2008

The Role of Social Networks in Technology Appropriation over time

Rachelle Bosua
Department of Information Systems,The University of Melbourne, Victoria, Melbourne, rachelle.bosua@unimelb.edu.au

Antonette Mendoza
Department of Computer Science and Software Engineering* The University of Melbourne, Victoria, Melbourne, mendozaa@csse.unimelb.edu.au*

The Role of Social Networks in Technology Appropriation over time

Rachelle Bosua
Antonette Mendoza*
Department of Information Systems,
Department of Computer Science and Software Engineering*
The University of Melbourne, Victoria, Melbourne
Email: rachelle.bosua@unimelb.edu.au
mendozaa@csse.unimelb.edu.au*

Abstract

A number of factors and elements influence the introduction and long-term use of Information Systems (IS) in organisations. Studies in long-term technology use indicate that influences that support users' decision to adopt technology are not sufficient to encourage long-term use. Based on two case studies in an educational setting, we suggest that social networks play a key role in facilitating technology appropriation and encouraging continued long-term use of technology. Findings indicate that supportive social networks are instrumental to share knowledge, enhance learning, build trust, encourage users to resolve complex problems and subsequently pursue and sustain technology use over long periods of time.

Keywords

Social networks, long-term use, technology adoption, adaptation, appropriation.

INTRODUCTION

The introduction and implementation of new technologies in organisations enable users and the organisation as a whole to achieve productive outcomes. This requires effective long-term use, persisting well after the initial adoption of a technology. However, facilitating and ensuring effective long-term use has been a daunting task among managers, IS professionals and researchers, as expectations and needs of users change over time. Long-term technology use is particularly difficult when management decisions enforce the use of specific technologies within organisations. In these scenarios, even though users may dislike a system, they have no other choice but to continue using the system to perform their daily tasks. There is a large body of research about technology adoption and the early periods of technology use in Information Systems (IS) that investigate influences that affect adoption and acceptance of a technology (Brown et al. 2002; Davis 1989; Karahanna et al. 1999; Rogers 1995; Taylor and Todd 1995; Venkatesh et al 2003). Even though there is an improved understanding of technology adoption and use in various contexts, little attention is paid to understanding the process of how and why users adopt and then continue using a technology over time and influences that may encourage or discourage long-term use.

We define technology appropriation as: "*the way that users evaluate and adopt, adapt and integrate a technology into their everyday practices*" (Carroll et al. 2002). Technology appropriation requires constructive and incremental learning as users get used to, adapt and use new technology over time. Based on previous studies, it has been found that multiple plateaus of temporary stabilization in technology use occur during long term use of a technology. In addition, previous findings reveal that rejection of a technology may take place long after adoption and various support mechanisms need to be made available for users during long-term use (Mendoza et al. 2005; 2007; 2008).

Even though formal and informal training of technology is instrumental during the early stages of technology appropriation, periods that follow require continuing and sustained support to ensure persistent use of the technology. This support often comes in the form of learning through knowledge sharing with peers or other users in the same learning situation who have already appropriated or are at the same level of appropriating the technology. Studies have indicated that effective learning and knowledge sharing occur in groups or communities that share common practices such as Communities of Practice (CoPs) (Lave and Wenger 1991; Newell et al. 2003; Wenger 1998; Wenger and Snyder 2003).

In instances where users are not drawn together through mutual practice, users need to acquire knowledge from other sources to complement or extend individual knowledge. Empirical evidence suggests that knowledge flows largely through social networks and that users draw on and rely on their social networks (SNs) to source knowledge (Bosua 2007; Bosua and Scheepers 2007). It therefore seems as if social networks may be invaluable in supporting individual appropriation and long-term use of technology. To date, there has been little exploration

of the influences and role of SNs in encouraging long-term use of technology. Also, most research in social network analysis is rooted in mathematical algorithms with a quantitative basis. In this study we follow a qualitative approach by focusing on social networks as a socio-cultural phenomenon in educational institutions.

Our previous findings published elsewhere, have focused on the process of long term use of technology and influences that encourage and discourage use (Mendoza et al 2007; 2008). In this paper we extend prior work by refining our understanding of the role of SNs in long-term use of an ICT in an educational setting. The underlying question addressed in this paper is: *What is the role of social networks in encouraging long-term use of a technology in an educational environment?* We explore this question by discussing theories relating to social networking and technology use, followed by the research methodology. The research findings are then presented and their implications are discussed. The paper gives concluding remarks and avenues for further research.

THEORETICAL BACKGROUND

Technology adoption, acceptance and use

Technology acceptance and use has long been an important IS research topic (Davis 1989; Moore and Benbasat 1991; Taylor and Todd 1995; Venkatesh and Davis 2000). One of the most prominent models to predict technology adoption and use has been the Technology Acceptance Model (TAM). According to this model, adoption and usage of a technology are predicted by intentions to use the technology, which in turn are influenced by perceptions and attitudes about the technology. Perceived usefulness and perceived ease of use are the main determinants of user acceptance (Davis 1989). Revisions to TAM (Venkatesh et al. 2003) have been made with inclusions of some social influences and key moderators. However, one shortcoming of TAM is that user perceptions are different before and after adoption (Carroll el al. 2002; Karahanna et al. 1999).

Another theoretical approach to technology use builds on the Diffusion of Innovation Theory (Rogers 1995). According to this theory, the innovation decision process takes place in sequential stages. It starts from a user gaining knowledge about the innovation, to forming an attitude towards it, to deciding to adopt or reject the innovation, to implementing the new idea and finally confirming the decision (Rogers 1995). Similar to TAM, the Diffusion of Innovation Theory emphasises more the adoption of an innovation rather than the process of appropriation as users adapt and re-invent the technology to suit their long term needs.

Some studies in technology use have emphasized that studying long-term use is an important topic for IS research. According to these studies, users adapt their practices to accommodate a new technology and also adapt the technology to suit their needs over time (Ciborra 1996; DeSanctis and Poole 1994; Leonard-Barton 1988; Majchrzak et al. 2000; Trigg and Bodker 1994; Tyre and Orlikowski 1994). According to Tyre and Orlikowski (1994), users modify a technology to suit their needs and most adaptations are episodic and discontinuous in nature. Adaptations take place following initial implementation – during a window of opportunity. The technology then stabilizes and the window of opportunity may close. More recent studies suggest that users, through recurrent interaction with the technology, ignore certain properties of the technology or invent new properties and attain "*stabilization-for-now*" (Orlikowski 2001). Carroll et al. (2002) conducted field research on mobile technologies and developed a Model of Technology Appropriation (MTA). According to MTA, a technology introduced in an environment (technology as designed) is changed over time. This changed technology (technology in use) is an outcome of the process of appropriation, which involves users' trialling, evaluating and adapting the technology to suit their personal needs based on their perceptions and various other influences. Little attention is paid to understanding the role of supportive social networks in encouraging and discouraging use of various technologies in different environments. In the next section the notion of social capital, role of social networks and theoretical elements associated with social network theory are described.

The notion of social capital and role of social networks

Social capital, described as the goodwill engendered by social relations that can be mobilized to facilitate action, has informed a variety of studies such as society and human behaviour, education and organisation and more recently knowledge sharing and collaborative learning (Cummings et al. 2006; Huysman 2006; Cross et al. 2001). Nahapiet and Ghoshal (1998) define social capital as "*... networks of relationships that constitute a valuable resource for the conduct of social affairs*". Social capital exists essentially in social relations and facilitates productive activity by making information available which then facilitates action (Coleman 1988). Information that flows through the social networks in organisations therefore represents 'capital' that is of value to one or more groups. Social capital highlights the importance of 'networks of relationships' (or social networks), developed and strengthened over time, which provides the basis for mutual trust, collaborative learning and collective action (Cummings et al. 2006; Huysman, 2006).

A number of studies have acknowledged the role of social networks in knowledge creation, sharing and learning, particularly through participation in communities or Communities of Practice (CoPs) (Lave and Wenger 1991; Wenger and Snyder 2000). CoPs are mechanisms that draw users together through common interests and practices and contribute to more effective knowledge sharing in organisational workgroups (Bosua 2007; Bosua and Scheepers 2007). A large part of the knowledge created by users, teams and workgroups are embedded in social networks. Moreover, knowledge that flows through social networks, form the basis for the development and exploitation of intellectual capital. Hence, social networks allow for a two-way interaction of experience and competence that are both crucial to the evolution of practice (Bosua and Scheepers 2007; Cross et al. 2001; Wenger, 1998). As a result, knowledge sharing through social networks is instrumental in fostering individual and collective learning and may form the basis for users and groups to create new knowledge or share experiences that shape or influence existing ideas, attitudes or orientations towards ideas, concepts or processes. Hence, social networks may play a significant role in providing knowledge to facilitate and support the introduction and learning of new ideas, concepts, processes or even technologies in groups or individually.

A social network (or knowledge network) consists of a collection of *nodes* and *ties*, with nodes representing actual people in the network and ties representing the type of link that exists between the various nodes. Ties can either be 'weak' or 'strong' indicating a loose (or more distant) relationship or a strong relationship respectively. Strong ties are visited regularly while loose ties are visited occasionally (Cross et al. 2001; Granovetter 1983). Resources in the network are available through the contacts or connections provided by social networks. Network members can use the strength of weak ties and 'friends of friends', to gain access to specific information or knowledge that has not been available otherwise (Boissevain 1974; Coleman, 1988). The notion of strong and weak ties has been explored by a number of researchers to clarify their effect on aspects such as type of knowledge contributions, viscosity and density in networks, and effect on learning (Cummings et al. 2006; Cross et al. 2001; Granovetter 1983). According to Hansen (1999) strong ties are more effective to transfer tacit knowledge while weak ties are more effective to transfer explicit knowledge. Granovetter (1983) views weak ties an important source of innovation and new ideas since they contribute by linking users to information outside an existing social network. Based on nodes and ties of a social network there are four ingredients that are characteristic of a social network:

- *Facilitating knowledge sharing*: Social networks are viewed as useful channels to source knowledge, and exchange ideas and expertise (Bosua 2007; Newell et al. 2003). Knowledge sharing is more efficient when facilitating mechanisms namely knowledge brokers, advocates, champions and CoPs are present in social networks. Knowledge brokers link the right people, while knowledge advocates spread new or specific knowledge through a social network. Knowledge champions actively promote and facilitate knowledge communication using their acquired skills while CoPs are powerful mechanisms that foster learning and knowledge sharing practices in a community (Bosua and Scheepers 2007).

- *Social Identity*: A social network creates an identity feeling which exerts a positive effect on users in the network to share knowledge (Newel et al. 2003). Consequently users' know '*who knows what*' in a social network which ultimately influences who they consult or share knowledge with. Additionally social networks create a feeling of 'oneness' which means that users in the network feel that others are 'similar' to them in some or other way (Nahapiet and Ghoshal 1998; Granovetter 1983).

- *Trust:* Trust emerges over time through user interactions in a social network. Two different variations of trust have been suggested i.e. '*goodwill trust*', (trusting another person will not act against your interests), and '*competence trust*', (trusting another person has adequate skills and expertise) (Newel et al. 2003). Both variations of trust are important precursors to the sharing of best practices in a social network.

- *Teamwork:* Social networks create strong team-working skills and relationships which again build upon and create social capital in organisations. Team-working have proved to be more powerful in solving complex problems in social networks (Cross et al. 2001; Nahapiet and Ghoshal 1998). Teamwork is essential for knowledge creation and sharing since it combines perspectives and skills from many users, often from other departments or units within or from outside an organisation.

In this paper we were specifically interested in understanding the role of social networks in encouraging and facilitating productive use of technologies over time. Hence we used the practice lens of social networks to identify characteristics of social networks that support and encourage appropriation and long term use of technology. The next section describes the research methodology followed and case studies used in this investigation.

RESEARCH METHODOLOGY

The aim of this research was to gain a deeper understanding of how and why users draw on social networks in their natural settings, as they adopt and then adapt a technology to suit their needs. The research was qualitative in nature and we chose case studies since they are ideal instruments to investigate contemporary phenomena that concern humans, organisational and ICT issues in their natural settings (Yin 2003). Two case studies were conducted in a large Australian University. As we were particularly interested in individual actions associated with technology appropriation, the unit of analysis was an individual within a larger workgroup/team. Using two case studies aided in cross-case comparison of our different findings (Yin 2003).

One case study examined users of an ORACLE-based Enterprise-wide Information (EIS) system, developed to provide automated support for key business processes such as HR, Financials and Research (Bosua 2007). The case study was conducted 18 months after the university rolled out the first of a series of planned modules. A phone-in Helpdesk was established to support the 2500 university-wide users adapting and using the new technology. Helpdesk-staff were recruited from HR, Financials and other Administrative departments and had no prior knowledge of the EIS. Eight participants agreed to participate in the study. Five were Helpdesk staff who had to learn the technology through ongoing use of the EIS, conduct training classes on a needs base and transfer expertise to phone-in users that required support. They were not experts in all modules, but at times were one step ahead of users that adapted and used the new technology. Three out of the eight participants had no prior experience with the EIS.

Another case study examined users of a Learning Management System (LMS) (Mendoza et al. 2007). A longitudinal study was appropriate since we were interested in gaining a deeper understanding on adoption and long-term use of the technology. The LMS was chosen for this study because it was a new IS system introduced by the university to support teaching and learning among staff and students. All staff were faced with the decision to adopt and use the technology. The university set up centralized training courses to aid academic staff interested in learning to use the LMS. Twenty three participants were recruited from training courses run by the university and agreed to participate in the study. None of the participants had prior experience with the LMS. However, 15 out of the 23 had experience using technology-based learning systems such as WEBRAFT (9) or had developed their own web pages as a communication tool in their teaching practices (6 participants).

The research used multiple methods including interviews, follow-up interviews, focus groups, scrap books, participant observation, and document analysis. Interviews formed the key data gathering instrument and were complemented with participant observations that allowed the researchers to perceive user actions in actual settings to confirm ways in which individuals exploited their social networks in appropriating technology. Focus groups were used to encourage interaction and greater openness among users as they shared technology experiences, expectations, likes and dislikes with each other (Vaughn et al. 1996). Key artefacts (templates, tools and documents) inspected during the field work helped to gain a deeper understanding of the elements individuals used in their daily work practices. The use of multiple methods allowed us to triangulate data (Lee 1991) on participants' perceptions and actual experiences with the technology during continued use. Table 1 represents data collection timelines, number of participants, techniques used and various issues explored at different time-periods.

The EIS case study conducted over 8 weeks, commenced with interviews, followed by follow-up interviews and participant observations while key documents were analysed. The LMS case study commenced with interviews, followed by focus groups, participant observations and follow-up interviews over 44 weeks. Scrap books were given to all LMS participants at the first interview with the aim of capturing and tracking participants' expectations, likes and dislikes of the technology when the researcher could not be present. The scrap book was used to validate *post hoc* recollections made by participants (Carroll et al. 2002).

With the consent of the participants, all interviews and focus groups were audio-recorded while field notes were made by the researchers during the interviews, focus groups and observations. All data was transcribed and coded using descriptive codes to generate general and specific patterns and themes. Diagrams and a time ordered matrix were used to display, analyse and refine themes emerging from the data during different times in the research (Miles and Hubermann 1994; Langley 1999). Themes and patterns were linked to existing theories on social networks and technology appropriation.

Table 1: Data collection timelines, number of participants, techniques and issues explored

Case study	Timeline (weeks)	No. of participants	Techniques	Issues explored
EIS	1 wk	8	Interviews	• User actions and behaviour of how social networks were harnessed during technology use and individual learning/adaptation • Social network support for knowledge sharing and learning • Structures and roles in support of technology use and appropriation
	2-8 wks	8	Follow-up interviews, participant observation, note taking and document analysis	
LMS	1–2 wks	23	Interviews	• Post hoc recollection of reasons for attending training and the decision to adopt technology
	3–4 wks	3 groups of 3, 4 and 2 14	Focus group, scrap book Interviews, scrap book	• Users' experiences and expectations while using the technology. • Likes and dislikes about the technology
	7–8 wks	22	Participant observation, scrap book	• Role of the technology in users' teaching practices. • Experience with the 'look and feel' of the interface. • Features used to suit their needs and reason for selection.
	16–20 wks	22	Follow-up interviews, participant observation, scrap book	• Changing expectations, experiences and needs of participants. • Likes and dislikes about the technology and its features. • Reasons for continued use of the technology.
	24 wks	22		
	32 wks	8	Follow-up interviews, scrap book	
	36 wks	6		
	44 wks	11		

RESEARCH RESULTS

This section describes how participants used the EIS and LMS to support technology appropriation and use. Findings, based on themes identified during the data analysis, are reported in two major sections that follow. Case 1 focused on how social networks helped EIS users learn and use a new technology. Case 2 focused on early and continued use of the LMS over time and the role of social networks during this period.

Case 1 – EIS use over 8 weeks

Access to expertise in supportive social networks to solve problems

Participants indicated that their social networks helped them solve difficult technology problems they could not solve on their own using the technology. They could draw on their social networks and always found the right answers to difficult problems. Social networks therefore provided an informal, open network structure in which participants could freely ask any type of questions: *"I simply ask... I do a bit of detective work sometimes and find out who the right person is if I don't know [who to ask]"* or *"I do the rounds until I find the information that I need"* or *"I make people feel comfortable because sometimes they feel they ask silly questions"*. Participants indicated that they built and extended their social networks over time and they were pretty confident of who knew what type of solution to problems. *"I know who to ask; for certain areas it could be anyone"* or *"When it's a difficult question I know that someone would have the answer on the top of their head"*. Observations highlighted the fact that participants freely gave advice and helped others requesting help in their social network, knowing they could source solutions to problems.

Access to codified knowledge stored in artefacts

Apart from access to experience in social networks, participants could also access codified knowledge compiled by others. Codified knowledge proved to be useful in solving problems and supported individual learning processes. Participants were often thinking of ways in which they could codify useful knowledge that could be offered to users when required: *"…we have course documentation, and we are learning towards scripts which are basically step by step guides on how to perform a particular function of an EIS module …when I think it is necessary I try and convert what is hidden away in my head into training materials [for users], so I try and make sure our training materials are very fresh"*. Fieldwork highlighted that participants drew extensively on these scripts to complement their queries and fill their knowledge gaps while also learning aspects of the new technology. Participants indicated they could easily share knowledge using their own codified knowledge which in turn often saved them time to explain things verbally to others: *"We do share knowledge using our documents on our S-drive as well, we put information there and say okay if you want to know you go there, and occasionally I will email and say this is where you can find it and they just go and find it there"* or*" We have different ways of sharing knowledge - we can share knowledge without talking"*.

Sharing of knowledge

Participants commented on the value of their social networks to share knowledge. Observations confirmed the fact that knowledge flowed largely and freely between contacts in social networks and that they were instrumental conduits to source solutions to problems and communicating these verbally: *"I think social networks are very important for sharing knowledge"* or *"I have a large [social] network I draw on … we network to communicate"* or *"We verbally share knowledge…when we come up with something [problem solution problem] we make an effort saying it's either this way or that way: this is what is happening, new problem, this is how you fix it.*

Role of knowledge brokers, advocates and champions in supportive social networks

Participants indicated that they found the role of knowledge brokers, advocates and champions supportive while learning to use the new technology. Knowledge brokers often connected individuals seeking knowledge or linked individuals trying to solve problems in one social network to experienced people in other social networks. Friends referring friends on usually formed the key process to source knowledge: *"I have a good friend so I might give her a call and ask her where I should go to and vice versa, if the has a problem she will call me and so on, I mean its this unspoken things- we are good friends and we will share knowledge well, we will equally help with the stuff"*. At times participants acted as knowledge advocates and communicated specific technological problems to others: *"Depends on the area where the problem is coming from, I would communicate it to the right channels – I will communicate it to the people that need to know of the problem"*. Participants acting as knowledge champions were present in social networks. They could easily understand problems encountered and actively helped others to enable continued use of the technology: *"Its my ability to think and my ability to analyse situations and understand what people are trying to say…I like these sort of challenges [helping people]"* or *"Its part of my job to support users, I have the responsibility to make sure they use the EIS"*.

Development of trust in social networks

Participants indicated that they relied on the trust resulting from their social networking to communicate successfully: *"It's just because of the trust and respect we have for each other that helps our communication along quite well"*. One of the participants indicated that trust and respect for members in her network created a strong bond between them. The honesty derived from trust enabled participants to help each other through difficult activities associated with using the technology: *"We trust each other's judgement…the network that I have, we have a very strong bond which is based on trust and respect for each other.. we have the trust with each other so that we can say look I am sorry I really don't know the answer to that, let's try it together"* or *"Sharing knowledge [in a social network] comes down to trust again"*.

Developing knowledgeable teams and communities of practice

One participant indicated that the sharing of knowledge and expertise was much easier in a community: *"Sharing is easier in a community"*. Participants indicated that their social networks often formed the basis to develop and build small communities or CoPs. Interviews and fieldwork confirmed that these small communities fostered learning and technology use under great pressure which created a strong bond between informal social network contacts: *"We depend on each other totally and I think there is a very strong bond may I use the word 'love'. The network that we have is a strong bond which is vital because we are under a whole lot of pressure all the time"*. Participants expressed views that their social networks enabled them to strengthen their team knowledge to help others: *"…anyone struggling, we help them and try and support them as best as we can [as a team of experts] and that is what our role is we want to add value in that way"*.

Case 2: LMS use over 44 weeks

Early use and support from informal networks

During early use, participants were trialling the technology in their everyday teaching environment, *"I've been starting to set up folders…I've gone in and put in my profile…so it's just really playing"*. They were also changing their existing practices to suit the technology: *"At the moment, I've been taking the stuff from WEBRAFT and I've had to adapt it, as we begin to use the LMS"*. The manuals were useful as an initial reference, *"One of the good things about the manual, is that it shows you the screen you should be looking at and that's always reassuring, but – I think you'd only need that for a short time"*. But, the lack of ease of learning the new technology and usability issues featured as a strong influence that discouraged participants from using the technology. This is reflected in comments such as: *"It's not easy to learn to use... I really struggled ... it was not taking me sensibly through the task"* or *"Its going to take me quite some time to get a map*

of it into my head and to understand... the fact that there's confusing labels and many steps is kind of difficult". Even though the technology was not easy to learn to use and had usability issues, participants relied on strong support from super-users and peers in the department. This is reflected in comments such as: *"There's an informal group of people in our department who are using LMS...telling new people like me things that we needed to know"* or *"I've had to get help...from [one of the trainers] of LMS and the IT person in our department was able to work out the problem I was having related to blank spaces after a URL...".*

Mutual adaptation and supportive networks

With time, most participants had adapted to the technology *and* adapted the technology to suit their immediate needs as a part of mutual adaptation. Participants used the LMS in a limited way, *"I've done a bit of configuring of the menus... and made some announcements, so the basics just for the moment".* They chose features that best suited their teaching practices at the time and rejected other features, *"People have to sign a plagiarism document ...so I don't see using the online submission".* However, some participants were still in the process of learning to use the technology and were faced with problems (in weeks 7-8, 24 and 44). They contacted their local IT support staff and peers to help support further exploration and adaptation to suit immediate needs, *"[The] academic IT support person has been very supportive and my colleague next door...because she has used it, if you go and ask her something, there is help readily available and we are not waiting for someone outside".*

Problem resolution and supportive networks

The inability to resolve problems was noted as a strong negative influence that discouraged continued use of the technology throughout the study (noted in weeks 3-4, 7-8, after 16, 24 and 44). It was observed that lack of IT and peer support to resolve problems, forced one participant to stop using the LMS *"…We don't have any support–technical assistant to help us...if there were a group of us in the department using it and would say 'come on let's do it together' that might be better...I'm isolated and with a reasonable teaching workload it's not happening".* The inability to leverage their support networks in terms of contacting the trainer or IT helpdesk support staff led four participants to avoid using some of the features or worked around them, *"I actually wanted instant feedback from someone who knew the system ...I find that it is really frustrating there isn't expertise to support us in using this [LMS]".*

Sharing information and supportive networks

As participants gained experience and confidence with using the technology, it was observed that they developed social networks by sharing information and resources with others via the LMS (16-20 weeks) to complete tasks in their everyday needs, *"…the nice thing is if you are marking among 3-4 people we can tell them to straight away enter into the LMS...in the old method they had to do it on a spreadsheet and I had to get it all together".* However, a few participants expressed a lack of usefulness due to the inability to share information with the outside world and form new social networks. They commented that people outside the University were unable to access information on the LMS, *"One issue that I had was that we have two external people acting as supervisors...I wanted to load them into the LMS to access the discussion and groups and I was told that we can't do that...".* A few participants expressed the need to form social networks and share ideas with other experienced users who had already adapted the LMS, *"I'd like to attend training and it would be good if they showed us what others have done with the LMS to get some creative ideas".* The lack of a support network to perceive further use of the LMS was one reason why four participants stopped using it (observed in weeks 7-8 and 16-20), *"...convince me that the LMS works, nobody did that...I don't see a benefit in using the LMS".*

Supportive networks for further exploration and use

Participants communicated with peers and super-users to either resolve their problems or make decisions on using new features provided by the LMS. This is reflected in comments such as: *"I get help from the tutor because it's too annoying and time consuming to upload stuff"* or *"I didn't use the grade book, I was planning to...I got that mail from my colleague...about the problems he had with it... grade book would obviously have been useful...except it isn't quite".* With time, participants continued to express the need for further exploration of the technology (noted in weeks 7-8, 24 and 44), *"We should use the grade book because it gets results to students and they will be alerted when it comes up".* To support this further exploration and use of technology, participants expressed a need for a specialised support network that comprised of local IT support staff and super-users, *"...I found it was just much better to have one-on-one sessions, ask [outside LMS-IT, local IT support staff] particular things that I need to know rather than sitting through 3 hours of training...there are couple of people who are experts... it's just been easy to have them here".*

Summary of findings

Based on our findings from both cases, Figure 1 summarizes the impact of various social network characteristics that support the activities that encourage appropriation and use of different technologies over time.
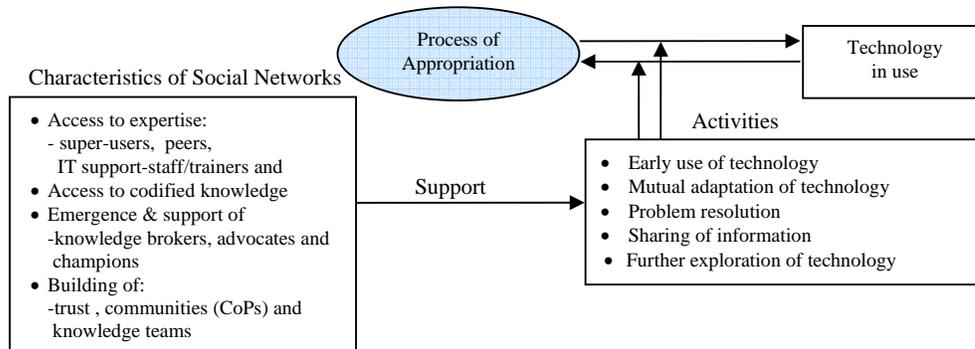

Figure 1: Characteristics of Social Networks that support technology in use

DISCUSSION

This research has addressed the question: *what is the role of social networks in encouraging long-term use of a technology in an educational environment*? We view our findings (shown in Figure 1) from a social network perspective to gain a deeper understanding on the aspects of social networks that positively impact on the influences that encourage appropriation and long-term use of a technology.

Users, when introduced to a technology are in the process of adopting and adapting the technology to suit their immediate needs. During this process, the lack of ease of use and ease of learning to use the technology cause users problems. Findings from our study suggest that quick access to knowledge experts such as peers, IT support staff, trainers and super-users through social networks help users to resolve existing problems while adapting and using a technology. In the LMS case study, findings indicated that users simply rejected features or the technology as a whole when they were unable to resolve problems due to the absence of peer support and the lack of easy and timely access to trainers and experts. The supportive role of social networks played a key role in helping novices of the LMS and EIS to learn a new technology, encourage users to persist using and explore new dimensions of a technology, helping in solving specific technology related obstacles and problems and finally help users perceive long-term benefits of using a specific technology. In our case studies, it was remarkable how individuals mastered the technology and became super-users and knowledge champions over time. We therefore suggest that managers and team leaders acknowledge and encourage the role of social networks in supporting technology appropriation and long term use. It is also important that new users of technology are introduced to and made aware of various skills and expertise in social networks in organisations.

Findings also suggest that access to codified knowledge embedded in social networks is instrumental in helping users to solve problems. Social networks facilitate access to codified knowledge that would otherwise be impossible, e.g. in the EIS case study, participants willingly shared codified artefacts in social networks to complement verbal explanations, which often saved time explaining things. Additionally, when users in social a network do not know the answers to difficult problems, knowledge brokers open up access to experts from other social networks, or link local people in one social network to more peripheral connections from other social networks. Knowledge champions were knowledgeable about different technological workarounds to the same problems and played key supportive roles in encouraging long-term use of technology. For example in the LMS case study, peers and super-users provided support in resolving problems. Knowledge champions thus served as exemplars, mentors and role models to new technology users. Fieldwork confirmed that people willingly open up their social networks to help others when required which is an indication of the goodwill and trust present in personal relations. We therefore suggest that organisations and teams encourage and invest in the codification of key knowledge that may support appropriation and learning processes of one or more technologies. Additionally knowledge brokering, advocacy and championing roles should be more formally promoted, acknowledged and rewarded in organisations and teams.

Findings also indicate that social networks are strengthened and sustained by the presence of trust, which again encourage users to continue using a technology. Fieldwork confirmed that strong bonds resulting from trust form the basis for knowledge teams or communities (CoPs) to develop as a result of mastering specific technology-

related use problems over time. Sustainability of technology use over time may be encouraged when users see benefit from using a technology. We therefore suggest that social networking activities are encouraged as an informal platform for users to ask questions of varying difficulty with the guarantee that solutions to difficult questions will yield responses.

How can we then, support and nurture appropriation and long-term use of a technology? Users often have difficulty in overcoming problems while using a technology, on their own. What is revealed from this study is that the presence of strong and supportive social networks are important catalysts to help users overcome individual problems and fears with technologies. Social networks may therefore be determining elements that organisations and teams should harness and leverage to help users in building their technology-related skills, motivate them to attempt 'unknown' technology features and encourage long-term use of a technology.

CONCLUSION

Findings from this study have a number of key considerations and contributions: firstly, managers and team leaders should be aware of the long-term benefits and key supportive role that social networks can play in technology appropriation and long-term use. Supportive roles in social networks such as knowledge brokers, advocates and champions are instrumental in sourcing knowledge by linking social networks, distributing knowledge through advocacy processes and promoting technology use through the setting of examples. Absence of these roles can trigger rejection of a technology. As a result, managers, trainers and IT professionals should therefore ensure that new users know who has specific, similar or unique technological skills in social networks and ensure that skills and expertise levels are made explicit in a form that can facilitate quick and easy access to experts, peers or super users. Additionally, knowledge brokering, advocacy and championing roles need to be encouraged through appropriate rewards and incentive schemes. Secondly, formation of communities (or CoPs) in social networks or teams of knowledge experts should be encouraged, even institutionalized to provide supportive structures to users and groups that appropriate and use technology. Finally, it's important that workgroups and teams carefully consider codification of specific knowledge that may provide useful support in encouraging mutual adaptation and use of a technology. These artefacts may be useful at times of need when specific technology experts are not available. Measures should be instituted to encourage the contribution of content and mutual sharing of such artefacts. Considering these findings, ICT can be harnessed to enable, support and facilitate mechanisms to provide quick access to knowledge experts and codified artefacts in social networks.

Future research should investigate long-term use of different technologies in different environments by different cohorts focussing on establishing processes and mechanisms that promote, facilitate and support access to experts and codified knowledge in social networks to ensure sustained and long term appropriation and use of technology. Additionally, a quantitative analysis of social networks may yield interesting results and other views of network structures that may pinpoint specific network-related problems which may complement these findings.

REFERENCES

Adler, P. and Kwon, S-W. 2002. "Social Capital: Prospects for a new concept", *Academy of Management Review* (27), pp 17-40.

Boissevain, J., 1974. *Friends of Friends,* Blackwell, Oxford.

Bosua, R. 2007. "Towards a model to explain effective and efficient knowledge sharing in workgroups in complex organisational settings", *PhD Dissertation,* The University of Melbourne*,* December.

Bosua , R. and Scheepers, R. 2007. "Towards a model to explain knowledge sharing in complex organisational settings", *Knowledge Management Research and Practice* (5:1), pp 93-109.

Brown, S.A., Massey, A.P., Montoya-Weiss, M.M. and Burkman, J.R. 2002. "Do I really have to? User Acceptance of Mandated Technology", *European Journal of Information Systems* (11), pp 283-295.

Carroll, J., Howard, S., Peck, J. and Murphy, J. 2002. "A Field Study of Perceptions and Use of Mobile Telephones by 16 to 22 year Olds", *Journal of Information Technology Theory and Application (JITTA)* (4:2), pp 49-62.

Ciborra, C.U. 1996. *Groupware and teamwork*, John Wiley & Sons, New York.

Coleman, J.S. 1988. "Social Capital in the creation of Human Capital", *American Journal of Sociology* (94), pp S95-S120.

Cross, R., Parker, A., Prusak, L & Borgatti, S. 2001. "Knowing What We Know: Supporting Knowledge Creation and Sharing in Social Networks", *Organisational Dynamics* (3:2), pp 100-120.

Cummings, S, Heeks, R. Huysman, M. 2006. "Knowledge and learning in online networks in development: a

social-capital perspective", *Development in Practice* (16:6), pp 570-586.

Davis, F.D. 1989. "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology"', *MIS Quarterly* (13:3), pp 319-339.

DeSanctis, G. and Poole, M.S. 1994. "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory", *Organisation Science* (5:2), pp 121-147.

Granovetter, M. 1983. "The Strength of Weak Ties: A Network theory revisited", *Sociological Theory* (1), pp 201-233.

Hansen, M.T., 1999. "The search transfer problem: the role of weak ties in sharing knowledge across organisational sub-units", *Administrative Science Quarterly* (44), pp 82-111.

Huysman, M., 2006. "IT to support knowledge sharing in communities, towards a social capital analysis", *Journal of Information Technology* (21), pp 40-51

Karahanna, E., Straub D.W. and Chervany, N.L. 1999. "Information Technology Adoption Across Time: A Cross-sectional comparison of Pre-adoption and Post-adoption Beliefs", *MIS Quarterly* (23:2), pp 183-213.

Langley, A. 1999. "Strategies for theorizing from process data". *Academy of Management review* (24:4), pp. 691-710.

Lave, J. and Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation,* Cambridge: Cambridge University Press.

Lee, A. S. 1991. "Integrating Positivist and Interpretive Approaches to Organisational Research", *Organisation Science* (2), pp 342-365.

Leonard-Barton, D. 1988. "Implementation as Mutual Adaptation of Technology and Organisation", *Research Policy* (17:3), pp 251-267.

Majchrzak, A., Rice, R., Malhotra, A. and King, N. 2000. "'Technology Adaptation: The Case of a Computer-supported Inter-organisational Virtual Team", *MIS Quarterly* (24:4), pp 569-600.

Mendoza, A., Carroll, J. and Stern, L. 2005. Adoption, adaptation, stabilization and stagnation: software appropriation over time, *Proceedings of the 16th Australasian Conference on Information Systems (ACIS)*, Sydney, Australia.

Mendoza, A., Carroll, J. and Stern, L. 2007. "Plateaus in long-term appropriation in an information system", *Proceedings of the 18th Australasian Conference on Information Systems (ACIS),* Toowoomba, Australia.

Mendoza, A., Carroll, J. and Stern, L. 2008. "Influences on continued use of an information system: a longitudinal study", *Proceedings of the 16th European Conference on Information Systems (ECIS),* Galway, Ireland.

Miles, M. B. and Huberman, A.M. 1994. *Qualitative Data Analysis: a sourcebook of new methods,* California, Sage Publications.

Moore, C.G. and Benbasat, I. 1991. "Development of an Instrument to Measure the Perception of Adopting an Information Technology Innovation", *Information Systems Research* (2:3), pp 192-222.

Nahapiet J. and Ghoshal, S. 1998. "Social capital, intellectual capital and the organisational advantage", *Academy of Management Review* (23:2), pp 242-66.

Newell, S., Robertson, M., Scarborough, H. and Swan, J. 2003. *Managing Knowledge Work*, UK:Palgrave,

Orlikowski, W.J. 2001. "Desperately seeking the "IT" in IT research-A call to theorizing the IT artefact". *Information Systems Research* (12:2), pp 121-34.

Rogers, E.M. 1995. *Diffusion of innovations*, 4th ed., Free Press, New York.

Taylor, S. and Todd, P.A. 1995. "Understanding information technology usage - A test of competing models", *Information Systems Research* (6:2), pp 144-176 .

Trigg, R. and Bodker, J. 1994. "From Implementation to design: Tailoring and the Emergence of systematization in CSCW", *ACM Conference Computer-supported Cooperative Work CSCW,* pp 45-54.

Tyre, M.J. and Orlikowski, W.J. 1994. "Windows of Opportunity: Temporal Patterns of Adaptation in Organisations", *Organisation Science* (5:1), pp 98-118.

Vaughn, S., Schumm, J.S. and Sinagub, J.M. 1996. *Focus group interviews in education and psychology*, Sage Publications, Thousand Oaks.

Venkatesh, V., Morris, G., Davis, G.B. and Davis, F.D. 2003. "User Acceptance of Information Technology: Towards a unified view", *MIS Quarterly* (27:3), pp 425-454.

Venkatesh, V. and Davis, F.D. 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies", *Management Science* (45:2), pp. 186-204.

Wenger, E. C. 1998. *Communities of Practice: Learning, Meaning, and Identity*, UK:Cambridge University Press.

Wenger, E. C. and Snyder, W. M. 2000. "Communities of Practice: The Organisational Frontier", *Harvard Business Review* (78:1), pp 139-145.

Yin, R. K. 2003. *Case Study Research, Design and Methods,* 3rd ed., Sage Publications, Newbury Park.

COPYRIGHT