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MANAGEMENT | REVIEW ARTICLE

Knowledge sharing and technological innovation: The effectiveness of trust, training, and good communication

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Abstract: The purpose of this study is to research factors associated with knowledge sharing that managers can leverage to ensure a strong innovation management process and successfully deliver technological innovations to the intended customer. The research question this study pursues is: What factors associated with knowledge sharing lead to successful technological innovation management? The findings of this study yielded three factors paramount to knowledge sharing in technological innovation groups: (a) trust, (b) training on technology, and (c) good communication. The data show that managers should focus on implementing practices emphasizing these factors in their teams and/or organizations. Future research should focus on further evaluation of factors that positively affect knowledge sharing in technological innovation units.

Subjects: Management Education; Management of Technology & Innovation; Innovation Management

Keywords: communication; knowledge sharing; technological innovation; trust

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1. Introduction

Research shows that knowledge sharing has benefits and leads to growth as well as organizational success. Al-Alawi, Al-Marzooqi, and Mohammed (2007) determined that factors such as trust and communication were positively related with the practice of knowledge sharing. Knowledge sharing

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PUBLIC INTEREST STATEMENT

With constant advances to mobile and computer technology, technological innovation between organizations is very competitive. However, an organization cannot thrive if its employees do not share knowledge and collaborate with one another. This rapid evidence assessment (REA) assesses factors associated with promoting effective knowledge sharing in technological innovation. Three factors associated with effective knowledge sharing were gleaned from the REA: (a) trust between employees; (b) training on technologies and knowledge sharing practices; and (c) good communication between employees. Managers who are able to leverage these factors in improving knowledge sharing are likely to have more success in delivering groundbreaking technological innovations to the general public and expanding the technological capabilities of society.

can also be leveraged in innovation management (specifically management of technological innovations). Technological innovations are changes to or completely new releases of technology including software (e.g. iPhone operating system updates), hardware (tangible technology with revolutionary capabilities), and process improvements to research and development (R&D) in technological innovation. An innovation can be defined as a "process to change an idea or technique into a new innovative product or service that creates value for the customers" (Yasini, 2016, p. 163). Innovation management is defined as the "set of critical abilities of director or leader of any organization, because it makes possible for the administrator to create organizational growth and profitability" (Yasini, 2016, p. 165). In other words, managers are responsible for ensuring that delivered innovations are not a waste of resources and will benefit the organization as a whole.

The purpose of this study is to provide evidence-based recommendations for practitioners in innovation management to ensure successful deliveries of technological innovations. This study will conduct a systematic review to pursue the proposed research question, analyze the results, and provide recommendations for practitioners. The research question this study will pursue is: What factors associated with knowledge sharing lead to successful technological innovation management? Some literature exists on technological innovation and knowledge sharing; however, few studies yielded a synthesis of factors associated with knowledge sharing and technological innovation management. This study aims to fill that gap.

2. Literature review

This section will discuss the four concepts associated with the research question: (a) knowledge sharing, (b) trust, (c) training, and (d) innovation management. Following the conceptual discussions is a brief analysis of theories associated with the concepts. Three associated theories were analyzed for this study: (a) absorptive capacity theory, (b) participative leadership theory, and (c) social exchange theory. The section concludes with hypotheses drawn from the literature review to validate in the rapid evidence assessment (REA).

2.1. Knowledge sharing

Knowledge sharing can be very beneficial to organizations. In the case of Toyota, the car dealer found success through knowledge sharing with other organizations in its supply chain (Dyer & Nobeoka, 2000, p. 316). Toyota shared knowledge on lean production techniques within its supply chain, resulting in superior productivity (Dyer & Nobeoka, 2000). As a result of this knowledge sharing, Toyota sustained steady growth from 1965 to 1990 (Dyer & Nobeoka, 2000).

Bij, Song, and Weggeman (2003) studied factors affecting knowledge sharing in strategic business units (SBUs). Bij et al. (2003) tested 10 factors in their study (including co-location, individual commitment, and risk-taking behavior) across 277 SBUs of US-based technology firms to determine which factors (if any) had an effect on knowledge sharing. The findings of the study demonstrated that with the exception of two factors (use of information technology and organizational redundancy), there was empirical support that each of the factors positively correlated with knowledge sharing.

2.2. Trust

Trust between employees is an essential element of successful knowledge sharing within an innovative organization. Olander, Vanhala, Hurmelinna-Laukkanen, and Blomqvist (2015) state that considerable knowledge is embedded in the personnel, and if staff handles such knowledge carelessly or leaves taking the knowledge with them, not only is the door opened to harmful competitive imitation (McEvily & Chakravarthy, 2002) but the potential for disruption of the innovative activity also increases (p. 220). This statement can apply to both intra-organizational (within an organization) knowledge sharing and inter-organizational (between separate organizations) knowledge sharing. Olander et al. (2015) also stated that information security is sometimes seen as an obstruction to "innovative knowledge sharing behavior" (p. 220). There is risk involving in trusting personnel with

potentially significant knowledge. Managers must work with subordinates in creating a balance of trust between and knowledge security.

2.3. Training

Research shows that training is another important element of successful knowledge sharing in innovative organizations. In order to foster innovation, it is important to understand knowledge surrounding the subject matter of innovation (e.g. innovations of technology products or process improvements). According to Neirotti and Paolucci (2013), "training at all organizational levels may facilitate employees' exposure to a variety of knowledge and encourage openness to new ideas that are likely to be a source of technological and organizational innovations" (p. 95). Personnel must be able to understand the knowledge and implications of learned knowledge before leveraging knowledge in innovation. Neirotti and Paolucci also point out that "training is thus one of the practices that may stay at the foundation of firms' absorptive capacities" (p. 95). Training is important to gathering knowledge in order to understand and analyze knowledge.

2.4. Innovation management

Innovations are products of a multi-step process that includes development, adaptation, and delivering the products to end-users (Bakir, 2016). Murphy, Perera, and Heaney (2015) define an innovation as an "idea developed and commercially implemented into an institution, industry, business, or project" (p. 209). Thus, innovation management is the "set of critical abilities of director or leader of any organization, because it makes possible for the administrator to create organizational growth and profitability" (Yasini, 2016, p. 165). There are two types of innovations: product innovations and process innovations. Product innovations are those innovations where the outcome is a "qualitatively superior product from a given amount of resources" (Murphy et al., 2015, p. 210). Process innovations are defined as "introductions of advanced management techniques" (Murphy et al., 2015, p. 210). Both types of innovations continue to define organizations in today's business arena.

Innovations have been constantly developed through time, but a rapid interest in innovation has grown since 1990 (Walecka-Jankowska, 2015). Everett Rogers produced a book in 2003, *Diffusion of Innovations,* on how ideas spread through organizations (Valente, Dyal, Chu, Wipfli, & Fujimoto, 2015). One of the main assertions of the Rogers text is that "new ideas and practices often spread through interpersonal contacts largely through interpersonal communication" (Valente et al., 2015, p. 89). Hence, interpersonal communication is an entity in the innovation process that directors and leaders of innovation teams must manage appropriately and leverage to maximize team and organizational success.

2.5. Associated theories of knowledge sharing

Three theories will be discussed in this section: (a) absorptive capacity theory, (b) participative leadership theory, and (c) social exchange theory. Absorptive capacity theory will be discussed first.

2.5.1. Absorptive capacity theory

Absorptive capacity is defined as an organization's ability to "recognize the value of new, external knowledge, assimilate it, and apply it to commercial ends" (Bilgili, Kedia, & Bilgili, 2016, pp. 700–701). In order to engage in knowledge sharing within an organization, an organization must first collect knowledge. According to Chang, Hou, and Lin (2013), absorptive capacity (or capability) is a "function of an organization in the prior related knowledge field, the development of absorptive capability and its subsequent innovative performance display shows the 'history-and-path-dependence' phenomenon" (p. 58). That is, a failure to acquire and sufficiently analyze knowledge does not allow an organization to reap the full benefits of knowledge sharing in the technological innovation process (Chang et al., 2013).

2.5.2. Participative leadership theory

Participative leadership theory holds that both subordinates and leaders participate in the decision-making process (Huang, Iun, Liu, & Gong, 2010). The objectives of participative leadership are shared

decision-making and influence between managers and subordinates, as well as giving subordinates "greater discretion, extra attention and support, and involvement in solving problems and making decisions" (Lam, Huang, & Chan, 2015, p. 836). Participative leadership is linked with absorptive capacity theory as knowledge sharing is not only the process of gathering knowledge, but also sharing the responsibility of knowledge analysis and utilization in the technological innovation process.

2.5.3. Social exchange theory

Social exchange theory can be described as a "two-sided, mutually contingent, and mutually rewarding process involving 'transactions' or simply 'exchange'" (Emerson, 1976, p. 336). With respect to knowledge sharing in the technological innovation process, social exchange is paramount as knowledge sharing within an innovation team cannot take place without social exchanges between employees.

2.6. Hypotheses

Based on the literature review, two hypotheses were developed to focus the collection and analysis of data for this study. In performing the REA, the data will be synthesized to determine whether the following hypotheses are supported by the data. The hypotheses are as follows:

- H1: Since interpersonal communication is a factor in the innovation process, trust is an important factor in successful knowledge sharing.
- H2: Training on technology targeted by a team for innovation as well as training on the knowledge sharing process improves knowledge sharing.

3. Method

This section will provide a discussion of the process that will be used in performing the REA. Discussed elements in this section include a discussion for why the REA method was chosen, inclusion and exclusion criteria, and the quality appraisal method used for evaluating sources. An REA is a systematic review of literature in pursuit of a proposed research question, followed by a synthesis of the literature that strives to develop new insights and evidence-based recommendations for practitioners. This is known as Evidence-Based Management. The Center for Evidence-Based Management (n.d.) states that management should be based on critical thinking and the best available evidence. This study provides an analysis of the available literature (critical thinking) combined with the best available evidence.

3.1. Searches and inclusion/exclusion criteria

Fourteen sources were included in the synthesis. In locating sources to be included in the synthesis, UMUC OneSearch was used. The following search statements were used to obtain data:

- "knowledge sharing and technological innovation"—1,268 results.
- "knowledge sharing and technological innovation management"—752 articles.

Multiple criteria were used to narrow the large pool of sources. Articles that were not scholarly (e.g. trade publications, gray literature, periodicals) were not included in the synthesis. A timeframe from 1987 to present was used in order to ensure that classical or seminal references were not missed in the evaluation of available literature. Sources that did not have an available full-text version were not included in the review. Finally, sources that were not relevant to knowledge sharing and/or technological innovation management were not included. It should also be noted that there were several duplicates of articles between the two search statements. Both search statements were used to ensure an inclusive review of data on the topic.

The aforementioned criteria narrowed the pool of sources to 625. Due to an anomaly in the UMUC OneSearch tool, the original number of articles was listed as 768 for the first search statement, but review of the entire list of articles yielded a total of 416 articles. For the second search statement,

the total article yield was 209 articles. From the remaining 625 articles, 31 were chosen through scanning many titles and abstracts. The Weight of Evidence (WoE) quality appraisal framework was then applied to the 31 articles. Using the WoE framework, 14 articles were chosen for inclusion in the synthesis.

3.2. Quality appraisal

The WoE framework examines the following three dimensions of a source to determine its worthiness for inclusion into a review: (a) the soundness of the study, (b) the appropriateness of the study method for answering the research question, and (c) the relevance of the study's subject matter to the research question. (Gough, Oliver, & Thomas, 2012). Each of the 31 evaluated sources was given a quantitative score. A three-point scoring system was used for each of the three aforementioned WoE dimensions; one was the lowest possible score and three was the highest. The numerical cut-off for inclusion into the review was the mean score of 6.645. This value was chosen to allow for the largest selection of analyzed literature while maintaining a high standard for sources included in the review. In light of this, one other cut-off was implemented in the quality appraisal process. If an article received a "one" in any category (regardless of whether the total score was above the mean score for all articles), the article was not included in the synthesis.

4. Results

A thematic synthesis was performed to determine whether there was evidence to support the hypotheses derived from the literature review. In examining the 14 articles, three themes were noted in the literature: (a) the necessity of trust within teams, (b) the benefit of training team members on technologies and knowledge sharing, and (c) and the necessity of good communication to successful knowledge sharing.

Table 1 highlights the statistics from the overall analysis. The grand mean of the 31 source scores was 6.645. The skewness factor was −0.7664, which indicates that there were a higher number of values above the mean. However, the Central Limit Theorem holds that a sample of at least 30 indicates an approximately normal distribution. Given the sample size of 31 for this article, it is reasonable to assume the data are normally distributed around the mean.

Table 2 highlights the themes gleaned from the REA along with the included sources associated with each theme. Trust as a factor in promoting knowledge sharing was found to be the most prevalent theme; 6 out of the 14 included sources were associated with trust. Employee training on technologies was the second theme as a factor in promoting knowledge sharing; five included sources were associated with training on technology. Good communication between employees was the

Table 1. WoE statistics from REA

Mean	6.64516129
Median	7
Mode	7
Minimum	3
Maximum	9
Range	6
Variance	2.4366
Standard deviation	1.5609
Coeff. of variation	23.49%
Skewness	−0.7664
Kurtosis	−0.1069
Count	31
Standard error	0.2804

Table 2. Summary of data included in thematic synthesis

Theme	Summary of related data from REA	WoE scores			
		AoSM	SoS	MRQ	Sum
Trust	• Knowledge sharing enablers such as trust, management support, and team work have a positive effect on technological innovation (Yecil et al., 2013)	3	3	2	8
	• Organizations sharing relevant knowledge in innovation network had higher performance than those that did not (Spencer, 2003)	3	3	3	9
	• Trust is based on individual perceptions of the entire team (Kosonen et al., 2014)	3	3	3	9
	• Distrust is one of the main barriers to knowledge sharing in technological innovation (Teagarden et al., 2008)	2	2	3	7
	• Team members are not as willing to share knowledge and participate as a team member if there are low levels of trust in a team or organization (Henttonen & Blomqvist, 2005)	3	2	2	7
	• Trust is an important factor in determining one's willingness to import and share knowledge (Andrews & Delahaye, 2000)	3	2	2	7
Training on technology	• Firms with a broad knowledge base are more capable of developing radical innovations (Zhou & Li, 2012)	3	3	3	9
	• An organization's ability to successfully combine knowledge acquired external to the organization depends on internal members of a knowledge sharing network (Tortoriello, 2015)	3	3	2	8
	• Knowledge sharing is more efficient and beneficial when more employees are trained in a given technology area (Keith et al., 2010)	3	3	2	8
	• In technological innovation, knowledge building activities in the elementary stages of development work should be included (Ensign, 1999)	2	2	3	7
	• Organizational learning is important in developing "learning capacities" to increase a team's ability to understand and leverage new technologies (Teo et al., 2006, p. 276)	3	2	3	8
Good communication	• Use of information and communication technology can enable easier communication, which leads to a higher likelihood of successful innovations (Radaelli et al., 2014)	3	3	2	8
	• Ineffective knowledge sharing can be a barrier for effective implementation of innovation (Janiunaite & Petraite, 2010)	3	2	3	8
	• Positive correlation between "high rate of technological collaboration and great technological content and knowledge" (Schiller, 2015, p. 123)	3	2	3	8

Notes: AoSM = appropriateness of study mechanism; SoS = soundness of study; and MRQ = match to research topic.

third theme as a factor associated with promoting knowledge sharing; three included sources were associated with good communication.

5. Discussion

This section provides a discussion of the three themes discovered in the REA. The three factors associated with knowledge sharing in technological innovation were trust, training on technology, and good communication.

5.1. Theme 1: Trust

Trust was the most prevalent theme found in the literature; 6 of the 14 included sources highlighted trust as a factor associated with knowledge sharing. This finding provides support for H1. Spencer (2003) performed a study on 1,154 "firm-year observations" of strategies used in the development phase of the innovation process (p. 223). From the analysis of the data, Spencer determined organizations that shared relevant knowledge enjoyed higher innovation performance than those that did not. Yecil, Buyukbese, and Koska (2013) also found trust (in addition to management support and teamwork) has a positive effect on knowledge sharing in technological innovation. These findings highlight the need for trust in knowledge sharing relationships as well as strong communication (which will be discussed in Theme 3). Trust was also emphasized in Henttonen and Blomqvist's (2005) study on trust in collaborative technological innovation. In a study of 23 members of a global virtual team, Henttonen and Blomqvist found open communication fostered trust between team members. Spencer as well as Henttonen and Blomqvist supports the notion that innovation management efforts centering on trust are more likely to enjoy success.

Spencer's article also highlights the presence of participative leadership theory and social exchange theory as relevant theories associated with successful knowledge sharing. Given Spencer found organizations that shared relevant knowledge enjoyed higher innovation performance, responsibility for knowledge sharing is shared among employees. This is the essence of participative leadership as multiple personnel are responsible for understanding that knowledge, sharing it, and leveraging it appropriately. Spencer's study also ties into social exchange theory as interpersonal communication is required to share knowledge.

Kosonen, Gan, Vanhala, and Blomqvist (2014) studied 244 users in an online technological "open innovation and brainstorming community" and found trust is based on each individual's perception of the overall team or organization (p. 1). If an individual believes that each person is participating in an effort for their own personal gain, there is a good possibility the team or organization can fail. Similar to Spencer (2003), Kosonen et al.'s (2014) study highlights the presence of participative leadership theory and social exchange theory. Kosonen et al.'s (2014) finding that trust is based on how each individual views the group implies that every member of a team or organization is responsible for the appearances of the team (participative leadership theory). Social exchange theory is also relevant in that each member of the team and organization must communicate with each other in order to establish trust and effective knowledge sharing. Distrust between employees is a barrier to effective knowledge sharing (Teagarden, Meyer, & Jones, 2008).

Andrews and Delahaye (2000) found trust is an important factor in determining one's willingness to not only import but share knowledge. This finding links to absorptive capacity theory and demonstrates the connection between the need for trust and strong communication between employees. In order to share knowledge in a team or an organization, the team or organization must import/acquire knowledge.

5.2. Theme 2: Training on technology

The second theme found in the literature was the benefit of training members in an innovation team or unit on the technology being targeted for innovation as well as training on the knowledge sharing process. Five out of the 14 included studies supported the claim that training on technology is beneficial in enhancing knowledge sharing within an innovation team, thus providing support for H2.

In a study of 99 graduate-level information systems students, Keith, Demirkan, and Goul (2010) found knowledge sharing was more efficient when more employees were trained in a given technology area. Organizations possessing an employee base with a diverse knowledge base have been determined to be more capable of developing radical innovations (Zhou & Li, 2012). Keith et al. (2010) also highlight the relevance of absorptive capacity theory to knowledge sharing. In order to understand and acquire the knowledge (absorptive capacity theory), personnel must be trained appropriately. Tortoriello (2015) found in a study of 249 employees that an organization's absorptive capacity as well as its ability to analyze and share knowledge depends on the ability of individuals to collect and share knowledge. That is, if employees cannot gather and analyze knowledge, training on technology is ineffective. Organizations and practitioners must be mindful to ensure that the method of instruction in training sessions is compatible with the learning styles of employees.

Teo, Wang, Wei, Sia, and Lee's (2006) empirical study on 299 leaders of technological innovation organizations and teams highlighted training as a factor in improving knowledge sharing. Teo et al. (2006) found for "technology assimilation," organizational learning is important in leveraging technological advantages and developing "learning capacities to increase a team's ability to understand and leverage new technologies" (p. 276). In other words, training is important in understanding technologies and sharing knowledge and insights about a technology within a team or organization. Ensign (1999) found that employee training on technologies is especially important in the early stages of technological innovation development. As seen in Keith et al.'s (2010) study, absorptive capacity (understanding and acquiring knowledge) is essential to participation in knowledge sharing and ultimately, technological innovation.

5.3. Theme 3: Good communication

A third factor noted in the literature pertaining to the enhancement of knowledge sharing was good communication between employees of a team or an organization. While this factor does not directly support either of the two hypotheses, an analysis of the literature demonstrated this factor is important to the study. Three articles out of the 14 included sources discussed the need for good communication in fostering an environment of effective knowledge sharing. In an empirical study on technological innovation networks in Brazil, Schiller (2015) found a positive correlation between technological collaboration and "great technological content and knowledge" (p. 123). That is, the higher the level of collaboration and communication between employees, the more likely the technological innovation will be a high-quality product. Radaelli, Lettieri, Mura, and Spiller (2014) found information and communication technology are effective in enhancing communication between employees, leading to a higher likelihood of successful innovations. Lack of communication and social exchange between teammates is a barrier to effective knowledge sharing (Janiunaite & Petraite, 2010).

5.4. Practice and researcher implications

This study is useful to managers of technological innovation teams or organizations that aim to improve knowledge sharing within his or her group and in turn improve innovation outputs. In focusing on the factors of trust, training on technology, and good communication, a manager is likely to improve the quality of innovation output for their team. This review provides evidence-based research that supports implementing practices associated with emphasizing the three aforementioned factors. Recommendations for practitioners include implementing training programs on targeted innovations, team-building exercises, and holding frequently planned structured meetings to ensure strong communication. These practices target the three prevalent factors and are likely to be effective in improving effective knowledge sharing. For scholars, this study serves as a source that provides a synthesis of several articles related to knowledge sharing and technological innovation management. In filling the literature gap of producing a synthesis on the relationship between knowledge sharing and technological innovation management, the study produced new insights which scholars may further build on and examine.

5.5. Limitations

In performing this REA, three limitations must be recognized. First, any shortcomings or limitations present in the analyzed sources also affect the validity of this review. The WoE tool was utilized in order to minimize the effects of such limitations on the quality of this review. Second, an REA cannot account for every possible factor that may enhance effective knowledge sharing. While the REA is useful for pointing out prevalent themes in the literature, there is a risk for the omission of relevant factors. Thirdly, in using the WoE framework, certain judgment was used in assessing the 600 + sources for inclusion into the review, and further judgment was used to narrow the final pool of sources for the synthesis. As this judgment is somewhat subjective, the study's replicability is affected. Thus, justifications for assigned scores were given in Appendix A to mitigate the negative effect on the study's replicability.

6. Conclusions and future research

Three factors play a large role in the use of knowledge sharing for successful technological innovation management: (a) trust, (b) training on technology, and (c) good communication. Trust is vital in effective knowledge collection and sharing. Training is important in teaching employees how to effectively collect knowledge and learn the subject matter of technological innovations. Good communication between employees is required for knowledge sharing to take place between employees. These are factors managers can leverage in determining appropriate practices to implement in improving technological innovations and associated processes. Future research should focus on other factors that may be associated with improving knowledge sharing in technological innovation units. There was a scarce selection of literature discussing knowledge sharing and technological innovation. Further research is necessary to fully assess the factors that play a role in knowledge sharing and improving technological innovation.

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Appendix A
Weight of evidence chart

Author	Appropriateness of study mechanism	Soundness of study	Match to research question	Key Points	Sum of factors
Alkhuraiji, Liu, Oderanti, and Megicks (2016)	3—Case study	2—Good methodology and limitations discussed	1—Discusses KS; little to no discussion of TI	• Not a good match	6
Andrews and Delahaye (2000)	3—Case study	2—Limitations not discussed	2—Relevant to KS and TI, but study not performed at the team level	• Trust is an important factor in determining one's willingness to import knowledge and share knowledge (pp. 806–807)	7
Bolivar, Zhang, Puron-Cid, and Gil-Garcia (2015)	3—Empirical study	2—Response rate on surveys was low (~32%)	1—Somewhat related to KS and TI	• Policy-makers in the study believe that Web 2.0 technologies can be a relevant tool for gathering suggestions about the quality of public services (p. 211) • Does not improve TI in the delivery of public services • Not a good match as the examination is between an organization and the public	6
Bond, Shipton, Jones, Butler, and Gibbs (2007)	1—Article	1—Limitations are not discussed	2—Some applicability to KS; little to TI	• Not a good match	4
D'Andrade, Neto, Quelhas, Lima, and Ferreira (2016)	3—Empirical study	2—Limitations?	1—Focuses on organizational innovation	• Focuses on organizational innovation	6
Ensign (1999)	2—Literature review	2—Review of literature completed but this is not an empirical study	3—Good applicability to KS and TI	• In technology innovation, "technological knowledge building activities during the early stages of a development task" should be included (p. 214) • Training is beneficial to members of an innovation team	7
Fukugawa (2006)	3—Empirical study	3—Sound methodology and discusses limitations	1—Discusses cross-industry groups; not teams	• Not a good match	7
Gao, Xie, and Zhou (2015)	3—Empirical study	3—Detailed methods and transparency	1—KS isn't related to TI, but technological diversity	• Not a good match	7
Guerra and Camargo (2016)	2—Literature review	1—Short limitations section ... only discusses narrow selection of databases	1—Not related to KS and TI	• Not a good match for the study	4
Henttonen and Blomqvist (2005)	3—Case study	2—Good methodology but did not discuss limitations	2—Discusses KS in virtual teams	• Trust is defined as "an actor's expectation of the other actors' capability, goodwill and self reference visible in mutually beneficial behavior enabling co-operation under risk" (p. 108) • Team members are not as willing to share knowledge and participate as a team member if there are low levels of trust (p. 108)	7
Janiunaite and Petraite (2010)	3—Case study	2—Limitations not discussed; management implications discussed	3—Strong relation to TI and KS	• "Knowledge conversion into innovations" (p. 22) • Ineffective knowledge sharing can be a barrier for effective implementation of innovation (p. 22)	8

(Continued)

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Appendix A (*Continued*)

Author	Appropriateness of study mechanism	Soundness of study	Match to research question	Key Points	Sum of factors
Johnston and Diamond (2010)	1—Article	1—No methods	2—Somewhat related to KS and TI	• Not good for inclusion	4
Keith et al. (2010)	3—Empirical Study	3—Sound methods and limitations discussed	2—Discusses how technology knowledge of an individual influences knowledge sharing ability	• Innovation team leaders can render informed decisions about where to invest resources based on the technology expertise of their employees (p. 148). • Knowledge sharing is more efficient and beneficial when more employees are trained in a given technology area (p. 148)	8
Kosonen et al. (2014)	3—Empirical study	3—Sound methods and limitations discussed	2—Discusses trust in knowledge sharing during the innovation process. Does not directly tie in to technological innovations	• Trust is based on "individual perceptions of the collective" (p. 6) • This is important for managers of an innovation team to ensure that there is an atmosphere of openness and honesty within the team	8
Kuo, Sher, Lin, and Shih (2012)	3—Empirical study	3—Discusses limitations and management implications	1—KS is present, no real tie to TI	• Not a good match	7
Lemos, Sobrinho, Pacheco, Ferrao, and Goncalves (2011)	3—Empirical study	1—Limitations are not discussed.	1—Not a good match to KS and TI	• Not a good match	5
Lin and Chen (2006)	3—Empirical study	3—Sound methods and limitations discussed	1—Related to KS and TI but focuses on inter-organizational rather than within a team	• Not a good match	7
Liu, Ray, and Whinston (2010)	3—Empirical study	2—Modeling isn't the same as collecting data from real humans	1—Only KS, no TI	• Not a good match; no TI discussion.	6
Marz, Friedrich-Nishio, and Grupp (2006)	3—Empirical study	3—Sound methodology and limitations addressed	1—Focuses on KS and TI on a global scale; this study focuses on an innovation team	• Not a good match	7
Ponton (2014)	1—Article	1—No methodology (article)	1—Not really connecting KS and TI	• Not a good choice for inclusion	3
Radaelli et al. (2014)	3—Empirical study	3—Detailed methodology; management implications and limitations addressed	2—Discusses KS and how technology can be used to spark innovation	• Use of Information and Comm Technology (ICT) can enable easier communication, which leads to a higher likelihood of successful innovations (p. 409)	8
Ryszko (2016)	3—Empirical study	3—Detailed methods and transparency	1—Small connection between KS and TI	• Influence of KS on TI is very small	7
Schiller (2015)	3—Empirical study	2—Management implications discussed; limitations missed	3—High relevance to KS and TI	• Positive correlation between high rate of technological collaboration and great technological content and knowledge (p. 123) • "Innovation networks" are beneficial in bolstering KS and TI (p. 124)	8
Spencer (2003)	3—Empirical study	3—Detailed methods and transparency in methods	3—High relevance to KS and TI	• Study found that organizations that shared relevant knowledge in their "innovation network" had higher innovation performance than those that did not (p. 230)	9

(Continued)

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Appendix A (*Continued*)

Author	Appropriateness of study mechanism	Soundness of study	Match to research question	Key Points	Sum of factors
Teagarden et al. (2008)	2—Literature review	2—Not an empirical study	3 -Highlights barriers to knowledge sharing in technological innovation	• Distrust is one of the main barriers to KS in TI (p. 195)	7
Teo et al. (2006)	3—Empirical study	2—Sound methodology but little discussion on limitations	3—Good relationship with KS and TI	• Organizational learning is important in "exploit[ing] technological advantages" and developing "learning capacities" to increase a team's ability to understand and leverage new technologies (p. 276)	8
Tortoriello (2015)	3—Empirical study	3—Detailed methods and transparency; limitations noted	2—Moderate	• Article assesses absorptive capacity of organizations • "The ability to recombine successfully diverse sources of knowledge acquired outside of the organization" depends on those internal members of the KS network (p. 594)	8
Trigo (2013)	3—Empirical study	2—Limitations?	1—Discusses KS and non-TI	• Non-TI; this study focuses on TI and KS	6
Vico, Hellsmark, and Jacob (2015)	2—Case study	1—Methodology only relies on other sources, no data collection	1—KS is discussed, but no relation to	• Not a good match	4
Yecil et al. (2013)	3—Empirical study	3—Detailed methods and transparency	2—Moderate relevancy between KS and TI	• Knowledge sharing enablers (e.g. trust, management support, and teamwork) have a positive effect on TI	8
Zhou and Li (2012)	3—Empirical study	3—Detailed methods and transparency	3—High relevancy (KS and TI connection)	• Firm with a broad knowledge base is more capable of developing radical innovations (p. 1098)	9

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