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Emerald Article: Teams as a Process for Knowledge Management

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Abstract

Within the expansive body of literature on knowledge management, very little research is found that examines the use of teams as a sub-process of knowledge management. This article addresses this limitation by providing a theoretical framework that examines the similarities between the benefits of incorporating teams into the workplace and incorporating knowledge management principles. Recognizing that knowledge management has several critical dimensions, the framework that ties workplace teams to each of these knowledge management dimensions is built. Knowledge management and teams in the workplace are viewed at the individual, team and organizational level of analysis. This research contributes to the field by offering a framework that can serve to further the research on utilizing teams as a sub-process to knowledge management.

1. **Introduction**

"While an organization's 'data' resides in its computer systems, its 'intelligence' is found in its social system" (Spitzer, 2007, p. 255). Knowledge management provides a means to capture and store an organization's data while individuals and teams generate the knowledge for the organization - *the organizational intelligence*. The merger of the intelligence generating functions of teams with the knowledge capturing and distributive functions of knowledge management systems becomes a powerful tool for organizational innovation.

Teams are the building blocks of organizations and aid in the institutionalization of new knowledge into the organization (Li, D'Souza & Du, 2011). Salas, Cooke, and Rosen (2008) noted that advances have been made in team research, but emphasized the field must keep pace with continuing demands of the workplace. Knowledge management is one such place for the increased utilization of teams. Most research findings in the knowledge management literature focus on the inner workings of teams and how knowledge management principles positively influence the performance of teams. This conceptual review looks at the reverse, where utilizing the benefits of current research from teams and small groups can benefit the discipline of knowledge management. In today's complex work environment incorporating teams as a sub-process of knowledge management, further supporting knowledge creation, storage, and transfer within the organization, makes economic sense with most organizations already incorporating the use of teams at some capacity.

Knowledge management can be defined in multiple ways. Gao, Li, and Nakamori (2002) identified knowledge management as a process requiring purposeful activities to be initiated. Sun (2010) recognized knowledge management as a process due to the disciplines continued growth. In some instances knowledge management is referred to as a technical platform used to retain

and deliver knowledge (Liebowitz, 2004; Marshall & Brady, 2001; Randeree, 2006) while others

view it as a people-embodied activity (Datta & Acar, 2010; Mohamed, Stanosky & Murray,

2006). Viewing knowledge management as a people-embodied activity the incorporation of

teams as a sub-process to knowledge management would be a natural pairing – further enhancing

the effectiveness, efficiency, and production of organizations.

     Lastres (2011) defined knowledge management as "the leveraging of the organizations'

collective wisdom (know-how) by creating systems and processes to support and facilitate the

identification, capture, dissemination and use of the organization's knowledge to meet its

business objectives" (p. 23). Many organizations have realized that this collective wisdom lies in

the intellectual capital of its employees. The creation of processes, as identified in this definition

of knowledge management, is the focus of this manuscript, utilizing teams as a sub-process for

knowledge management to obtain organizational objectives.

     Knowledge management is more than just information management. It also includes

activities designed to extract implicit knowledge and to manage explicit knowledge while

developing a supportive culture that uses knowledge management as an instinctive part of

everyone's thought process (Lai & Taylor 2011; Liebowitz, 2003). Knowledge management is a

multi-discipline field that spans the disciplines of "economics, information systems,

organizational behavior and theory, psychology, strategic management, and sociology: (Argote

et al., 2003, pp. 571-572), to name only a few. Knowledge is the leverage point of learning and

performance and can be viewed as a vital organizational resource. It is important for

organizations to understand how to identify processes for its management. In the same way that

knowledge management processes can be used within an organization, teams can be used as a

central process for knowledge management.

Argote et al. (2003) identified a framework for organizing the literature on knowledge management. This framework involved organizing knowledge management into two critical dimensions: *knowledge management outcomes* and *knowledge management context*. The critical dimensions outlined by Argote et al. (2003) will be identified along with support from the literature demonstrating how teams can be used as a vehicle to achieve knowledge management goals. Prior to viewing the literature on teams and how they can support the proposed framework from Argote et al. (2003) we will first take a brief look at teams.

2. Teams

Davenport (2001) stated that it is critical to develop knowledge-oriented cultures in which the exchange of shared and unshared knowledge among individuals is provided. One way to achieve a knowledge-oriented culture is through the use of teams, groups, and learning communities within the organization.

Composed from various definitions of teams, research from Cohen and Bailey (1997) defined a team as "a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes… embedded in one or more larger social systems (p. 241). Identifying knowledge management as the organizations social system, teams can be incorporated as a process of knowledge management to help obtain organizational goals and outcomes. Other definitions of team are provided by Kozlowski and Bell (2003) where a team is defined as a:

> Collective who exist to perform organizationally relevant tasks, share one or more common goals, interact socially, exhibit tasks interdependencies, maintain and manage boundaries, and are embedded in an organizational context that sets boundaries,

constrains the team, and influences exchanges with other units in the broader entity (p. 334).

Here, knowledge management becomes the organizational entity setting the boundaries for the team to operate in. Ilgen, Hollenbeck, Johnson, and Jundt (2005) identified teams as "complex, dynamic systems, existing in larger systemic contexts of people, tasks, technologies, and settings" (p. 519).

Teams are used to streamline tasks, resolve complicated problem- solving activities, develop new innovative products, and perform a number of other critical tasks that could not be completed in a timely manner by any one individual. Work required by organizations today has become more complex, requiring the capabilities of teams in order to collaborate and work effectively toward solving complex problems (DeChurch and Mesmer-Magnus, 2010). Salas, Cooke, and Rosen (2008) stated that organizations use teams when faced with complex and difficult tasks. Additionally, as tasks become too complex for any one individual, organizations have to rely on teams or dyads.

Teams are often referred to as groups. For purposes of this article, teams can be used interchangeably with groups. Teams are usually made up of two or more individuals that have a common purpose or goal; two members are often defined as dyads. Some researchers view dyads as part of the team phenomenon, while others view them as a separate phenomenon.

Not all team members have an equal reward or punishment structure, however they all have a common purpose or task at hand. Team members work interdependently as well as individually. Each individual within the team brings to the table a different set of skills, knowledge, life experiences, as well as a different perspective based on the individual's level within the hierarchy of the organization. These skills, knowledge, and experiences are shared

through problem identification, task achievement, and team member interactions as the team works toward their common goal. It is here that the creation, retention, and transfer of knowledge takes place and knowledge management critical dimensions are manifested.

3. Knowledge Management Critical Dimensions

Argote et al. (2003) introduced a theoretical framework for organizing the knowledge management literature. Knowledge management outcomes include knowledge creation, knowledge retention, and knowledge transfer whereas knowledge management context involves properties of units, properties of the relationships between units, and properties of knowledge (Argote et al., 2003).

In the following sections, each of these critical dimensions are expanded showing how the use of teams can be used as a process to support knowledge management objectives. The first of these two dimensions to be discussed is knowledge management context.

4. Knowledge Management Context

Knowledge management is explained by where the context occurs. Argote et al. (2003) identified three properties where knowledge management occurs: properties of units, properties of the relationships between units, and properties of the knowledge itself. The following three sections identify how teams embedded within the organization, as a sub-process of knowledge management, can enhance each of the identified knowledge management contexts introduced by Argote et al. (2003). Table 1 identifies current research relating teams to the knowledge management context.

4.1 Properties of Units

Properties of units vary slightly from one research study to the next. Argote et al. (2003) defined properties of units as an organization, an individual, or a population of organizations.

When looking at levels of performance for an organization Rummler and Brache (1995) viewed three levels of analysis: organizational level, process level, and job/performer level. Swanson and Holton (2001) identified three levels for the domains of performance analysis: organization, process, and individual. Swanson (2007) later revised these levels of analysis to include the additional levels of work team, and job level.

Properties of units compose a system of interconnecting parts, where an action taken at one level affects the other levels. Here, the sum of the parts (levels of analysis) are greater than the sum of the whole. This is a general systems theory perspective. Swanson and Holton (2001) explained general systems theory as "the performance of the whole is affected by every one of the parts and the way that any part affects the whole depends on what at least one other part is doing" (p. 117). Venkitachalam and Bush (2012) viewed properties of units from the knowledge management perspective as the connectivity from one staff member to another, constituting a "component of organizational know-how" (p. 358).

In the context of knowledge management, properties of units should include: a population of organizations (industry), organization, team, and the job/individual levels. From these properties of units, knowledge management could be viewed as a process within the organizational structure, composed of inputs and outputs designed to meet organizational goals. This level of analysis places teams as a process for knowledge management, affecting the organization through the moderating functions of knowledge management (Figure 1).

Expanding this systems perspective further: collaboration between individuals creates new knowledge which benefits the team; teams collaborating with other teams create new knowledge which benefits the organization; and organizations collaborating with other organizations create new knowledge benefiting the industry as a whole and the environment in

which they operate. Thus, incorporating teams as a knowledge management process would

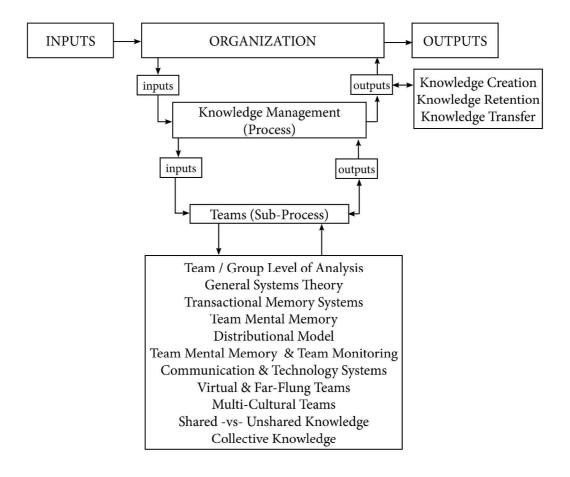benefit individuals, teams, the organization, and the industry as a whole.

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┌──────────┐        ┌─────────────────────────────────┐        ┌──────────┐
│  INPUTS  │───────▶│          ORGANIZATION           │───────▶│ OUTPUTS  │
└──────────┘        └─────────────────────────────────┘        └──────────┘
                         ┌────────┐           ┌─────────┐
                         │ inputs │           │ outputs │◀──┐
                         └────────┘           └─────────┘   │
                         ┌──────────────────────────────┐   │   ┌──────────────────────┐
                         │   Knowledge Management       │   │   │ Knowledge Creation   │
                         │        (Process)             │◀──────▶│ Knowledge Retention  │
                         └──────────────────────────────┘       │ Knowledge Transfer   │
                         ┌────────┐           ┌─────────┐        └──────────────────────┘
                         │ inputs │           │ outputs │
                         └────────┘           └─────────┘
                         ┌──────────────────────────────┐
                         │     Teams (Sub-Process)      │
                         └──────────────────────────────┘
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Team / Group Level of Analysis
General Systems Theory
Transactional Memory Systems
Team Mental Memory
Distributional Model
Team Mental Memory & Team Monitoring
Communication & Technology Systems
Virtual & Far-Flung Teams
Multi-Cultural Teams
Shared -vs- Unshared Knowledge
Collective Knowledge

Figure 1. System View of Knowledge Management

4.2 Properties of the Relationships between Units

Organizational units connected to one another provide opportunities to share / transfer knowledge and to create new knowledge within each respective unit. One such method of transfer can be found in transactive memory systems. Transactive memory systems can be viewed as a distributional model where team members are able to capture and organize knowledge in order to anticipate and execute orders (Kozlowski & Ilgen, 2006). A transactive memory system provides transfer of knowledge between team members as well as providing transfer of knowledge between teams, benefiting the organizational unit.

Another concept from team literature that provides knowledge to be transferred between units is team mental models. Team mental models consist of knowledge structures that are held in common among team members (Kozlowski & Ilgen, 2006), the understanding of knowledge shared by team members (Burtscher, Kolbe, Qacker, & Manser, 2011). Additionally, Burtscher et al. (2011) highlighted the benefits of team monitoring where team members assess other team members actions. Both team mental memory and team monitoring have been linked to improving team performance (Burtscher et al., 2011).

Some teams are designed out of necessity rather than convenience, such as virtual teams. Virtual teams consist of teams in which team members are located in different geographical locations from one another. Additionally, virtual teams could consist of team members from different units of the same organization. Ebrahim, Shamsuddin, and Taha (2009) pointed out that virtual teams are required to work across boundaries of time and space, relying on computer technologies and information systems. Virtual teams provide an extra level of complexity in which knowledge sharing and knowledge transfer must be conveyed between geographically dispersed team members and between organizational units. Here, team members have to adjust

for the lack of conveniences that face-to-face teams typically provide, such as relying partially

on non-verbal cues (Malhotra & Mahchrzak, 2004). Due to the importance of communication

placed on virtual teams, computer-mediated communication tools play a critical role in

knowledge sharing and knowledge transfer between team members and organizational units

(Ebrahim et al., 2009). Some technology tools utilized by virtual teams include: instant

messaging and chat, groupware / shared services, remote access and control, web conferencing,

file transfer, e-mail, and telephone (Ebrahim et al., 2009).

An extension of virtual teams is the 'far-flung team', which is described as globally

distributed multi-disciplinary virtual teams (Malhotra & Mahchrzak, 2004). Malhotra and

Mahchrzak (2004) presented far-flung teams as being critical to managing knowledge resources

for global organizations. Technology required for far-flung teams to communicate and share

knowledge takes two forms: electronic spaces that provide 'same time, different place'

communication (synchronous), and technology providing 'different-time, different place'

methods for communication (asynchronous) (Malhotra & Mahchrzak, 2004). Some of these

technologies utilized for far-flung teams include: audio conferencing, video-conferencing,

application sharing, electronic whiteboarding, threaded discussions, shared document

repositories, and workflow organization (Malhotra & Mahchrzak, 2004).

Multi-cultural teams, of which virtual teams and far-flung teams are often considered, have

an extra level of complexity added due to the cultural and language differences between team

members. Baba, Gluesing, Ratner, and Wagner (2004) highlighted that "linguistic fluency does

not necessarily mean cultural fluency" (p. 552), meaning that cultural values and philosophies

can interfere with knowledge sharing between team members in multi-cultural environments. In

efforts to account for cultural differences in multi-cultural teams, Malhotra and Mahchrzak

(2004) utilized information technology tools for support: multi-media entries which identified each author as part of the team's knowledge repository, comment and annotation tools, personal folders for interaction between team members to take place, and alternative labels or keywords provided to team members for review and comment.

Organizational performance and innovation are supported and can be enhanced by utilizing the benefits provided from teams. Regardless of the team structure, whether a virtual team is used in comparison to a far-flung team, the benefits of utilizing the relationships between units of knowledge from team member to team member can only help benefit the team as a whole, and in turn, the knowledge management process.

4.3 Properties of Knowledge

Memory systems are typically divided into two distinct systems: *procedural memory* and *propositional memory*. Procedural memory includes combining a number of perceptual-motor skills with cognitive skills, while propositional memory consists of knowledge that can be expressed and represented symbolically (Tulving, 2007). A propositional memory system is divided into two specific types of memory systems: episodic memory and semantic memory. Episodic memory involves the recording/retrieval of personal events in a person's life, a representation of a person's experiences, while semantic memory includes the lexicon of a person's organized knowledge, facts, and knowledge about the world (Tulving, 2007).

At the basic level, three memory systems exist that represent ones' knowledge: procedural, episodic, and semantic. Procedural knowledge primarily consists of incorporating one's motor skills; however, specific information cues can also aid a person's procedural knowledge. Similarly, information cues can aid in assisting a person's recall of an event, schema, or script; information cues can assist with the recall of episodic memory. Semantic memory is

best perceived as being organized conceptually, with individual facts and ideas (Tulving, 2007).

To further the description of semantic memory, Tulving (2007) described semantic memory as

depending "on the situation in which knowledge is actualized and the use to which it is put" (p.

38).

Other views of knowledge make the distinction between implicit and explicit knowledge,

which could be considered subcategories of the semantic memory system. Implicit knowledge,

often referred to as tacit knowledge, refers to knowledge that is known by an individual but

cannot easily be externalized; it is knowledge that is known but is hard to explain. Explicit

knowledge, on the other hand, is knowledge that has been externalized, either through discussion

or captured in written or digital form. Argote et al. (2003) identified implicit knowledge as

harder to transfer than explicit knowledge. Prior to being captured, implicit knowledge should to

be transferred, externalized.

Implicit and explicit knowledge is primarily considered at the individual level of analysis.

However, they can also be considered at the organizational level (Chou and Wang, 2003). At the

team level, implicit and explicit knowledge is also considered, although they are often called

shared and unshared knowledge. Stasser and Titus (1985) differentiated between these two types

of information when studying teams. Shared information refers to knowledge that is shared

among all team members, whereas unshared information refers to knowledge that is held only by

a single team member (Stasser and Titus, 1985). From the viewpoint of the team, unshared

information could be considered analogous to implicit knowledge whereas shared knowledge

could be analogous to explicit knowledge. Exposing unshared knowledge so that it can be

transferred into share knowledge is critical for effective team decision-making.

Typically, team members are unlikely to discuss unshared information (Stasser, Vaughan, & Stewart, 2000), which could be detrimental to team performance (Schreiber & Engelmann, 2010). Further research has concluded that it is better to discuss unshared information rather than relying on shared information (Larson et al., 1994). Better decision-making can be found in teams composed of team members willing to discuss unshared information, compared to teams in which team members only discuss shared information (Stasser et al., 2000).

One method that has been utilized to transfer unshared information to shared information is to incorporate the functions available in information systems. Chow and Wang (2003) listed the advantages of using information systems for this purpose: they can increase information exposure, they can remove constraints to interactions, and they have the ability to support collaboration. Further, codified knowledge, knowledge found in documents and software (Zander & Kogut, 1995), is easier to transfer then non-codified knowledge (Argote et al., 2003). As knowledge management works to transform non-codified knowledge into codified knowledge, unshared knowledge could similarly be transformed into shared knowledge, producing more productive teams, further benefiting the knowledge management function.

By improving the overall effectiveness of the team, whether through information systems or other methods, the team further supports the organization through task completion. This transformation from unshared knowledge to shared knowledge, at the team level, could remain codified at the team level. Keeping this newly codified knowledge at the team level helps the organization replicate this knowledge when needed while at the same time preventing this knowledge from entering into the hands of anyone external to the organization: "whereas externally competitors will find difficulties in copying the organizational know-how that is often unique and tacit (Venkitachalam and Busch, 2012, p. 359). This codification of newly created

shared knowledge supports the functions of knowledge management, supporting teams as a

process to knowledge management within the organizational setting.

Table 1. *Team Systems Within the Knowledge Management Context*

Knowledge Management Context		
Properties of Units	Team / Group Level of Analysis	Argote, McEvily & Reagans (2003); Rummler & Brache (1995); Swanson & Holton (2001); Swanson (2007)
	Teams as a Sub-Process to KM	- This Publication -
	Individuals Impact Teams, Teams Influence Organizations	Argote, McEvily & Reagans (2003); Rummler & Brache (1995); Swanson & Holton (2001); Swanson (2007)
Properties of Relationships Between Units	Transactive Memory Systems	Kozlowski & Ilgen (2006)
	Team Mental Models – Distributional Model	Kozlowski & Ilgen (2006)
	Team Mental Model & Team Monitoring	Burtscher, Kolbe, Wacker & Manser (2011)
	Use of Communication & Technology	Ebrahim, Shamsuddin & Taha (2009); Malhotra & Mahchrzak (2004); Ebrahim, Ahmed & Taha (2009); Malhotra & Mahchrzak (2004)
	Virtual & Far-Flung Teams	Baba, Gluesing, Ratner & Wagner (2004); Ebrahim, Ahmed, & Taha (2009); Malhotra & Mahchrzak (2004)
	Cultural Differences	Baba, Gluesing, Ratner & Wagner (2004); Malhotra & Mahchrzak (2004)
Properties of Knowledge	Procedural –vs- Propositional Memory Systems	Tulving (2007)
	Episodic –vs- Semantic Memory	Tulving (2007)
	Implicit –vs- Explicit Knowledge (Individual)	Argote, McEvily & Reagans (2003); Chou & Wang (2003)
	Shared –vs- Unshared Knowledge (Teams)	Stasser & Titus (1985); Stasser, Vaughan & Stewart (2000); Schreiber & Engelmann (2010); Larson, Foster-Fishman & Keys (1994); Chou & Wang (2003)

5. Knowledge Management Outcomes

Knowledge management outcomes are categorized as: *knowledge creation*, *knowledge retention*, and *knowledge transfer* (Argote, 2003). Knowledge creation refers to how new knowledge is created in organizations, knowledge retention refers to how knowledge is embedded in an organization's memory, and knowledge transfer refers to how knowledge generated in one domain can affect another domain within the same organization (Argote, 2003).

In the following three sections each of these knowledge management outcomes will be discussed further with an emphasis on teams as a knowledge management sub-process. Table 2 identifies current research relating teams to the knowledge management outcomes.

5.1 Knowledge Creation

Knowledge creation was defined by Argote et al. (2003) as new knowledge that is generated within an organization. This knowledge could be generated at each level of analysis: job / individual, team, organization, and industry. Knowledge creation could be stimulated, partially, by a lack of congruence or a lack of fit between knowledge structures (Argote et al., 2003). Nonaka, von Krogh, and Voelpel (2006) expanded the definition of knowledge creation to reflect an organizational level of analysis. Further, they defined organizational knowledge creation as a process, where knowledge created by individuals is made available, then crystallized, into an organization's knowledge system. Within this knowledge creation process, knowledge created by an individual is shared by team members, which is then transferred to the team and codified into written or digital format, and finally becomes part of the organization's knowledge system, supporting the knowledge management process.

At the individual level an information-processing model can be used to explain how individuals process information. The information-processing model consists of a few basic

elements: information from the environment; the processing objective; an attention phase; the

encoding, storage, and retrieval of information; the processing workspace; a response; and finally

feedback (Hinsz, Tindale, & Vollrath, 1997).

Teams are analogous to information-processing units. Hinsz et al. (1997) identified

information processing at the team level as "the degree to which information, ideas, or cognitive

processes are shared, and are being shared, among the group members and how this sharing of

information affects both the individual- and group-level outcomes" (p. 43), in addition to

affecting the organization. This shared aspect requires team member action to take place in either

physical form (face-to-face) or in a virtual form (digital).

The processes of encoding, storing, and retrieving information occur at both the

individual level and the team level. The one distinction between the two is the social aspect that

is required at the team level. Salas et al. (2008) emphasized communication as the central

mechanism in the team setting.

As stated earlier, knowledge can be divided into two separate domains: tacit knowledge

and explicit knowledge. Tacit knowledge, also termed implicit knowledge, is held by an

individual but has not been externalized. Explicit knowledge has been externalized so that others

can interact with it. Knowledge is created through the interactions between and the sharing of

implicit and explicit knowledge (Nonaka et al., 2006). Nonaka et al. (2006) devised a four-stage

model (SECI) where these interactions occur: socialization, externalization, combination, and

internalization (each of these four interactions are explained further under the knowledge transfer

section of this article).

A main objective for a knowledge organization is to provide continuous opportunities to

create, exploit, and accumulate new knowledge (Nonaka, 1994). Four levels of knowledge

creation; acquisition, generation, exploitation, and accumulation of knowledge, were proposed

by Nonaka (1994), addressing knowledge creation at the organizational level of analysis. A

distinction between top-down, bottom-up, and middle-up-down hierarchies was made (Nonaka,

1994). For bottom-up and middle-up-down hierarchies, Nonaka (1994) indicated that the self-

organizing nature of teams is essential to the creation of new knowledge, where teams are

capable of creating deeper knowledge through more focused investigation and investment. In

contrast, Nonaka (1994) presented that top-down organizations, ones with a more traditional

hierarchical division of labor, benefit more from unfocused search due to the command structure

from upper management. A new model of a *hypertext organization*, combining the benefits of

the hierarchical and the self-organized structures, was proposed (Nonaka, 1994), furthering the

importance of the team structure within organizations. This new hypertext organization benefits

the organization by expanding its capabilities to shift efficiently and effectively between

different forms of knowledge creation, enriching this new knowledge through "interactive

amplification of tacit and explicit knowledge" (Nonaka, 1994, p. 34). Nonaka (1994) identified

teams, and the concept of a hypertext organization, as being essential to the knowledge creation

function of knowledge management, placing teams as a sub-process to knowledge management.

5.2 Knowledge Retention

Argote et al. (2003) described knowledge retention as embedding knowledge into some

type of a long-term repository. Other views on knowledge retention consider codifying

knowledge from organizational members, or from external sources, that can be retrieved when

called upon (Alavi & Leidner, 2001). One form of knowledge retention in a team setting is a

transactive memory system. In a transactive memory system, individual knowledge is shared

with other team members, which can be retained and recalled collectively (Liang, Moreland, &

Argote, 1995). Individual knowledge is embedded into the collective knowledge of the team through a transactive memory system, providing a repository of knowledge for team members. Utilizing a transactive memory system produces what Gibson (2001) called a "knowledge-holding system that is larger and more complex than any one individuals' own memory system" (p. 124).

5.2.1 Transactive Memory System

Transactive memory explains the phenomena where shared experiences lead groups of people to encode, store, and retrieve information collectively (Liang et al., 1995). Stasser, Vaughan, and Stewart (2000) described transactive memory system as a way to coordinate team members' information search, storage, and retrieval efforts, in which an individual team member's recall is supported by their experiences with other team members. Liang et al. (1995) identified transactive memory system as a system with a collective knowledge of who knows what. Further, Liang et al. (1995) described transactive memory system as "an external storage device" (p. 385) that can be accessed by each team member.

By incorporating a transactive memory system to teams in the workplace, teams who were trained together recalled more information compared to being trained individually. By training the team together it was believed that teams had the time to develop transactive memory systems, thus improving their information storage and providing better recall of information (Liang et al., 1995).

In Liang et al.'s (1995) study, participants were trained on how to assembly a radio. Participants were either trained as a group or trained individually. Participants who were trained in a group were tested one week later with their same group. Participants trained individually were tested one week later in a group consisting of other participants who were trained

individually. Participants trained in a group setting remembered significantly more than participants who were trained individually. Additionally, participants who were trained in a group made significantly less errors than those trained individually (Liang et al., 1995). From this study, Liang et al. (1995) found transactive memory systems operated more strongly in groups that learned as a group. These groups were found to:

1.   Recall different aspects of the task,

2.   Coordinate their task activities, and

3.   Trust one another's expertise (p. 390).

Transactive memory systems provide a means for knowledge retention for teams and the organization, furthering support for knowledge management functions. Knowledge transfer is the next knowledge management outcome to be discussed.

5.3 Knowledge Transfer

Along the lines of general system theory, Argote et al. (2003) favored the view of knowledge transfer in which experience acquired by one unit has the ability to affect another unit or level of analysis. Effective knowledge transfer has the ability to transfer knowledge from the individual to the team, from the team to the knowledge management process level, from the knowledge management process to the organization, and from the organization to the industry.

Gibson (2001) identified four key components to expand the concept of information-processing related to teams, termed *collective cognition*: accumulation, interaction, examination, and accommodation. Collective cognition, according to Gibson (2001), does not reside in individuals alone, but resides in the interrelations between activities of team members. Accumulation occurs when groups acquire knowledge; interaction represents the communication connections between team members; examination consists of negotiated interpretations, status,

and roles; and accommodation occurs when knowledge becomes entrenched so that processes

occur more automatically (Gibson, 2001). When maximizing knowledge sharing and transfer is

desired, collective cognition could lead to better collaborative thought. Gibson (2001)

highlighted a current trend to incorporate teams into knowledge management, which "may go a

long way toward increasing the effectiveness of 21st century organizations" (p. 131).

In addition to Gibson's four key components, Nonaka et al. (2006) listed four modes of

knowledge conversion. In this model knowledge is created from converting tacit knowledge and

explicit knowledge. This model was assigned the acronym SECI by Nonaka et al. (2006), which

stands for socialization, externalization, combination, and internalization:

1) Socialization aims at sharing tacit knowledge among individuals.

2) Externalization aims at articulating tacit knowledge into explicit concepts.

3) Combination aims at combining different entities of explicit knowledge.

4) Internalization aims at embodying explicit knowledge into tacit knowledge
   (p. 1182).

Individual knowledge can be created and/or transferred by each of the four knowledge

conversion modes listed above. Through this transfer of knowledge, individuals capture

knowledge differently based on their previous knowledge and experiences. This transfer of

knowledge provides the team with a collective knowledge, providing a richer source of

knowledge for the organization, supporting the knowledge management process.

Table 2. *Team Systems Within the Knowledge Management Outcomes*

Knowledge Management Outcomes		
Knowledge Creation	Knowledge Creation as a Process	Nonaka, von Krogh & Voelpel (2006)
	Information-Processing Model	Hinsz, Tindale & Vollrath (1997)
	Communication	Salas, Cooke & Rosen (2008)
	Interactions Between & Sharing of Explicit Knowledge	Nonaka, von Krogh & Voelpel (2006)
	SECI Model	Nonaka, von Krogh & Voelpel (2006)
	Four Levels of Knowledge Creation	Nonaka (1994)
	Organizational Structure	Nonaka (1994)
Knowledge Retention	Transactive Memory System	Liang, Moreland & Argote (1995); Gibson (2001)
	Collective Knowledge of Team Members	Gibson (2001)
Knowledge Transfer	General Systems Theory	Swanson & Holton (2001)
	Collective Cognition	Gibson (2001)
	SECI Model	Nonaka, von Krogh & Voelpel (2006)

6. Conclusions

Knowledge management provides a means to capture and store an organization's data while individuals and teams generate the knowledge for the organization - *the organizational intelligence.* Organizations in every arena are striving for new processes, methods, frameworks, and best practices to better understand and leverage their most important human resource – knowledge. Teams are one such strategy that allows companies to successfully leverage human capital and intellect, meeting customer demands in a competitive global environment. This conceptual article identified two areas where teams benefit the organization: teams can be utilized as a sub-process to knowledge management, and teams can effect organizations through knowledge management functions.

The frameworks and theories surrounding teams and knowledge management have many similar benefits and knowledge structures. Nonaka (1994) indicated that the self-organizing nature of teams is essential to the creation of new knowledge in which teams are capable of creating deeper knowledge through more focused investigation and investment. In congruence with this viewpoint, the theoretical model introduced in this manuscript identifies teams as a process for knowledge management providing better utilization of knowledge creation, transfer, and storage.

Practitioners in the field of knowledge management can easily incorporate teams as a first step in creating a knowledge management culture. The advantages of knowledge utilization experienced from teams can be expanded to the larger organization as a systematic process toward implementing knowledge management functions. Some limitations may be experienced through these efforts depending on the type of teams incorporated. For instance, it would be easier to implement a local team where team members are able to function fact-to-face as opposed to a virtual team where team members are forced to communicate across information technology systems.

Future research could focus on transferring knowledge from team to team and from team to department within the knowledge management framework. Does the utilization of teams provide better knowledge creation, transfer, and storage for the organization compared to operating without teams? When viewing teams as a sub-process to knowledge management research could be conducted to identify what outputs are desirable to the process of knowledge management. Once these desired outputs have been identified the appropriate inputs to the sub-process of teams could be explored to determine how to best obtain the desired outputs for the process of knowledge management.

Knowledge management and information systems often ignore the complex and nested nature of team knowledge acquisition and sharing.   Liang et al.'s (1995) study indicated that teams who were trained together recalled more information compared to being trained individually. By training the team together it was believed that teams had the time to develop transactive memory systems, thus improving their information storage and providing better recall of information (Liang et al., 1995). This complex system of team knowledge management can benefit greatly from the capability of information technology systems that leverage the learning and performance complexities of teams. This is a rich area of research that leverages theories and frameworks from knowledge management, information science, human resource development, psychology and management toward the goal of learning and performance innovation for the individual, team, and organization.

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