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KNOWLEDGE SHARING DURING TECHNOLOGY IMPLEMENTATION: ENABLING ELEMENTS AND PROBLEMS

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Abstract

Organizational change due to the implementation of new technologies or newer versions of technologies in organizations is a process with many challenges. During this change process, users need to make sense of the new technology, adapt their work practices to use the technology and/or change their patterns or routines of work to make full use of the technology. This paper focuses on knowledge sharing during change associated with the implementation of new or newer versions of technologies in four case study organisations. We use a qualitative research method and our findings identify the 1) key interrelated elements that enable effective knowledge sharing (people from specific teams, IT-artefacts and change-related activities) and 2) specific problems that hinder effective knowledge sharing during change associated with technology implementation. Our findings are of specific relevance to managers that need to plan, control and coordinate change processes and manage teams that are subject to change associated with technology implementation.

Keywords: change management, knowledge sharing, technology adoption and adaptation, technology implementation.

1 INTRODUCTION

The implementation of new technologies or newer versions of technologies in organisations is never straightforward. Many questions that can be raised about the implementation process for example: once implemented, will the technology be used as envisaged; will there be any resistance from users in terms of using the new technology, or how will change from old to new technologies impact on existing work practices? Considering a 75% likelihood that information technologies (particularly software) may be underutilized or fail to be used in organisations following its implementation, the former questions are crucial, especially from a managerial perspective (Markus 2004).

Despite a large body of literature on Change Management, Organisational change and the management of change with respect to Information Technology (IT), change associated with technology implementation is a difficult process (Markus and Robey 1988; Markus 2004). This can be attributed to the complexity of the social and organisational environment in which the technology will be used. Even though new technology may provide additional or innovative features that may better support the work of individuals or teams, studies indicate that users often avoid or resist using new technologies. These may result in variations of using technologies, sometimes modifying or even ignoring some unwanted or less-favoured features of new technologies (Majchrzak et al. 2000; Orlikowski 2000). The latter may seriously impact on the intended purpose and overall benefits of technology as a whole.

Prior research on change processes associated with technology implementation, indicates that a combination of Social Networks (SNs) and user-created manual and automated IT artefacts, are essential to support and enable productive technology use (Bosua and Mendoza 2008). Little is known about how knowledge is shared during the change processes associated with the implementation of a new technology. Additionally, there is limited understanding of problems associated with knowledge sharing during the change from old to newer systems. Considering these limitations, this research asks the following research question: *what are enabling elements and problems associated with knowledge sharing during change associated with technology implementation?* This study forms part of a larger

study that explores knowledge management and effective support mechanisms during adoption and longer-term use of new technologies. In this paper, the focus is on elements that enable and hinder knowledge sharing during technology implementation from a managerial perspective.

To answer this research question, change management and knowledge sharing literature are described in Section 2 followed by the research methodology in Section 3. Research results are given in Section 4, with a discussion of these in the next section. Section 6 concludes by describing insights and limitations associated with this study.

2 BACKGROUND LITERATURE

Technology implementation involves the introduction of new technologies or newer versions of technologies in organisations. This implementation process involves the adoption and adaptation of these technologies by users to suit their needs. An integral part of the technology adoption and adaptation process involves Change Management, which in turn, is part of Organisational Change. A large body of literature exists that describes the phenomenon of Organisational Change with respect to economic, technical and social aspects (Beer and Nohria 2000; Cummings and Worley 2005; Tsoukas and Chia 2002). Part of this literature involves Change Management with respect to Information Technology (IT) (Markus, 2004; Markus and Robey, 1988). Change associated with IT can be on a small or a large scale e.g. organisation-wide or more localized in a team or business unit.

The body of change management literature with respect to IT, describes a variety of change-related aspects such as: theories, models, processes and methods of how organizational change can be conducted, management or implemented (Boudreau and Robey 2005; Harison and Boonstra 2009; Markus 2004), resistance to change (Davidson 2006; Lapointe and Rivard 2005); use-patterns associated with the implementation of new technologies (Edmonson et al. 2001; Bosua and Mendoza 2008) emerging system properties, changes in work patterns (Boudreau and Robey 2005; Harison and Boonstra 2009; Markus 2004) and perceptions and behaviour that relate to technology appropriation (Rosenberg and Holden, 2000; Sawyer and Southwick 2002), as well as organisational structures to support users when using technology (Orlikowski 2000; Orlikowski and Barley 2001).

A different strand of literature in Knowledge Management focuses on knowledge sharing and identifies social support in the form of Social Networks (SNs) when individuals in teams need to solve difficult problems (Borgatti and Cross 2003; Bosua and Scheepers 2007; Cross et al. 2001) SNs are supportive networks of humans that are related and play a key role in the generation of social capital and the creation and sharing of knowledge (Adler and Kwon 2002; Nahapiet and Ghoshal 1998). In addition to SNs one study has suggested that SNs complemented by user-created IT-artefacts are central to knowledge sharing activities associated with technology use (Bosua and Mendoza 2008). Even though this study establishes the importance of SNs and IT-artefacts in knowledge sharing during technology implementation, there is limited understanding how these elements (SNs and IT-artefacts) feature in knowledge sharing during change associated with the rollout of a new technology.

Organisational change and the management of change, particularly with respect to IT have been reported to have a high likelihood of failure. This can be attributed to different aspects such: negative reactions and perceptions of users relating to changes in work processes associated with using new technology, inadequate support structures during periods of change, inflexibility of technology and the lack of adequate training programs for users (Mendoza et al., 2010; Orlikowski 1992; Volkoff et al. 2007). Studies in technology adoption and adaptation indicate that once a technology is implemented, use patterns are incremental and evolve from initial adoption to longer-term use. Use patterns therefore vary from active initial use, to stable patterns of use, followed by further appropriation of the technology (Mendoza et al, 2008). Even though literature on technology implementation focuses on frameworks, models and processes to facilitate organisational change and user behaviour during change, little is known about the role and interrelationship between people, IT artefacts and accompanying activities that enable effective knowledge sharing for change. This paper focuses on this gap and is particularly important for management in order to better plan and guide the

change management process associated with the implementation of new technologies in organisations. The next two sections describe the research methodology and findings of this study.

3 RESEARCH METHODOLOGY

The research followed a qualitative, case study approach. The interest was to gain a deeper understanding of elements that facilitated and supported the sharing of knowledge during change associated with the implementation of new technologies. We also focused on problems that hindered knowledge sharing during change from old to new technologies from a management perspective. Case studies were conducted from 2010 to 2011 in four large organisations (three national and one multi-national). Cases were chosen based on the rolling out of new technology in the respective organisations. (Due to ethical reasons pseudonyms are used for organisation names in the case descriptions that follow).

Case Study1: ChocCo – a global Confectionary company

ChocCo specializes in the manufacturing of chocolates, gums and candies with its headquarters in the UK and subsidiaries in 60 countries worldwide. ChocCo leads this field and industry trends (e.g. technology trends) require ChocCo to react fast to make the most of its existing resources. This study was conducted in Melbourne and focused on ChocCo's change from an old to a new ERP system that integrated 30 different ERP instances worldwide.

Case Study 2: CertifiCo – a profesional Accounting body in Australia

CertifiCo offers certification accreditation in Accounting and with approximately 132,000 members in Australia and Asia Pacific, CertifiCo plays an advisory role to formulate and interpret Accounting standards. CertifiCo assesses candidates' technical knowledge and offers exams to raise their competency levels. The study focused on CertifiCo's change from a manual paper-based exam delivery system to a more secure and cost-saving electronic exam delivery and distribution system.

Case Study 3: TeleCo – a large Telecommunications company in Australia

TeleCo provides services and solutions to a multiple businesses, customers and clients. TeleCo is one of Australia's largest fixed-line providers of home, business, mobile and public phones. This study focused on TelCo's change from an internal Sales Service System with an outdated software and hardware platform, to a more modern and effective Sharepoint infrastructure that provided a document library to better support the sales services.

Case Study 4: EduCo – a large public University located in Victoria, Australia

This case study focused on the university's change from an ageing telephone network and cabling distribution system to a more robust and reliable CISCO Internet Protocol (IP) telephone system. The old system was inadequate in providing secure and supportive services and could not be integrated with any newer internal systems or software in this organisation.

Table 1 summarizes the case organisations with respect to business type, type of change associated with the implementation of new technology, roles interviewed and data collection techniques. Interviews were face-to-face, open-ended and lasted approximately one hour each. With consent, all interviews were audio-recorded and field notes taken during interviews. Interviews were transcribed and descriptive codes were used to generate general and specific themes to facilitate the data analysis (Neuman, 2006).

4 RESEARCH RESULTS

Findings, based on themes identified during the data analysis are reported in this section. The data is organized according to four major themes across the four cases: 1) the role of individuals or teams to share knowledge, 2) IT artefacts used to support knowledge sharing, 3) activities that enable knowledge sharing. In addition, problems that hindered knowledge sharing involving the roles of people, IT artefacts and change processes across the four cases are reported as a fourth theme.

Key Business Type, Organisation Size and Type of Technochange	Participant roles and Number of interviews (n)	Data Collection techniques
Case study 1: ChocCo - Manufacturing of Confectionary Multi-national (Large) - <i>Change from various ERP instances to a standardized instance for Australia</i>	Knowledge Director and Project Team leader (n=2)	Interviews, key documents and artefacts
Case study 2: CertifiCo - Accounting Body National (Large) - <i>Change from a manual exam paper delivery system to an electronic delivery and transfer system</i>	Knowledge Manager, knowledge executive, Quality management consultant, Administrative and Technical Consultants (n=5)	
Case study 3: TelCo - Telecommunication National (Large) - <i>Change from an old sales service system and database to a more effective Sharepoint platform system</i>	Knowledge Manager and Change Manager (n=2)	
Case study 4: EduCo - Educational Organisation National (Large) - <i>Change from an aging telephone network system to a robust CISCO system</i>	Change and Communication Manager, Project Manager (n=2)	

Table 1. Key business, type or organisation, Technochange, participant roles & data collection techniques

Theme 1: SNs – the role of individuals and teams to share knowledge

As a part of social networking, three communication roles were noted to enable knowledge sharing during the change process namely: 1) Communication brokers, 2) Experts or champions from the implementation team and 3) Superusers and experts from the business team.

Communication brokers from different SNs enabled the sharing of knowledge between vendor and business teams (noted in ChocCo, TelCo). These teams had the responsibility to find and gather experts (e.g. ERP or Sharepoint experts) to share knowledge between teams, within organisational departments and with vendors outside the organisation. For example one of the participants from ChocCo commented: *“I was the interface between the vendor and business teams, ensuring the business gets the right outcome from the project. I talk to the business team, ‘Are these our business requirements’, if yes, we pass it to process [the implementing staff], if no, we will go back to the technical team [vendor team] and change it. Ensuring the ERP project delivered the right outcome to meet the business needs”*(ChocCo Project Team leader). The TelCo Knowledge Manager commented that a multi-skilled knowledge broker team facilitated training and sharing expertise on how to use the new system: *“...we provide information... it pretty much [depends on] the design and the confidence in that team, both technical background and sales background, like myself, but also other people from media, publicity, marketing, sales, adult education, and we had all the skills in that team”*.

Experts or champions from the implementation team helped people adopt and use the new system. In this study, it was noted that experts and champions formed part of the same SN. For example one participant commented on his SN support as follows: *“You need to be hand-held, and that’s why you need to have people who really understand the system and they sit down with you, and make you feel more comfortable with the system... the most successful part was when we invested more in that knowledgeable help [knowledge sharing]”*(ChocCo Knowledge Director).

Change champions played an important role in initiating and encouraging change associated with using the new system as they had both the business and technology expertise to share: *“My manager decided that Lotus Note was very old fashioned, Sharepoint was the way to go. So part of the drive was the role new technology play in this phase, part of the reason also because original systems had been built with a very specific purpose So it [the new system] was more extending capability and also because at a corporate level, the company was moving down to a Sharepoint path to manage documents, and not Lotus Notes, we kind of need to move forward ...”* (TelCo Change Manager). It was also noted in the EduCo case study that the implementation team facilitated training and helped users change over from the old system to the new CISCO system: *“We [implementation and support team] deliver all the change initiatives required for people to adopt the new product, that is what we do, so we look the current state and the future state, what education is required, training, communications and leadership”* (EduCo Change and Communication Manager).

Some users and experts from different teams such as the business or vendor teams emerged as superusers creating an effective social networking environment. ChocCo invested in superusers in order to leverage from their SNs to transfer expert knowledge to help users with the transition from the old to the new system: "A good example of that is we created a role named super user. These people who were in the business, they actually had a business role; they actually understood how to use the system in the most effective way. We invested, we trained them during the project life, and then they became basically the owner of those functions, going forward the go-to-person." (ChocCo Knowledge Director). Similarly in CertifiCo, superusers from the business team trained users on the new system with the help of the vendor team. The vendor was able to explain why the business needed the new system. For example, one of the managers from CertifiCo commented, "A lot of communication was happening during the training session when this vendor was in Melbourne ...to help us understand the system more from the vendor team, the product manager came for the training problem... this vendor is very good... like why you want to do X, or why you should do Y, he focussed on separating the business process and business system functionality and he highlighted the system is just a tool to achieve efficiency" (Administrative Consultant).

Theme 2: IT Artefacts created and used to support knowledge sharing during technology change

A range of IT artefacts were either present and used (i.e. already embedded in SNs) or created in organisations to support knowledge sharing. IT artefacts found to be useful to share tacit and explicit knowledge during change included: video conferences, organisational portals, email, intranets, organisation-wide document repositories and discussion forums. For example in ChocCo the Knowledge Director commented: "...we used a portal, discussion forum on the portal, video ... we used a document repository, search function, so it's one thing to collect the documents, that's the explicit form of sharing knowledge...the advantage is you can go across multiple time zones, across the world very quickly with the information, no doubt about that. You can get to a document with a common look and feel, I look at the document, I know this is the role responsibility and this is the action, so it's very accessible, it's fast, and it's efficient".

Similarly some CertifiCo participants suggested that IT artefacts (e.g. their pilot system and its repositories) were useful to share knowledge during change, as one of the participants indicated: "we ran a pilot system for people to have a try, and then they could give their feedback about their feelings and of course in that way, they will have a much better understanding of the system...I believe we had success with it, because when people experience what it is, looking at what the solution is, then of course they have a much better understanding about the solution" and "... so it's like a storage system [the repository], it acts like a record keeper, it records all the exam papers we have, then it also acts like a go-between between moderators and the internal staff when we need to send and receive stuff" (Quality management consultant).

Information Sharing via dedicated Email boxes, documented knowledge, Intranets, online newsletters and 'change websites' were also considered a useful way to share knowledge as they provided a link between users and experts (CertifiCo, TelCo, EduCo). For example some comments were: "We do have a functional mailbox setup for people to come and ask questions, ..., so we can get that sort of feedback" or "they basically had those emails, had a link to the summary of the email, and by clicking on the link, there is the intranet with full details of whatever it is, so it was from two different channels"(CertifiCo Technical Consultant). The EduCo project team created a change website page to share information with users: "We created a website to introduce our new IP phone to our customers, it's a public website, and it contains information about the telephone, training materials, the interactive tutorial provided by the manufacturer, FAQs and the search functions"(Project Manager).

The value of documented knowledge on how to use the new system facilitated user communication and recall at later stages of system use. Such documents helped users to recall important aspects of system use to help others as one manager from CertifiCo commented: "We need to use the system to send the exam papers each semester, that's six months apart, so if you ask me now to go back and show you how, I can't even recall every step. The challenge is to make sure that everything is documented in a user friendly way, that we can easily follow the steps again. So we need the instructions. Although it has details of everything, I still feel I need more practice, I feel people are there to help me to actually do it, hands-on support, - I always find out that hands-on support are more effective than paper support" (Quality Management Consultant).

TeleCo had dedicated Intranets that inter-related IT artefacts with online newsletters and emails that encouraged users to share change-related knowledge as one participant stated: “...there are (online) newsletters and emails, where we pull all these contributors together. Because our end users are in sales, we then worked with our internal communication team and they sent out weekly updates to sales - and we get to change to target end users. And also they have intranet sites, they basically had those emails, had a link to the summary of the email, and click on the link, there is an intranet got the full details of whatever it is, so it was from two different channels” (Change Manager). An EduCo participant emphasized that the use of IT artefacts alone to share knowledge was inadequate, so the link between people and artefacts was important: “... IT artefacts alone don't enable the change, the change is enabled through coaching managers, leadership activities, business rules ... IT artefacts purely are to facilitate the communication, but not the change. ...it's people on the process. .. for example we developed IT artefacts in the form of fact sheets, saying references, initial operational support, physical copies and they are on the website again, you have a single source there” (Knowledge Executive).

One EduCo participant emphasized the value of a specific change website to facilitate change. This allowed people to make first connections with key people, allowing them to share both explicit and tacit knowledge. Once they knew each other, they used IT artefacts to share explicit knowledge: “... the website is set up as a central source, and you can go to it and get information. Then the ongoing communications depend on these areas, some are stakeholder specific. So we direct emails and presentation sessions to stakeholder groups. In the future, we will use things such as video conferencing, and pre-record sessions of how to use the system online” (Change and Communication Manager).

Theme 3: Activities used to encourage knowledge sharing during technology change

Managers indicated that interaction and frequent communication between the right people was essential particularly in the beginning stages of the change period as it helped people to understand each others' 'working styles' and allowed the sharing of tacit knowledge through socialization. Additionally, frequent communication raised awareness of the new system and reduced uncertainty and potential resistance of use: “...if you want to explain the change, you want a face to face [meeting], then do a lot of follow up. It depends on the relationship you build, it would be good to build the relationship and understand each other during the early phase of the project” (ChocCo Change Manager) and “...most of it [collaboration] is face to face, because it's not something you can put into email, because people may ignore it - it's not just a message you only need people to read. We want to tell people we can make it simple and elegant to use ... we know we have to put effort into it - you can't just put a message there, people need to see the value and you need to highlight the value, which is the means to make the change better” (ChocCo Change Manager).

Activities such as classroom-based and one-on-one training, group-thinking teams, knowledge sharing sessions, and one-on-one ongoing support were considered important activities to share expertise during periods of change (noted in ChocCo, CertifiCo, TelCo and EduCo).

The ChocCo Knowledge Manager indicated: “The way to do it is to engage and train them [the users], educate them and why this is important. Train them how to use the system and a lot of people will come with you, and say 'yeah, I can see this is so much better. I understand now why my data needs to be more robust and more visible by other people, because it is better for the organisation’”. The Change and communication manager of EduCo indicated: “Transferring knowledge is really important, that's why we do training to achieve that, getting managers to own the change, so they can start to make their ownership, change comes through when people think it's relevant to me, maybe to the possible plan. In this project, we really need to make sure that everyone is on board, they actually use the system effectively, and make sure there is a change champion, and everyone does.” Additionally, managers also commented of the value of 'forward training workshops' whereby a central team of experts in one country trained a specific team in another country and once that team had adequate expertise, they could train another team from another country and so forth” “... a central global team would come to the country, say from the UK, and based themselves in Australia, with the Australian team. If the next team was the Japan team, the Australia team would then go to Japan and so on. So there would be a lot of workshops, bringing different people from different parts of the world. They develop a set of process flows through Visio, or other means, going back, and say,

these are the common processes of this particular activity....particularly, once you go live its important with IT artefacts” (ChocCo Project Team leader).

Managers of all four cases stated that ongoing support in the form of one-on-one training was a good approach to effectively share knowledge about business processes and the new system: “... *one of the things we are doing is trying to share as much knowledge as possible , it was really one-on-one training for individuals as we actually roll out the system... they included things like online-quizzes”* (TelCo-Knowledge Manager) and “*it’s just the nature of things - we have to be prepared to hold hands and provide one-on-one advice...*”(TelCo Change Manager).

Group thinking teams were formed in ChocCo and CertifiCo to share experiences. These teams comprised senior managers and allowed representatives from sister organisations and other organisations that used similar kinds of systems, to share their views and past experiences about the change and use of new systems, e.g. one of the participants commented: “*We used to run what we call ‘Town Hall’ meetings. So this is where the team leader would pull it all together... typically this would be once a month, or once a week at really busy times...We have an open conversation explaining the updates,.the change and its progress, talk about what’s going on with stakeholders and what activities worked, and perhaps someone like the technology leader, sort of giving updates where they are with the infrastructure”* (ChocCo Knowledge Director).

Similar to group thinking teams, another useful knowledge sharing activity was dial-in knowledge sharing sessions to help users, “... *we also ran a couple of what we called dial-in knowledge bite sessions, so they could dial into a number and ask questions and get feedback from experts as they present and demonstrate [knowledge]”* (TelCo Change Manager).

Theme 4: Problems that hinder knowledge sharing in Technology change

Based on the data collected across the four case studies, eight common problems emerged as discouraging factors for the sharing and transfer of knowledge and expertise during technology change in the organisations. The discouraging factors include: 1) time constraints 2) information overload via emails 3) lack of timely updates and maintenance of information 4) loss of knowledge transfer due to changes in roles and responsibilities 5) loss of prior information during change from old to new systems 6) language barriers and differences in time zones 7) lack of an integrated system to easily search and access of information and 8) lack of one-on-one support during change.

1)Time constraints for users included reading of and listen to captured information: most managers expressed frustration about users attitudes to new technology. They commented that users of new technology complained that they had to spend large amounts of time reading large documents or listening/viewing long audio and video files associated with tnew systems (noted in ChocCo, CertifiCo, TelCo), E.g the ChocCo Knowledge Director commented: “...*people don’t go and read the documents, it’s important to have them, it’s good to have, but if you want effective benefits from your ICT over time, you have to invest in changing people’s attitudes towards reading documents”* and “...*voice or even video recording, anything more than about 10-15 minutes, people don’t go back and use them, they wait for the next one, and then this is how the miscommunication appear”* .

2) Information overload of users via email: some project managers (CertifiCo, TelCo) indicated that sending of change emails to users (e.g new system updates and more on how to use new systems, was ineffective: “...*people may get bombard by email, so some people may miss the email, and they didn’t read it...people don’t really read them, anything you sent out, whether it’s an email or a newsletter, when we actually put something on the front page of the site... nothing could be effective if they just never read anything”* (CertifiCo Technical Consultant) and “*People don’t read their information, emails...too many emails...people just say there are so much happening, and they delete everything”* (TelCo Change manager) .

3) Lack of timely updates and maintenance of information by managers: managers in 3 organisations commented that it was also difficult to maintain and update knoweldge stored as information in IT artefacts over time (noted in ChocCo, EduCo, CertifiCo): “*I think some of the frustrations is, it can be hard to maintain information from the start of the project, yes but then a year late, you go back and wonder why would we do that [update information], it’s really complicated to come back and try to navigate and maintain the document”* (ChocCo Project team leader). According to EduCo’s

Change and Communication manager, updates and maintenance of IT artefacts took some effort e.g a blog was used in one instance to update users with information. Initially it was thought that this blog would be used frequently but managers found much effort was required to regularly update the blog *“Blogs are great to have, but it took us energy to keep it updated, that’s why we used it at the start, and then stopped later”*.

The CertifiCo Knowledge Manager indicated that using IT artefacts for communication and updating of knowledge was only effective if these artefacts were updated and maintained regularly with consistent and accurate information, *“In terms of how we communicate Visio, PowerPoint, email, Intranets, where you can access the particular information or functional areas, its good but you’ve got all those tools that build the knowledge at the point of switching the system on or go- live, whatever it is, how they then maintain the information over time, is a different set of tools”*.

4) Loss of knowledge transfer due to change in expert roles and responsibilities: another problem noted by some managers across the organisations was that people with essential knowledge and expertise changed roles or organisations and took their key expertise [tacit knowledge] with them, *“...the super users in one or two years move on to different roles and don’t tend to come back when we need them, or it could be because they have developed much more with the project, they are more into the next thing. It’s really hard, because ideally you want them back for a year doing a handover but they just don’t”* (ChocCo Project team leader) and *“ People change organisations, and the real problem is you can have the help there at the time that the system is new, but I know in that organisation we have lost the knowledge over time and they haven’t replaced it. Several years later, because they haven’t maintained that level of knowledgeable help over time, the documentations are not updated, as well as the mapping of the documents changed”* (ChocCo Knowledge Director) .

The lack of knowledge champions and superusers in organisations was a problem for some managers. The Knowledge manager at CertifiCo indicated that it was preferable to have champions and super-users within the organisation with wider knowledge about the organisation and its business processes, *“The system failed once before, and the reason why it failed before was because the solution was very, very complex, it wasn’t designed by people who actually worked in the business, but it was designed by external consultant rather than people who understand our business requirements and business rules and therefore it could be nothing but frustrating with no contact or training or we could never consult”*.

5) Language barriers and differences in time zones: as a global organisation, one difficulty ChocCo faced was the inability to effectively share knowledge with people speaking different languages in large teams as the Knowledge Director and Project team leader stated: *“Its a difficult team because they speak different business languages... particularly the large team have such problems, that’s why your team should be smaller”* and *“as a global project, you are dealing with people in India or other countries, so that’s some of the challenges would be, and again, it comes back to sharing knowledge across languages and a lot more now we use communicator, and share desktops, and those things”*

6) Information loss during change: changeover from old (e.g. Lotus Notes) to newer/totally different new systems (e.g. MicroSoft Office) was perceived as serious since large numbers of IT artefacts used to share knowledge associated with past practices ceased to exist as ChocCo Project team leader remarked: *“We lost Lotus notes databases and workflows - Lotus notes was principally our tool... it also had repositories, and a lot of that stuff was lostwho knows what documents are the right document, where they are moved to. So the legacy systems was kind of lost and the integrity was lost too Just little changes and it makes the whole thing different and the whole organisation changes”*.

7) Lack of an integrated system to facilitate search and access to up-to-date information: searching and accessing information (codified knowledge) was also considered as hinderances during technology change (seen in ChocCo, CertifiCo, TelCo). The ChocCo Knowledge Director commented: *“People do not know how to find it [codified knowledge]. Then the knowledge is not effectively shared, so you need to be able to collect the information you need and put it into a format that is accessible to people, and that was a big problem...the biggest thing to do is to get people understanding where the relevant information is and why it is important to them”*. ChocCo’s Project team leader said: *“Things tend to get lost because it relies on someone to document that, put it into PowerPoint or Visio, and then put in onto the Intranet. It gets lost because versions get out of control,*

unless managers really work closely in modifying and updating the information. You should be able to get access to these straight away/ The frustrating part is there are so many documents”. He further commented: “...so if you knew where it came from or who created it you could do some search, and if you really knew what you are looking for, you probably could find it...so it’s tough”.

8) Lack of one-on-one support during change: online training programs to share knowledge seemed less effective compared to face-to-face training as indicated by ChocCo’s Knowledge Director: “...we certainly create online training but we found that usage of the online training was very low. People just don’t find time to do it. Where at least, you could sit in a training session, and let someone tell them... you have to do this! You know, it’s more effective”. CertifiCo’s Technical Consultant commented about their online training environment: “I guess its only good at technology, but they got poor sound and resolution on the screen, that may not be a good user experience... I prefer face-to-face support”.

Summary of Findings

Based on the results from four case studies, Figure 1 illustrates the interrelationship between people, IT artefacts and various activities that support change during technology implementation. In addition, Figure 1 also shows some problems that may disrupt the use of technologies during change from old to new systems.

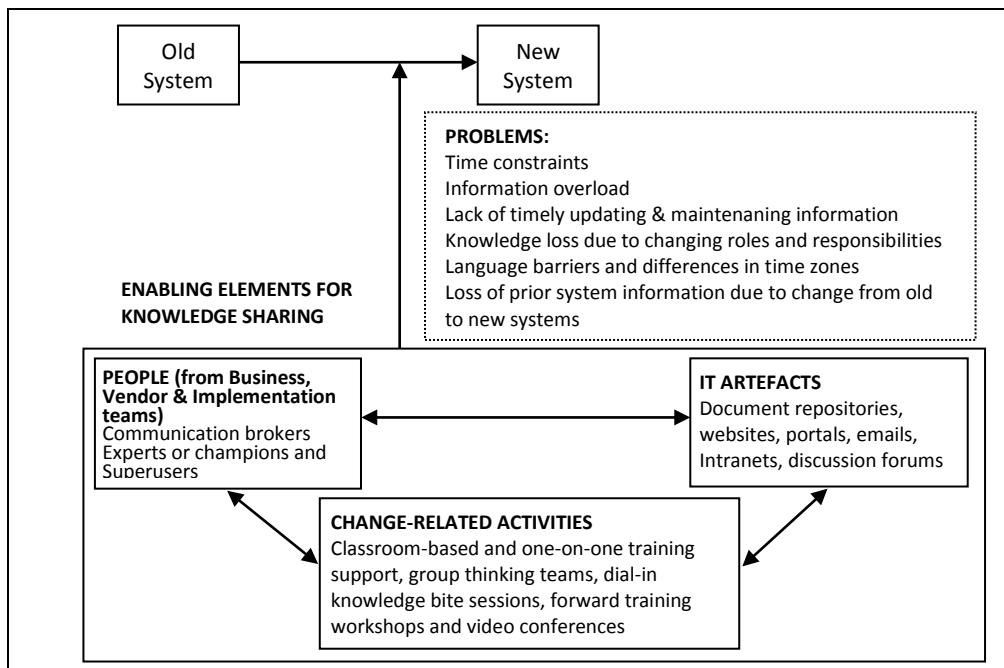


Figure 1. Enabling elements for knowledge sharing during technology implementation

5 DISCUSSION

This paper has addressed the research question: *what are the enabling elements and problems associated with knowledge sharing during change associated with technology implementation?* Based on findings from this study, there are three interrelated enabling elements such as people, IT artefacts and activities that support knowledge sharing during change associated with the implementation of new technology (see Figure 1).

Communication brokers, experts, change champions and super users play important roles in sharing expertise that influences technology implementation and use. In this study, communication brokers linked vendor and business teams by finding and involving experts to share their expertise with and train users. In addition, results also suggest that experts and change champions from the business and implementation teams were instrumental in the sharing of business and technical expertise respectively. It was noted that people in the business team were trained to use the new system as super

users. This strategy of positioning business team members as super users demonstrates the value of the system from both a business and technical perspective. Based on their perceived value and familiarity with the new system, super users in business teams could influence other users to adopt and use the technology. Therefore it is important for senior managers to identify, assign and train key players from different teams (implementation, vendor and business) as communication brokers, experts, change champions and super users to enable the sharing of knowledge between different teams, departments and units in an organisation.

Findings also indicate that collections of IT-artefacts is another element that supports knowledge sharing during change associated with the implementation of new technology. In this study a number of IT-artefacts were identified as enablers that support knowledge sharing. Examples include document repositories, website, portals, emails, intranets and discussion forums. These elements were frequently used by people to codify and share tacit and explicit knowledge within and between teams in organisations. However, this study also suggests that IT-artefacts alone are not sufficient in knowledge sharing activities. People used IT-artefacts as a medium to store, access, share and re-use knowledge. Considering the importance of IT-artefacts, business and IT managers should realize that IT-resources need to be set aside to create, update, maintained and make these artefacts available to share knowledge within and between different teams involved in technology implementation.

Furthermore, this study suggests that key activities focused on one-on-one and classroom-based training, group thinking teams and forward training workshops, and dial-in knowledge sessions can enable knowledge sharing during change processes. Findings from this study suggest that activities such as knowledge-bite sessions and group thinking teams were effective forums to share expertise within organisations and between global teams. Additionally, the findings support prior work that highlights the need for a variety of support mechanisms such as one-on-one, classroom and workshop-based training sessions, super-users and peer support to facilitate knowledge sharing and technology appropriation (*ref omitted*). It was evident from all four case studies that support in the form of a variety of activities is essential in encouraging users to adopt and use new technology.

As illustrated in Figure 1, for effective knowledge sharing to occur, people, IT-artefacts and various activities need to be inter-related. People use different kinds of IT-artefacts to share expertise and knowledge. Additionally explicit knowledge can be stored as documents in repositories and content management systems. Therefore, an IT-artefact can serve in two ways: 1) a storage unit of information and 2) a medium to interact with, reuse or transfer stored information. People, alongside IT-artefacts and various activities encourage effective knowledge sharing between external and internal knowledge sources. When knowledge sharing in person is not possible, IT-artefacts may serve as a medium to replace face-to-face communication and transfer knowledge to large groups of selected people. Management should therefore devote resources to link people, IT artefacts and activities to create suitable knowledge sharing mechanisms and opportunities that relate to change associated with effective implementation and adoption of technologies.

If the inter-related nature of people, IT-artefacts and various activities play an important role in sharing knowledge during technology implementation of a new technology, then *why do organisations still find it a daunting task to support and enable change during the implementation of new technology?* One reason could be the lack of an in-depth understanding of the problems that hinder knowledge sharing during technology change. Findings from this study have identified eight problems (from a manager's perspective) that may discourage knowledge sharing during change. These include: 1) time constraints for users to read and listen to information 2) information overload for users via emails 3) lack of timely updating and maintaining of information by managers 4) loss of knowledge transfer due to change in expert roles and responsibilities 5) loss of information during change from old to new systems 6) language barriers and differences in time zones 7) lack of an integrated system to easily search, access and update information and 8) lack of one-on-one support during change.

Identified problems can be related to each of the three enabling elements in Figure 1 namely as people, IT-artefacts and activities. In terms of people, in this study it was noted that managers were frustrated since users failed to read and listen to lengthy documents and audio recordings of information related to change and use of the new technology, especially when time was an important commodity. Linked to these time-constraint issues is also the notion that users experienced an

information overload in terms of having to read large amounts of documents (in the form of emails). Also, findings from this study suggest that communication and knowledge sharing across different time zones and countries can be problematic. For example in one of the multi-national organisations, it was noted that language differences made it difficult to share knowledge effectively. It is therefore important that managers identify the most effective communication medium and timing to share knowledge with users.

Furthermore this study suggests that the changing nature of roles and responsibilities of knowledge experts hinder effective knowledge sharing during the change and implementation of a technology. While explicit knowledge can be stored and accessed using IT-artefacts, the movement of people within and across organisations and roles makes it difficult to retain experts' tacit knowledge. Managers should therefore find ways to capture and transfer important tacit knowledge to avoid this problem.

In terms of IT-artefacts (and people) this study suggests that the lack of timely, accurate and continuous updating and maintenance of stored information by experts, knowledge brokers or champions impacted on knowledge sharing activities associated with change. For example, results indicated that managers were aware of these problems. In addition, the study also indicates that change from an old to a newer system often includes the loss of important artefacts and repositories of information stored in these systems. In this study, with the introduction of new system, users expressed frustration associated with the loss of legacy knowledge and artefacts they used during prior workflow activities to share knowledge. Therefore, while using IT-artefacts is an important aspect in knowledge sharing, managers should be aware that updating and retaining of relevant information (including legacy information) in an accurate and timely manner is required to support knowledge sharing during change. Furthermore, findings indicate that an important strategy in easily searching, accessing and updating information could be achieved by providing an integrated system that includes important information rather than having information distributed across different systems and/or IT-artefacts. With respect to activities, this study supports prior findings by highlighting the need for effective support mechanisms to be set in place apart from normal classroom-based training (*ref omitted*). Especially, in this study, in addition to online and classroom-based training, users expressed the need for one-on-one training to facilitate the implementation of new technologies.

6 CONCLUSION

This study has identified and provided a deeper understanding from a managerial perspective, of enabling elements for knowledge sharing during the implementation of new technologies. Additionally, this study also highlights key problems that may hinder effective knowledge sharing during change from old to new systems. While elements such as people from different teams, IT-artefacts and specific activities are required to support knowledge sharing during technology change; it is the inter-relatedness between these elements that contribute to effective knowledge sharing. Results of this study may better inform managers of key elements that need to be considered and introduced to facilitate effective knowledge sharing during technology change. Managers may need to better plan and invest in resources including identifying and involving experts and knowledge champions from different teams and organisational levels. Also, tacit knowledge needs to be captured and preserved to facilitate the change to and ongoing use of new technologies. Furthermore, managers could invest in designing supportive IT-artefacts to encourage knowledge sharing within and across people and teams in the organisation. Finally, this study may help managers in acknowledging, identifying and establishing strategies to overcome problems associated with knowledge sharing during change.

This research is limited to only *managerial* views of knowledge sharing for successful change associated with the implementation of technologies. Future research should focus on how *users* view technology change from a knowledge sharing perspective. Additionally, the model on the interrelationship between enabling elements for knowledge sharing (shown in Figure 1) could be tested and refined in a broader organisational context, for new insights and perspectives.

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