KNOWLEDGE CREATION AND TRANSFER

TACIT KNOWLEDGE SHARING IN DESIGNING, CONSTRUCTING, AND TESTING OF ERP SYSTEMS: AN EXPLORATORY MULTI-SITE CASE STUDY

Ramaraj Palanisamy
Associate Professor
Department of Information Systems
The Gerald Schwartz School of Business and Information Systems
St Francis Xavier University, NS B2G 2W5, Canada
Tel: (902) 867-2184
Fax: (902) 867-3352
Email: rpalanis@stfx.ca

This study examines tacit knowledge sharing in designing, constructing, and testing of ERP Systems in a geographically distributed environment. To mitigate the risks in implementing ERP systems, a knowledge based approach is followed. The ERP implementation team depends upon knowledge to understand the business rules and processes required for the ERP systems. The value of ERP implementation is increased when tacit knowledge has been integrated into ERP systems. This paper attempts to understand how Canadian organizations are sharing the tacit knowledge in geographically distributed ERP implementation environment. A case study methodology is followed to accomplish the research objective. Three organizations from telecommunication, government, and retail sectors participated in the study. For data collection, semi-structured interviews were conducted with four to six respondents from each firm. The findings about tacit knowledge sharing in three firms that have implemented ERP systems are presented. The findings are categorized into three phases: tacit knowledge sharing in design, construction and testing of ERP systems. The lessons learned are given by presenting a cross-comparison of the three case studies. Based on the case analysis, the activities for tacit knowledge sharing in geographically distributed ERP implementation environment are given.

Key words:

Enterprise Resources Planning, Geographically Distributed environment, tacit knowledge sharing, ERP design, configuration of ERP systems.

1. INTRODUCTION

Enterprise Resource Planning (ERP) systems offer great promise to businesses wanting to consolidate and integrate the many elements that comprise business practice. The ERP systems are information systems used for enterprise integration and are enterprise online interactive systems that support cross-functional processes using a common database (Mabert et al., 2003), that can integrate across multiple functional areas by focusing on processes, rather than the individual functions (O'Leary, 2002). ERP systems, as this typical description shows, are a "packaged business software system that enables a company to manage the efficient and effective use of resources by providing a total, integrated solution for the organization's information-processing needs" (Fui-Hoon Nah et al., 2001, p. 285). ERP packaged solutions are sophisticated, complex, and comprehensive, as well as diverse. They are viewed as alternatives to in-house development and as means of decreasing internal development costs (Verville and Halingten, 2001). ERPs are defined as a suite of integrated software applications that links back-office and front-office operations and their internal and external supply chains. As such, ERP has become the center of the organization's application architecture, or what some have referred to as 'the enterprise backbone' (Pricewaterhouse, 1998). Geographically distributed ERP implementation projects (or any IS development project) are projects that consists of multiple groups working together to accomplish project goals from different geographical locations (Kotlarsky and Oshri, 2005). The team members must share tacit and explicit knowledge in order to implement the ERP systems. Significant challenges arise when such knowledge sharing cross geographical boundaries.

Many organizations are using ERP systems to gain competitive advantage by integrating their business functional areas and providing users greater access to real time information. On the other hand, some are becoming wary of ERP

solutions due to the enormous amount of time and money needed to implement these complex systems and their high risk for failure. These systems are complex and implementing one can be a challenging, time consuming and expensive project that place tremendous demands on corporate time and resources (Davenport, 1998; Chung, and Snyder, 1999; Sarkis and Gunasekaran , 2003). Despite this fact, over the past years, thousands of companies have implemented ERP systems, because ERP is a key ingredient for gaining competitive advantage, streamlining operations, and having ''lean'' manufacturing (Trunk, 1999; Zuckerman, 1999). Some have successfully implemented while others have struggled. Many companies have enjoyed the benefits of ERP systems; but many have also had to settle for minimum returns, complete abandonment of the system, or even bankruptcy (Mandal and Gunasekaran, 2003; Umble et al., 2003). After implementing SAP AG's SAP R/3 system, Volkswagen AG experienced trouble delivering spare parts to car dealers (Recktenwald, 2000). Sobeys Inc. and Hershey Food Corp. experienced similar processing problems resulting in stock shortages due to their SAP R/3 implementations (Hoare, 2001). Hershey suffered an earnings decrease of 18.6% after the implementation of its ERP (Osterland, 2000). Further, in a study conducted by the Harvard Business School, '65% of executives believe ERP systems have a least and moderate chance of hurting their business because of potential implementation problems' (Hill, 1999). ERP implementations are said to be 'the single business initiative most likely to go wrong' (Cliffe, 1999). Cases like these have sensitized the industry to the importance of understanding the problems that can arise and knowing how best to overcome them. To mitigate these risks, a knowledge management framework is suggested to be put in place during ERP implementation phases (O'Leary, 2002).

The design, construction, and testing phases of ERP implementation are considered in this study. These phase descriptions are derived from Markus and Tanis (2000) and Bancroft et al., (1998). The design phase includes activities such as defining targeted business processes, developing the reengineered design for business processes, gaining user acceptance, and understand the implications of change; the construction and testing phase includes developing and testing the business applications, developing a comprehensive configuration, building and testing interface programs, and testing the systems (Ko et al. 2005).

In the ERP implementation processes, people from different and often competing units work together to capture and share both the explicit and tacit knowledge about organizational processes (Baskerville et al., 2000). Knowledge sharing is found to be critical in ERP implementation success in any firm (Klaus and Gable, 2000; Kawalek and Wood-Harper, 2002) and successful ERP implementation requires organizational groups to get rid of the barriers of knowledge transfer (Jones et al., 2006). Knowledge sharing during ERP implementation becomes necessary since ERP redefines people's jobs, business processes and traditional intra-organizational boundaries (Lee and Lee, 2000). Compare to traditional information systems the ERP implementation phases require more knowledge (Jones and Price, 2004), which entails a wider variety of experiences, world views, perspectives and abilities (Robey, Ross and Boudreau, 2002). Organizational members must understand where and how their function fits in the entire ERP system (Welti, 1999). In other words, the members must understand how their tasks fit into the overall process and how their process fits with other organizational business processes (Lee and Lee, 2000).

Since much knowledge is embedded into organizational processes, knowledge sharing is challenging (Davenport, 1998). As ERP implementation is a project, and as a project is an organization of people dedicated to a definite goal, individual needs competence to perform a task (Koskinen et al., 2003). For instance, ERP implementation tasks include such as designing, constructing, and testing of ERP modules which are accomplished by sharing explicit and implicit knowledge of the people. The ERP implementation team often relies upon knowledge and advice in order to understand the business rules, frameworks and processes embedded in the ERP software (Lee and Lee, 2000).

Normally it is difficult to articulate tacit knowledge through a formal use of language. However the tacit knowledge could be represented in the form of metaphors, drawings, non-verbal communications and it is equivalent to practical expertise. If the tacit knowledge is lost during the changeover to ERP, the organization may have trouble getting back valuable sets of skills (Baskerville et al., 2000). As a result, tacit knowledge sharing becomes an important ingredient for ERP implementation.

This research is an attempt to understand how Canadian organizations are sharing tacit knowledge in geographically distributed ERP implementation environment. The design, construction, and testing phases of ERP implementation are considered for this study. To achieve this objective, an explorative study was conducted using qualitative case research. Three Canadian organizations participated in this study. These case studies threw light on a number of issues that need careful consideration for tacit knowledge sharing in geographically distributed ERP implementation environment. This paper is organized as follows: section two gives a review of relevant literature; section three deals

with the research methodology; section four presents the findings from the case studies; section five deals with discussion followed by the implications for theory and practice; and finally, the conclusions are given.

2. LITERATURE REVIEW

2.1 Problems in Geographically Distributed Environment (GDE)

Traditional coordination and control mechanisms tend to be less effective in geographically distributed environment because of the constraints such as distance, time zone, and cultural difference (Herbsleb and Mockus, 2003). Distance reduces the power of communications, especially when people experience problems with the communication media that cannot replace face-to-face communication (Smith and Blanck, 2002). Time zone differences limit the opportunities for real time collaboration and increases the response time considerably, when working hours at different geographical locations are different (Sarker and Sahay, 2004). Therefore, receiving a reply for a simple question may be longer and end up with unproductive waits. Cultural differences are embedded in the collective knowledge of the groups in different geographical locations, expressed in different languages, values, working and communication habits, and assumptions made about the topic of communication (Baumard, 1999). The other related problems are: loss of communication richness (van Fenema 2002), lack of understanding/ misunderstanding of counterpart's context (Orlikowski, 2002), and asymmetry in distribution of information among sites (Carmel, 1999). When the different geographical locations have incompatible tools, technologies, and infrastructure, the problems are multiplied (Sarker and Sahay, 2004).

2.2 Ways of Managing the Problems in Geographically Distributed Environment (GDE)

Based on a review of literature Kotlarsky (2005) suggest three strategies to manage the problems with the geographically distributed projects: (i) divide the work, which aim to make the coordination easier for integrating the project implemented in remote locations (ii) follow context-specific coordination methods for geographically distributed environment and (iii) establish efficient communication patterns across the remote locations. Divide the work practices the distribution of work among the locations. The division could be based on sequential structure or product structure (Grinter et al., 1999). In sequential division, the work is handed over to a remotely located site after completing certain steps (Carmel, 1999). In product structure, each product module is developed at a single site.

The literature suggests a number of coordinating methods. Mockus and Herbsleb (2002) suggest for standardizing the implementation methodology, storing it in a shared repository, giving access in order to distribute across the site locations, and educate the team members of all sites on the stored methodology; van Fenema (2002) encourages the team members to visit remote sites for face-to-face interactions; Battin et al. (2001) suggest establishing liaison between locations; and Espinosa et al. (2003) emphasizes for providing web-based access to the remotely located team members to get an update on the progress made in the implementation.

The literature recommends the various communication patterns across the geographically distributed locations. Some of them are: scheduling systematic phone/ video meetings between the team members (Herbsleb and Mockus, 2003); establishing protocols/ rules/ common expectations concerning communication (Sarker and Sahay, 2004); and Paasivaara (2003) emphasize on the clarity in communications.

2.3 Tools and Technologies to support GDE

Kotlarsky (2005) summarized the following categories of tools to overcome the problems in GDE: (i) a powerful ICT infrastructure for high speed data transfer (ii) collaborative technologies to connect and communicate with remote colleagues and (iii) software engineering tools to support the implementation activities conducted in parallel at remote locations. A reliable, secured, and high bandwidth ICT infrastructure is required to connect and communicate with remote sites (van Fenema, 2002). The various collaborating technologies are email (Sarker and Sahay, 2004), chat/ instant messaging (Smith and Blanck, 2002), phone/ audio conference (van Fenema, 2002), video conference (Carmel and Agarwal, 2002), internet/ intranet (Mockus and Herbsleb, 2002), group calendar, discussion list, and electronic meeting system (Carmel, 1999). The software engineering tools for collaborative implementation are: configuration and version management tools (Cheng et al., 2004), source management system (Smith and Blanck, 2002), document management system (Mockus and Herbsleb, 2002), replicated databases/ repositories (Handel and Herbsleb, 2002), and CASE tools (Herbsleb et al., 2000).

2.4 Social aspects of GDE

In the social aspect of the geographically distributed environment, an effective team depends on the trust among the members (Smith and Blanck, 2002). Trust is the foundation for open and effective communication among team members. Trust is the belief that in a group environment the other's action will be beneficial rather than detrimental (Child, 2001). Besides creating rapport between the members of the dispersed teams is a challenge (Kotlarsky and Oshri, 2005) and rapport is the 'quality of the relation or connection between interactions, marked by harmony, conformity, accord, and affinity (Bernieri et al., 1994).

2.5 Knowledge

Knowledge can be defined as a justified true belief, creating meaning (Krogh et al. 2000), and as a capacity-to-act (Wittgenstein 1995; Svielby 1997). Two types are: tacit knowledge and explicit knowledge (Nonaka, 1991; Nonaka & Takeuchi, 1995). Explicit knowledge is formal and systematic. Tacit knowledge is highly personal, context-specific, subjective, and difficult to verbalize or communicate (Krogh et al., 2000; Nonaka and Takeuchi, 1995); it is the inductive knowledge that involves insights, intuition, hunches from individual's experiences (Polanyi, 1966). Tacit knowledge is gained through experience and interactions between individuals and processes (Nidumolu, 2001) and it is expressed in the form of human actions such as evaluations, attitudes, points of view, commitments, motivation, etc (Koskinen et al., 2003). Tacit knowledge is rooted in the actions, experience, and involvement of individuals in a specific context, and includes both cognitive and technical knowledge dimensions (Nonaka, 1994). Cognitive tacit knowledge is a set of mental models influencing an individual's actions/decisions and technical tacit knowledge is the technical know-how that is applicable to a specific situation. Normally it is difficult to articulate tacit knowledge through a formal use of language. However the tacit knowledge could be represented in the form of metaphors, drawings, non-verbal communications and it is equivalent to practical expertise.

2.6 Knowledge Transfer/ Sharing

Knowledge transfer also known as knowledge sharing (Huber, 1991) follows a "source and recipient" generic model. Knowledge transfer is often interpreted as the transfer of knowledge from a source to a recipient (Gupta and Govindarajan, 2000). It is a process by which individuals collectively and iteratively refine a thought based on their experiences (Chua, 2003) and the original idea may be modified or rejected (West and Meyer, 1997). There are several views about knowledge transfer. It prevents reinventing the wheel (Bender and Fish, 2000), creates shared understanding (Nickerson and Zenger 2004), reduces uncertainty or turns individual learning into organizational learning (Nonaka, 1994). Szulanski (1996) defines knowledge transfer as "dyadic exchanges of organizational knowledge between a source and a recipient unit in which the identity of the recipient matters." Knowledge transfer refers to the process of how previous knowledge acquired could be applied to a different situation (Karlsen and Gottschalk, 2004). Knowledge transfer could be seen as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote and Ingram, 2000). In this process, the source (or a contributor) shares knowledge that is used by an adopter (recipient). Knowledge transfer takes place when the recipient understands the ins and outs of the knowledge and its implications so that the transferred knowledge could be applied (Argote, 1999). Knowledge transfer occurs at various levels: knowledge transfer between individuals, from individuals to groups, from individuals to explicit sources, between group, across groups, and from the group to the organization (Alavi and Leidner, 2001).

There are four ways of transferring knowledge: informal, formal, impersonal, and personal (Holtham and Courtney, 1998). Informal settings include unscheduled meetings and conversations which are good at promoting socialization. However this makes it hard to disseminate the knowledge to the whole organization (Alavi and Leidner, 2001). Through-out the use of cubical style office layouts conversations could be initiated or joined by others of the group that might not have happened in a more structured environment (Jones et al., 2006). This helps foster the socialization process and allows for further dissemination of knowledge that might have been possible. Formal transfer of knowledge such as meetings, training sessions, or seminars promotes greater distribution of knowledge but hinder creativity, which is needed in successful knowledge application. Personal channels are good for distributing context specific knowledge and impersonal transfer of knowledge uses knowledge repositories for readily generalized knowledge (Alavi and Leidner, 2001; Karlsen and Gottschalk, 2004).

2.7 Knowledge Sharing in Geographically Distributed Environment (GDE)

Sharing knowledge is important to building trust and improving the effectiveness of team work (Storck, 2000). When the knowledge is not effectively shared, project might suffer from coordination problems leading to failed collaborations (Herbsleb and Moitra, 2001). The challenges for effective knowledge sharing process are cultural, geographical, and time zone differences (Herbsleb and Mockus, 2003). Despite the sharing of specialized knowledge, individuals should focus on knowing who knows what, knowing where the expertise is located (Faraj and Sproull, 2000). This approach is called as creating transactive memory (Kotlarsky and Oshri, 2005), which is defined as the knowledge set possessed by team members coupled with an awareness of who knows what (Wagner, 1987). In GDE, another connectivity mechanism between individuals and teams is collective knowledge, which comprised of elements of knowledge that are common to all the team members (Grant, 1996).

2.8 Tacit Knowledge Sharing in ERP implementation

During ERP implementation, organizational members share their knowledge about their ways of performing routine activities as well as their underlying opinions, assumptions, and interpretations of the environment (Pan, Newell, Huang and Cheung, 2001). Organizational members begin to value the ERP systems, when their tacit knowledge has been integrated into ERP implementation processes (Lee and Lee, 2000). Integrating tacit knowledge is one of the difficult tasks during ERP implementation (Jones, 2005), because the knowledge embedded in routine organizational processes makes it difficult for members to articulate or unable to express what they know (Pan et al., 2001).

Tacit knowledge sharing is facilitated when individuals concerned are encouraged to express their ideas freely (Nonaka, 1991; Hinds and Aaronson, 2002). Some of the techniques that could be used to transfer the tacit knowledge are brainstorming, story telling, and giving freedom to express less than fully formed ideas (Brown and Duguid, 2000; Wenger and Snyder, 2000). Organizations that failed to share the member's tacit knowledge during ERP implementation may not be able to identify and include the core knowledge of the organization into their ERP systems (Baskerville et al., 2000). In general, organizations that lose tacit knowledge may also face strategic crisis (Spender, 1996), especially during ERP implementation because ERP forces the organization to redefine its culture, structure, and strategies (Baskerville et al., 2000).

Explicit knowledge sharing during ERP implementation is affected by rank, seniority, and titles of team members, physical workspace, and team members' relationships with the various organizational units (Jones and Price, 2004; Volkoff, Strong and Elmes, 2002). However, not much research has been done on these factors in the context of tacit knowledge sharing (Jones, 2005).

Since ERP implementation team includes members from various functional areas, more opportunities are created to share the tacit knowledge of the team members (Baskerville et al., 2000). The team requires more diverse knowledge than the knowledge required for individual jobs and each team member must understand what the others do by sharing their tacit knowledge in order to effectively map the various business processes for ERP implementation (Jones, 2005). Subsequently, the team must also interact with organizational members for notifying the expected changes during and after the ERP implementation (Robey et al., 2002). In this knowledge exchange process between the implementation team and the organizational members (Volkoff et al., 2002), inadequate sharing of knowledge between these two groups can result into unsuccessful implementation (Pan et al., 2001).

To configure the ERP software, the team must also gain knowledge about the business rules and processes. Most firms hire external consultants to facilitate this knowledge sharing process (Lee and Lee, 2000; Soh et al., 2000). This involves tacit knowledge sharing between the consultants and team members by transferring know-how and skills possessed by the consultants (Al-Mashari and Zairi, 2000). On the other hand, some of these know-how and skills about the ERP software might be difficult to document (Osterloh and Frey, 2000) and failure to share the consultants' tacit knowledge may lead to failure of ERP implementation (Welti, 1999).

3. RESEARCH METHODOLOGY

The research study presents the experiences of three firms that implemented ERP systems. These firms were selected from telecommunication, government, and retail sectors. The CIOs or top IS executives were contacted to know whether they had implemented or were implementing ERP systems. If so they had been contacted for participation in the study. The data was collected from three organizations, choosing one from each sector. The key members of the

ERP implementation project including project managers, team leads, business process integration managers, team members, functional users, and change management managers were contacted for data collection. A series of semi-structured phone-interviews was conducted with four to six representatives from each firm. In addition to phone interviews, the respondents were contacted through email for background information, and clarification. All the interviews were taped and were transcribed by a professional typist, and respondents were contacted for missing information.

3.1 Profile of Companies

For confidentiality, the name of the company is disguised as A-telecom Company. A-telecom is a consolidation of four companies: A-Communications, A-telecom.net, A-telecom knowledge services, and A-telecom business-solutions. A-Communications, wholly owned subsidiary of A-telecom, is one of the region's leading retailers of communication solutions with 51 retail locations in four eastern-provinces of Canada. A-Communications offers a wide variety of communications solutions including cellular phones and service, Internet services, two-way radios, pagers, satellite communications, home networking products, corded and cordless phones, and related accessories and servicing. A-telecom.net continues to add value to the online experience of its customers by providing access to exclusive content and account management tools through a portal website. Besides providing detailed information about A-telecom's latest products and services, A-telecom.net is also host to daily information such as weather, local news, movie show times, horoscopes and much more.

A-telecom knowledge services delivered through its wholly owned subsidiary unit provides the telecommunications industry with made-in- Canada eLearning, technical documentation, TeleWeb sales channel, and pre-and post-sales technical support for customer product inquiry, maintenance and training needs. A-telecom business-solutions, is a full-service business-solutions provider that serves clients through three service lines: systems integration and software engineering, infrastructure services and product fulfillment. These areas offer clients a broad delivery capability to plan, design, build and operate IT solutions that span both corporate and operational systems, and to provide their infrastructure needs. A-telecom business-solutions has more than US 280 million in revenues and employs 1,900 people with offices throughout Canada.

For confidentiality the government's name has been disguised as *A-Government*, which is a combination of public sector entities that all interact with each other to provide services to its residents and citizens. The mission of the *A-*Government is to provide a fully integrated Corporate Financial Management Systems, for enhanced decision making, and improved cost control. The *A-Government* is exploring innovative ways of delivering government services to its residents and citizens. The strategic use of IT is playing a key role in implementing the ways of delivering its services.

For confidentiality the retailer's name has been disguised as A-Retailer. A-Retailer distributes food products through corporate and franchised retail stores and distribution networks to independent accounts in Canada. A-Retailer is a leading national grocery retailer and food distributor; owns or franchises more than 1,300 stores throughout Canada under various retail banners. A-Retailer franchisees employ more than 75,000 people and collectively generate over 12 billion in retail sales. In addition to supplying product to the stores, A-Retailer provides value-added services including advertising, pricing, training, store supervision and store development.

4. TACIT KNOWLEDGE SHARING IN GEOGRAPHICALLY DISTRIBUTED ERP IMPLEMENTATION

4.1 Tacit Knowledge Sharing in designing ERP Systems

Knowledge transfer between individuals:

At the beginning of ERP design project, A-Telecom has chosen a specific group of individuals from functional areas. A specific responsibility has been allocated for each individual based on his or her expertise/ background. For example, person with technical background was held responsible for technical issues of ERP systems; individual with business process design background has been assigned for functional design of ERP systems. The individuals periodically had online meetings with consultants and functional executives of the company to design the ERP system. These meetings facilitated the individuals for transfer of knowledge based on the specific expertise/ background of each individual in the group to another member of the organization, leading to enhancement of the

quality of knowledge transferred. In case of A-Government, the scenario was different. The ERP design team made a request of information from various individuals. Subsequently, based on the request more interactions were held between individuals through online meetings, documentation, consultant interaction and others. These requests for information facilitated one on one interaction, whereby the individuals were deeply involved in scoping and designing the ERP systems. In case of A-Retailer, business analysts usually met with particular subject area experts to walk through their part of the systems. The walk-through meetings made use of video technology, documentation, large repository of information that contained diagrams, graphs and other types of media for transferring the tacit knowledge between the individuals. Moreover, the consultants joined the ERP design team at the very early stage so as to smoothen the one on one knowledge transfer. The consultants offered training programs to internal personnel on the software functionality of the modules to transfer the tacit knowledge.

Knowledge transfer from individuals to explicit sources

The ERP design team members at A-Telecom are always required to document their expertise/ procedures and processes during the projects. These documents were later used by the different departments of the company. A-Government used what is called SAP methodology to transfer knowledge from individuals to explicit sources. In case of A-Retailer the interaction with explicit sources was minimal, since there was a lot of documentation containing requirements/ future functionalities (for example type of data that is stored, how it is transmitted and received from other sources). However, the knowledge-documents that were created from various meetings between business analysts and clients had been transferred to explicit sources through the company's repositories. The consultants went through the mapping processes, generic training during the scoping phase and then disseminated that information to explicit sources. This information was later on used by designers as a guide to the project. But in cases of controversies, designers met with clients too. In general, A-Retailer had a lot of interactions with their users during the analysis and design phase of ERP.

Knowledge transfer from individuals to a particular group

The transfer of knowledge in this category is almost the same as the previous category. The only difference is no documentation is necessary when the knowledge is transferred from individuals to a particular group. Based on this fact, specific experts from the project team of A-Telecom were sent to different units of the company to solve specific problem (based on their expertise and other criteria). The ERP project team was usually integrated with classroom training sessions concerning business processes, functions, configurations and technical work at the A-Government. Remotely located members of the business community who were affected by the designing of ERPs were given the most attention to attend these programs. A lot of knowledge was transferred during the classroom sessions. Based on these sessions, documentation preparations and sketching of the system design were done. In case of A-Retailer, the Design team members received training from the consultants regarding the scoping phase of the project and returned to their individual departments/ locations. The members from the respective functional areas implemented a department wise transfer of knowledge about the design and mapping processes.

Knowledge transfer between groups

At A-Telecom, it was found to be an extensive interaction between the groups of consultants and project team members during the design of ERP systems. A-Government formulated different groups and the ERP design took advantage of the interactions of the following groups: project functional groups with the business group, project technical group with the business, communication group with the business, business management group with the business, IS maturity group with the business, and change management group with the business. These groups interacted with the project team, or with each other or with the business and the various stakeholders of ERP design. In case of A-Retailer generally main interaction between groups was through web-based systems, whereby documents and other information were retrieved. A web-based repository containing documentations of various remotely located functional areas was created and internal application software for tracking and automating repository systems was also developed. When the mapping of business processes was done using the transfer of knowledge from the repository, a walk through phase was followed to eliminate any confusion that might occur among the departments. All departments usually attended the meetings and each department was responsible to explain its business processes to the others. This process was always done through video/ audio conferencing. The people presenting in these meetings were internal core team managers. This was done in order to reduce reliance on consultants.

Knowledge transfer from a specific group to the organization as a whole

At A-Telecom, online-newsletters were used as the major method of reaching the whole organization. Apart from newsletters, the company frequently pulled together at least three people from different geographical locations that really need face to face interaction. The three people meetings enabled the whole organization to get feedbacks on various aspects of the project. In case of A-Government, the knowledge transfer was mainly done through constant documentation preparation, and meetings between the project team members and different levels of the organization. Weekly meetings, email, internal systems that tracks and sends automatic notifications that updates employees about current events/circumstances were extensively used. In case of A-Retailer, through the systems built by the company, the employees were able to bring up lists that could automatically be updated with any particular cues and other information available in the system. The ERP design team acquired knowledge about the systems and disseminated the acquired knowledge back to the specific units of the organization. This was helpful for the company's employees who had never been exposed to ERP software.

Tacit knowledge sharing between ERP design team with the organization

A-Telecom conducted an extensive training (online as well as offline) program to achieve a successful transfer of knowledge from the team members to the rest of the organization. In case of A-Government, there was a multitude of documentation. When team members moved back to their specific units, their knowledge was always left in various data repositories of the company. Also, there was a just in time training for the business community and the users groups. In other words, when the project team members went back to their distantly located units, they also took their knowledge, leading to dissemination of that knowledge within those individual business units. A-Retailer extensively used its documentation repositories to achieve knowledge transfer for this category. It provided end users' training, whereby all business processes and testing scenarios that had been written were disseminated to the whole organization. The training was usually designed by the core project team members. Personnel involved in training end users were sometimes from a contracted company or the core team members themselves.

Selection of target business processes in the design phase

A-Telecom selected the business processes based on the effort required to do each specific business process manually, in other words, the business processes that involved a lot human errors and tedious tasks were given the first priority (selected first). Another criterion is in terms of how much a change was required to automate a specific process. This enables the evaluation of feasibility in costs, time and quality of automating that specific process. A-Government selected target business processes through examination of business cases that identifies benefits, costs, and return on investments, focusing on what people wanted to be implemented. A-Retailer introduced the term "tribal knowledge" which widely used by the company's experts. Tribal knowledge involves the use of the past projects, business case scenarios that justifies expenses showing feasibility in costs, revenues and other related factors. On the other hand, business processes were selected according to the match between the requirements of the particular business processes with the system's functionalities. The company sent in its functional analysts and project managers to perform a scope analysis into the distantly located departments. For example a company's business analyst would meet with the warehouse personnel and request for information on their current business processes. This enabled that particular analyst to learn the business. Hence, determine issues such as if a specific department needs to go live on ERP module, or if that department is going to use only a specific portion of the module, or if a department should use a specific type business that does not require certain modules.

4.2 Tacit Knowledge Sharing in constructing ERP Systems

At A-Government, the project team interacted with the business executives during the ERP system configuration. The project team ensured that the system is configured to meet the various business requirements. In spite of that, expression of ideas in the configuration phase was minimal, based on the fact IT employees were not concerned much with how the procedures worked (in the perspectives of functional side, not technical), since there was another department (consists of some members from the IT department) known as "competence centre" responsible for taking over the work from the consultants in the previous phases. In some cases, one person was in charge of making final decisions of how the project should go; hence the company experienced minimal issues in expressing issues to the people responsible (example project manager). The project team applied SAP methodology to achieve a successful transfer of knowledge to learn from the organizational users who were distantly located. In general, the A-Government made use of written documentations that involves configuration, system process, design documents, work procedures, classrooms and emails to achieve a successful transfer of knowledge.

In case of A-Telecom, consultants were extensively relied for system configuration based on the fact they had more

expertise with the systems and the business. A-Retailer used a standard structure for configuration that was already in place. Employees responsible usually confirmed to that existing architectural structural or create from scratch. This method guaranteed the company to have a right architecture right from the beginning. Consultants along with IT project team were involved for system configuration.

Dialogues concerning what people think about the system and how it should be were held during the configuration at A-Telecom. Consultants were also held responsible as well to come up with solutions to the problems in the configuration exercises. Individuals apart from project team members had a high involvement in expressing ideas to solve the configuration problems. Though most of the configuration tasks were done through trial and error, the consultants (PeopleSoft) aided in understanding how things worked, and finally through extensive software training. Distantly located employees went through training but in a different level. Also, the company usually allocated certain periods of support, like 30 to 40 days during the configuration of the project, where people would go to particular offices for questions and answers about the system configuration. Moreover, the core team implementing ERP consisted of members from different departments (especially IT personnel). From this perspective, there was always knowledge transfer to each individual that in turn went back to the whole organization. For example, an IT person in the core team, attended various meetings of the team, listened to all presentations including the ones of different expertise (unrelated to his/hers).

A-Retailer used prototyping methodology for sharing tacit knowledge in ERP system configuration. The reason is in the prototyping methodology, the project team usually presents the prototype to the users/employees, a process that in turn allows distantly located employees to express their views about the prototype presented. This approach ensures that the project do not go out of scope, since there will be more interaction with the users as it happened with A-Retailer. On the other hand, if the project is more of traditional methodology (the project goes through a number of phases, whereby at the end of each phase, the client/ user signs off), there will be minimum input from users. In general, A-Retailer used historical data, documentation based on past projects. Comparisons were made to the on going projects such as ERP configuration and factors that facilitated success or failure were applied. The learning for the project team started from the design of ERP system and continued in other phases including system testing. The learning outcomes were extensively documented by people in charge of design and disseminated to the individual departments of the company.

4.3 TACIT KNOWLEDGE SHARING IN TESTING ERP SYSTEMS

A-Telecom implemented various test plans, whereby the project team figured out what aspects of the system needs to be tested. Initially the company had modules that needed to be integrated; individual test plans and integrated test plans were then used to push data to one another. Three types of testing were used. First, system testing that involved the developer who actually coded the particular component of the project that was tested. Second, destructive testing, which makes use of a different developer testing the system by trying to crash or break, in general using it incorrectly. Finally there was a user acceptance testing that was designed by the users, to make sure that it meets their satisfaction. To devise the various test plans, the employees apart from the project team, were allowed to express the ideas, however there was usually testing strategy defined for each component of the project. The test plans were devised in a more collaborative manner. The method allowed individuals to work together, share their ideas and differences. Especially, during destructive testing there were a lot of expressions of ideas from various individuals within the company and outside. There was a lot of documentation on the system tests and user acceptance final tests (destructive testing was documented too but not extensively since they relied more on experience of the individual tester). Therefore, in case an employee has an application of 250 tests to produce, he/she could actually refer to the documents and provide feedbacks on what tests were involved (the tests within the documents were all numbered). On the other hand, communication was more verbal in terms of sharing knowledge from destructive tests that have done. The reason was destructive testing usually involves a team of people.

At the A-Government, the testing responsibility was given to a specific testing team that comprised of members of the project and business accepting it. The example of testing criteria used by the team was “pass or fail” that was later on reported to the executive hearing committee for final decisions. The ERP team has to signoff on the output of the testing; thereby team members shared their tacit knowledge. If the business (client) was not happy about the system created, then the team had to do more learning on the recommendations. Thereby learning occurred throughout the testing process. The project team suggested the various areas that have to be tested and incorporated real world situations as a simulation approach. Example of real world situation would be making real business transactions with the new system. Also, A-Government provided user acceptance testing phase. The phase enabled business users to

be engaged, but this was only when the system was working perfectly.

In case of A-Retailer, sharing of ideas was present in all the testing of project modules. Employees, the project team and others affected by the system always shared their knowledge in devising test plans. The company has highly skilled employees with deep expertise in their respective areas. As a result, the company was able to devise test plans, since they know how the new systems should look and work. Learning was mainly through empirical information that came from the systems' testing (also used in later projects). The team members based on their expertise and skills identified the areas to check for and tested the specifics of technology by identifying the common problems. The test results were shared with the distantly located project manager and the whole ERP team (usually through written documentations and online meeting/ presentations). This was because the various modules of the project were affected with the testing results. From this perspective, after every member of the project team has learned, then knowledge was disseminated back to the individual business units where each project team member worked/came from. The company provided test plans to employees as a guide to complete the whole testing process. The test plans were basically templates that outline step by step instructions on using different modules of the system. For example, if a person is in the accounting module, then he/she will need to choose the chart of account in order to go to lower level accounts. Therefore, if an individual encounters a problem with the system (even though he or she followed the guide), then the issue was brought up to the technicians and was reviewed.

5. DISCUSSION

Table 1 shows the summary of the three case studies. As seen in all three cases an ERP implementation involves various different methodologies which in most cases is context specific. The reasons for ERP adoption are all generally the same, they were looking for a system that would be used to replace their legacy systems and achieve system wide integration throughout the organization. As well a driving factor for all three was the impending year 2000 issue. The other generalizations that can be made from the case studies is that they all support an as-is and to-be analysis so that the ERP system could effectively replace their financial legacy systems. All other areas differed from implementation to implementation which shows that no two implementations were the same. A-telecom could have identified the area that needs to be replaced and then a fit gap would have been done after the team had been formed. Since phased implementation was followed, some interfaces could have been built from capital system into PeopleSoft or a structured manual process could have been added to create a journal in GL. High price project managers and consultants prepared a detailed plan for implementation. The implementation had been followed along the plan. After the system had been tested, several times the plans were backed out and modified.

5.1 Tacit Knowledge Sharing in designing ERP Systems

Since ERP implementation team members were from diversified backgrounds, the members were able to share the tacit knowledge in a spectrum of functional areas. The degree of involvement of people in sharing the tacit knowledge varied with business case objectives and the levels of employees. Functional users and user relationship with the ERP design team were the major factors facilitating the transfer of knowledge. During the changes in the business processes, it has been found more interaction of functional design team members with the users. The involvement of other employees (apart from the project team) was high through tribal knowledge as it has been found with A-Retailer. During the design phase, tribal knowledge simplified the process of identifying key processes resulting in large savings and efficiency. There is a lot of sharing of ideas during the mapping phase whereby various personnel would be involved. The teams usually sat together in a room/ virtual-room mapping the warehouse processes, figuring out how the business will work with the systems and vice versa. It has been found that the supporting team is very critical about any new system design. The reason is to make sure that the system design is feasible and will do what it is supposed to do. There were always a number of things came across that couldn't be expressed easily. For example sometimes project members were given within their premises and they have to work using their own instincts.

In sharing the tacit knowledge, it has been found that there were unresolved solutions to design problems arose (agreements and disagreements). For example, in case of A-Telecom, assets module enabled the company to keep a huge load of specific location data concerning where the assets live. This module was one aspect of old company's system design. The issue was raised by PeopleSoft (the vendor of the ERP software used by A-Telecom) who didn't have such functionality. On the other hand, the accounting department of A-Telecom didn't need such functionality. Therefore, unresolved solutions arose (agreements and disagreements) between the company's accounting department and the engineers of the old system. Engineers had to find some other place that the functionality of locating assets

will fit. The meeting between the two parts was not an easy process to go through.

In case of A-Retailer, a guarantee of efficiency of the new system was hard to prove to users. Proving efficiency of the system was like the process of advertising a new product. There was no guarantee that ERP system design (as new product) will be accepted by the users. There were always changes in how things are done year to year. Hence, the company often found a need to make reengineering recommendations to most of its users in order to adopt the better ways of doing things.

The employees went through the learning about the implications of the ERP changes (new system) from the rest of the organization. In all the three cases, ERP project team was comprised of business representatives, and the knowledge acquired from the new system was always disseminated back to the remotely located business areas. The project team learned the implications of the ERP changes while doing the project itself through ways such as solving problems, being part of the project, and working through the issues, and bringing forward solutions to the business. A-Retailer used two major methods for learning the implications of the ERP changes. First is comparing the outcome of the project with what the team expected using its own tracking systems. Second, it used a simple debriefing at the end of each project that determined failure and success.

A-Government followed a three phase process for learning the implications of the ERP changes. Firstly, the conference room pilot phase, whereby test data, actual screens and business scenarios were presented to the different teams representing organizational members. The online presentations were focused on the frequently done transactions. Secondly, departmental pilot phase that involved taking of all the testing into a departmental mode in parallel with all the other departments. This procedure prioritized transactions that were not done often mostly. Departmental pilot phase was very long, whereby A-Government tested out its departmental business procedures. In this phase, personnel at the departmental level were brought in for training, and hence enabled dissemination of knowledge back to the whole organization. Finally, the integrating pilot phase that everybody in the organization attended a meeting and the project team took transactions from the current system, ran them through the new system from department to department, all the way. This ensured the transactions could flow through all the departments. The meetings in all the three faces enabled a smooth transfer of knowledge to the whole organization.

5.2 Tacit Knowledge Sharing in configuring ERP Systems

In configuring ERP systems in all three cases, user acceptance from business areas was the main issue. There was a huge uncertainty on if the users were happy with the product or not. Another issue was the commonality of the gap of specification. Sometimes it happened that ERP project went out of scope, mostly because in between the phases different parts involved in the project bring new ideas. At A-Telecom, experts involved in the projects tried to be “vanilla” (term implying perfectionism and being over the top) leading to wrong decision making and caused a lot of business processes were created as a result. It has been found that the amount of configuration requirements was based on the type of software that was implemented (Example Oracle, PeopleSoft and others). Some times the configuration was done correctly, however it led to incorrect setting up of how a specific department handled the transactions. In general it has been found that there was no clear cut knowledge transfer between the IT people and the departments during configuration, there were always signals for disasters waiting to happen.

5.3 Tacit Knowledge Sharing in testing ERP Systems

During testing, data conversion from the legacy systems seems to the ERP system was found to be a problem with the A-Government. The reason was the complexity of validating 100 percent of the data, acceptance of data, and establishing path and criteria for the data. Data migration techniques, testing validation, task failed and task hasn’t failed criteria were intensively used during the testing. System failures (didn’t work as expected) happened because people/employees never understood some things earlier in the design phase, lead to difficultness of transferring knowledge with high quality.

Table 1 – Case Study Comparisons

	A-telecom	*Government*	A-Retailer
Background Information	Telecommunications Regions leading retailer of communication solutions 51 retail locations	Government Sector Combination of public sector entities that all interact to provide provincial wide services Largest Public sector implementation at it's time	Retail food distribution Franchised retail stores and distribution networks Provides services such as advertising, pricing, training, and store development.
ERP Adoption Reasons	Main frame based legacy systems Y2K largest driver Distributed information	Replacement of ineffective, costly legacy systems Impending Y2K issue Achieve system wide integration	Impending Y2K issue System Wide integration Replace Legacy Systems
ERP Modules to replace legacy systems	General Ledger, Accounts Payable, Purchasing. Project & Assets management Inventory Control	Finance/Controlling, Materials Management	Finance, Materials Management, Sales and distribution, controlling, profit center accounting, asset accounting
ERP Implementation Strategy	Phased Implementation	Big bang approach	Big bang approach
Software used	PeopleSoft	SAP	SAP

Analysis of the cases revealed the following activities for tacit knowledge sharing in geographically distributed ERP implementation environment:

- Divide the implementation work across geographically distributed units
- Develop coordination methods
- Establish communication patterns
- Create trust and rapport among the implementation team members
- Use ICT tools to connect, communicate, and collaborate
- Document the expertise/ tacit knowledge for future use
- Establish repositories for storing and retrieving the tacit knowledge
- Send people to geographically distributed units
- Organize training sessions for the implementation teams
- Encourage interactions among the individuals and the groups
- Disseminate the evolved tacit knowledge to all remote locations
- Develop and disseminate tribal knowledge
- Encourage questions-answers/ dialogue/ feedback sessions
- Encourage expression of ideas
- Develop a methodology for transferring the tacit knowledge
- Encourage the team members to listen to the presentations
- Use the prototyping methodology in implementing ERP systems

- Devise the implementation plans in a more collaborative manner
- Authorize sign-off responsibility with team representatives
- Create transactive memory and collective knowledge
- Nurture the information sharing attitude
- Bring up the issues/ problems
- Increase the aptitude for learning

5.4 Implications

The three dimensions of this study are: (i) geographically distributed work (ii) ERP implementation phases and (iii) tacit knowledge sharing. The three cases presented demonstrated the possible ways of sharing tacit knowledge in a geographically distributed ERP implementation environment. The activities for tacit knowledge sharing are evolved as a result of the analysis of the cases. The human aspects of this study involve the ERP implementation team members, and other stakeholders such as top management. Using the ICT tools by these people for effectively sharing the tacit knowledge in ERP implementation phases is another highlight of the study. The implications for human, ERP systems, and tacit-knowledge sharing aspects are both theoretical and practical.

THEORETICAL IMPLICATIONS

From the theoretical perspective, this study suggests that more attention is needed to understand the relationship among the geographically distributed work, ERP implementation phases and tacit knowledge sharing. The IS literature gives technical solutions and collaborative tools to the knowledge sharing (Battin et al., 2001). However, effective ways of using the ICT tools to leverage the tacit knowledge in geographically distributed ERP implementation environment is lacking. The effective ways of using the ICT tools for successful knowledge sharing are worthwhile to explore by future research. For example, how the ICT tools could be used for creating trust and rapport among the team members who are remotely located. Another finding out of the case analysis is to evolve a methodology for transferring the tacit knowledge in a geographically distributed environment. People need to have continuous participation and collaboration in the process of tacit knowledge sharing. Another implication is exploring the knowledge transfer practices in a mobile situation. That is when people are changing their locations, how does the knowledge transfer process work? Besides, the roles and responsibilities of the facilitator/ facilitating mechanisms who/which facilitates the knowledge transfer process should be also explored by the future research.

PRACTICAL IMPLICATIONS

For a practical viewpoint, in order to achieve success knowledge transfer in a geographically distributed ERP implementation environment, the activities evolved out of the case analysis would be useful. The organizations need to introduce these activities that facilitate a knowledge sharing environment in ERP implementation. Especially the use of ICT tools to simulate the face-to-face interacting situations is recommended. Some of these activities could be also divided as it has been accomplished by the 24-hour knowledge factory model (Gupta and Seshasai, 2004), which advocates continuous work on the knowledge-sharing tasks by team members located in time zones that allow for 24-hour knowledge sharing. In this, the team members who are remotely located work on the knowledge sharing around the clock. Planning the knowledge sharing activities in the ERP implementation phases is a predecessor for successful knowledge transfer process. The team members should be having opportunities for social interactions prior to their involvement in the knowledge sharing process. The management should show commitment by dedicating resources to address people related issues in facilitating tacit knowledge sharing in geographically distributed ERP implementation.

6. CONCLUDING REMARKS

The three case studies given in the paper explained the practices and processes of sharing tacit knowledge during ERP design, construction, and implementation. In all the three cases, ERP implementation process was mainly relied on implementation team member's knowledge with inputs from the organizational members. Some of the obstacles in sharing the tacit knowledge were highlighted. In general, during the ERP implementation organizational members

especially the stakeholders of the ERP systems are to be involved in the process of sharing tacit knowledge. This would help the organization to achieve the ERP implementation success.

Innovative approaches are to be developed to involve the various stakeholders for tacit-knowledge sharing processes. For instance, A-Telecom organized virtual teams in conducting brainstorming sessions called Excite. Besides, selecting group business leads from different functional areas for JAD sessions during ERP implementation also recognize the importance of involving people. Overall, representation from business community including at the remote locations for sharing the tacit knowledge during the implementation is required. The representation could be done in the forms of advising the implementation team, taking responsibility for knowledge sharing, documenting the tacit knowledge by self creation, and others.

The list of ERP modules to be implemented and type of ERP software would determine the type of tacit knowledge to be shared. Representatives from the proposed modules could participate in the tacit knowledge sharing process. For this purpose, constructing stakeholders – modules matrix would be helpful to identify the people to be involved in the tacit knowledge sharing process.

Another important finding in all the three cases was the absence of a formal knowledge management system (KMS) to facilitate the process of implementing ERP. A-Retailer was using an in-house decision support system instead of a formal KMS, which is a system that needs to be developed for ERP implementation. As knowledge sharing is a critical component of ERP implementation success, the tacit knowledge requirements could be predetermined. Foreseeing the knowledge requirements beforehand would create a crystal clear intent for the implementation team. In this context, the stakeholders of ERP systems need to be motivated by providing incentives for their participation in tacit knowledge sharing activity.

Another challenge for sharing tacit knowledge would be to properly document the knowledge for later retrieval, share, and use. Further research is required to develop innovative techniques for documenting the tacit knowledge. The techniques could include training (as it was done in the case of the A-Government) as critical component in tacit knowledge documentation. For knowledge sharing, organizations could use the intranet to disseminate the knowledge required for ERP implementation. In some cases interim modifications were done and the need for sharing tacit knowledge for modifying the business processes to fit the system was recognized.

Though the people's capabilities are not to be overestimated, the implementation team needs to understand the limitations. Developing innovative tools for sharing tacit knowledge would facilitate the people to speak out their ideas, whether they are fully formed or not. Networking the various stakeholders for a free exchange of ideas would smoothen the process of maintaining the group dynamics within and between the different implementation teams. Besides, the usage of IT tools such as decision support systems, as did by A-retailer, could be used to build relationships among the groups for creating conducive atmosphere for knowledge sharing. In other words, team building exercises are to be carried out before involving the people for tacit knowledge sharing.

The type of ERP implementation strategy (Phased or Big bang approach) plays a major role in tacit knowledge sharing. When the implementation is done in the phased manner, people's tacit knowledge also could be shared in a phased manner. On the contrary, for big-bang approach, the tacit knowledge requirements need to be well-planned beforehand. Moreover, the ERP software doesn't seem to restrict the practice of sharing tacit knowledge. Tacit knowledge sharing is an ongoing activity which has to be done in a continuous manner to facilitate the various phases including design, configuration, and implementation. The limitation of this study is the number of respondents interviewed. The future research could focus on a large sample from various industrial sectors including different types of ERP software. Also, the future research could focus on developing innovative tools to assess the tacit knowledge requirements and to share the tacit knowledge.

REFERENCES

Alavi, M., and D.E. Leidner. "Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues," *MISQ Review, 25(1), 2001, pp.*107-136.

Al-Mashari, M., A. Al-Mudimigh and M. Zairi. "Enterprise Resource Planning: A Taxonomy Of Critical Factors," *European Journal of Operational Research,* 146(2), 2003, pp. *352*-364.

Argote, L. Organizational learning: Creating, retaining and transferring knowledge**.** Boston: Kluwer Academic, 1999.

Argote, L., and Ingram, P. "Knowledge transfer: A basis for competitive advantage in firms," *Organizational Behavior and Human Decision Processes,* 82(1), 2000, pp.150-169.

Bancroft, N., Seip, H., and Sprengel, A. (1998) Implementing SAP R/3, Manning Publications Co., Greenwich, CT.

Baskerville, R., Pawlowski, S., & McLean, E. (2000). Enterprise resource planning and organizational knowledge: Patterns of convergence and divergence. Proceedings of the 21st ICIS Conference (pp. 396-406), Brisbane, Australia.

Battin, R.D., R. Crocker and J. Kreidler (2001). ' Leveraging Resources in Global Software Development'. *IEEE Software* 9March/ April):pp. 70-77.

Battin, R.D., R.Crocker and J. Kreidler (2001). 'Leveraging Resources in Global Software Development'. *IEEE Software* (March/ April): pp. 70-77.

Baumard P (1999) *Tacit Knowledge in Organizations* . Sage, London.

Bender, S. and A. Fish. "The Transfer Of Knowledge And The Retention of Expertise," *Journal of Knowledge Management*, 4:2, 2000, pp. 125-137.

Bernieri, F. J.J., J.M. davis, R. Rosenthal and K.C.R. (1994). 'Interactional Synchrony and rapport: Measuring Synchrony in Displays Devoid of Sound and Facial Affect.' *Personality and Social Psychology Bulletin* 20: pp.303-311.

Brown, J.S. and Duguid, P. (2000). Balancing Act: How to capture knowledge without killing it. *Harvard Business Review*, May-June, 73-80.

Carmel, E. (1999). Global Software Teams: Collaborating Across Borders and Time Zones. Upper Saddle River, NJ, Prentice Hall P T R.

Carmel, E. and R. Agarwal (2001). "Tactical Approaches for Alleviating Distance in Global Software Development'. *IEEE Software* (March – April): pp:22-29.

Cheng, L., C.R.B. De Souza, S. Hupfer, J. Patterson and S. Ross (2004). ' Building Collaboration into *IDEs'. Queue* 1(9):pp. 40-50.

Child, J. (2001). 'Trust – The fundamental Bond in Global collaboration'. *Organizational Dynamics*, 29(4):pp.274-288.

Chua, A.(2003). Knowledge Sharing: A game people play. *Aslib Proceedings*; 2003. 55(3), pp. 117-129.

Chung, S. and Snyder, C. (1999). ERP initiation: A historical perspective, In: *Proceedings of America Conference on Information Systems'99 (AMCIS)*, 213-215 (1999).

Cliffe, S. (1999). ERP Implementation, *Harvard Business Review*, January/February, 16-17 (1999).

Davenport, T. Putting the enterprise into the enterprise system, *Harvard Business Review*, 16(4), 121-131 (1998).

Espinosa, A., J.N. Cummings, J.M. Wilson and B.M. Pearce (2003). 'Team Boundary Issues Across Mutliple Global Firms'. *Journal of Management Information Systems* 19(4): pp: 157-190.

Fui-Hoon Nah, F., Lee-Shang Lau , J., Kuang , J. (2001). Critical factors for successful implementation of enterprise systems, *Business Process Management Journal***,** Vol. 7, No. 3, pp. 285-297.

Grant, R.M. (1996). Toward a knowledge-based theory of the firm' *Strategic Management Journal* 17(Winter):pp.109-122.

Grinter, R.E., J.D. Herbsleb and D.E. Perry (1999). 'The Geography of Coordination: Dealing with Distance in R & D work'. International ACM SIGGROUP Conference on Supporting Group Work 9Group 99), Phoenix, Arizona, USA, ACM Press.

Gupta, A.K. and V. Govindarajan. " Knowledge Flows within Multinational Corporations," *Strategic Management Journal*, 21:2, 2000, , pp.473-496.

Gupta, Amar and Seshasai, Satwik, "Toward the 24-Hour Knowledge Factory" (January 2004). MIT Sloan Working Paper No. 4455-04 Available at SSRN: http://ssrn.com/abstract=486127 .

Handel, M. and J.D. Herbsleb (2002). 'What is Chat doing in the workplace? *Conference on Computer Supported Cooperative work*, New Orleans, LA, USA.

Herbsleb JD and Mockus A (2003) An empirical study of speed and communication in globally-distributed software development. *IEEE Transactions on Software Engineering* **29** (6), 1-14.

Herbsleb JD and Moitra D (2001) Global software development. *IEEE Software* (March-April) , 16-20.

Herbsleb, J.D., A. Mockus, T.A. Finholt and R.E. Grinter (2000). ' Distance, Dependencies, and Delay in Global Collaboration'. *Conference on Computer Supported Cooperative Work*, Philadelphia, Pennsylvania, USA.

Hill, S. Jr., (1999). It Just Takes Work, *Manufacturing Systems, Selecting and Implementing Enterprise Solutions Supplement*, A2-A10 (1999).

Hinds, R.S. and Aaronson, J.E. (2002). Developing the requisite organization attitudinal and behavioral conditions for effective knowledge management. *Proceedings of the 8th Annual Americas Conference on Information Systems*, pp. 2059-2065.

Hoare, E.S. (2001). SAP software saga talk dries up; Grocer agrees to curb comments. *The Chronicle-Herald*. January 27, C6 (2001).

Holtham, C. and N. Courtney . "The executive learning ladder: a knowledge creation process grounded in the strategic information systems domain", *Proceedings of the 4th Americas Conference on Information Systems***,** Association for Information Systems, Baltimore, MD, pp. 594-7, 1998.

Huber, O.P. "Organizational learning: The contributing processes and the literatures," *Organization Sciences*, 2(1), 1991, pp. 88-115.

Jones, K. "Knowledge Management As A Foundation For Decision Support Systems" *The Journal of Computer Information*

Systems. Stillwater, 46:4, Summer 2006, pg. 116 -125.

Jones, M. C. and R.L. Price, 2004, "Organizational knowledge sharing in ERP implementation: Lessons for industry." *Journal of End User Computing*, 16:1, 2004, pp. 21-40.

Jones, M.C. (2005). Tacit Knowledge Sharing during ERP implementation: A Multi-site Case Study. *Information Resources Management Journal*, Apr-Jun, 18(2), pp. 1-23.

Jones, M.C., Cline, M, and Ryan, S. "Exploring knowledge sharing in ERP implementation: an organizational culture framework," *Decision Support Systems*, 41:2, 2006, pp. 411-434.

Karlsen, J. T. and P. Gottschalk, P. "Factors affecting knowledge transfer in IT projects," *Engineering Management Journal*. 16:1, 2004, pp. 3-11.

Kawalek, P. and Wood-Harper, T. (2002). The findings of thorns: User participation in enterprise systems implementation. *The DATA BASE for Advances in Information Systems*, 33(1), 13-22.

Klaus, H. and Gable,G. (2000). Senior manager's understandings of knowledge management in the context of enterprise systems. *Proceedings of the 6th Annual Conference on Information Systems*, pp. 981-987.

Ko D-I, Kirsch LJ and King WR (2005) Antecedents of knowledge transfer from consultants to clients in enterprise system implementations. *MIS Quarterly* **29** (1), 59-85.

Koskinen, K.U., Pihlanto,P., and Vanharanta, H. (2003). Tacit knowledge acquisition and sharing in a project work context, International Journal of Project Management, Kidlington, Vol. 21, No.4, pp.281-290.

Lee, Z. & Lee, J. (2000). An ERP implementation case study from a knowledge transfer perspective. *Journal of Information Technology*, 15, 281-288.

Kotlarsky, J. (2005). Management of Globally Distributed Component-based Software Development Projects, (Doctoral Thesis), ERIM Ph.D. Series Research in Management, Erasmus University, Rotterdam School of Management: 59, ISBN- 90-5892-088-7.

Kotlarsky, J. and Oshri, I. (2005). Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. *European Journal of Information systems*, 14, 37-48.

Krogh, G.V., Ichijo, K. and Nonaka, I. (2000), Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation, Oxford University Press, Oxford

Mabert, V.A., Soni, A., and Venkataramanan (2003). Enterprise resource planning: managing the implementation process, *European Journal of Operations Research*, Vol. 146, No. 2, pp. 302-314.

Mandal, P. and Gunasekaran, A. (2003). Issues in implementing ERP: A case study, *European Journal of Operational Research*, Vol. 146, No. 2, pp. 274-283.

Markus, M. L. and Tanis, C. (2000). The enterprise systems experience- From adoption to success. In Zmud, R. W. (ed.), Framing the Domains of IT Management: Project the Future... Through the past, Pinnaflex Educational Resources, Cincinnati, OH, 173-207.

Mockus, A. and J.D. Herbsleb (2002). ' Expertise Browser: A Quantitative Approach to Identifying Expertise'. *International Conference on Software Engineering*, Orlando, FL, USA.

Nickerson, J. A., T. R. Zenger. "A Knowledge-Based Theory Of The Firm: The Problem-Solving

Perspective," *Organizational Science*, 15:6, 2004, pp. 617-632.

Nidumolu, S.R. (2001). Situated learning and the situated knowledge Web: Exploring the ground beneath *knowledge management. Journal* of MIS, 18(1), 115-150.

Nonaka, I. (1991). The knowledge creating company. *Harvard Business Review*, Nov.-Dec, pp. 96-104.

Nonaka, I. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science*, 5:1, 1994, pp. 14-37.

Nonaka, I. The knowledge creating company. *Harvard Business Review*, Nov.-Dec, 1991, pp. 96-104.

Nonaka, I., and Takeuchi, H. 1995. *The knowledge creating company*. New York: Oxford University Press.

O'Leary, D. (2002). Knowledge management across enterprise resource planning systems life cycle, *International Journal of Accounting Information Systems*, Vol. 3, pp. 99-110.

Orlikowski WJ (2002) Knowing in practice: enacting a collective capability in distributed organizing. *Organization Science* 13 (3), 249-273.

Osterland, A. (2000) Blaming ERP, *CFO Magazine*, Jan. 01 (2000) (http://www.cfo.com/Article?article=1684).

Osterloh, M. and Frey, B.S. (2000). Motivation, knowledge transfer, and organizational forms. *Organization Science*, 11(5), 538-550.

Paasivaara, M. (2003). ' Communication Needs, Practices, and Supporting Structures in Global Inter-organizational Software Development Projects'. Workshop on Global Software Development, part of the International Conference on Software Engineering (ICSE), Portland, Oregon, USA.

Pan, S.L., Newell, S., Huang, J.C. and Cheung, A.W.K. (2001). Knowledge integration as a key problem in an ERP implementation. *Proceedings of the 22nd ICIS Conference*, pp. 321-328, New Orleans, LA.

Polanyi, M. (1966). *The tacit dimension*. London : Routledge & Keganpaul.

PricewaterhouseCoopers (1998). *Technology Forecast: 1999*. 10th Anniversary Edition,

PricewaterhouseCoopers Technology Centre, Menlo Park, California, (1998).

Recktenwald, J.Experts offer advice on successful ERP implementation. *CNET Networks*. [Online] (2000) (http://techrepublic.com.com/510202201028835.html).

Robey, D., Ross, J.W., & Boudreau, M-C. (2002).Learning to implement enterprises systems: An exploratory study of the dialectics of change. *Journal of Management Information Systems*, 19(1), 17-46.

Sarker S and Sahay S (2004) Implications of space and time for distributed work: an interpretive study of US-Norwegian system development teams. *European Journal of Information Systems* 13 (1), 3-20.

Sarkis, J. and Gunasekaran, A. (2003) Enterprise resource planning- modeling and analysis. *European Journal of Operational Research*. 146(2), 229 -232 (2003).

Smith PG and Blanck EL (2002) From experience: leading dispersed teams. *The Journal of Product Innovation Management* 19 (4), 294-304.

Soh, C., Kien, S.S., & Tay-Yap, J. (2000). Cultural fits and misfits: Is ERP a universal solution? *Communications of the ACM*, 43(4), 47-51.

Spender, J.C. (1996). Organizational knowledge learning and memory: Three concepts in search of a theory. Journal of Organizational Change, 9(1), 63-78.

Storck, J. (2000). ' Knowlledge diffusion through 'Strategic communities "*Sloan Management Review* 41(2);pp.63-74.

Svielby, K.E. (1997). *The new organizational wealth-managing and measuring knowledge based assets*, 1st edition, Berret-Koehler Publishers, San Francisco, CA.

Szulanski, G. "Exploring internal stickiness: Impediments to the transfer of best practice within the firm**,"** *Strategic Management Journal*, 17:1, 1996, pp.27-44.

Trunk, C. (1999) Building bridges between WMS & ERP, *Journal of Transportation and Distribution*, 40(2), 6-8 (1999);

Umble, E.J., Haft, R.R. and Umble, M.M. (2003). Enterprise resource planning: Implementation procedures and critical success factors, *European Journal of Operational Research*, 146(2), 241-257 (2003).

Van Fenema, P.C. (2002). 'Coordination and Control of Globally Distributed Software projects' (Doctoral Thesis). Department of Decision and Information Sciences. Erasmus University, Rotterdam School of Management: 572.

Verville, J. C. and A. Halingten, *Acquiring Enterprise Software: Beating the Vendors at Their Own Game*, Prentice-Hall (PTR), NJ, (2001).

Volkoff, O., Strong, D.M., and Elmes, M.B. (2002). Between a rock and a hard place: Boundary spanners in an ERP implementation. Proceedings of the 8th annual Americas Conference on Information Systems, pp. 958-962.

Wagner, D.M. (1987). "Transactive Memory: A Contemproray Analysis of the Group Mind'. Theories of Group Behavior. G. Mullen and G. Goethals. New York, Springer Verlag.

Welti, N. (1999). Successful SAP R/3 implementation: Practical management of ERP projects. Reading, MA: Addison-Wesley.

Wenger, E.C. and Snyder, W.M. (2000). Communities of practice: The organizational Frontier. *Harvard Business Review*, January- February, pp. 139-145.

West, P. and Meyer, G.D. (1997). Communicated knowledge as a learning foundation. *International Journal of Organizational Analysis*. 5(1), pp. 25-58.

Wittgenstein, L. 1995. *Philosophical investigations* (Original, 1953), Blackwell, Oxford.

Zuckerman, A. (1999). ERP: Pathway to the future or yesterday's buzz? *Journal of Transportation and Distribution*, 40(8), 37-43 (1999).