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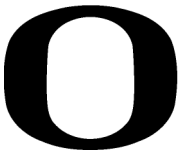

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Techniques and Technologies to Support the Transfer of Tacit Knowledge among Co-Located Teams

CAPSTONE 1 Bibliography

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Table of Contents

List of Tables and Figures

Introduction to the Annotated Bibliography

Problem

Tacit knowledge is a concept first introduced by Michael Polanyi in 1958 and examined further in 1966 in his book *The Tacit Dimension*. He states that "there are things we know but cannot tell", and provides two examples of skills which one may learn and internalize to the extent of being unaware of the particulars involved with the act: (a) riding a bicycle and (b) swimming (Polanyi, 1962, p. 601).

Spender (2003) extends this early description of tacit knowledge to the contemporary organization, and defines it as "intangible, implicit, and profoundly attached to people" (as cited in Dinur, 2011, p. 1). Stenmark (2000) notes that experienced workers are similarly unaware of what they know or how to share it. According to Stenmark (2000), tacit knowledge is challenging to share for "three reasons: (a) we are not necessarily aware of our tacit knowledge, (b) on a personal level, we do not need to make it explicit in order to use it, and (c) we may not want to give up a valuable competitive advantage" (p. 9).

While *explicit knowledge* can be codified, documented and easily shared, *tacit knowledge*, according to Spender (2003), is far more difficult to manifest. Nonetheless, Droege and Hoobler (2003) make the case that tacit knowledge is more valuable to a firm than explicit knowledge because "it is difficult to imitate, it is rare, and it possesses value if firms can leverage it to improve competencies, capabilities, processes and products" (p. 53). Nissen (2005) also believes that while tacit knowledge could have the most potential to add value to the organization, it presents the greatest difficulty with transference. Nonaka (2007) argues that for highly successful Japanese corporations, "making personal knowledge available to others is the central activity of the knowledge-creating company" (p.165).

Knowledge sharing and knowledge transfer. The terms *knowledge sharing* and *knowledge transfer* are often used interchangeably in the literature to refer to aspects of a larger tacit knowledge conversion process. Paulin and Suneson (2012) find that "knowledge sharing is found more frequently by authors focusing on the individual level, while knowledge transfer is used more frequently when groups, departments, organizations, or even businesses are in focus" (p. 87). According to *The Encyclopedia of Knowledge Management*, *knowledge sharing* is defined as "The exchange of knowledge between and among individuals, and within and among teams, organizational units, and organizations" (Schwartz, 2006, p. 493). *Knowledge transfer* is defined as "the focused, unidirectional communication of knowledge between individuals, groups, or organizations…" (Schwartz, 2006, p. 493).

The view that *knowledge sharing* is more closely related to Polanyi and Nonaka's theory that knowledge is highly personal and difficult to separate from its context is more closely aligned with this researcher's interest in *tacit knowledge sharing*, and thus preference is given to use of that term. However both phrases are used in this study, depending on the context presented within specific references.

Purpose

Nonaka and von Krogh (2009) make the case that tacit knowledge is a valuable asset to any organization, and the "competitive advantage of firms rests on the processes of coordinating and combining [knowledge] assets" (p. 636). However, the depth and expertise inherent in tacit knowledge make it difficult to share (Gubbins et al., 2012; Mládková, 2012; Swap, Leonard, Shields, & Abrams, 2001).

The purpose of this annotated bibliography is to identify literature that describes techniques and technologies that promote tacit knowledge sharing among workers within co-

located teams in multinational corporations. In this case, the concept of a co-located team is defined as "the positioning of departments and offices of…personnel in close proximity to each other" (Song, Berends, van der Bij, & Weggeman, 2007, p.55).

Techniques to support tacit knowledge sharing are generally described as processes, behaviors, programs, or organizational cultures that provide an atmosphere that is conducive to knowledge sharing (Borges, 2013). Techniques may be formal or informal programs or processes, such as job rotations (Arya & Mittendorf, 2004; Nonaka, 2007), brown-bag lunches, mentoring or coaching (Mládková, 2012; Swap, et al., 2001), or storytelling (Whyte & Ralake, 2013). Nonaka (2007) argues that redundancy creates a "common cognitive ground" that facilitates the transfer of tacit knowledge (p.168). Other authors address related techniques for tacit knowledge transfer of job engagement and intrinsic motivation (Leppala, 2012; Osterloh & Frey, 2000), and knowledge sourcing (Gray & Meister, 2004).

Technologies to support tacit knowledge transfer are generally described as electronic tools that facilitate knowledge sharing (Teo, Nishant, Goh, & Agarwal, 2011). Stenmark (2000) questions whether tacit knowledge must be made explicit before it can be transferred and offers Intranet documents as one potential technology. Technologies such as social media and Web 2.0 may offer other potential solutions (Panahi, Watson, & Partridge, 2012).

Research question

What technologies and techniques can managers and team members employ to promote the transfer and sharing of valuable *tacit knowledge* (Nonaka, 2007) within a co–located team in a multinational corporation?

Audience

This annotated bibliography is specifically addressed toward MNC managers and their co-located team members who work with complex information and who seek to promote the transfer and sharing of tacit knowledge within their teams (Flanagan, Eckert, & Clarkson, 2007). For the purposes of this study, complex information is defined as information that is integrated from multiple sources, and involves multiple business units (Flanagan et al., 2007).

Juceviciene and Mozuriuniene (2011) posit that while sharing tacit knowledge is challenging for many organizations, it is even more so within large, multinational corporations (MNCs) where the sheer number of employees makes it all the more difficult to figure out where and how to locate the tacit knowledge resources. Stenmark (2000) acknowledges that "the problem of who knows what grows with the size of the organization" (p. 11). A multinational corporation is defined in this study as "a corporation that is registered in more than one country or that has operations in more than one country. It is a large corporation that both produces and sells goods or services in various countries" (Multinational corporation, n.d.). MNC's often have a complex landscape that employees must learn to navigate in order to maximize their productivity and contribution (Flanagan et al., 2007). Knowledge workers who deal with complex information in industries such as information technology, aerospace, manufacturing, or engineering (Garcia-Perez & Ayres, 2009) may find this report useful.

Search Report

Data collection. Data in the form of published articles is collected using the University of Oregon library online databases. References meeting the following criteria are given priority:

- Published in an academic, peer-reviewed journal;
- Published between 2000-2013;

- Available online first, with consideration for particularly relevant sources that may require hard copy;

Reference evaluation criteria. References are evaluated using a set of criteria provided in an article titled *Critical Evaluation of Information Sources*, located on the University of Oregon Libraries website (Bell & Frantz, 2013). The following key criteria are reviewed and analyzed for each article included in the annotated bibliography:

- "the **Authority** of the author and the background of the publisher; in this study, focus is on peer-reviewed journals and professional credentials;
- the **Objectivity** of the author; works are reviewed for bias, arguments supported by evidence, and opposing points of view;
- the **Quality** of the work; works are reviewed for obvious spelling or grammatical errors, logical structure, and clarity;
- the **Currency** of the work". In this study literature is collected if published between 2000 and 2013, in order to capture articles that reflect the recent increase in use of social media and other new technologies.

References meeting the evaluation criteria are further evaluated for content relevancy, using the following parameters:

- Addresses the primary issue of tacit knowledge sharing within a corporation, and identifies co-located teams working with complex information.
- Identifies organizational approaches to tacit knowledge sharing.
- Identifies techniques or technologies that promote tacit knowledge sharing.

Search strategy. Initial searches are conducted using the keywords: *tacit knowledge sharing, tacit knowledge conversion,* and *tacit knowledge transfer*, and limited to the Business

subject category within the Articles & Databases search tool. Databases searched include (by default): Academic Search Premier, Business Source Complete, EconLit, Factiva, JSTOR, New Palgrave Dictionary of Economics Online, Newspaper Source, Regional Business News, and UO Local Catalog.

The initial keywords are selected based on this researcher's observation that experienced team members, while valued for their knowledge and experience, seem to find difficulty completing their own work due to barrages of questions and requests for their knowledge. The knowledge held by these team members is extremely difficult to codify and closely tied to their individual experiences, making it tacit in nature. Thus the question arose, *is there a better way for team members to share their tacit knowledge within the team?*

As shown in Table 1, search on the terms *tacit knowledge transfer* or *tacit knowledge sharing* results in 86 initial hits. These are filtered to those published no earlier than 2000 to capture articles that reflect the recent increase in use of social media and other new technologies, peer reviewed articles, and articles broadly related to tacit knowledge sharing within co-located teams in MNCs. This filtering results in 13 potential references.

Table 1

Keywords, databases and search results

Keywords	**Results**	**Database**
Tacit knowledge sharing, tacit knowledge transfer	86 hits (filtered to 13)	UO Business
Tacit knowledge, knowledge workers	86 hits (filtered to 14)	UO Business
Job rotation, knowledge sharing	40 hits, no relevant articles	UO Business
Time management, knowledge source	146 hits, many duplicate	UO Business
Subject matter expert	139 hits, no relevant articles	UO Business
Knowledge diffusion, externalization	131 hits (filtered to 3)	UO Business
Tacit knowledge	120 hits, no new articles	UO Business

knowledge silo	92 hits, filtered to 2	UO Business
co-located, knowledge	100 hits (filtered to 1)	UO Business
knowledge management, tacit	88 hits, no new articles	UO Business
tacit knowledge, technology	1263 hits (4 relevant so far)	JSTOR

Additional references are located by perusing bibliographies of relevant articles (this is especially true for the underlying theories of tacit knowledge sharing). A review of the table of contents of specific journals such as the *Electronic Journal of Knowledge Management* and *Journal of Knowledge Management* is also conducted, resulting in additional potential references.

Documentation approach. Collected references are documented and organized using the Zotero software tool, which manages the pdf copy, full bibliography, abstract, and the research notes. The tool allows for a system of "tagging", which indexes keyword tags from embedded metadata and also accepts user-provided tags. Tags are generated to categorize references into those that provide general information about knowledge management and tacit knowledge (BASE), those that suggest techniques for knowledge sharing (TECHNIQUES) and those that suggest technologies for knowledge sharing (TECHNOLOGIES).

References are scanned electronically and pertinent information is highlighted or noted within the pdf document using the PDF X-change viewer tool. Additionally, an Excel spreadsheet is kept to track each source and the keywords and search process used to locate it.

Annotated Bibliography

The 15 references selected for presentation in this scholarly annotated bibliography are organized into two categories as a way to address the research question posed in this study: What technologies and techniques can managers and team members employ to promote the transfer and sharing of valuable *tacit knowledge* (Nonaka, 2007) within a co-located team in a multinational corporation? The first category examines references that provide *techniques with potential to increase tacit knowledge sharing within co-located teams*. A *technique* is defined by BusinessDictionary.com as "a systematic procedure, formula or routine…" (Technique, n.d.). The second category examines references that provide *technologies with potential to increase tacit knowledge transfer within co-located teams.* A *technology* is defined by Chien-Hsing Wu et al. (2010) as a tool "that contains knowledge objects and [a] virtual sharing platform", such as software, database or the Internet (p. 513).

Each annotation consists of three elements including: (a) the full bibliographic citation, (b) an abstract, and (c) a summary. The abstracts are condensed versions of the published abstracts, and the summaries draw upon the content within each article that addresses the research question.

Techniques with Potential to Increase Tacit Knowledge Sharing within Co-Located Teams

Borges, R. (2013). Tacit knowledge sharing between IT workers: The role of organizational culture, personality, and social environment. *Management Research Review*, *36*(1), 89-108.

Abstract. This study examines how organizational, individual, and environmental factors influence tacit knowledge sharing among IT professionals using a survey method and standard questionnaire. The results of 143 respondents indicate that hardworking,

responsible, and introverted employees tend to share their tacit knowledge when they feel they are in a supportive and team-oriented environment, are not overly threatened by competitiveness, and experience good social interactions in the workplace. The research provides some support for the assumption that IT professionals should be managed under particular organizational rules by proposing that IT workers have a strategic role regarding the transmission of tacit knowledge.

Summary. This study "focuses on the transmission of tacit knowledge from one individual to another through social interaction [rather than] the codification of tacit knowledge in the effort to turn it into explicit knowledge" (Borges, 2013, p. 102). The study provides supporting evidence to previous findings that conscientiousness is the most influential personality trait affecting an individuals' decision to share knowledge. The study also supports previous literature findings that organizational culture plays a significant role in knowledge sharing behavior, and that "team-oriented, supportive cultures…ease the transmission of knowledge" (Borges, 2013, p. 103). The article supports the research question of techniques to use to support tacit knowledge transfer within co-located teams through the suggestion to *create a social culture* in which (a) employees feel supported, (b) that de-emphasizes competitiveness, and (c) that emphasizes team sharing.

Dinur, A. (2011). Tacit knowledge taxonomy and transfer: Case-based research. *Journal of Behavioral & Applied Management*, *12*(3), 246–281.

Abstract. This research is built upon empirical evidence from six knowledge transfer case studies [of multinational companies] so as to examine tacit knowledge and provide

insight into what makes it tacit. Nine distinct, however not mutually exclusive types of tacit knowledge were identified through this research: Skill, Cause-effect, Cognitive, Composite, Cultural, Unlearning, Taboo, Human, and Emotional. Each type can be discerned with its unique set of elements that is essentially responsible for it being tacit, or subjective. In addition, the relationship between the problematic nature of knowledge and its transferability is explored. Various knowledge transfer channels are examined for their richness. Results indicated that no transfer channel was rich independently of the knowledge it transfers, and that all effective channels involved an active 'pull' of the knowledge by its recipient.

Summary. Six case studies are examined within U.S.-based MNCs in order to gather data regarding "individual unit-to-unit knowledge transfers from US, European, and Asian subsidiaries" (Dinur, 2011, p. 252). Data are categorized into tacit and explicit types of knowledge; the tacit types are sorted further into six additional categories. Using the question *"what makes this practice component tacit, or difficult to transfer?*" (Dinur, 2011, p. 257) the researcher identifies the elements of best practice that are transferred, and the corresponding transfer mechanism. Mechanisms include documentation, immersion/exchange, training/interaction, short-term visit, long-distance/virtual communications, expatriate leadership, and hands-on practice. The article supports the research question through the suggestion of the author that a *rich transfer channel*, which involves the recipient in the transfer, is the most effective tacit knowledge transfer approach. Channels and their corresponding skills are provided in a detailed table on page 262. Some example techniques include: apprenticeship, socialization through long-term exposure, hands-on practice, time and use of information, codification, and dialogue.

Garcia-Perez, A., & Ayres, R. (2009). Collaborative development of knowledge representations - a novel approach to knowledge elicitation and transfer. *Electronic Journal of Knowledge Management*, *7*(1), 55–62.

Abstract. This study pilots a proposed knowledge elicitation method involving a project team made up of one or more knowledge experts, stakeholders who have a vested interested in the knowledge, and a knowledge transfer facilitator. The article outlines an approach where elicitation and transfer, and possibly also knowledge creation are carried out in one process. The team works together to develop a representation of the experts' domain knowledge, altering the traditional role of the knowledge management specialist from elicitation to facilitation.

Summary. This article supports the research question by proposing a technique for knowledge transfer that addresses deficiencies found within commonly accepted knowledge management systems including: lack of motivation, poor communication, and disagreement between experts. The authors suggest that a *representation or model of expert knowledge* facilitates knowledge transfer more effectively than eliciting knowledge, codifying, verifying, and maintaining it through a typical knowledge management system. A concept map, spreadsheet, or complex dependency diagram are examples of representations provided. This aligns with Nonaka's (2007) theory that tacit knowledge sharing can be best accomplished through the use of metaphor and symbolism, and provides potential techniques for sharing tacit knowledge. The authors' suggested process involves a team including the knowledge expert, a facilitator, and 1-3 stakeholders who focus on a specific piece of knowledge (such as a product lifecycle). Techniques include eliciting information through: (a) interviews conducted with the

team, (b) a proposed representation system, (c) collaborative modeling meetings, and (d) the final representative product.

Gubbins, C., Corrigan, S., Garavan, T. N., Connor, C. O., Leahy, D., Long, D., & Murphy, E. (2012). Evaluating a tacit knowledge sharing initiative: a case study. *European Journal of Training & Development, 36*(8), 827–847. doi:10.1108/03090591211263558

Abstract. This paper aims to present a case study illustrating the issues involved in the tacit knowledge conversion process and to determine whether such conversion delivers value to the organization in terms of business value and return on investment (ROI). A single-case multiple baseline participants experimental design, replicated across two participants, was utilized. Aaron's KM V-model of evaluation is utilized to determine the ROI of the initiative. While the evaluation of the tacit knowledge conversion initiative suggests positive value to the business; analysis of the conversion process also reveals a number of individual level factors, which reinforce the challenges associated with efforts to access, capture and share expert tacit knowledge.

Summary. The article presents a case study that reveals the micro-level issues involved in converting tacit expert knowledge. The study is focused on an experienced machine operator with a unique skillset and the process of codifying his knowledge in order to allow new employees to perform the same tasks. The study highlights the challenge knowledge experts have in identifying *what they know* in order to make it explicit, and codifying it in a manner that allows for accurate interpretation. The article supports the research question through the suggestion to employ a technique that utilizes an

experienced interviewer to elicit all of the required information, and that uses metaphors to "fill gaps in our language and transfer meaning" when used in the proper context.

Nonaka, I. (2007). The knowledge-creating company. *Harvard Business Review*, *85*(7/8), 162–171.

Abstract. This 1991 article by Japanese organizational theorist Ikujiro Nonaka shows us another way to think about knowledge and its role in business organizations. He uses vivid examples from highly successful Japanese companies such as Honda, Canon, NEC, and Sharp. Managers at these companies recognize that creating new knowledge depends on tapping the tacit and often highly subjective insights, intuitions, and ideals of employees. The tools for making use of such knowledge are often "soft"--such as slogans, metaphors, and symbols--but they are indispensable for continuous innovation.

Summary. This article provides concrete examples of the four stages of Nonaka and Nishiguchi's (2001) spiraling theory of knowledge creation (socialization, externalization, combination, and internalization). Nonaka posits that successful Japanese companies are able to tap into the tacit insights, intuitions, and hunches of their employees because the organizations maintain a "collective sense of identity and fundamental purpose" (Nonaka, 2007, p. 164), much like a living organism. Nonaka theorizes that organizational culture lies at the heart of effective knowledge sharing. While his theories are based on Japanese companies during the 90's, his ideas are intriguing and form the foundation for many of the studies referenced here. Nonaka's suggested techniques for knowledge sharing include *apprenticeship, observation, imitation,* and *practice,* but he contends that in order for the organization to gain as a whole, the knowledge must be made explicit (and shareable by more than the expert and

the apprentice). Thus, he suggests the use of *metaphors* and *symbolism* to articulate intuitions and insights, making tacit knowledge explicit.

Ryan, S., & O'Connor, R. (2013). Acquiring and sharing tacit knowledge in software development teams: An empirical study. *Information and Software Technology*, *55*(9), 1614–1624.

Abstract. Sharing expert knowledge is a key process in developing software products. Since expert knowledge is mostly tacit, the acquisition and sharing of tacit knowledge along with the development of a transactive memory system (TMS) are significant factors in effective software teams. We seek to enhance our understanding human factors in the software development process and provide support for the agile approach, particularly in its advocacy of social interaction, by answering two questions: How do software development teams acquire and share tacit knowledge? What roles do tacit knowledge and transactive memory play in successful team performance?

Summary. This study presents a theoretical model describing the techniques for acquiring and sharing tacit knowledge supported by development of a transactive memory system (TMS) through social interaction. A second predictive model provides a tool that addresses the research questions posed in this annotated bibliography. The elements of the predictive model and other demographic variables are incorporated into a larger online survey for software development teams, completed by 46 software SMEs, consisting of 181 individual team members. The results show that team tacit knowledge is acquired and shared directly through the techniques of (a) *good quality social interactions* and (b) *the development of a TMS*, with the quality of social interaction playing a greater role than transactive memory. Both TMS and team tacit knowledge

predict effectiveness but not efficiency in software teams. As face-to-face social interaction is key, co-located, functionally rich, domain expert teams are advocated.

Swap, W., Leonard, D., Shields, M., & Abrams, L. (2001). Using mentoring and storytelling to transfer knowledge in the workplace. *Journal of Management Information Systems*, *18*(1), 95–114.

Abstract. Much knowledge, particularly knowledge with rich tacit dimensions, is transferred informally through processes of socialization and internalization. We focus on two transfer mechanisms--mentoring and storytelling--that can leverage the knowledge of an organization, particularly its tacit knowledge, to build core capabilities. We draw on relevant research in learning and cognitive psychology to clarify the conditions under which mentoring and storytelling can be most effective as carriers of knowledge. Finally, we present recommendations for specific managerial practices that follow from our analysis.

Summary. This article utilizes a literature review process to locate and analyze works on mentoring and storytelling. Drawing on Nonaka and Takeuchi's (1995) theory of internalization and socialization, the authors posit that the informal techniques of *mentoring* and *storytelling* facilitate tacit knowledge sharing. They find little evidence to support a direct link between mentoring and organizational performance, but are able to support the "role mentoring plays in the transfer of skills, managerial systems, and values" (Swap et al., 2001, p. 100). The authors find that stories are also powerful methods for promoting connections or evoking visual imagery, and can be valuable for communicating tacit knowledge such as managerial systems, norms, and values.

Whyte, G., & Ralake, M. (2013). An investigation into the effectiveness of storytelling as means of sharing tacit knowledge. *Proceedings of the European Conference on Information Management & Evaluation*, 309–317.

Abstract. The aim of the study is to investigate the effectiveness of storytelling as means of sharing tacit knowledge at Eskom Distribution in the Western Region of South Africa. In total, eight stories were collected from four regional executives (storytellers) and were analyzed using an interpretive approach from six randomly selected knowledge workers (storytakers). The findings of this study clearly demonstrated that valuable tacit knowledge can be captured through storytelling. In addition the results suggest that the storytelling form allows for a rich application of the story beyond the original intent of the storyteller.

Summary. This study uses a case study approach to gather data related to knowledge sharing using storytelling. Research is conducted using interviews to elicit stories from four executives and the resulting interpretations of the *storytakers*. The researchers record the intended learning points of the stories and compare them to the interpretations of the storytakers. While the scope of this study is limited, the findings are intriguing. The researchers find that *storytelling* is a highly effective technique for sharing tacit knowledge, including technical information.

Technologies with Potential to Increase Tacit Knowledge Transfer within Co-Located Teams

Chien-Hsing Wu, Shu-Chen Kao, & Lan-Hsin Shih. (2010). Assessing the suitability of process and information technology in supporting tacit knowledge transfer. *Behaviour & Information Technology*, *29*(5), 513–525. doi:10.1080/01449290903490666

Abstract. The transfer of tacit knowledge, one of the most important issues in the knowledge sharing context, needs a multi-dimensional perception in its process. Information technology's (IT) supporting role has already been addressed in the process of tacit knowledge transfer. However, IT has its own characteristics, and in turn, may have dissimilar support suitability. This study seeks to examine the supporting importance of IT types for the knowledge transfer stages.

Summary. This small-scale study conducts an assessment using the analytic hierarchy process (AHP) to examine the role of IT to support tacit knowledge transfer by looking closely at (a) importance rank of transfer stages for the transfer efficacy and (b) the support suitability of IT types for the transfer stages. The assessment hierarchy has three levels, which are the goal, process and support levels. According to the 21 domain scholars and specialists' assessment analysis, the main results suggest that (a) for goal level, both the knowledge provider's and receiver's cognitive system are of more importance, (b) for process level, *database technologies* and *information system applications* obtain the higher importance in supporting the provider's cognitive system and externalization, and (c) *software tools* and *information system applications* are more likely to support the receiver's cognitive system and interpretation.

Panahi, S., Watson, J., & Partridge, H. (2012). Social media and tacit knowledge sharing: developing a conceptual model. *World Academy of Science, Engineering and Technology*, (64), 1095–1102.

Abstract. This paper is intended to theoretically investigate and map social media concepts and characteristics with tacit knowledge creation and sharing requirements. By conducting a systematic literature review, five major requirements found that need to be

present in an environment that involves tacit knowledge sharing. These requirements have been analyzed against social media concepts and characteristics to see how they map together. The results showed that social media have abilities to comply some of the main requirements of tacit knowledge sharing. The relationships have been illustrated in a conceptual framework, suggesting further empirical studies to acknowledge findings of this study.

Summary. Through an analysis of approximately 70 articles selected from peer-reviewed journals, the authors find that tacit knowledge transfer requires technologies that "support free-form communication and collaboration" (Panahi et al., 2012, p. 1095). Their research finds literature that connects commonalities between social media concepts and tacit knowledge sharing requirements such as social interaction, experience sharing, observation, mutual trust and information relationship/networking. The authors suggest web technologies such as *social networking, online discussion forums, blogs, wikis,* and *social web platforms* as potential technological solutions to support knowledge sharing.

Senapathi, R. (2011). Dissemination and utilisation: Knowledge. *SCMS Journal of Indian Management*, *8*(2), 85–105.

Abstract. This paper explores mechanisms for disseminating knowledge. It does this by first defining what knowledge is, and followed by a discussion on different media through which knowledge may be disseminated. Knowledge transfer has always existed in various forms like on-the- Job peer discussions, formal apprenticeship, corporate libraries, professional training and mentoring programs. With today's widespread use of ICT and Internet, knowledge is not present just in books but is available at the click of a button from any geographical location. With computers becoming more widespread,

specific adaptations of technology such as knowledge bases, expert systems, and knowledge repositories have been introduced to further simplify the process.

Summary. This article serves as a reference for multiple types of knowledge and associated dissemination mechanisms. Through the use of examples collected from organizations in India, the author illustrates technological mechanisms for sharing tacit knowledge, such as *computer or web-based training simulators, e-learning systems, groupware tools,* and expertise finders such as *knowledge portals.*

Singh, A. K., Singh, M. D., & Sharma, B. P. (2013). Modeling of knowledge management technologies: An ISM approach. *IUP Journal of Knowledge Management*, *11*(3), 41–55.

Abstract. Smooth knowledge flow and its sharing is the backbone of knowledge management (KM). Technologies play an important role to enhance effective Knowledge Sharing (KS) within the industry. Therefore, it is important to identify and recognize KMTechnologies (KMTs) in the industries to enhance smooth sharing of tacit as well as explicit knowledge. In this study, 24 KMTs have been identified as basic facilitators of KS and KM. Interpretive Structural Modeling (ISM) has been used to evolve mutual relationships among the KMTs. Identification of KMTs at the root of the hierarchy (called driving KMTs) and those at the top of the hierarchy (called dependent KMTs) is the main aim of this research.

Summary. Through the use of interpretive structural modeling (ISM) the researchers identify 24 knowledge management technologies and analyze them using the MICMAC principle, which is based on multiplication properties of matrices. Technologies are divided into four categories and hierarchies: (a) autonomous, (b) dependent, (c) linkage, and (d) driver. The authors define KMT's at the root of the hierarchy as *drivers* and those

at the top of the hierarchy as *dependent.* The results indicate that *Internet, e-mail, groupware*, and *enterprise portal* are the technologies with maximum effectiveness, and those which should be given priority by managers who seek to implement a knowledge management system.

Song, M., Berends, H., van der Bij, H., & Weggeman, M. (2007). The effect of IT and co-location on knowledge dissemination. *Journal of Product Innovation Management*, *24*(1), 52–68. doi:10.1111/j.1540-5885.2006.00232.x

Abstract. The exchange of knowledge has become not only very important for innovation but also highly complex. To facilitate knowledge exchange, electronically mediated interactions are growing rapidly, replacing traditional face-to-face communications. However, literature provides contradicting results regarding the effectiveness of computer-mediated communication (CMC) versus face-to-face communication. This study attempts to reconcile differences in the literature on the benefits of CMC technologies and co-location. Focusing on knowledge dissemination in technology development processes in high-technology firms, the study investigates the relative impact of CMC technologies and co-location of research and development (R&D) staff, as well as the mutual interaction between them.

Summary. Co-located R&D teams "often communicate with their materials, samples, instruments, prototypes, products, and machines at hand to illustrate or support what they want to convey or to show what they cannot verbalize" (Song et al., 2007, p. 56). This intensive transfer of tacit knowledge is of particular interest to this researcher, as it represents a similar process used within a technology manufacturing environment. This study uses empirical data collected from 277 high-technology firms in the United States.

Results support the main effects of CMC technologies and co-location of R&D staff on knowledge dissemination. The authors conclude that effective knowledge dissemination requires a balanced investment in co-location and information technologies to be able to deal with the heterogeneous but interdependent types of knowledge dissemination. They suggest the use of technologies such as *content management systems, groupware (e.g., collaborative notebooks, electronic whiteboards, and forums), e-mail,* and *web pages*.

Stenmark, D. (2000). Leveraging tacit organizational knowledge. *Journal of Management Information Systems*, *17* (3), 9-24.

Abstract. Tacit knowledge is inherently elusive, and in order to capture, store, and disseminate it, it is argued that it first has to be made explicit. However, such a process is difficult, and often fails due to three reasons: (1) we are not necessarily aware of our tacit knowledge, (2) on a personal level, we do not need to make it explicit in order to use it, and (3) we may not want to give up a valuable competitive advantage. During an empirical study of recommender system usage, it was noticed how such technology could be used to circumvent these problems, and make tacit knowledge, in the form of our professional interests, available to the organization as a whole. Using Polanyi's theories, it will be shown how intranet documents can be used to make tacit knowledge tangible without becoming explicit, suggesting that tacitly expressed entities are not necessarily beyond the reach of information technology.

Summary. Through a case study approach, this study seeks to provide evidence that *recommender systems*, such as those used in intranet documents to create a digital fingerprint of users' interests, have potential to transfer tacit knowledge. By tracking users' searches and interests, the recommender system is able to act as an expert locator

within the organization. The system does not require users to make their knowledge explicit in order to be effective, minimizing the problems that can manifest when attempting to elicit and codify tacit knowledge.

Teo, T. S. H., Nishant, R., Goh, M., & Agarwal, S. (2011). Leveraging collaborative technologies to build a knowledge sharing culture at Hp analytics. *MIS Quarterly Executive*, *10*(1), 1–18.

Abstract. In a progressively knowledge-dependent economy, businesses need to pay greater attention to harnessing the knowledge that resides in their organizations. However, despite increasing investment in knowledge management (KM) tools, organizations often experience frustration in developing a knowledge sharing culture. **Summary.** This article describes how HP's Decision Support and Analytics Services (referred to as HP Analytics) unit in India promotes initiatives aimed at changing the behavior of employees in order to successfully foster a knowledge sharing culture as it implemented a cost-effective KM platform using *web-based collaborative technologies*. Experiences in the use of *blogging over a multi-year period* to support branding the KM program, establishing interest groups, and using opinion leaders as KM ambassadors provide important lessons for CIOs and other organizational leaders who seek to use technology to build a knowledge sharing culture.

Conclusion

There are abundant resources dedicated to the study of knowledge management and knowledge sharing. References selected for presentation in this annotated bibliography describe techniques and technologies that promote tacit knowledge sharing among workers within co-located teams in multinational corporations. In this case, the concept of a co-located team is defined as "the positioning of departments and offices of…personnel in close proximity to each other" (Song, Berends, van der Bij, & Weggeman, 2007, p.55).

Dinur (2011) and Chien-Hsing Wu et al. (2010) attempt to classify tacit knowledge by *type* as well as *level* of tacitness. Dinur's study results in nine types of tacit knowledge, including (a) skill – such as swimming or riding a bike, (b) cause-effect – complex problem solving techniques that draw upon intuition or insight, (c) cognitive – "attitudes, intentions, or thoughts", (d) composite – large, varied array of complex information that requires internalization to comprehend, (e) cultural – deeply embedded cultural concepts, (f) unlearning – the act of learning a new way to do the same thing (requires one to "unlearn" their current method), (g) taboo – "socially loaded knowledge", generally not discussed, (h) human – "when using the knowledge requires human relationship and trust", (i) emotional – knowledge that "taps into an emotional issue" (p. 260-1). Dinur finds that, by categorizing the type of tacit knowledge, a more effective transfer technique can be applied. For example, a skill requires practice to internalize and is best learned through hands on practice, apprenticeship, and long term visits, while composite information can be codified but may require time and exposure to internalize.

Because tacit knowledge is embedded within one's experiences, it presents unique challenges to organizations that seek to tap into it. Analysis of the selected literature provides insight into three emerging themes presented below: (a) defining tacit knowledge sharing and its

relevance in organizations, (b) organizational culture and tacit knowledge sharing techniques, and (c) tacit knowledge sharing tools and technologies.

Tacit Knowledge Sharing within Organizations

Knowledge management (KM) is the overarching "process of capturing, distributing, and effectively using knowledge" (Koenig, 2012). Within the realm of KM, knowledge sharing and knowledge transfer are key concepts (Chien-Hsing Wu, Shu-Chen Kao, & Lan-Hsin Shih, 2010) that have garnered significant attention. Organizations recognize that knowledge is an asset to be used as a competitive advantage (Nonaka et al., 2009). According to Nonaka (2007), "successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products" (p. 162). Gubbins et al. (2012) believes that the inimitable nature of tacit knowledge makes it especially valuable as a source of sustainable competitive advantage.

Knowledge creation is achieved through collaboration and sharing of existing knowledge (Nonaka et al., 2009). According to Stenmark (2000), tacit knowledge is challenging to share for "three reasons: (a) we are not necessarily aware of our tacit knowledge, (b) on a personal level, we do not need to make it explicit in order to use it, and (c) we may not want to give up a valuable competitive advantage" (p. 9). While *explicit knowledge* can be codified, documented and easily shared, *tacit knowledge*, according to Spender (2003), is far more difficult to manifest. Nonetheless, Droege and Hoobler (2003) make the case that tacit knowledge is more valuable to a firm than explicit knowledge because "it is difficult to imitate, it is rare, and it possesses value if firms can leverage it to improve competencies, capabilities, processes and products" (p. 53). Nissen (2005) also believes that while tacit knowledge could have the most potential to add value to the organization, it presents the greatest difficulty with transference.

Barriers to tacit knowledge sharing. While knowledge management initiatives abound, many organizations have been unsuccessful in their attempts to manage the knowledge sharing process. There are many barriers to sharing tacit knowledge. Borges (2013) and Teo et al. (2011) acknowledge that individuals may perceive the externalization process negatively due to the potential risk of losing power and competitive advantage. Garcia-Perez et al. (2009) find that motivation is the most important barrier, followed by communication and disagreement between experts. Nonaka et al. (2009) and Stenmark (2000) point out that in Polyani's view tacit knowledge is inexpressible and cannot be externalized and written down. Others (Dinur, 2011; Nonaka et al., 2009) recognize that knowledge exists on a scale of tacitness, which allows for transfer of certain types of knowledge and not others. Finally, Gubbins et al. (2012) discover through their micro-level study that, even under ideal conditions, effectively codifying complex tacit knowledge poses many challenges, including (a) communication code, (b) conflicting information processing preferences, (c) unaddressed existing knowledge that required *un*-learning, and (d) identifying and articulating subconscious knowledge.

The participatory nature of tacit knowledge sharing. Knowledge sharing involves both the sender and the recipient; the recipient must be able to understand the context enough for the knowledge to be useful, and the sender must tailor the communication to the knowledge type and recipient as much as possible (Dinur, 2011; Gubbins et al., 2012; Nonaka et al., 2009). Chien-Hsing Wu et al. (2010) find that the "knowledge receiver's absorptive capacity is significantly related to the implementation of knowledge transfer" (p. 514), and conclude that for effective knowledge transfer, "the cognitive systems of both knowledge receiver and provider have the highest and second highest importance, respectively" (p. 520).

Techniques and technologies for sharing tacit knowledge generally fall into two categories (a) *pull*, or the initiative of an individual to seek out knowledge, and (b) *push*, or the deliberate dissemination of knowledge to one or more individuals (Dinur, 2011; Stenmark, 2000). While push techniques or technologies allow for a controlled message and reach a wider audience, pull techniques or technologies are often more effective for internalizing tacit knowledge since they actively involve both the sender and the recipient, and the message can be tailored to the receivers' context and learning style.

Techniques to Support the Sharing of Tacit Knowledge

Organizational culture and social interaction. The literature reveals organizational culture and social interaction as consistent themes, suggesting that the foundation of a "supportive, team oriented culture, along with strong social ties" (Borges, 2013, p. 103) is necessary for the transfer of tacit knowledge. Teo, et al. (2011) note that "deliberate and planned initiatives are required to change employees' behavior and promote knowledge sharing" (p. 2), and Borges (2013) finds that successful KM initiatives "create a social environment wherein employees feel comfortable and less threatened by competitiveness" (p. 103). Nonaka (2007) contends that organizational redundancies that "encourage frequent communication and dialogue…help create a common cognitive ground among employees and thus facilitates the transfer of tacit knowledge" (p. 168).

Socialization "centers on the transmission of tacit knowledge between individuals, without the concern of making it explicit" (Borges, 2013, p. 90). Ryan and O'Connor (2013) find that "good quality social interactions" are "the primary means by which tacit knowledge is shared" (pp. 1614-1617). Swap et al. (2001) agree that tacit knowledge is "transferred informally through processes of socialization and internalization" (p. 95). However, Nonaka (2007) notes

that "social interaction is a rather limited form of knowledge creation" (p. 165) because it never becomes explicit, and is not shared with the organization as a whole. HP Analytics recognizes the value of sharing information throughout the organization through the use of technological tools, while placing the focus of their KM initiative on creating a knowledge sharing culture (Teo et al., 2011).

Eliciting tacit knowledge. Garcia-Perez et al. (2009) and Gubbins et al. (2012) find that eliciting tacit knowledge from experts can be an effective means for externalization and transfer. Both studies recommend the use of an experienced interviewer who is able to coax information through probing questions. While both studies also advocate the use of metaphors and representative models, Garcia-Perez, et al. include the additional recommendation to include the interviewer in a team with other stakeholders who provide additional insight and perspective on the expert's knowledge, and assist in the creation of a meaningful model of the information gleaned. The study by Garcia-Perez et al. also recommends that organizations focus on a specific piece of knowledge (such as a product lifecycle), rather than create broad rules and knowledge repositories. This may seem a piecemeal approach, but Gubbins et al. also find that smaller, focused initiatives are more successful than large, overarching projects.

Apprenticeship and mentoring. Mentoring, apprenticeship, job rotation and practice are common themes in the literature. Nonaka (2007) provides a fairly well known example of an employee at Matsushita Electric company who apprenticed under a master baker to learn the secrets of bread kneading so she could transfer that knowledge into a home bread machine Nonaka contends that an apprentice learns tacit skills "through observation, imitation and practice" (p. 165). Swap et al. (2001) and Dinur (2011) also suggest apprenticeship or mentoring as potential knowledge transfer techniques. According to Swap et al., "most mentors are in a

position to teach because they have developed expertise through years of practice" (p.108). Dinur finds that apprenticeship is most effective for sharing the following knowledge types (a) skill, (b) cause-effect, (c) cognitive, (d) unlearning, (e) human, and (f) emotional.

Personality traits and motivation. Themes of motivation and personality types were discussed in much of the literature. Stenmark (2000) notes that "people do not share knowledge without a strong personal motivation" (p. 21). Garcia-Perez et al. (2009) conclude that experts' motivation to share knowledge increases through discussion of their own experience with colleagues. Borges (2013) finds that the personality traits of introversion and conscientiousness are most likely to support tacit knowledge sharing (in software development teams) when they feel they are in a supportive and team-oriented environment, are not overly threatened by competitiveness, and experience good social interactions in the workplace**.** "Conscientiousness is closely related to knowledge sharing because when responsible, persistent, and hard-working individuals perceive that the dissemination of knowledge is part of their duties they tend to do what is expected of them" (p. 93).

Storytelling. Whyte et al. (2013) and Swap et al. (2001) illustrate the use of stories to transfer tacit knowledge. Swap et al. provide examples of stories used to communicate managerial systems, underlying cultures, values and taboos. They note that "stories, particularly those that are concrete and readily identified with, are particularly powerful for transferring knowledge rich in tacit dimension" (p. 105). Both studies caution, however, that stories are not effective transfer techniques for critical skills or deep knowledge of content domain.

Technologies to Support the Sharing of Tacit Knowledge

Suitability of technology in tacit knowledge sharing. Selected literature that proposes technological solutions for transferring tacit knowledge also addresses the suitability of

technologies for the transfer of such complex information. While Chien-Hsing Wu et al. (2010) acknowledge technologies as supporting mechanisms, they contend that the proper use of IT can "assist knowledge providers in transmitting knowledge and knowledge receivers to absorb and utilize knowledge" (p. 515). According to Stenmark (2000), "We should not look on technology alone as the solution to our problem of finding and sharing knowledge but, at best, as a facilitator that helps us initiate and sustain social interaction." (p. 11). Similarly, Garcia-Perez et al. (2009) state that technologies alone do not guarantee that knowledge transfer occurs. Teo et al. (2011) find that successful technology tools are "supplemented with participation initiatives designed to change employees' behavior to facilitate knowledge sharing" (p. 2). In contrast, Panahi et al. (2012) point out that the traditional techniques of socialization, mentoring, observation, etc. are cost prohibitive and do not keep pace with today's fast moving organizations.

Many discuss the difficulty with making tacit knowledge explicit in order to use the tools, or provide an alternative solution (Stenmark, 2000). Stenmark (2000) relies on Polanyi's work, which "envisions tacit knowledge as the backdrop against which all understanding is distinguished" (p. 10). By taking this stance, he is able to show how technology "may be used to address knowledge that has not been made explicit" (p. 11). Others reference rich multimedia channels (Chien-Hsing Wu et al. 2010), social media (Panahi et al., 2012), or Web 2.0 tools (Singh et al., 2013; Song et al., 2007) as solutions that allowed the sharing of tacit knowledge.

Web 2.0 technologies. Web 2.0 technologies permit a level of user interaction and include social media, collaborative applications, blogs, forums, wikis, etc. They frequently incorporate multimedia including text, audio, video, and other formats. The advent of these technologies allows users to communicate in real time using methods that can mimic face-to-face interactions. Panahi et al. (2012) find that these technologies are suitable for sharing tacit

knowledge because they "support free-form communication and collaboration". While the impact of real-time tools on co-located teams may seem nominal, since the tools include record features, any converted tacit knowledge may be accessed at a later date and distributed throughout the wider organization (Panahi et al., 2012).

In their report, Teo et al. (2011) describe how HP encouraged blogging through a contest that encouraged users to both generate content and explore and read other employee blogs. Since blogs can include embedded multimedia, they are an effective solution for distributing tacit knowledge. The authors find that it is important to "choose collaborative tools that are easily available, scalable, and do not require much training so that employees can readily use them" (p. 14). Singh et al. (2013) also find that Web 2.0 technologies such as Internet, e-mail, and groupware enhance knowledge sharing. Similarly, Song et al. (2007) find that groupware (e.g., collaborative notebooks, electronic whiteboards, and forums), e-mail, and web pages are effective tools for sharing tacit knowledge, particularly in co-located teams. Senapahti (2007) suggest groupware tools and expertise finders such as knowledge portals as technological knowledge sharing solutions.

E-Learning systems or simulators. Senapahti (2007) discusses e-Learning Systems or Simulators such as those used to train pilots or soldiers. Chien-Hsing Wu et al. (2010) also find literature supporting e-learning technologies for tacit knowledge transfer. These tools may be extravagant, simulating physical, psychological and emotional skills, or more basic systems that present users with dummy scenarios through a text-based application. These tools allow users to gain tacit knowledge through practice, observation, and a teacher-student relationship. Additionally, the tools simulate expert knowledge, without the need to locate the expert and

establish context. This type of knowledge transfer can include an efficacy score, providing the knowledge recipient more control of the internalization process.

Recommender systems. Stenmark (2000) makes a case that the use of *recommender systems*, such as those used in intranet documents to create a digital fingerprint of users' interests, has potential to transfer tacit knowledge. By tracking users' searches and interests, the recommender system is able to act as an expert locator within the organization. The system does not require users to make their knowledge explicit in order to be effective, minimizing the problems that can manifest when attempting to elicit and codify tacit knowledge.

Summary

Analysis of selected literature uncovers both anticipated and unexpected solutions for tacit knowledge sharing within co-located teams. Many studies reference the impact of an organizational culture that fosters a social atmosphere and places high value on knowledge sharing. Techniques to promote tacit knowledge sharing include (a) mentoring, (b) interviews with knowledge experts, and (c) storytelling. Technologies that enable tacit knowledge sharing include (a) Web 2.0 tools such as blogs, wikis, and social media, (b) recommender systems integrated with Intranet sites, and (c) E-Learning simulators.

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