can save lots of time by using Wiki or other tools because finding information is much easier.</i>	<i>This technologies help time saving because finding information is easier and quicker and employees can communicate much more quickly.</i>	- Retrieving information - Organizing information - Presenting information - Time control
	Improved collaboration	Working collaboratively around information improves employee's performance as tasks can be performed using collective knowledge	<i>When an employee does a research about a product, he or she put its information in the Wiki to test it and other employees can edit it and put comments on it.</i>	<i>If anything inaccurate does get on one of these internal tools, it usually gets corrected pretty quickly by someone in the company.</i>	- Collaboration around information - Creating and updating information
	Improved communication across hierarchical barriers	Web 2.0 tools help individuals through different channels to be connected to their managers and removed hierarchical communication barriers.	<i>Using Web 2.0 tools help us to frequently communicate with not only our colleagues but also with our managers and even executive team.</i>	<i>We use internal web 2.0 tools to make sure that our employees are in full awareness of everything that going on.</i>	- Collaboration around information
Enablers of the technologies	Ease of use of technologies	The openness and ease of use of web 2.0 tools help individuals to contribute into the knowledge sharing process and have broad access to the company's information.	<i>Web 2.0 tools are easy to use and people can use other colleague's knowledge and information and present their own information easily.</i>	<i>Using these tools it is easy to just type a sentence and then you can share it with everyone.</i>	
	Ease of organizing information	Web 2.0 tools help employees to improve their productivity as information can be stored and organized in right place for later easier retrieval.	<i>Wiki has made our job easier because we can search and find information directly in a page we know the information has been stored in.</i>	<i>We are tagging pages [in Web 2.0 tools] and then it is easier to find similar pages and relevant pages about a topic.</i>	

Table 5. Summary of benefits of Web 2.0 technologies and their impacts on individual performance

4.2.1. Improved Time Saving

Almost all participants emphasised that internal Web 2.0 tools like Wiki and Yammer saved them lots of time because finding relevant information in these technologies is easy and fast. Two of the middle level managers who were using Wiki for training new employees highlighted the importance of Wiki and Yammer for time saving. They argued that using Wiki sped up their work process and saved them time because, for example, instead of creating an on-boarding page for every new employee, they could make a page on the Wiki or Yammer and put all information in there, and refer all new employees to that page. A solution manager in one of the software engineering companies described this benefit and provided me with the following example;

I'll give you an example. I think I spent like a week putting together an on-boarding pack for new employees on our Wiki. Then, during the course of a year, I on-

boarded around 30 people, instead of setting [aside] a week for each of them, going through the on boarding, I just referred them to the documentation which I already put on the Wiki. (Interviewee C, solution Manager)

Participants highlighted that unlike external Web 2.0 tools, internal tools like Wiki and Yammer were considered as the appropriate places for finding relevant and appropriate information which helps them to save time. They argued that using these tools helped them to have easy access to information whereas they had previously been stuck dealing with bunches of unstructured information in their traditional tools like email. One of the software developers argued that these tools helped him to do his tasks faster because he is able to find required information very quickly.

These technologies definitely help with time saving. If you need some information, you are not trapped in sorts of files, directories and all policies or something like that. You just do some key term search and usually what you are after will be in the first page that comes back to you. So I think they save lots of time for employees. (Interviewee E, software developer)

Both middle level managers and software developers highlighted ‘time saving’ as the most important benefit of internal Web 2.0 technologies for personal knowledge management. Furthermore, these technologies could also improve timeliness, as people can have access to information on real time. The online community manager stated that the timeliness benefit of using these technologies leads to rapid knowledge sharing between individuals in organisations;

Nobody in our company ever finds anything out a day after it happens. They find it out within 10 minutes, because with these tools it is so easy to just type a sentence and then you’ve shared everything with everybody. (Interviewee D, online community manager)

4.2.2. Skills for improving time saving

As it is shown in the table 5, four PKM skills were found to facilitate time saving benefit for employees; *retrieving information, organising information, presenting information and time control*. Participants reported that they will be able to save time if they know how to retrieve information appropriately. Interpreting data shows that the knowledge and ability to search keywords using Web 2.0 tools make finding required information faster. Therefore it saves lot of

time for employees. Using Web 2.0 tools has made finding information much easier. However, employees still need to know how to search and where to search. The ability to organise information in appropriate sections and categories also helps individual employees to save time as information can be retrieved later - easier and faster. Participants argued that skill to organise information helped save time because when people classify and organise information in an appropriate way, they are not trapped in a multitude of files and directories.

The ability to present and broadcast information also helps employees to save time, as information doesn't need to be presented in the traditional way using power point and other tools. Three of participants argued that if they were able to present information to other colleagues using Web 2.0 technologies they could have wider audiences and save time because information can be easily put on certain pages on internal Web 2.0 tools like Yammer and Wiki. Colleagues can then be invited to see that information from wherever they are and any time they want, without wasting any time.

The final skill employees need to save time is the fact they need to be able to control and manage their time. Two of the employees argued that as there are too many Web 2.0 technologies available to participate, managing and using them requires appropriate time management and time control. If employees are not able to manage their time, they will not be able to use all of them effectively. One of the Middle level managers (*solution manager*) stated that the problem is that too many communities are available and employees should be able to manage their time in order to participate in necessary technologies, not in all of them.

4.2.3. Improved collaboration

Another important benefit of Web 2.0 tools, especially internal tools is that they help employees to work collaboratively around the available information in these tools. Internal tools like Yammer and Wiki were regarded as the best tools for this purpose. All participants acknowledged that the way pages can be collaboratively updated or fixed improved their personal performance. One of the software developers highlighted the importance of Wiki for this purpose when he was asked about the differences between traditional and Web 2.0 tools;

The most important difference [between Web 2.0 and traditional tools] is that everyone can edit information. So, for example [using Wiki], I make a few pages for

testers, because I am a developer and testers test what I developed and I have to explain to them. So I ask them to see my page, then when they see something wrong, they can fix my mistake, so it is collaborative and saves me a lot of time.
(Interviewee A, software developer)

Middle level managers also stated that internal Web 2.0 tools improve collaboration between employees, and improve their overall performance. They argued that the open nature of these tools and the way information can be edited or updated by colleagues helped individuals to better fulfil their tasks. One of the middle level managers said that they were less worried about inaccurate information because Wiki and Yammer provided an opportunity for employees to fix mistakes, and to collaboratively come to a conclusion about issues. He said, *“If anything inaccurate does get on one of these internal tools, it usually gets corrected pretty quickly by someone in the company”*. Therefore, working collaboratively around information improves an employee’s performance, as tasks can be performed easier and faster with using collective knowledge.

4.2.4. Skills for improving collaboration

As was discussed in the previous section, one of the most important benefits of using Web 2.0 technologies at the individual level is that employees can work collaboratively to fix problem or edit contents. However, these benefits will be realised more significantly if employees know how to collaborate around information. Avery et al. (2001) identified collaboration around information as one of the seven important skills needed to manage personal knowledge. Participants reported that Web 2.0 tools were designed to improve collaboration between employees, however, they also argued that some of employees don’t know how to participate collaboratively in these technologies. One of the software developers argued that, *“When you go to any company to work, you need to know how to edit or add information. Editing and adding information is not very easy, because each Web 2.0 tool has its own way of editing and its own framework for adding and editing information”*. Therefore employees need to have the skill to work collaboratively and be committed to participate in teamwork and be present online when they are needed.

Another important skill that can improve collaboration is the ability to create and update information. This skill emerged from inductive analysis of data. Data analysis revealed that lack

of engagement in the Web 2.0 technologies occurred because some employees didn't know how to create pages and update information. One of the middle level managers expressed his concern about existing old and out of date information and said, "*Keeping pages up to date is sometimes hard because people are able to create their own pages. They put all their information on that page, but they supposedly should go and update what they put there when the situation has changed, but that doesn't happen often. So the information gets quickly outdated, and I think that is one of the key challenges*". Therefore, a further skill, creating and updating information, seems necessary to improve collaboration around information. As a new skill employees should be able to create and update information. This ability helps employees to collaboratively fix problems and update old and obsolete information.

4.2.5. Improved communication across hierarchical barriers

Another important benefit of using Web 2.0 technologies at the individual level was the capability of these technologies to improve communication between employees and break down hierarchical barriers. Participants acknowledged that because of the available channels of communication created by Web 2.0 tools and easy access to knowledge, they could easily communicate with their colleagues and their managers.

Both internal and external Web 2.0 tools were regarded as beneficial channels for sharing personal knowledge and removing communication and hierarchical barriers. However, due to increased security issues associated with external tools, and possibilities of losing information, external technologies were used only for communicating with customers and to some extent for advertising products. Participants stated that they found using internal tools (Wiki and Yammer) more useful than external platforms for removing communication barriers and sharing personal knowledge inside organisations. One of the middle managers highlighted that using Web 2.0 tools has made employees closer to each other and to their managers.

I started seeing people come closer to the company with using these technologies and they can communicate with their managerial team even though the managerial level is hard for everyone to see in person. (Interviewee C, solution manager)

The open nature of these technologies helps everyone in the organisations, regardless of their organisational rank, to participate in knowledge sharing and decision making processes.

Therefore, people could communicate more easily with each other and convey their opinions to other people including their managers and executive team. One of the middle level managers (Online community manager) outlined this benefit and believed that compared to the traditional tools, which are mostly one way interaction technologies, internal Web 2.0 technologies could significantly cut the levels of editorial, processes and hierarchy.

so rather than perhaps having to wade through structures that are put in place by CRM or document management system or having certain ways of grabbing documents, information [using internal Web 2.0 technologies] is shorter and quicker, therefore, we can communicate much more quickly. I guess it also cut out levels of editorial and kinds of processes and hierarchy and all kind of that stuff. (Interviewee D1, online community manager)

4.2.6. Skills for improving communication across hierarchical barriers

As it is shown in the Table 5, Collaborating around information was recognized as the only PKM skill that could improve communication across hierarchical barriers between different levels of employees. If employees work collaboratively using Web 2.0 technologies, they can be more connected to other employees including their managers. Using Web 2.0 technologies can help lower rank employees to communicate easier with their managers. These tools minimize communication barriers and increase collaboration around information. Participants stated that Web 2.0 tools help them to collaborate around information and saw this as a way that they can come closer to each other and to the company. One of the middle level managers (HR manager) stated; “*we use Yammer, Skype and Wiki for internal communication for collaborating. Employees use them to get connected to their managers to ask questions and communicate policies*”. Therefore, if employees understand how to work collaboratively around information using Web 2.0 tools, they can also be connected to the managers and other higher rank employees.

Enablers

Ease of use of technologies and *ease of organising information* are categorized as the two important characteristics of Web 2.0 technologies that help employees to have easy access to

knowledge and better manage their personal knowledge and information. The following two sections describe participants' views about these enablers.

4.2.7. Ease of use of technologies

Ease of use of Web 2.0 tools was considered as the first important characteristic of Web 2.0 tools that enable employees to perform their personal tasks easier and faster. Almost all interviewees highlighted the fact that employees can easily use these tools to manage their personal knowledge. Both software developers and middle level managers mentioned that the ease of use of these tools encouraged them to share their knowledge and also provided an opportunity for them to have broad access to their colleagues' information. The solution manager compared Web 2.0 to other traditional tools like email and said, *“Using these technologies [Internal Web 2.0 tools], people can easily get quick answer to any question and you don't have to go through back and forth email and this kind of things”*.

Easy access to knowledge and the way information can be presented using these tools help employees to improve their personal performances. Two of software developers stated that they use these tools to easily present information about the products they develop. They acknowledged that easy using nature of these technologies improved their performance because they don't need to gather many people in a room to present their products for them, but they can easily put information in one of the internal Web 2.0 technologies, where everyone in the company can see it, edit it, or put comments on it. One of the software developers highlighted this benefit as follow:

In my personal point of view, using Web 2.0 technologies for presenting information makes our job easier because it is hard to gather all employees to present a topic to them, but when you put information in Web 2.0 tools, they can see it easily from everywhere they are. (Interviewee B, software developer)

Although one of the software developers raised his concern about the necessity of needing basic knowledge of HTML to edit information, other participants were highly satisfied about the ease of use of Web 2.0 technology for personal knowledge management. One of the software developers compared Wiki to email and stated;

When I put something in Wiki, everyone in the company can see it, and use it in his job, but using email, I should send [a piece of information] to individual employees one by one. It is hard to broadcast information with other traditional technologies, but the openness of Wiki has made this task easier. (Interview A, software developer)

4.2.8. Ease of organising information

The second important enabling characteristic of Web 2.0 technologies reported by participants was the fact that these tools enabled them to organise and classify their information easier. Internal Web 2.0 technologies like Wiki and Yammer were considered as the most beneficial tools for organising and classifying information. Using these technologies help employees to be able to organise their personal information in such a way that information can be available in appropriate section and to make later retrieval easier and faster. In this research, middle level managers believed that the capability of Web 2.0 tools to organise information in certain sections and categories has made processing their tasks easier and faster. The HR manager in one of the software engineering companies stated: *“We have certain pages [in the Wiki and Yammer] which we put our policies and procedures. Our information is structured in categories and subcategories in this way. It helps information retrieval more easier”*.

Software developers also stated that Web 2.0 technologies help them to store their information in certain pages in order to retrieve information easier and faster. They stated that organising information in these tools reduced information overload and duplication of information and individuals don't need to deal with a mass of unstructured information. Software developers also reported that organising information using these technologies has made their job much easier because they could find information according to the different topics and categories more easily. Using these tools also helped them to directly go to the page which belongs to a certain group and comment on that page instead of posting it to the entire company's pages.

[In our Wiki] We have an index. We are six teams. For example in the first page you can see, first team, second team, etc. within each team we classify our data based on different topics and then sub classify them depending on the topics. This way of organising information makes information retrieval easier. (Interview A, software developer)

4.3. Challenges

Challenges of using Web 2.0 technologies for PKM are grouped in four categories: *existing inaccurate and inappropriate information, lack of participation, lack of knowledge about the nature of technologies, and security sensitivity*. This section describes participants' personal views about the challenges they had experienced in using Web 2.0 technologies for managing their information at the individual level. However, as these challenges are general, some of them may apply also at the organisational level. Analysis of data revealed that three challenges, *inaccurate and inappropriate information, lack of participation and security sensitivity*, could be addressed by PKM skills. After each challenge, the relevant and required PKM skill to minimise that will be described in detail.

Challenges	Impact on Individual performance	Interviewees' comments		PKM Skills
		Software Developers	Middle Managers	
Inaccurate and inappropriate information	Existing inaccurate information misleads employees and wastes their time because some employees may rely on wrong information and waste their time	<i>When we read something in our Wiki, We also compare it with other information on the internet to make sure it is the right information because not all information is accurate.</i>	<i>For me a disadvantage or challenge in using these tools is the fact that there is much inaccurate information available in these tools.</i>	<ul style="list-style-type: none"> -Evaluating information -Organizing information -Presenting information -Creating and updating information
Lack of participation	Lack of engagement in Web 2.0 tools minimizes employees' productivity because employees are not available when they are needed and information is not updated.	<i>For me, one barrier to using these technologies is that people are not often present on these technologies.</i>	<i>In term of Wiki, when something change and people don't update information, you will end up with mass of old and out of date information</i>	<ul style="list-style-type: none"> -Collaboration around information -Creating and updating information
Security sensitivity	The openness of Web 2.0 tools brings some security concerns that limit employees to access to knowledge they need.	<i>So we are really bothered about the information we really need. We can only use security credential knowledge which is on the Wiki.</i>	<i>People have got limitation about security and they might not share everything in the Web 2.0 tools</i>	<ul style="list-style-type: none"> -Securing information
Lack of knowledge about the nature of technologies	Manager's lack of knowledge about Web 2.0 tools and their strictness about security limit employees to use these tools appropriately.	<i>For example one manager said "the tool is not working, because people don't posting like email</i>	<i>One of our executive thought that employees use social networking for leisure, so they didn't let employees to use it.</i>	

Table6. Summary of the challenges of Web 2.0 technologies and their impacts on individual performance

4.3.1. Inaccurate and inappropriate information

Finding accurate information has previously been identified as one of the main concerns of employees who are using Web 2.0 technologies (Anderson and Mohan, 2011). In this study, all participants expressed their concerns about finding relevant and accurate information in technologies. One of the software developers argued that unfortunately not everything in Wiki or Blog is the right information, and they needed to regularly check it with other external sources like Google and Wikipedia. However, there is again no guarantee that information in Wikipedia or other sources is accurate and people need to check their information regularly with their colleagues and managers.

Once, I extracted some information from our wiki and I showed it to my manager. He completely rejected that information and told me not everything in the Wikis or Blogs is correct information and you need to compare it with other sources to make sure it is the right information. (Interviewee B, software developer)

Another software developer noted that sometimes employees put wrong information in these platforms and said “*I normally refer to the person who edited that page and hint to him that his information is incorrect or there is more new information available that can complete that page*”. Availability of too many Web 2.0 technologies and their open nature appear to be one of the reasons behind existing inaccurate information, because of the fact that people can easily create information and put whatever they want on these platforms.

Rather than inaccurate information, middle level managers showed their concerns regarding putting inappropriate information in Web 2.0 technologies. Existing inappropriate information was more prevalent in the external social networking technologies than using tools like Wiki or Yammer. Two of the middle level managers believed that one of the important challenges of using these technologies is the fact that sometimes people write inappropriate information which may harm the reputation of their company. One of the middle managers confirms this challenge and provided me with the following example;

I had an employee who wrote aggressive comments and there was some swearing in that and I had HR involved and we took care of it as an off brand behaviour and that resulted in disciplinary action. (Interviewee C, solution manager)

It seems inevitable that organisations need to put some filtering system in place to prevent employees entering inappropriate contents on Web 2.0 tools. On the other hand, individual employees need to be more concise and clear about what they put in these technologies to make sure inaccurate information doesn't put their organisation's reputation or their own career in danger.

4.3.2. Skills for minimizing inaccurate and inappropriate information

Existing inaccurate information was reported by participants as one of the most important challenges of using these technologies for personal knowledge management. Analysis of data revealed that four PKM skills can minimize this challenge; *evaluating information, organising information, collaborating around information, and creating and updating information.*

Employees need to be able to evaluate information correctly and fix inaccurate information whenever are needed. Dorsey (2000) argues that in order to find valuable and relevant information, employees should be able to evaluate the widely available information that is not filtered. Participants stated that evaluating information through comparing with other sources and check information with their colleagues helped them to minimize inaccurate information. One of the software developers said *"When we read something in our Wiki, we also compare it with other information on the internet to make sure it is the right information"*. Therefore, ability to evaluate existing information can minimise inaccurate information in Web 2.0 technologies.

Another important PKM skill that participants highlighted to minimise inaccurate information is the ability to organise information in right sections and categories. One of the reasons for existing inaccurate and unstructured information was because employees didn't put information in right section and categories. Participants stated that the way that information can be organised in Web 2.0 technologies has made finding information easier and minimised existing irrelevant and inaccurate information. One of the Middle level managers (HR manager) stated that; *"For our projects we create new pages. So our information is structured in categories and subcategories in the way that information is in correct places"*.

Ability to collaborate around information is considered as another important skill that can minimise the challenge of inaccurate information in Web 2.0 tools. Web 2.0 tools are available to support collaborative work. These tools work as enabler for working collaboratively, but as

Dorsey (2000) argues, in order to use technologies effectively, employees need to understand underlying principles of effective collaborative work. Employees who are able to work collaboratively around information can fix problems and correct inaccurate information with sharing their knowledge via these tools.

While participants complained about the lack of participation in Web 2.0 tools from some employees, they acknowledged that inaccurate information in internal tools can be fixed pretty rapidly by someone in the company. One middle level manager stated that *“It is a sort of peer review. If something doesn’t have quality or is inaccurate, someone else come and put comment on it or adds required information and edits it and gets it right”*. Therefore, if employees know how to collaboratively work around information they will be able to increase the quality of information and minimise existing inaccurate information in these technologies.

The last important skill which is considered important to address the challenge of inaccurate information is the ability to create and update information. Participants showed their concerns about the contents which were not updated regularly. They said Web 2.0 tools like Wiki contained old, obsolete and inaccurate information, because some employees don’t participate in information creation process and when they create information, they leave it intact. For these reason, the capability to create information and keep it up to date is realised as one of the important skill that employees need to manage their personal knowledge and prevent inaccurate information.

4.3.3. Lack of participation

One of the most important challenges addressed by participants was the fact that some of employees are not participating regularly in Web 2.0 platforms. All participants stated that these tools are not regularly updated by employees and also said that employees are not available when they are needed. Middle managers complained about this challenge and argued that they can rarely convince employees to update their information. One middle manager said;

I think one of the barriers with something like Yammer is that sometimes not everyone is logged in to it when we want them or they don’t check the feeds to see what is coming up. You might tag someone information or ask them a question, but you don’t receive any response, because they are not online. (Interviewee F, HR manager)

Another middle level manager pointed his finger to the older generation of employees and stated that generation divide is an important factor for participating in these technologies. He argued that younger generation are more familiar with these tools, use them more appropriately and most of time are present online, while there is less interest from the older generation to participate in these technologies. He argued;

We see the younger generation who come to our company use these platforms and they easily adjust themselves with these platforms and ask question about different topics, but again people who have been working in company for a long time are more reluctant to use these platforms to ask question or share knowledge. (Interviewee C, solution manager)

Software developers also admit this challenge. However, they criticised their managers for not motivating employees to participate in these platforms. A software developer said “*the challenge is hard to get updated [information]. I mean sometimes there is no motivation to participate in Wiki. Employees don’t receive pay rise if they put a lot of things on Wiki*”. Therefore, participate in these technologies need management support and encouragement by their managers to participate in these tools. Management support can significantly impact on using and participating in these tools. The solution manager argued;

[Using] Web 2.0 in organisations is a cultural shift and no cultural change can happen without executive support. People look to see what their managers are doing or what they think is serious. People are going to do what is measured by top management. If the top management doesn’t care about how much they are sharing, they don’t going to share information. (Interviewee C, solution manager)

4.3.4. Skills for improving participation

Two PKM skills are recognised as the important skills that can address the challenge of lack of participation. These skills are; *collaborating around information* and *creating and updating information*. The finding suggests that employees can be encouraged to participate in knowledge sharing processes in Web 2.0 technologies if they know how to collaborate around information and create and update their information. One of the reasons that employees are reluctant to participate in knowledge sharing process is that they don’t know how to collaborate around

information. Therefore, providing necessary training to edit available information and create new information in Web 2.0 technologies encourage employees to participate in this technologies and improve their individual performance.

4.3.5. Security sensitivity

Participants' concern about information security was considered to be another important challenge for using Web 2.0 technologies at the individual level. Due to the public access element of external Web 2.0 technologies like Facebook, Twitter, and LinkedIn, most of participants saw security issues as the main concern that limits them to use these tools. They acknowledged that they are not permitted to share their information with their colleagues in these platforms. One middle level manager said, they didn't allow staff to share anything in social networking technologies and argued, *they [Social Networking Sites] are not appropriate for sharing information with staff, because they have got a public element so we wouldn't use them to share information from one colleague to another.*

Internal Web 2.0 technologies such as Wiki, Yammer, and Flowr appear to be in better position in terms of security because they have been designed to be used inside companies. However, despite this, participants stated that they are still not allowed to put their sensitive and important information in Wiki or Yammer even though only staff inside the organisation can use them. One of the middle level managers highlighted the security challenge and said *"Even though you might use secure Wiki or Forum that only certain people can see it, but still as soon as you post your information and publish it, people can see it"*. One software developer also raises his concern about the limitation of access to the information because of security reasons and said;

We are really bothered about the information we really need. We can only use security credential knowledge which is on the Wiki. (Interviewee B, software developer)

Due to the openness of these technologies, not only using external technologies but also using internal tools, there is always chance of leaking personal information. Therefore, security issues in Web 2.0 technologies can significantly impact on individual performance and limit employees to access to knowledge they need because fear of leaking information constrain them to use these

technologies appropriately. When one of the software developers was asked to compare Web 2.0 with traditional technologies like email in terms of information security, he stated;

It [Wiki] is more risky than traditional technologies because email is private, but the Wiki is completely open inside an organisation. Nobody post sensitive information. I mean, why you would put sensitive information on the Wiki when it is open to everyone. (Interviewee A)

4.3.6. Skills for improving security

The ability to secure information was one of the skills that participants highly regarded as important and necessary skill to secure personal information. Participants argued that security issues can be minimised if employees are able to set appropriate password to prevent certain teams or individuals to have access to their information. One of the Middle level manager confirmed that employees need to know how to secure their information. She addressed this as a very important skill to secure information and said “We insist and get everybody trained to make sure that they understand good password management. Another middle level manager highlighted the importance of securing information and said “*we encourage and train our staff to use Password Safe, which each site we are log in, whether it is Yammer, Wiki or Blog has a different and a relatively complex password. So Password Safe is quite important from our perspective to make sure that password that we chose are strong*”. Therefore, ability to secure information is an important skill to prevent security issues in today insecure cyberspace.

4.3.7. Lack of knowledge about technologies

As the nature of Web 2.0 tools are different from each other and each tool has its own specific features, employees are expected to use them according to the tasks they wants to perform, but during the interviews, it was indicated that not all managers and employees really know how these technologies work, and what are the differences are between them. Therefore, when there is no knowledge about technologies and employees don’t know how these technologies work, they may have expectations that are not aligned with the nature of the tools. One of the software developers raised this issue and argued that some of employees always compare these tools with each other and have wrong expectation from these tools based on wrong assumptions. He said;

For some reasons I don't know why, people compare Wiki with social networking sites. They constantly compare it and say we don't need social networking, because we have a Wiki. (Interviewee A, software developer)

Other software developers also showed their concerns about the executive lack of knowledge about the nature of external Web 2.0 technologies. Two software developers mentioned that a manager's lack of knowledge about the nature of technologies cause them to have unrealistic expectations of these tools. One of them complained about this challenge and said; *"as I experienced in my previous job, managers and executive team didn't know what social networking really was. Because of this, they had expectations which were not aligned with actual and potential nature of the tool"*.

Individuals from three out of four companies stated that their employers blocked their access to Facebook, because they thought employees use social networking for leisure and believed this would minimise the productivity of staff and waste their time. One middle manager said *"Facebook is not counted as a productive platform to do your work, because we think it is more personal and less about work"*. The Following table summarises some of the comments from participants which show the importance of PKM skills to manage personal knowledge using Web 2.0 technologies.

Skills		Participants' comments
Dorsey's Skills	Retrieving information	<i>Most of our staff are software developers, so they are very good at finding information they need. They search a lot better than, say coming downstairs and ask for policies and procedure manuals. It is much easier to search it online and find it there. (Middle level manager, interviewee F)</i>
	Evaluating Information	<i>When we read something in our Wiki, we also compare it with other information on the internet to make sure it is the right information. (Software developer, interviewee B)</i>
	Organising Information	<i>Some information has been put in wrong section and in incorrect categories so it makes finding information much harder. It may mislead you and you should spend more time to find right information. So, classification and organising information is the most important step or initial step in managing these pages.(Software developer, interviewee E)</i>
	Collaborating around information	<i>For example, I make few pages for testers, because I am a developer and tester test what I developed and I have to explain them, so, I ask them to see my page, then when they see something wrong, they can fix my mistake, so it is collaborative and people should know how to do it.(Software developer, interviewee A)</i>
	Presenting information	<i>One thing I did and continued using as an entry point to the Web 2.0 was to publish the agenda and the outcomes of our weekly team meetings on our forums. In that way I don't need to send email to the team. I am only sending one sentence which is "I am going to publish all the meeting agendas and the outcome of the meetings on this forum". (Middle level manager, interviewee C)</i>
	Securing information	<i>We encourage and train our staff to use Password Safe, with each site we are logging on, whether it is Yammer, Wiki or Blog has a different and a relatively complex password. So Password Safe is quite important from our perspective to make sure that passwords that we chose are strong. (Software developer, interviewee F)</i>
Proposed new Skills	Creating and updating information	<i>Keeping pages up to date is sometimes hard because people are able to create their own pages. They put all their information on that page, but they supposedly should go and update what they put there when the situation changed, but that doesn't happen often, so the information get quickly outdated and I think that is one of the Key challenge.(Middle level manager, interviewee C)</i>
	Time control	<i>Other than that, sometimes it is too much [Web 2.0 tools]. I remember a friend once told me what is the community of the day? These communities are created in our social networking platforms every week. So the phrase "What is the community of the week" is teasing the fact that we have got too many communities to participate in. (Middle level manager, interviewee C)</i>

Table 7. Summary of PKM skills that facilitate realisation of benefits and mitigation of challenges.

Chapter 5. Discussion

This chapter will present deeper discussion and analysis of findings regarding the main themes that were addressed in the empirical findings chapter with a focus on enabling better understanding of the benefits and challenges of using Web 2.0 technologies for PKM. A comparison between the existing literature (chapter 2) and the findings of this study (chapter 4) will also be provided in order to get a clearer picture of benefits and challenges of using Web 2.0 tools technologies at the personal level. Challenges and benefits of using these technologies were easier to identify than PKM skills because participants attributed most of benefits to the technologies itself. However deeper analysis of data revealed that PKM skills were important for minimising some of the challenges and realising some of the benefits of using Web 2.0 tools.

5.1. Benefits of Web 2.0 technologies and impacts on individual employees

The most commonly discussed benefit of using Web 2.0 technologies at the personal level was improved time saving. Even though there are always concerns about using external Web 2.0 tools for personal interests rather than work purposes, internal Web 2.0 tools like Yammer and Wiki were highly regarded as beneficial time saving tools for managing individual knowledge. One reason for this may be that these tools are not connected to the outside of the workplace and are limited to inside the organisations. This issue is also supported by existing literature which highlights managers' concerns about spending too much time using external tools for personal purposes (Kaplan and Haenlein, 2010; Razmerita et al., 2009).

Easy retrieval of information, especially in the internal tools, speeds up and improves personal performance. Two of the participants said that before emerging Web 2.0 technologies, they needed to spend lots of time to find information from a friend or manager, but at the present time, all they need to do is to put some keywords on the search engine of one of these Web 2.0 tools and then they quickly find required information. Therefore time saving was regarded as the most important benefit of using Web 2.0 tools for PKM. However, to take advantage of this benefit, employees need to have PKM skills such as, *retrieving information, organising information, presenting information* and *time control*. These skills help employees to use these technologies more professionally and do their tasks faster and save lots of time.

This research suggests that internal tools can significantly help employees to work collaboratively around available information. This is supported by existing literature about using Web 2.0 tools for improving collaboration (Paroutis and Al Saleh, 2009; Pachler and Daly, 2009; Balim and Dogerlioglu 2011; Andriole, 2010). Working collaboratively helps employees to update and fix their personal information and improves their personal performance. The open nature of Web 2.0 tools has provided this chance for employees to have easy access to information and knowledge and enable them to work on available information in the internal tools whenever is needed.

Middle level managers highlighted that while there is some level of resistance between employees to participate in knowledge sharing processes, they felt that using these tools was still the best possible way to correct wrong information because any wrong information can be pretty quickly fixed or corrected by another employees. One middle manager said *“in terms of the internal technologies, information is self regulated and peer regulated and if anything inaccurate does get on one of these internal tools, it usually gets corrected pretty quickly by someone in the company.”* Analyzing data showed that using Web 2.0 tools can also support teamwork and peer to peer collaboration. Therefore working collaboratively around information improves an employee’s performance as tasks can be performed much easier and employees can fix mistakes and come to conclusions about different issues.

Both internal and external Web 2.0 technologies were considered beneficial for improving communication and removing hierarchical barriers. While external tools like Facebook, and Twitter are very helpful for communicate with customers, internal technologies like Wiki, Yammer, and Flowr, are used to improve communication and removing organisational communication barriers inside the organisations. People can use the internal tools to not only communicate with their peers but also get connected to their managers and executive team. The open nature of these technologies has provided a chance to employees to participate in knowledge sharing processes regardless of their organisational rank and position. In this way lower rank employees can be also involved in decision making process, as their voice can reach their managers much easier and faster.

Using these technologies also help management team to be aware of shortcomings and deficiencies inside their organisation. One of the middle level managers highlighted the

importance of these tools for multinational companies and said “*for multinational organisations, using these tools help employees to easily be connected to their managers and to know what is going on in the company’s headquarters*”. The benefits of Web 2.0 tools to improve communication between employees is supported by the findings of previous researchers, (Paroutis and Al Saleh, 2009; Pachler and Daly, 2009; Razmerita et al., 2009). However, other than improving communication between employees, findings of these study proves that using these technologies can also break down organisational hierarchical barriers and improve communication between employees and their employers.

Ease of use of technologies and easy access to information and knowledge available in Web 2.0 technologies enable employees to perform their tasks faster and easier. Findings of this research showed that ease of use of these tools help individual employees to save time, remove communication barriers and improve their personal performances by helping them to collaboratively work around information and have easy access to their colleague’s information. The easy nature of using these technologies encourages employees to collaborate around information and participate in knowledge sharing processes in the company. Therefore, using these tools help employees to easily organise information, retrieve information, and evaluate information with other available sources in these tools.

Findings of these research show that the perception about ease of use of these technologies appears to be the most important characteristics of these tools which can motivate employees to use them in their daily knowledge sharing process. Existing literature also supports this perception as the most valued characteristics of these technologies (Trkman and Trkman, 2009; Hernandez et al., 2006). Paroutis and Al Saleh (2009) argue that ease of use of Web 2.0 technologies motivate employees to use these technologies at their work for the purpose of knowledge sharing. Therefore, the openness and ease of use of these technologies helps individuals to contribute into the knowledge sharing process and have broad access to the company’s information that helps them to manage their personal knowledge more efficiently.

Another characteristic of Web 2.0 technologies, especially internal tools is the perception of ease of organising information. Ability to organise and codify information in different categories and subcategories enables and encourages employees to use these tools and to have easier access to structured information which improves their personal performances. Employees can organise

their personal information in a way that information can be retrieved easier because information can be organised in certain categories and subcategories.

This perception is supported by existing literature about the benefits of Web 2.0 tools for organising information (Razmerita et al., 2009; Tu et al., 2012). The ease of organising information using Web 2.0 tools allows individual employees to create, codify and organise their personal information (Razmerita et al., 2009). Therefore, easy access to organised and structured information appears to improve individuals' performances and helps them to do their task more easily. This perception also helps employees to avoid information overload as information can be organised in a logical order.

5.2. Challenges of Using Web 2.0 technologies and impacts on individual employees

Challenges of using Web 2.0 technologies for PKM addressed in the empirical findings chapter were recognised in four categories: inaccurate information, lack of participation, lack of knowledge about the nature of technologies and security. In order to enable better understanding of challenges raised from this study, these challenges will be discussed briefly as follow.

One of the most important challenges addressed by participants was existing inaccurate information in the Web 2.0 technologies. This issue is supported by existing literature. Anderson and Mohan (2011) argued that finding accurate information in Web 2.0 tools is a challenge for employees who use these technologies. Participants showed their concern about this challenge and argued that existing wrong or old information sometimes misleads them. One of the important reasons behind existing inaccurate information in Web 2.0 technologies is because of the fact that people can easily create information and put whatever they want in these platforms. Therefore, employees need to be clear and concise about the information they put in these platforms.

To avoid creating inaccurate information, employees need to regularly check their information with other external sources like Google or check information with their colleagues and managers. Therefore, as it was discussed in the findings chapter, employees need to have PKM skill to evaluate available information with external sources and also with their colleagues to avoid putting inaccurate information in these tools. Employees also need to be able to update their information in order to avoid obsolete and out of date information. One software developer said

confirmed the need to have these PKM skills and stated, “*when we are not sure about the accuracy of a piece of information, especially information which is not completely internal to our company, we normally Google it or check it with our manager to make sure the information we have got in the Wiki is correct or not.*”

Lack of participation was addressed as another important challenge of using Web 2.0 technologies for managing personal knowledge. The issue is at first around updating information. Many employees don't usually update information they put in one of the internal tools and after a while information become incomplete, obsolete and out of date. Middle level managers also showed their concern about lack of being available online and argued that unfortunately employees are not logged in on Web 2.0 tools when they are needed. Lack of engagement in Web 2.0 tools minimises employees' productivity because their information becomes out of date very quickly.

Analysis of data revealed that for minimising the challenge of lack of participation, employees need to have two PKM skills; *collaborating around information* and *creating and updating information*. Employees can be more involved in knowledge sharing process if they are encouraged by managers and are able collaborate around information. Providing necessary training to edit available information and create new information in Web 2.0 technologies and motivating employees to participate in these technologies can minimise lack of participation and improve employees' individual performance.

Lack of knowledge about the nature of Web 2.0 technologies is the third challenge which participants emphasised on it. Web 2.0 technologies have different features and any tool has been designed for a different purpose, but some employees think they can be used in the same manner. This misunderstanding causes employees to have different expectations of these tools. While this research took place in software engineering companies, which due to the nature of their job there is high awareness about technologies compared to other companies, but there were still concerns about lack of knowledge of technologies.

Software developers and middle level managers had two different views in this regards. Software developers pointed their finger to their managers, and believed that lack of knowledge about these technologies makes them to have unrealistic expectations about these tools which are not

aligned with the nature of tools. For example one of the software developers stated that *“one manager said “the tool [wiki] is not working, because people don’t posting like email”*”. The reason behind this comment is that the manager didn’t really understand how these tools are working and what they have been designed for. On the other hand, middle level managers argued that employees use tools for leisure and they believed this will minimise their individual productivity and waste their time. Manager’s strictness and sensitivity about security also limits employee's use of these tools appropriately.

Information security is the last challenge raised from analysing data. Security concern appears to be one of the important preventive factors that limit employees to share their personal knowledge using Web 2.0 tools appropriately. Participants reported that security issues are more prevalent in external tools because these tools have public element and there is always chance of information leaking. Reliance on open ended and user-generated content in external tools like Facebook represent high security challenge for organisations (Jason, 2008). While participants believed that security issues rarely happen in their companies because employees are quite savvy and understand the internet world and the consequences of ignorance, they confirmed that there is still security concern and people should be very careful not to put their career and organisation’s reputation in danger. Security concerns prevent employees to appropriately share their knowledge with their colleagues and with other external partners. This issue is supported by existing literature (Rudman, 2011; Andriole, 2010)

Employees can use internal tools more freely as they are only used inside the organisation. Employees are able to share most of their information through these channels, but there are also some security limitations in the use of these tools. However, participants argued that they are still not allowed to put their sensitive information in these tools. While middle level managers insist on the importance of keeping information secure, software developers believed that manager’s strictness about securing information had lowered their productivity, because they are only able to share security credential information. So they saw this as an obstacle to sharing their knowledge with others.

5.3. Generational divide

Moving toward using new technologies including Web 2.0 technologies requires cultural shift in organisations. Not all employees can adjust themselves with these technological changes. Two of the participants highlighted that younger generation are more enthusiastic to participate in knowledge sharing process in these tools. They believed that younger generation are more computer savvy and can easily adjust themselves to these new platforms, while the older generation are more reluctant to share their knowledge via these channels and prefer to use traditional tools.

Previous studies also highlights this challenge and shows that younger generation are more eager to work collaboratively toward common goals, and share their knowledge through Web 2.0 channels, while older generation resists sharing their knowledge with other colleagues (Selwyn, 2009). Tapscott and Williams (2008) describe the younger generation as “collaboration generation” and believe that younger generation can easily work around common interests by drawing upon mass collaboration. Generational divide is an important factor in using Web 2.0 technologies at the individual level and requires more exploration in future studies.

5.4. Hierarchical divide and divergent perceptions

Analysis of data showed that hierarchical divide is an important factor that impacts use of technologies. While participants had similar views about benefits of using Web 2.0 technologies, they had different views about three out of four challenges of using these technologies at the personal level. The important reason behind this fact was that higher level managers had access to more technologies and could use them more freely, while other lower level employees were limited to use certain technologies and for certain purposes. For example, regarding the challenge of security, software developer complained about their access to information and argued that while their managers have access to most of important information, they are only allowed to use security credential contents. Therefore, it minimises their personal productivity.

Another divergent perception about using Web 2.0 technologies between middle level managers and software developers was about participation in these technologies. While, middle level managers pointed their fingers toward lower rank employees and believed that it is hard to convince them to update their information and make them to be available online, while software

developers argued that there is no motivation to participate in these technologies and people will not get pay rise or recognition if they work on these technologies regularly. Therefore, lack of motivation appears to be an important factor for which some employees are not keen to participate in these technologies. However, future studies are required to explore to what extent motivating employees can improve the level of their participation in these technologies. Participants' different views about these challenges are summarised in the following table.

Themes	Software Developers	Middle Level Managers
Lack of Participation	Software developers believed that there is no motivation to participate in Web 2.0 tools and said that employees don't get pay rise or recognition if they work on these technologies regularly.	Middle level managers argued that they provided the latest Web 2.0 technologies for employees but they believed it was hard to convince lower rank employees to update their information and make them available online.
Lack of Knowledge about the nature of technologies	Software developers pointed their finger to their managers and believed that lack of knowledge about these technologies makes them to have unrealistic expectations about these tools which are not aligned with the nature of tools.	Middle level managers argued that employees use tools for leisure and they believed this will minimise their individual productivity and waste their time.
Security sensitivity	Software developers believed that manager's strictness about securing information had lowered their productivity, because they are only able to share security credential information and they saw this issue as an important obstacle to share their knowledge with colleagues.	Middle level managers insist on the importance of keeping information secure believed that employees should not be allowed to share their sensitive information in these tools.

Table 8: Participants' different views about the challenges of Web 2.0 tools for PKM.

Chapter 6. Limitations and implications for research and practice

Three main limitations were faced by the researcher; the challenge of contextual nature of findings (limitation of transferability of results), limitation of small sample size, and timeframe limitation.

Firstly, research was conducted at four software engineering companies, where participants were professional and technical employees. They didn't experience some of challenges of using Web 2.0 technologies that were raised in the literature review chapter because they were able to easily overcome some of the technical challenges. Therefore, results of this study are strongly contextual and could not be easily transferred to other settings.

Secondly, Participants of this research were six employees from four multinational software engineering companies. A wider audience would have allowed for greater extrapolation of the results.

Thirdly, the researcher was bound with a six months limitation period and only two of the six participants responded to an invitation to engage in the participant check, a software developer and a middle manager.

As it was mentioned earlier in the finding chapter, participants didn't directly talk about PKM skills and there were few comments available about needs of PKM skills, because participants were relied extensively on technologies and their benefits for improving their performance and less about skills that they need to learn to perform their tasks. They argued that Web 2.0 technologies' capabilities minimised the need for some of these PKM skills. However, as was shown in the empirical findings chapter, deeper analysis of data showed that PKM skills are nonetheless important for managing personal knowledge. Existing literature also supports the importance of these skills for problem solving and appropriate use of technologies (Dorsey, 2000; Avery et al., 2001; Agnihotri and Troutt, 2008).

Figure 2 shows the connection between PKM skills and challenges and benefits which are addressed by these skills. This model (figure 2) is presented by the researcher as a tentative model to find solutions to challenges and benefits of using Web 2.0 technologies using PKM skills. In this research the more emphasis was on challenges and benefits of using these

technologies. As it was argued throughout this study PKM is very important for utilisation of Web 2.0 technologies and minimising challenges. Therefore, this model needs to be further explored in the future studies.

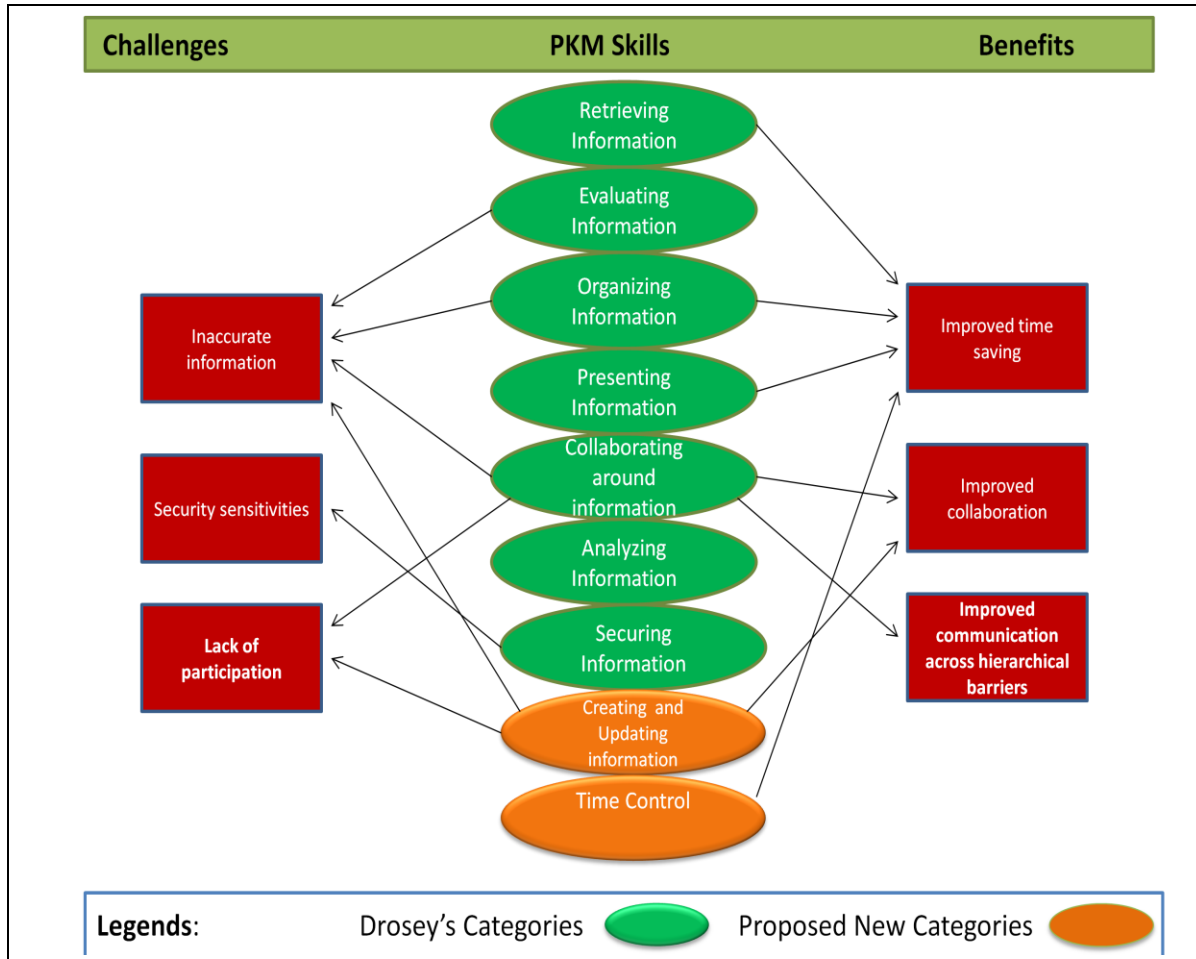


Figure 2. Benefits and challenges addressed by PKM skills (extension of Dorsey's seven PKM skills model)

Chapter 7. Conclusion

The purpose of this study was to investigate the benefits and challenges of using Web 2.0 technologies (Wikis, Blogs, Facebook, Twitter, etc.) for managing personal knowledge. In addition, it aimed to explore what PKM skills and technology enablers can facilitate the realisation of benefits and mitigation of challenges of using Web 2.0 technologies. Through conducting six semi-structured interview in four software engineering companies, key benefits of using Web 2.0 technologies were identified in three categories; *improved time saving, improved collaboration, and improved communication across hierarchical barriers*. In Addition, *Ease of use of technologies and ease of organising information* were found to be two key technology enablers. Results also identified four important challenges of Web 2.0 tools for PKM; *inaccurate and inappropriate information, lack of participation, lack of knowledge about the nature of technologies, and security sensitivities* to have impact on personal performances.

Results revealed that benefits and challenges of using Web 2.0 technologies have direct impact on individual performances and participants argued that if they realised these benefits and challenges and have appropriate PKM skills, they can improve their individual performances. that middle level managers and software developers had same view about benefits of Web 2.0 technologies but different views about three out of four challenges of using these tools for PKM; lack of participation, lack of knowledge about the nature of technologies and security. Findings of this research showed that hierarchical divide is an important factor that impacts use of technologies, because lower level managers only were allowed to use certain amount of Web 2.0 technologies because of security reasons. Therefore, unequal access to technologies has a direct impact on individual performances.

This research also applied PKM skill model proposed by Dorsey (2000) to identify how PKM skills might minimise challenges and realise benefits of using Web 2.0 technologies at the personal level. Participants attributed most of benefits and challenges to the technologies. However, deeper analysis of data revealed that PKM skills play important role in enabling benefits and reducing challenges. Analysis of data showed that employees need two further skills in order to better manage their personal knowledge. Therefore, In addition to the seven skills from Dorsey (2000), this research found two further skills, *creating and updating information*

and time control, and proposed an explanatory model for better understanding of how these skills can help individual employees to improve their personal performances using Web 2.0 technologies.

The findings suggest an extension of the Dorsey's PKM skill model (2000). A tentative model is proposed by the researcher which needs to be further explored in the future studies. Although there were few direct comments from participants about PKM skills as they placed more emphasis on the importance of technologies, analysis of data and reviewing available literature highlighted that PKM skills are still important and have direct impact on employees' performances.

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Appendix A



MMIM 592- Research Project in Information Management

Organization Information Sheet

I am carrying out research to investigate the benefits and challenges of using Web 2.0 technologies (Wikis, Blogs, Facebook, Twitter, etc.) for personal knowledge management in organisations. This research will look at the challenges and benefits of these technologies to find out to what extent these technologies enhance knowledge sharing between individual employees within the company. Another important aim of this research is to investigate whether personal information and knowledge management skills can help employees to receive benefits of these technologies and mitigate their challenges. For this reason, I would like to invite your organisation to participate in my research.

Interviews will take approximately 45-60 minutes with each participant. I am interested to learn about their individual perceptions and experiences with these technologies and I would like to learn about the benefits and possible challenges of Web 2.0 technologies.

I hope the findings of this research will be valuable to you and other organisations across New Zealand. The information gathered in the interview will be kept strictly confidential between my supervisor and me.

The findings of this research will be presented in a way that no individual or company will be identified. If, for any reasons, your company decides to withdraw from the study, you have a right to do so prior to 18 June 2012 when data analysis commences. In the event of withdrawal, any data collected from your organisation will be destroyed and omitted from the study.

Thank you for your time and help in making this study possible. If you have any queries please contact me on **021xxxxxxx** or email fathizrouh@myvuw.ac.nz. You may also wish to contact my supervisor Dr. Jocelyn Cranefield, on **04- xxxxxxxx** or email Jocelyn.Cranefield@vuw.ac.nz.

Best Regards,
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Appendix B



Research Questions;

1. **What are the benefits and challenges of using Web 2.0 technologies for PKM?**
2. **What are the technological enablers of Web 2.0 technologies?**
3. **What PKM skills can enable the realisation of the benefits and help in the reduction of challenges?**

Interview Questions:

1. Which of these Web 2.0 Technologies (Blogs, Wikis, Social Networking Sites, etc.) are you using in your company and how are you using them?
2. How do you use these tools to find and retrieve information? What are the benefits or challenges of these tools for finding information compared to traditional ways of knowledge sharing like using email and face to face communications? Can you give me an example?
3. How do you use these tools to evaluate information? How do you make sure about the quality of information? Can you provide me with an example?
4. How do you use these tools to organize and classify information? What are the advantages and disadvantages of these tools compared to traditional tools? Can you provide me with an example?
5. What barriers or problems have you experienced in using these technologies for sharing knowledge with colleagues? Can you give me an example?
6. What are the benefits of Web 2.0 technologies for sharing knowledge? Can you give an example?
7. How do you avoid risks such as inappropriate content, inaccurate information, and embarrassing information?
8. How do you use Web 2.0 tools to present information and communicate with colleagues? Did you find this use of the tools was successful/ unsuccessful comparing with other ways of presentation like using Power Point?
9. How do you secure your information using these technologies? What issues are involved and compared to other tools like email, what do you think are the advantages of these tools?
10. What do you do differently in compared to other means of communicating and managing information?

Appendix C



MMIM 592 – Research Project in Information Management

Consent Form for Interview Participants

I have read the attached Information Sheet and understand the nature of this research. I have had any questions about this research answered to my satisfaction. I understand that no personal identifying information will be recorded about me or my employer. I further understand that I can withdraw my consent from this research before 18 June 2012, and any data I have provided will be deleted.

I understand that the data I provide will be seen by the student's supervisor, Dr. Jocelyn Cranefield.

If you wish to see a summarized report of the outcome of this investigation, please provide your email address here:

By signing this form I hereby give my consent to being interviewed by Rouhollah Fathizargaran and to having the data I provide used confidentially in this research project.

Signature of participant

Date

SCHOOL OF INFORMATION MANAGEMENT

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