Determination of Research Readiness

Knowledge Sharing: An empirical study of the role of trust in an organizational setting

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Abstract

This study examines the role that trust plays in facilitating knowledge sharing in organizations. Knowledge sharing is of increasing importance for organizations as knowledge is a key resource and foundation for organizational performance.

The focus of the research is on social networks within knowledge-intensive organizations. One particular type of social network, among others, which this study intends on addressing, is called a Community of Practice. Communities of Practice are of interest because they have been identified in the past as important vehicles for the creation and dissemination of knowledge. Through the use of both survey instruments and observation, the performance of these networks with respect to facilitating knowledge sharing will be investigated. Of particular concern will be the impact of what are referred to as network principles and trust on subsequent knowledge sharing.

It is hoped that this research will provide greater insight into the determinants of knowledge sharing within and between organizations.

Contents

1. Introduction

A fundamental assumption of the knowledge-based view of the firm (Grant, 2002) is the idea that knowledge has market value and is overwhelmingly the most important productive resource for organizations. Also, according to this view (Grant, 2002), knowledge is subject to economies of scale (i.e. initial creation costs are higher than replication costs) and is a necessary resource for the production of goods and services for the marketplace. The central importance of knowledge to production and the creation of value make it an important area of study for researchers in management disciplines including strategy and organizational science. A better understanding of the nature of knowledge, its creation, use, sharing, combination and value facilitate an improved understanding of the functioning of firms in particular, and contemporary developed economies in general. Such an understanding is both valuable in itself and also a potential source of policies leading to the improved performance of firms and the economies within which they are embedded.

A great deal of research in knowledge management (KM) is concerned broadly with epistemological issues relating to how knowledge is acquired and how it may be differentiated from opinion, belief and other related concepts. Though these issues are fundamentally important to explore and explicate for any researcher in KM they are not the focus of this research. This research is concerned with examining knowledge sharing behavior; the lack of which has been identified by Hendricks (1999) as a significant barrier to effective knowledge management. Specifically, the research focuses on exploring the nature and impact of the various factors that have been documented as motivators or inhibitors for knowledge sharing in organizations. Key research concerns include: indentifying these factors, understanding how individuals or organizations influence these factors in order to motivate information and knowledge sharing, and examining how these influencing factors interact (specifically the influence of network structure and social networking principles on trust). Through understanding these determinants of knowledge sharing, as well as their interrelationships, this research hopes to further explicate and potentially make predictions with respect to the knowledge sharing behaviors within organizational social networks, among those, Communities of Practice. Studying these knowledge sharing determinants may also reveal the existence of alternative organizational hierarchies, structures, knowledge sharing processes, or provide useful management advice.

The choice to study members of a Community of Practice (COP) was made for both pragmatic and theoretical reasons. First, COPs are known for being knowledge intensive communities (Wenger, 1998; Wenger, McDermott, and Snyder, 2002; Brown and Duguid, 1991) that create, manage and share their own and company-wide knowledge. Second, COPs are self forming and self regulated (Choo, 2006), which creates an environment where trust takes the place of supervision (Mayer, Davis, and Schoorman, 1998). This self-supervising behavior makes COPs more likely to produce richer trusting relationships than other groups in organizations[1]. COPs are also fundamentally interesting because they provide a mechanism and potentially a vehicle for sharing knowledge. COPs have also been shown to be especially relevant for the sharing of what is termed tacit knowledge the sharing of which, it will be argued, is particularly sensitive to both trust and aspects of network structure. Finally, COPs display multiple social network principles, also of interest to the proposed study. For example, each member of a COP possesses a high

[1] Trust and trusting relationships are key constructs to the proposed research

information yield to the group because they are able to gain access to unique contacts (and information). Together all the members of the COP should be able to produce a much higher information yield (due to their total unique contacts) than other groups in the firm.

The research intends to use Social Network Analysis (SNA) as a methodology to construct network diagrams based on trusting relationships between and across members of the organization. The existence and nature of trusting relationships will be measured using confirmed preexisting instruments (i.e. Mayer and Davis, 1999; McAllister, 1995). Social networking principles (e.g. homophily, closure, brokerage, and small world/six degrees) will be observed and tested in connection with trust in hopes of creating alternative predictors of trust. The research will explore connections between these network principles and trust. The potential discovery of such connections will represent new knowledge in the field. Further, through an understanding of these connections it may be possible to purposely use specific networking principles or structures to positively influence trust within an organization. By directly and positively influencing trust, the organization may be able to positively influence the nature and extent of knowledge sharing within the organization, potentially leading to improved performance.

2. Literature Review

2.1. Data, Information, and Knowledge

Some authors (e.g., Alavi and Leidner, 2001; Earl, 2001) feel comfortable using the terms information and knowledge interchangeably since they argue there is little practicality to making the distinction. This approach tends to arise out of a systems or computer science backgrounds; and though this method may prove to be easier for scientific inquiry (data being easily quantifiable and measurable) it does not reflect significant distinctions that are important to make between data, information and knowledge. This point has been made by many organizational and knowledge management (KM) theorists (Tsoukas 2005a, Boisot 1998, 2002; Choo 1998; Davenport and Prusak 1998; Nonaka, 2002; Nonaka and Takeuchi 1995; Leonard and Sensiper, 2002; Thompson and Walsham, 2004; Huber, 1991).

It may be argued that data, information, and knowledge are three independent concepts that may be considered to be constituent elements of a continuum (Tsoukas, 2005a; Nonaka and Takeuchi, 1995; Nonaka, 2002; Boisot, 1998, 2002; Leonard and Sensiper, 2002). Boisot (1998, p.12) explains the relationship between the three concepts by simply stating, "knowledge builds on information that is extracted from data." Leonard and Sensiper (2002, p. 485) claim that "knowledge is a subset of information." Nonaka and his colleagues (Nonaka and Takeuchi, 1995; Nonaka, 2002) view data, information, and knowledge as active rearrangements of each other: "Information is a flow of messages [or meanings], while knowledge is created by that very flow of information, anchored in the beliefs and commitment of its holder" (Nonaka and Takeuchi, 1995 p.58-9). Nonaka (2002, p. 439) claims that "information is a necessary medium or material for initiating and formalizing knowledge." Huber (1991) and Boisot (2002) imply a similar intellectual framework by referring to knowledge as interpreted information. For example, Boisot (2002, p.72) notes that:

> *…it is never knowledge as such that flows between agents, but rather data from which information has to be extracted and internalized. Only when information has been successfully internalized and forms part of an agent's repertoire of expectations and behaviors can it properly be called knowledge.*

Tsoukas (2005a, p.120) locates the meaning of the terms data, information and knowledge along a continuum, "depending on the extent to which they reflect human involvement with, and processing of, the reality at hand…put simply, data require[s] minimal human judgment, knowledge maximum judgment." Thus, under this interpretation knowledge may be clearly distinguished from data and information. This is the position that will be adopted in this research.

2.1.1. Defining Data and Information

The term *data* is the plural of the Latin *datum* meaning something that is a given or accepted at face value. In information systems terminology, one may think of data as inputs and outputs from a system (numbers, characters, images). According to Boisot, data is 'a discrimination between physical states' (1998, p. 12) which is 'located in the world' (2002, p. 67) and 'can be characterized as a property of things' (1998, p. 12). It is not necessary for data to convey information to agents and two separate agents may interpret the same piece of data as two distinct pieces of information.

Data is often spoken of as being captured, processed, stored, or disseminated. As stated earlier, it is data, as opposed to knowledge, that flows between agents and systems. It is the responsibility of the agent to spot an opportunity or threat based on patterns within that data in combination with their past experience. Extracting the patterns within the data is a creative task of the agent and can be unique for each agent (Boisot, 2002).

Information may be thought of as a 'flow of messages' (Nonaka, 2002, p. 438) that establishes a relationship between things and agents (Boisot, 1998 p. 12). This relationship is best described in Boisot's (1998; see Figure 1) diagram. Boisot (1998) argues that data is inherent to objects and events (things). Agents then use 'perceptual or conceptual filters' to create a subset of these data from the objects and events. Once this subset of data (interpretation) is created within the agent, an established relationship between the two (agent and object) is formed. This established relationship between data source and agent is called information.

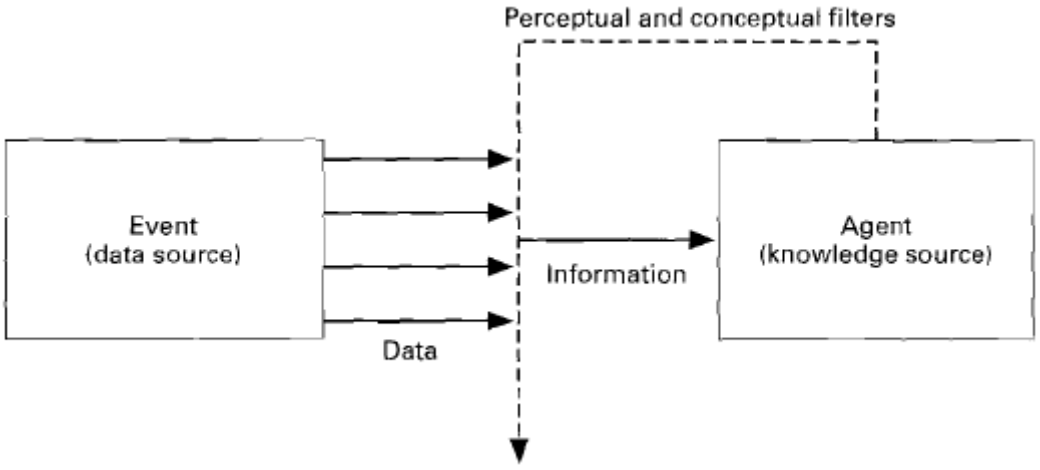

Figure 1: Boisot's Data, Information, and Knowledge Relationship (1998, p. 12)

2.1.2. Defining Knowledge

Using an activity theoretical approach, this research will define **knowledge** as: ***The potential of an activity, situated within a socially constructed domain, bounded by the developmental capacity of an individual.*** Though this definition is not presented in precisely this form by any other authors its components encompass the core ideas of many noted philosophers and organizational theorists.

This research does not attempt to resolve a two thousand year old debate on the definition of knowledge but only to provide a definition suitable and consistent with the rest of the research. This definition encompasses what this researcher feels are the most notable components of knowledge. Every component of the definition was carefully considered and is based on peer-reviewed research. The five important elements expressed in this definition of knowledge are:

1. Knowledge is created, interpreted, disseminated, and displayed through activity
2. Knowledge is situated within a particular domain
3. Knowledge is socially constructed and interpreted
4. Knowledge is personal and bounded by developmental capacity
5. There is a potential to knowledge (i.e. domain, social construction, and developmental capacity are partial determinants of the potential value of knowledge)

Since elaborating on these components is important but outside the immediate scope of this research, a more thorough explanation and justification for this definition is provided in Appendix 1.

Activity
Domain Situation
Social Construction
Developmental Capacity (Personal Ability and Capacity)
Potentiality

Table 1: Knowledge Definition Components
(Discussed in the Appendix)

2.1.3. Addressing Tacit and Explicit Forms of Knowledge

2.1.3.1. Understanding Tacitness

Following Aristotle's notion of practical knowledge, tacit knowledge reveals itself through action or experience (Spender, 1996b; Nonaka, 2002; Leonard and Sensiper, 2002). Tacitness is rooted in the actions of an agent and is revealed to the world through practice or activity (Seely Brown and Duguid, 1998). Using Ryle (1949) one might say that 'knowing how' puts 'knowing that' into practice. In other words, one must have the 'know-how'[2] or tacit knowledge before they may make the knowledge "actionable and operational" (Seely Brown and Duguid, 1998, p.95).

Tacit knowledge is personal and embodied (Nonaka, 2002; Spender 1996b; Polanyi, 1962, 1966). It is this quality which makes the codification (formalization) and dissemination of tacit elements of knowledge difficult (Nonaka, 2002). In Polanyi's (1966, p.4) words, "I shall reconsider human knowledge by starting from the fact that we can know more than we can tell." This is partially true because of the "variety of an individual's experience" (Nonaka, 2002, p. 444). Most tacit knowledge will find "involvement in a specific context" (Nonaka, 2002, p. 439) or closely associate with a particular "social or collective identity" (Spender, 1996b, p.53). If the agent is not associated with the source domain of action, then attaining the tacit knowledge is next to impossible.

According to Nonaka (2002), tacit knowledge involves both technical and cognitive elements. The cognitive elements are working/mental models created by the agent to form an understanding of the world around them. These 'perspectives' consist of: "analogies, schemata, paradigms, beliefs, and viewpoints" (p.439). These perspectives are also difficult to formalize and disseminate since they are developed within particular contexts (domains) and may vary across different domains. The technical element of Nonaka's (2002, p.439) tacit knowledge refers to "concrete know-how, crafts, and skills that apply to specific contexts" and may best be described using the Polanyi's/Tsoukas' concept of subsidiary awareness.

Building on the work of Polanyi[3], Tsoukas (2005b) discusses the concept of subsidiary awareness in respect to the 'know more than we can tell' element of tacit knowledge. Agreeing with Polanyi, Tsoukas (2005b) argues that tacit skills retain opacity and un-specificity in terms of their particulars. Since the practitioner does not know the particulars of the skill, the skill itself cannot be fully accounted or explicated. In other words, the practitioner is able to perform the skill without having theoretical knowledge of the particulars involved. For Tsoukas (2005b, p.158),

> *Tacit knowledge consists of a set of particulars of which we are subsidiarily aware as we focus on something else. Tacit knowing is vectorial: we know the particulars by relying on our awareness of them for attending to something else.*

Perhaps this is best explained through example. Suppose someone is driving in the rain and the car in front of them suddenly brakes, causing them to skid stop. In a classroom that driver might

[2] Particulars need not be apparent
[3] Polanyi's subsidiary awareness is discussed in the Instrumentalization section below

have been told to slightly depress the brakes and steer in the opposite direction of the way the car skids. In the heat of the moment, it is unlikely the driver will recall the theoretical classroom lesson. Instead, the driver would rely on their tacit knowledge of driving under these and other conditions built up in the past. They will also not have to consciously attend to moving their hands on the steering wheel and their foot on the brake. Based on their previous experience, the agent will form a reaction. The reaction will vary based on the past experience the driver has in similar situations. The less experience, the less likely the correct or prudent action occurs.

The previous example transitions nicely into the discussion of how tacit knowledge is developed. According to Polanyi (1962), tacit knowing occurs through a process of unconscious trial and error. This trial and error is a feeling out process, where the agent is improving in success, over time, without specifically knowing (in a theoretical sense) how. For Nonaka (2002) tacit knowing is a continuous activity developed through the communication of individuals in an effort to create mutual understanding. For Choo (2002, p.395), tacit knowing is achieved through, "extended periods of experiencing and doing a task, during which the individual develops a feel for and a capacity to make intuitive judgments about the successful execution of the activity."

Instrumentalization (Tacit Knowledge on Display)

The ability to display the instrumentalization of a tool, what Aristotle (1955) called techne, is one of the few undeniable ways an agent can put their tacit knowledge on display for the world to see. According to Polanyi (1966, p.7), "We can, accordingly, interpret the use of tools, of probes, and of pointers as further instances of the art of knowing." In its most basic form, the instrumentalization of an object/tool simply means to be able to use it properly and un-problematically. Some may consider this the embodiment of a tool; Yuasa (1987, p.25) called this learning with the body (tainin/taitoku); Boisot (2002, p.73) 'learning-by-doing'.

To achieve mastery with any tool, one must first learn to use the tool in its intended, domain specific manner. Polanyi (1962, 1966, and 1975) and Tsoukas (2005b) suggest that this is realized by the agent assimilating and dwelling in the tool (making it feel as if it is an extension of the body). In order to 'dwell' in the tool the agent must be able to focus their attention through the tool onto the focal target. The tool must not be in the agent's focal awareness[4]. Instead it "needs to become an instrument through which we act – of which we are subsidiarily aware" (Tsoukas, 2005b, p149). According to Polanyi (1966, p10), "in an act of tacit knowing we attend from something for attending to something else; namely, from the first term [proximal] to the second term [distal] of the tacit relation." "We are attending from these internal processes to the qualities of things outside, [t]he transposition of bodily experiences into the perception of things outside" (1966, p.14).

Tsoukas (2005b) provides a couple examples to illustrate this point:

> *I have a subsidiary awareness of my holding the hammer in the act of focusing on hitting the nail. In being subsidiarily aware of holding a hammer I see it as having a meaning that is wiped out if I focus my attention on how I hold the hammer. If a pianist shifts her*

[4] To place an object into focal awareness is to make it the object of attention

attention from the piece she is playing to how she moves her fingers; if a speaker focuses his attention on the grammar he is using instead of the act of speaking (p.146)

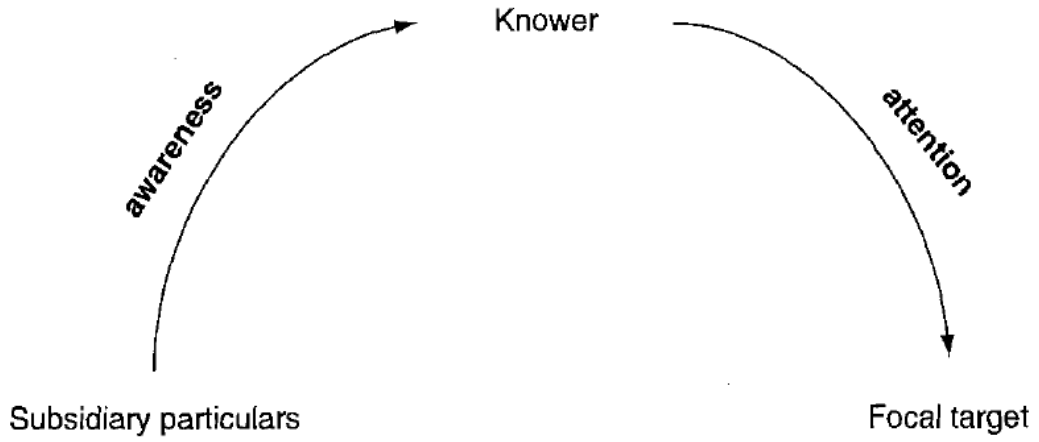

Figure 2: Tsoukas' (2005b) Representation of Polanyi's Personal (Tacit) Knowledge

According to Tsoukas (2005b) tacit knowledge forms a triangular relationship between subsidiary particulars, the knower and the focal target (See Figure 2). By acting (taking action) the knower links the subsidiary particulars to the focal target. "Subsidiary or instrumental knowledge, is not known in itself but is known in terms of something focally known" (Tsoukas, 2005b, p.156). Without the knower, there is no way to integrate subsidiaries to the focal target. Therefore, all tacit knowing is personal and rooted in action[5].

The result of ongoing usage of the tool is twofold. As the agent gains experience using the tool, they become less aware of how to use the tool to achieve optimal results (Tsoukas, 2005a). In addition, the instrumentalization of actions[6] enables the agent to increase 'awareness of the situation he/she encounters' and refine and improve their skill with the tool (Tsoukas, 2005a). In Tsoukas' words, "The ongoing process of transforming experience into subsidiary awareness…allows one to reach ever higher levels of skilful achievement" (Tsoukas, 2005a, p.128).

2.1.3.2. Explicit Knowledge

Explicit knowledge is routinely defined as knowledge that may be expressed formally using some system of symbols or formal systematic language (Choo, 1998, 2000; Nonaka, 2002). Explicit knowledge is understood to exist independently from the human agent who is the knower (De Long and Fahey, 2000). Choo (1998, 2000), further divides explicit knowledge into *object-based* or *rule based.* Object-based explicit knowledge is embedded into artifacts and is usually represented using a string of symbols, or is embodied in the entity itself (Choo, 2000). Some examples given by Choo (2000) include: products, patents, software code, computer databases, technical drawings, tools, prototypes, photographs, voice recordings, and films (p.396). Explicit knowledge is rule-based when it takes the form of rules, routines, or operating

[5] Tacit knowing is personal because it requires the knower. It is action oriented because it requires subsidiaries to be linked to focal targets by the knower (requires the knower to act).
[6] Actions must be purposeful and justified

procedures (Choo, 2000). Other examples of explicit knowledge include: documents, pictures, stories, diagrams and narratives (Seely Brown and Duguid, 2000 p.76).

Synonym	Author
Codified	Nonaka and Takeuchi (1995); Nonaka (2002); Boisot (1995)
Structured	De Long and Fahey (2000)
Encoded (Similar to Object-Based)	Blackler (2002); Thompson and Walsham (2004)
Embedded (Similar to Rule-Based)	Blackler (2002)
Articulated Knowledge	Choo and Bontis (2002)

Table 2: Synonyms of Explicit Knowledge

The formal expression of knowledge into a system of categories and symbols is called codification. According to Boisot (2002, p.68) codification, "refines the categories that the agent invokes or creates so that it can use them efficiently and in discriminating ways. The fewer data an agent has to process to distinguish between categories, the more codified the categories that it has to draw upon." Following a resource-based view of knowledge[7], it is commonly accepted that the more codified something becomes, the easier it is to disseminate without loss of integrity (Boisot, 2002; Nonaka and Takeuchi, 1995; Choo, 1998, 2000; Choo and Bontis, 2002; De Carolis, 2002; Spender, 1994). This is not always true as there may be issues from the receiving party in decoding, comprehending and assessing the value of the new explicit, codified knowledge.

The level to which something can be codified determines its placement on the explicit/tacit knowledge continuum. The problem with this viewpoint is that it assumes all knowledge may continue along an unsubstantiated continuum until the most tacit forms of knowledge become codified. This viewpoint mistakenly considers explicit and tacit knowledge as two opposite entities rather than two interdependent ones necessary in all acts of knowing. Polanyi argues that such encoded forms of knowledge are not knowledge at all; instead they are closer to resembling information or data.

2.1.3.3. Tacit Knowledge cannot be Codified (The myth of purely explicit knowledge)

In the field of knowledge management there is a fundamental divide between those theorists and practitioners who feel that tacit knowledge may be reduced to explicit knowledge and those that feel that both types are necessary and present in all acts of knowing. The former school of thought is more consistent with an information systems perspective that reduces all knowledge to that which has been codified and that which has yet to be codified. This school believes that knowledge can be dragged along a supposititious continuum from tacit to explicit and back. In other words, that all knowledge (including tacit) may be reduced or articulated to an explicit or codified form.

[7] A Resource-based view of knowledge views knowledge as an objective transferable commodity

Polanyi (1962) argued that tacit knowledge cannot be reduced to the explicit. Tsoukas (2005ab) added that tacit knowledge may also not be converted, captured, or translated, but merely put on display. This is true for a number of reasons but the first is simply because some dimensions of knowledge can never become fully explicated (Leonard and Sensiper, 2002; Boisot, 2002). This is what Polanyi (1962) referred to when he said, 'we know more than we can tell'. The reality is that agents often know more than they even realize they know, making it impossible for the knower to fully articulate what is known. Any attempt to codify the tacit knowledge will ultimately result in an incomplete representation since some of the knowledge stays with the knower (Boisot, 2002). As Duguid (2005. p.114) puts it, "codification is remarkably powerful, but its power is only released through the corresponding knowing how, which explains how we get to know and learn to do." Further difficulties arise once the knower makes an attempt to communicate their tacit knowledge to another agent, as they will realize that they may not fully articulate it because part of it remained tacit (De Carolis, 2002). This factor will be referred to as the *articulation coefficient*.

In his discussion of tacit and codified knowledge, Polanyi (1962, p.17) referred to what he called a 'personal coefficient'. By this, Polanyi meant that all codified knowledge requires the skill of a knower before it can be put into practice. This means that, "even the most theoretical form of knowledge, such as pure mathematics, cannot be a completely formalized system, since it is based for its application and development on the skills of mathematicians and how such skills are used in practice" (Tsoukas, 2005b, p.142). Duguid (2005, p.111) makes a similar case arguing, "while knowledge may include codified content, to be used it requires the disposition to apply it." In other words, to know requires both knowing how something is done and how to do it (which in most cases resides only in the agent). In Blackler's (2002, p.53) words codified knowledge, "require[s] operators to interpret the selective, de-contextualized and abstract symbols that machines [and other codified sources] present to them." This factor will be referred to as the *personal coefficient*.

Polanyi (1962, p.50) and Tsoukas (2005b, p.155) further point out that rules of art do not determine the practice of an art. Rather, rules are only maxims that serve as a guide to an art only if they can be integrated into practical knowledge. In other words, it is necessary for the agent to be able to understand and 're-attach' the information (codified/objectified knowledge) found in databases or books, for instance, in order to put the knowledge into practice. If the agent does not understand the domain or context of the explicated knowledge then they can make no valuable use of it. In the words of De Long and Fahey (2000, p.115),

> *[Codified] resources, no matter how highly analyzed, only become practical knowledge when individuals can apply their own experience and contextual understanding to interpret the details and implications for action.*

Choo and Bontis (2002, p.12) rephrase,

> *The application of explicit knowledge often requires individuals who can interpret, elaborate, demonstrate, or instantiate the formal knowledge with respect to a particular problem setting.*

In this case, documents are not knowledge but rather just documents until context specific meaning is generated within the knower using them (Thompson and Walsham, 2004). This factor, which can be called the *contextual coefficient*, closely relates to the personal coefficient discussed previously since an agent is always necessary to attach meaning and appropriately apply the information to a context specific problem or process.

In the way that objectified or explicit knowledge is used above, one may question whether or not codified forms of knowledge may even be considered knowledge. Once an attempt is made to codify human knowledge then one may argue that the resulting artifact is not knowledge at all, but rather information or data. Since human knowledge may not be fully articulated, requires the knower to interpret, and has a relevant context, it can be said that the resulting explicated symbols are closer to cues than individual pieces of knowledge. Further, the resulting articulated form makes no guarantee that it will be found, properly used, or internalized by the interacting agent (Boisot, 2002).

The opinion of this researcher is that explicated forms of tacit knowledge represent nothing more than glorified pieces of data or information. These artifacts are merely a tool in the knowing process, since even the most explicit forms of 'knowledge' are underlain by tacit knowledge and require the knower to interpret an appropriate context (Tsoukas, 2005b).

The two forms of knowledge are not in opposition (Tsoukas, 2005b) nor are they alternative forms of knowing (Spender, 1996b), but rather they complement each other in the knowing process. As Tsoukas (2005b, p.158) put it, "two sides of the same coin". Neither can exist without the other. Explicated artifacts act as guiding lights in providing meaning and interpretation to a tacit activity. "Uncodified knowledge provides background context and warrants for assessing the codified. Background no longer works as background when it is foregrounded." (Duguid, 2005 p.112).Using Ryle (1949) we may say that *knowing how* helps to make *knowing that* actionable. Getting more 'know that' (explicit, codified information) will not lead to 'know how' which is traditionally generated through practice (Duguid, 2005). Other methods to 'articulate' tacit knowledge are to put it on display (Tsoukas, 2005b) or allude to it (Choo, 2000). Choo (2000, p.396) proposes that tacit knowledge may be, "revealed through rich modes of discourse that include the use of analogies, metaphors or models, and through the communal sharing of stories. Other methods are discussed in the following sections.

2.2. Knowledge Sharing Definition

In a strict and literal sense knowledge cannot be shared; in that it is not like a commodity which can be freely passed around (Hendricks, 1999). Instead, knowledge sharing is a *process* involving at least two actors which has no identifiable starting or ending point (Boer, van Baalen and Kumar, 2002). The knowledge shared between the two interacting parties will have a unique meaning specific to the context of those actors (Boer, van Baalen and Kumar, 2002). The first actor or *knowledge owner* begins the knowledge sharing process through an act of *externalization*, which may or may not be a conscious act. The second actor then conducts an act of *internalization* to absorb the new stimulus (Hendricks, 1999). Davenport and Prusak's (1998) reflect this perspective in their formula for *transfer* which states: Transfer = Transmission + Absorption.

Perhaps the best way to understand the externalization and internalization process is to look at Boisot's (2002) concept of resonance or Fiol's (1994) idea of common understanding. Boisot, (2002) argued that knowledge sharing is no more than, "some degree of resonance being achieved between the knowledge states of two or more agents following some sharing of data among them" (p.68). The knowledge sharing between actors is always unique because the activation patterns of different actors will vary in resonation based on complexity.

In addition to resonance, an act of reconstruction is needed in order for knowledge to be shared. This reconstruction is motivated by the exchange of data (Boisot, 2002), information (Boer, van Baalen and Kumar, 2002; Coleman, 1988; Duguid, 2005), ideas, suggestions (Bartol and Srivastava, 2002) or through practice and observation (Hendricks, 1999). The receiving actor then reconstructs this data or information in order to facilitate action (Duguid, 2005). The level of success in the reconstruction may be viewed as degree of resonance.

2.3. Knowledge Sharing Factors

"[T]he factors that motivate people to codify and share knowledge for the benefit of others have been identified as a priority area for knowledge research" (Hall 2001, p. 277)

In order to construct a theoretical framework to understand the landscape of knowledge sharing factors (motivators and inhibitors), a literature scan was conducted. The literature surveyed produced knowledge sharing factors from three distinctly different bodies of literature. First, factors were identified by examining the philosophical or theoretical literature in which authors adopted a more metaphysical approach. Second, factors were identified through examining literature which addressed methodological research, and provided quantitative or qualitative support for their factors. A third body of literature surveyed included management or information journals which identified factors specifically from an organizational or managerial perspective. In most cases the last source was accompanied with suggestions, guidelines, and frameworks but contained little or no quantitative or qualitative proof.

In order to include many of the proceeding factors, two important assumptions had to be made:

1. An explicit definition of knowledge need not be stated in the work
2. If a definition for knowledge is provided it need not be universal

These two assumptions are vital, since including only those works in which the authors explicitly state and agree upon a definition for knowledge would produce only scattered and disconnected results. Applying these assumptions provides a rich web of factors derived from numerous perspectives, providing the reader a more thorough understanding of the landscape.

The organization of the factors into a framework is inspired by a paradigm arising from a passing statement suggested by Duguid (2005, p. 115) in his discussion of Community of Practice analysis. The statement suggests that there is a distinction between a person's willingness to share and their ability to do so. Based on this, factors will be classified into two main subgroups:

Classes of Motivators and Inhibitors to Knowledge Sharing

1. **Willingness Factors**: those factors relating to a person's *willingness* to share
    - A factor leading to a intellectual or emotionally-based voluntary constraint on sharing
    - i.e. the person will or will not share
2. **Ability Factors:** those factors relating to a person's *ability* to share
    - An involuntary constraint on sharing
    - i.e. the person can or cannot share

2.3.1. Willingness Factors

Duguid (2005) refers to **willingness factors** as *voluntary constraints on sharing*. He further states that, "these voluntary constraints on sharing can be thought of as the ethical entailments of practice. These entailments distinguish the 'can/can't' of knowledge flow from the 'will/won't'" (Duguid 2005; p.113). The willingness factors discussed below will be further classified into four subgroups: Ego; Motivation; Affect; and Organizational Trust.

2.3.1.1. Ego Driven

The first sub-grouping of willingness factors will be referred to here as *ego*. This paper will take a non-psychoanalytic view where ego manifests itself through a feeling of increased or inflated pride in an individual. *Ego* may be displayed through increased feelings of self respect, personal worth, or satisfaction in one's achievements (recognized by the individual, the group, or the organization). In the knowledge sharing literature numerous factors are mentioned that may be classified as *ego-driven* factors; these include discussions of *power/status*; *extrinsic* and *intrinsic (recognition*, *sense of achievement*, *enhanced team environment*) *rewards;* and *group bias*. A brief discussion of each is discussed below.

Power/Status

Organizational members constantly compete for promotions or raises. Members also feel that their knowledge in the organization comprises their trade value, which when shared somehow deteriorates (Husted and Michhailova, 2002). Such opinions and behaviors reiterate the belief that knowledge is power (Goman, 2002; Boisot, 2002) and unfortunately inhibit knowledge dissemination.

The connection between power and knowledge hoarding has been well documented. For example, the work of French and Raven, (1959) identified expertise (knowledge) as a source of power and further found that when this expertise (knowledge) was disclosed the action could result in an erosion of the discloser's individual power. Szulanski (1995) describes a similar phenomenon but refers to it as a fear of losing a 'position of privilege' or what Bartol and Srivastava, (2002) call 'superiority'. In his study Von Krogh (1998) found that sharing more knowledge than necessary led to reduced power and influence. In a survey of organizational members, Fraser, Marcella and Middleton (2000) found that only slightly more than half the people questioned felt that knowledge resulted in power within the workplace (51.1%). Interestingly though, as the authors sub grouped occupations they found that there was more discretion in higher occupational positions (54.7% in higher positions and 45.9% in lower groupings). Shockingly, when the authors segregated the results by sex they found that twice as many men felt that knowledge meant power in the workplace than women. This decrease in

power better explains an individual's reluctance to share with others (Bartol and Srivastava, 2002) but is only one of the ego-driven willingness factors.

A closely related willingness factor to power is inequality of status between interacting/sharing members (De Long and Fahey, 2000; Leonard and Sensiper, 2002). Traditional communication channels in an organization generally follow a model where instructions flow downward and information flows upward. Organizational members operating under such a model are reluctant to share in a way that violates the model (Hinds and Pfeffer, 2003). Members may also hoard because they might feel that their superiors would react negatively if they appeared more knowledgeable then them and they may simply be afraid of a negative response or the consequence of putting their knowledge on display (Husted and Michhailova, 2002). A good example of the latter where status influenced knowledge sharing may be seen in the research on nurses and doctors (Leonard and Sensiper, 2002) or on nurses and surgeons (Edmondson, Bohmer and Pisano, 2000). The former research seems to be consistent with survey results (Fraser, Marcella and Middleton, 2000) where 98.2% of respondents who held a higher position (managers and administrators) stated that they would be willing to share their knowledge with colleagues compared to 90.9% of those holding a lower position. Though there is virtually no way to avoid status inequality, the best strategy to avoid status driven hoarding is to deemphasize status distinctions within the organization (Hinds and Pfeffer, 2003).

Rewards

Knowledge management is highly dependent upon the contributions of individuals within the firm. Therefore, participation in knowledge sharing behaviors must be encouraged, facilitated, and rewarded. In some cases, not being adequately rewarded for sharing behavior directly leads to knowledge hoarding behavior (Szulanski, 1995, 1996; Bartol and Srivastava, 2002). In order to prevent hoarding, organizations must find ways to reinforce and reward knowledge sharing (Goman, 2002). This organizational recognition may take the form of monetary (extrinsic) or nonmonetary (intrinsic) rewards (Bartol and Srivastiva, 2002). Extrinsic rewards offer a tangible or economic benefit for the employee. Examples of extrinsic rewards may include higher pay, stock or partnership options, skill based pay systems, career advancement, a bonus or even access to privileged information and knowledge (Hall, 2001). Buckman Laboratories rewards its top sharers with an annual conference at a resort (Bartol and Srivastiva, 2002). Lotus Development (a division of IBM) (Davenport, 2002), Ernst and Young (Stevens, 2000), McKinsey and Andersen Consulting (Hall, 2001) base their performance evaluation and pay decisions on their employees knowledge sharing activities.

Intrinsic rewards are not quite so tangible and may include recognition, sense of achievement, or enhanced team environments. Rewards may be given on individual or team levels, but in order to have effect there must be a perception by the receiver(s) of procedural and distributive fairness (Bartol and Srivastiva, 2002).

Though popular, monetary rewards (extrinsic motivation) have hidden costs. Introduced as the corruption effect of extrinsic motivation (Deci, 1975) this phenomenon later became known in economics (Frey, 1997) as ‘crowding out’. Crowding out occurs when rewards are given to subjects for completing a task (ex. a child rewarded for doing homework). In the short run, the measure will be successful, but in the long run the subject will no longer do the task properly

without extrinsic motivation (ex. child will only do homework when rewarded). In extreme cases the subject will stop doing other tasks, unless they are rewarded for those as well. Osterloh and Frey (2000, p.542), summarize crowding out as; "When the use of the price system in the firm crowds out intrinsic motivation, the proclivity toward opportunistic behavior increases. In the extreme case, there is no intrinsic motivation left." Empirical evidence of the crowding out effect supports this theory with over 115 studies being conducted by three research projects from 1971 to 1995 (Rummel and Feinberg, 1988; Wiersma, 1992; and Tang and Hall, 1995).

These findings along with prevailing motivation theories suggest that using only extrinsic motivation is not an effective way to encourage knowledge sharing. Even though the quantity of knowledge sharing may perhaps be enhanced with extrinsic reward, its quality and longevity cannot (Hendricks, 1999). According to Davenport and Prusak (1998), the most successful companies combine extrinsic rewards with intrinsic rewards such as status or organizational recognition. Other authors give similar advice about aligning monetary incentives and more informal intrinsic motivators such as recognition (Szulanski, 1996; Hinds and Pfeffer, 2003; Husted and Michhailova, 2002; McDermott and O'Dell, 2001). Aligning the two types of rewards stresses the importance of sharing knowledge and makes that importance visible in the firm (McDermott and O'Dell, 2001). Organizational members might now be motivated to share for numerous reasons, including a hope for recognition or appreciation along with traditional formal financial rewards (Hendricks, 1999). Not all employees are motivated extrinsically as the Eurika system employees proved when they chose reputation-based rewards over financial ones (Husted and Michhailova, 2002).

An employee may also be intrinsically motivated through a *sense of achievement*. In this case, the reward comes in the form of personal satisfaction (Hall, 2001). The incentive system is in the work itself (Osterloh and Frey, 2000). It is the job of the organization to make the work challenging, satisfactory, and fulfilling for the employee. Intrinsic motivation to share knowledge may also come in the form of an *enhanced team environment.* Osterloh and Frey (2000) argue that this form of motivation raises self determination and builds psychological contracts (team spirit) between members; increasing knowledge flow. In their study, Fraser, Marcella and Middleton (2000) found that an enhanced team environment is one of the main motivators for knowledge sharing and the authors argue that the two are closely interrelated. Though no one reward technique is guaranteed to work, it is imperative for employees to understand the importance of knowledge sharing activities, and be encouraged to share. The best method is perhaps a combination of intrinsic and extrinsic motivation which does not cause a crowding effect.

Group Bias: Not Invented Here (NIH)

Following social identity theory, it can be argued that an individual's desire for positive self-evaluation leads them to have an in-group bias; where they attribute positive characteristics to their own group and negative characteristics to the those groups outside theirs (Abrams and Hogg, 1990). Argote (1999) argues that organizations contribute to this bias by distinguishing groups by name and publicizing or rewarding their performance. Doing so creates an environment where there is higher group identity and therefore higher intergroup competition, which impairs knowledge transfer across groups. Szulanski (1996) and Husted and Michhailova, (2002) call this type of willingness factor the 'not invented here' or NIH syndrome.

The 'Not invented here' syndrome is simply the resistance towards using knowledge created outside of your focal group. Reasons for this behavior generally fall in one of four categories (Husted and Michhailova, 2002). The first is a partiality for coming up with and using the groups own knowledge, which appears more prestigious. The second is a questioning of validity and reliability of the outside knowledge, which is fundamentally an issue of affect and trust. The third is a strong group affiliation, which can be the result of using rewards (both intrinsic and extrinsic). The last reason the authors (Husted and Michhailova, 2002) provide is 'group thinking' but other group decision psychological bias should also be considered under this category (i.e. group polarization, common-knowledge effect, etc.)

2.3.1.2. Motivation

Motivation has already been alluded to in the *rewards* section above as an *ego-driven* willingness factor. And even though it may be classified as such, it has been segregated as its own willingness factor because the body of literature and research is significantly different. Also, being motivated to do a task does not necessarily relate to being rewarded to do as such, even intrinsically. Though it is true that employees should be motivated to perform in a coordinated and goal-oriented way, what appears to lead them to do as such can differ significantly. As does the approach or methodology used to understand the problem.

Motivation theory may be studied using a content (needs) theory approach (i.e. Maslow, McGregor, Vroom, or Herzberg) that presents numerous individual motivation factors. An example of such a theory is Herzberg's (1968) Two Factor Theory which distinguishes between motivation and hygiene factors. Motivation theory may also be studied from a process-based approach which, "treats motivation as a process, and aims to identify how individuals will or should act to identify what their motivators are and to achieve the goals associated with these motivators" (Hendricks, 1999 p. 95).

In respect to knowledge sharing factors, what is important to remember is that intrinsic motivation is difficult to analyze and control (Osterloh and Frey, 2000). Intrinsic motivation is also challenging to change and the outcomes are more uncertain; sometimes even ending in undesirable results (Osterloh and Frey, 2000). Also, the lack of motivation may lead to 'the rejection in the implementation and use of new knowledge' (Szulanski, 2000).

2.3.1.3. Affective Response / Emotional Disagreement

For this category of willingness factors a special distinction must be made. As opposed to a voluntary constraint on sharing which is intellectually and rationally motivated (i.e. not being adequately rewarded for sharing or intellectually assessing that outside knowledge is inadequate) an *affective response* represents a voluntary constraint on sharing (willingness factor) which is emotionally (rather than intellectually) driven. In the knowledge management literature, this affective response traditionally manifests itself as a fear or a feeling of anxiety. These feelings might be motivated by a fear of failing (Leonard and Sensiper, 2002), of looking stupid, of being intimidated (De Long and Fahey, 2000), or perhaps even a fear of losing one's job if they shared what they know (Hall, 2001). Survey results (Fraser, Marcella and Middleton, 2000) suggest that there is little fear of sharing knowledge between colleagues but it is difficult to determine irrefutably how someone is triggered emotionally, and has been the focus of emotional

intelligence researchers for over 3 decades. For the purpose of this research there will be three classes of reasons for emotional disagreement; *integrity*, *reciprocity* and *misuse*. These three classes were selected because they were the most commonly mentioned in the literature reviewed, which specifically referred to an emotional vs. intellectual response.

Integrity, in this context, refers to the integrity of the information or knowledge one is absorbing or transmitting. According to Roberts and O'Reilly (1974, p. 212), "a subordinate's processing of received information is affected by his feelings about accuracy, not on an objective measure of accuracy". An employee may also be emotionally concerned over the integrity of their own work. By hoarding, employees display an avoidance of exposure (Husted and Michhailova, 2002) which tends to be the norm in competitive environments where insights and opinions are criticized or ignored. Employees avoid exposing their mistakes to colleagues in an effort to prevent career damage. When people are left fearful of getting 'punished' the result is further withdrawal (Goman, 2002) considering a person cannot be accused of making a mistake if they do not contribute. Affectively driven issues with integrity also contribute to an increased 'level of hostility' toward knowledge sharing at individual, group and organizational levels (Husted and Michhailova, 2002).

The second reason for emotional disagreement highlighted in this research is *reciprocity.* One's willingness to share anything usually depends on a feeling of reciprocity (Hall, 2001) or an assessment of how others will contribute knowledge back to them which is just as useful as the knowledge they contributed (Hendricks, 1999; Fraser, Marcella and Middleton, 2000). Though at times this measure may be quantified, when one makes the initial decision to share (not motivated by reciprocal obligation) they make an assessment of whether or not (and how) the person, group, or organization they are sharing with will reciprocate. This decision is motivated by both an affective response as well as an assessment of trust (see section 2.3.1.4.). In other words, a person's willingness to share their knowledge partially depends on an emotional assessment of reciprocity. Reciprocity, including the work of Coleman (1988), Burt (1992), and Obstfeld (2005) is discussed in more detail in section 2.3.2.4.

The third reason for emotional disagreement highlighted is *information misuse.* Information misuse represents an affective response triggered by an emotional assessment of how the information or knowledge will be used once it is shared. One example of this behavior might be not sharing for fear of losing ownership of the knowledge (Szulanski, 1995, 1996), or perhaps even worse, losing a position of privilege or superiority due to loss of ownership (Szulanski, 1996; Bartol and Srivastava, 2002). One might also fear hosting what Husted and Michhailova (2002) call 'knowledge parasites'. In her research study of Lotus Notes, Orlikowski (1993) witnessed that employees were reluctant to share information because they were afraid that the information would be used against them. Orlikowski's (1993) study nicely demonstrates an affectively driven *information misuse* reaction since the users had little to no rational intellectual reason to feel the information would be used that way.

The reality is that the aforementioned three reasons for emotionally driven knowledge hoarding only represent a small window into affective response willingness factors and much of this research is taking place outside knowledge management in fields like Organizational Behavior and Psychology, with studies in motivation, group decision making, or emotional intelligence.

This research does acknowledge that it is difficult to separate emotional from intellectual disagreements and many of the willingness factors discussed may in fact be triggered by both to a certain degree. Nevertheless, the inclusion of affectively driven factors as influencing knowledge sharing should not be ignored.

2.3.1.4. Organizational Trust

Understanding Organizational Trust

Prior to discussing the literature pointing to trust as a factor influencing knowledge sharing, it is important to understand the concept of trust as it applies in an organizational setting. In order to understand organizational trust one must first grasp the factors underlying why a trustor would trust a trustee. To do this Mayer, Davis, and Schoorman's (1995) model of organizational trust will be used (See Figure 3). Mayer et al. (1995) define trust as,

> *[T]he willingness of a party to be vulnerable[8] to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party. (p. 712)*

Mayer et al. (1995) further argue that it is individual traits or characteristics of the trusting parties which determine the level of trust that may be achieved between them. For instance, in order for a trustor to exhibit trust toward a trustee, the trustor must first have the 'propensity to trust[9]' (p.715) that particular trustee. In return the trustee must have *ability[10], benevolence[11], and integrity*[12] which together help the trustor determine the trustee's *trustworthiness*. Ability, benevolence, and integrity are all important factors for trust, yet each can vary independently. If all three are perceived as high by the trustor then the trustee is deemed trustworthy. It is also important to note that trustworthiness is a continuous variable. As the three characteristics vary, the level of trustworthiness can be said to move along a continuum. The extent to which one person is willing to trust another is determined by both the trustor's 'propensity to trust' as well as the trustor's overall judgment of the trustee's ability, benevolence, and integrity.

[8] Making oneself vulnerable implies something important may be lost. Trust is the willingness to take a risk. The level of trust directly relates to the level of perceived risk (Mayer, Davis and Schoorman, 1995; Zaheer, McEvily and Perrone, 1998)

[9] Propensity is defined as "the general willingness to trust others" (Mayer, Davis and Schoorman, 1995, p. 715)

[10] Ability is defined as the skills, competencies, and characteristics necessary to have influence in a specific domain. (Mayer, Davis and Schoorman, 1995, p. 717)

[11] Benevolence is defined as the extent to which a trustor believes the trustee wants to do good to the trustor. Act in a way that is not egocentric. (Mayer, Davis and Schoorman, 1995, p. 718)

[12] Integrity is determined by the trustor by making an assessment as to whether or not the trustee will adhere to an acceptable (to the trustor) set of principles. (Mayer, Davis and Schoorman, 1995, p. 719)

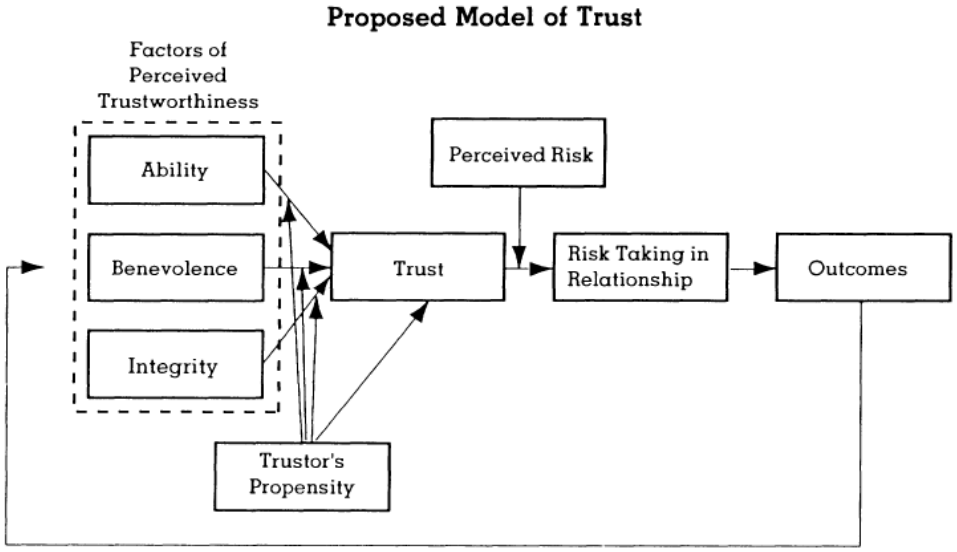

Figure 3: Mayer, Davis and Schoorman (1995) Proposed Model of Trust

Mayer et al.'s (1995) model is appropriate for use in this research because it is specifically formulated for use within an organizational setting. The only significant concern with this model is that it only considers an interpersonal dyadic (trustor/trustee) relationship and does not allow for an actor to treat a collective entity such as an organization as an object of trust[13]. To correct for this, a secondary model developed by Zaheer, McEvily and Perrone (1998) will be added (See Figure 4). The latter model allows for an actor to have interpersonal trust for another actor and inter-organizational trust for a collective entity (the supplier organization in Figure 4). In the case of inter-organizational trust, trust created by the actor is unidirectional since the collective entity may not exhibit trusting behavior. In the case of two agents (interpersonal trust), the perceived trust of one agent on the other may be reciprocated.

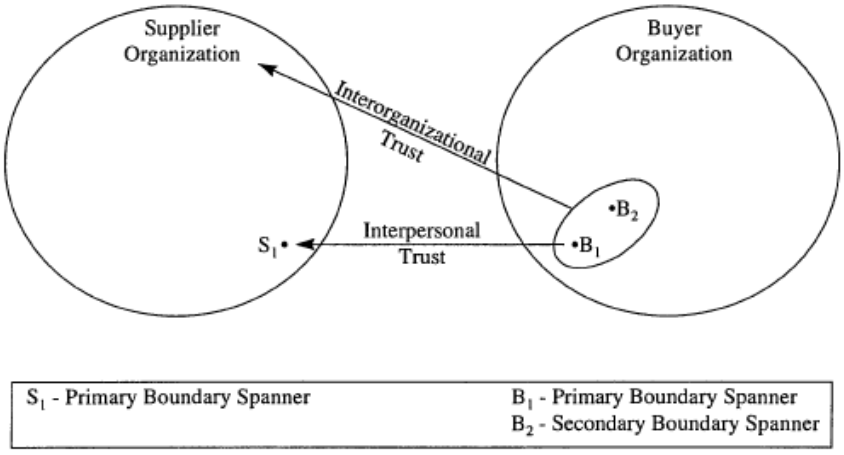

Figure 4: McEvily, Perrone and Zaheer's (1998) Inter-organizational and Interpersonal Trust Model

[13] Though a collective entity may be an object of trust it may not be the source of trust (McEvily, Perrone and Zaheer, 1998; McEvily, 2007)

Trust as a Willingness Factor

With respect to trust as a factor influencing information and knowledge sharing, the literature is quite consistent, though not always thorough. Trust has been said to influence an individual's desire to share information and ideas (Davenport and Prusak, 1998; Empson, 2001; McDermott and O'Dell, 2001; Husted and Michhailova, 2002; Hendricks, 1999; and Hinds and Pfeffer, 2003) or what Szulanski (1995; 1996) calls a desire to 'initiate a transfer'. Additionally, trust influences the timeliness of access to information, knowledge or referrals (Burt, 1992), as well as the extent of knowledge available (DeLong and Fahey, 2000; Husted and Michhailova, 2002). Trust and trustworthiness have also been associated with a decrease in efforts needed for information search and processing (Zaheer, McEvily, and Perrone, 1998); a decrease in information monitoring and safeguarding behaviors (Zaheer, McEvily, and Perrone, 1998; Roberts and O'Reily, 1974; Husted and Michhailova, 2002; and Orlikowski, 1993); an enhanced ability to draw distinctions and make decisions (Tsoukas, 2005ab; Roberts and O'Reily, 1974); and it is a core necessity in initiating and sustaining a collaborating organizational culture (Goman, 2002).

Trust is a fundamental concept in this research and will be discussed in richer detail below in the *Research Framework* section.

2.3.2. Ability Factors

As opposed to willingness factors, ability factors are *involuntary constraints on sharing*. According to Duguid (2005; p.113), "There are difficulties around what knowledge people *can* meaningfully share. Such involuntary barriers to sharing might be thought of as epistemic entailments of practice." Or the 'can/can't' of knowledge flow vs. the 'will/won't'. The distinction between the two types of factors is in a person's ability to act.

The ability factors discussed below will be further classified into four subgroups: Domain/Context; Tacitness and Expertise; Organizational Culture and Structure; and Network Structure.

2.3.2.1. Domain/Context

In the definition of knowledge given earlier, one of the key components was domain specificity or context. Knowledge is highly contextual and circumstantial (Goman, 2002). Knowledge is always developed in a specific context and is rarely interpreted by the receiver in the exact way it was intended by the transmitter (Husted and Michhailova, 2002). One of the key problems is representing the context in which knowledge was created and is relevant (Choo, 2000). It is this factor that makes transferring knowledge problematic (Brown and Duguid, 1991; Kogut and Zander, 1992; Empson, 2001).

Common reasons for contextual mismatches include differences in mental or conceptual frameworks, social distance, or culture and language (Hendricks, 1999). Knowledge is easier to transfer when it is rooted in the domain and practice of the individuals participating in the transfer (Brown and Duguid, 1998). This point was also made by Nonaka (2002, p. 442) about information when he argued; "The mere transfer of information will often make little sense if it is abstracted from embedded emotions and nuanced contexts that are associated with shared experiences." In order for knowledge to be shared the receiver and transmitter must have a

shared contextual base. The receiver must possess what Swap, Leonard, Shields, and Abrams (2001) call a "hook" or "receptor" which assimilates the information provided by the transmitter.

From an individual perspective, always having a contextual base to match the types of knowledge one might encounter is not a voluntary decision, and in many cases (as witnessed in the next section) requires a great deal of time and effort or is simply impossible. For this reason, context or domain may be considered the first involuntary ability factor influencing knowledge sharing.

2.3.2.2. Tacitness and Expertise

As discussed earlier, tacitness represents an indefinable portion of knowledge which is embedded in human skills (Polanyi, 1962; 1966). This tacit element of knowledge is also difficult to articulate (Nonaka and Takeuchi, 1995; Polanyi, 1966; Empson, 2001; Hinds and Pfeffer, 2003; Leonard and Sensiper, 2002) which makes it complicated to share or transfer. As an example, in their study, Epple, Argote and Murphy (1996) found that employees were having difficulty explaining how to hand toss a pizza because the knowledge was tacit in nature and required expertise.

Expertise[14] and tacitness are often discussed in conjuncture, and for good reason. As expertise increases, representations of a task become more abstract, conceptual, and surprisingly simplified, allowing the expert to process the information more rapidly (Hinds and Pfeffer, 2003). Unfortunately, these simplified representations make it difficult to access the expertise on a concrete level and articulate it in a way that someone with less expertise will understand (Hinds, Patterson, and Pfeffer, 2001; Hinds and Pfeffer, 2003) even if the expert is willing to share. It is this cognitive limitation which makes tacitness the second involuntary ability factor influencing knowledge sharing.

With respect to motivating the transfer of tacit knowledge; the literature review is robust, identifying a number of ways to assist in this transfer. One of these ways is to allow novices (knowledge receivers) to have numerous opportunities to work alongside experts (knowledge possessor/originator) through mentoring of apprenticeships programs, so that they may absorb the knowledge informally and unconsciously (Bartol and Srivastava, 2002; Swap, Leonard, Shields, and Abrams, 2001). Sharing tacit knowledge requires numerous exchanges and continuous practice (Nonaka, 2002) and should not be motivated by market mechanisms (Osterioh and Frey, 2000). Other notable methods for motivating tacit knowledge transfer include metaphors, models, analogies and stories. A short summary of these follows.

<u>Mentoring / Apprenticeship</u>

Two of the most common ways to transfer tacit knowledge are apprenticeships and mentoring (Choo, 1998). Through observation, imitation, and practice (Choo, 2000; Nonaka, 2002) the apprentice picks up as Polanyi (1962, p.53) puts it 'the rules of the art'. Tsoukas (2005b) explains further:

[14] Drawing on their experience, experts are able to recognize patterns, integrate them with information about the current context, and extrapolate from the patterns to anticipate the consequences of various alternative actions. *Expertise* may take 10 years or more of experience and practice to develop. (Leonard and Sensiper, 2002 p. 498)

> *[W]e learn to engage in practical activities through our participation in social practices, under the guidance of people who are more experienced than us (Maclntyre 1985: 181-203; Taylor, 1993); people who, by drawing our attention to certain things, make us 'see connections' (Wittgenstein 1958: no. 122; see also Shotter 2005) (p. 157)*

In organizational settings the mentor acts as an informal teacher; providing access to privileged information, familiarizing the protégé with the domain and non-formal aspects of the organization, as well as normative information such as norms and values (Swap, Leonard, Shields and Abrams, 2001). Over time and through continuous interactions, tacit knowledge is transferred from the mentor to the apprentice in numerous forms including; skills, norms, values, and assumptions (Leonard and Sensiper, 2002). A helpful example of this type of transfer may be seen in the work of Nonaka and Takeuchi (1995). The authors describe Tanaka who apprenticed herself with the head baker of the Osaka International Hotel and through observation and imitation was able to learn the 'art of kneading'.

Metaphors, Models, Analogies and Stories

Tacit knowledge can also be shared through analogies, metaphors, models, and stories (Choo, 1998; Nonaka, 2002; Swap, Leonard, Shields and Abrams, 2001). According to Nonaka (2002, p. 444), a metaphor is an important method of networking concepts and 'associating abstract imaginary concepts'. Analogies reduce "ambiguity by highlighting the commonness of two different things" (Nonaka, 2002, p. 444). Stories detail narratives of past organizational actions, employee interactions, and events. Stories are powerful tools for transferring tacit knowledge are often used to reflect organizational norms, values, and culture (Swap, Leonard, Shields and Abrams, 2001). Metaphors, analogies, and models are also valuable in motivating the transfer of tacit elements of knowledge as they construct vivid, elaborated images.

2.3.2.3. Organizational Culture, Structure, and Processes

Regardless of the tacitness of knowledge, its transfer may still be hindered or impossible if the organization's culture, structure or business processes do not allow for it. In their study of 50 companies involved in knowledge management projects, De Long, and Fahey (2000) found organizational culture to be, "the major barrier to creating and leveraging knowledge assets" (p.113). Other authors have similar findings and conclusions to those found in the survey about culture (Hargadon, 1998; Fraser, Marcella, and Middleton, 2000; Davenport and Prusak, 1998; Hendricks, 1999; Choo 1998, 2006; Nonaka and Takeuchi, 1995)

DeLong, and Fahey (2000) argue that organizational culture is reflected in values, norms, and practices. The three vary in their transparency with practices being the most transparent and values the least. "Values are manifested in norms that, in turn, shape specific practices." (p. 116) Organizational culture, through its rules and practices, determines the atmosphere within which people exchange and shapes the social exchange context [see Figure 5](DeLong, and Fahey, 2000). When this is done properly it facilitates the creation and implementation of knowledge.

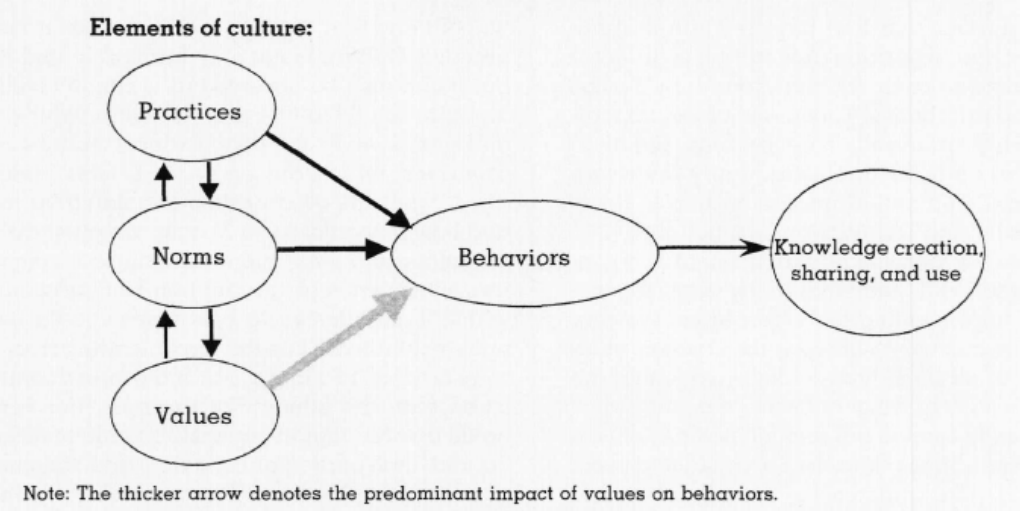

Figure 5: Culture and Knowledge (DeLong, and Fahey, 2000, p. 116)

Having a successful knowledge sharing culture does not mean that the organization must reinvent or recreate its existing culture. McDermott and O'Dell (2001) found that companies like American Management Systems, Ford Motor Company, Lotus Development Corporation, National Semiconductor Corporation, and Price Waterhouse Coopers LLP built their knowledge management initiatives to fit their existing cultures. Building and nurturing knowledge management initiatives can be quite tricky and requires adapting organizational processes. Countless advice exists in books and journals on how to initiate and manage knowledge initiatives, but for the purpose of this research much of it will be excluded. A brief discussion of organizational processes and a few samples of management advice are provided as an example.

Organizational Processes

Szulanski (2000, p. 25) makes the best case for organizational processes when he argues, "organizations learn to transfer knowledge by making those transfers less eventful." Conducting business process analysis along with change management initiatives are great ways to have knowledge policies reflect the culture in which they function (Thompson and Walsham, 2004). All of the 50 best-practice companies McDermott and O'Dell (20001) studied made sharing knowledge part of the business strategy, 'piggybacked' sharing knowledge with key business initiatives, and emphasized sharing as the "way we work" (p. 79).

> *Whether part of the business strategy or simply part of a department's work process, all of our best practice companies make a visible connection between sharing knowledge and the business [practical business goals, problems or results] (McDermott and O'Dell, 20001 p. 80, p.84)*

Management Support/Advice

In the literature review there were a number of other articles and books which provided management focused advice such as previously discussed with organizational processes. The breadth of this advice is quite copious yet it is all connected through some ability of management to act (i.e. structure, build or run the company) in a way to influence knowledge sharing. A number of examples are provided in Table 3, but none will be discussed in any further detail.

Sampled Subjects of Management Advice	Sampled Author(s)
Suggesting the creation of organizational roles	Brown and Duguid, 1998
Developing information strategies or architectures	Nonaka, 2002; Choo, 2000
Suggesting knowledge strategies	Choo and Bontis, 2002; Hinds and Pfeffer, 2003
Suggesting management hierarchies or structures	Nonaka, 2002
Managerial actions for creating knowledge cultures	De Long and Fahey, 2000; Goman, 2002; Palmquist, 2004
Helping facilitate access to knowledge and information sources	Choo, 2000; Bartol and Srivastiva, 2002; Swap, Leonard, Shields and Abrams, 2001
Strategies for evaluating and rewarding knowledge sharing	Stevens, 2000; Bartol and Srivastiva, 2002; Szulanski, 1995, 1996; Fraser, Marcella and Middleton, 2000
Advice for hiring, promoting, and mentoring employees	De Long and Fahey, 2000; McDermott and O'Dell, 2001

Table 3: Sampled Subjects of Management Advice

2.3.2.4. Network Structure (Social Networking Principles)

Network structure represents the last ability factor[15] discussed in the text. The creation of network structure in an organization, more often than not, is predetermined by organizational hierarchies, but the behavior of the individuals with respect to information and knowledge sharing is guided by the *social networking principles* closely related to structure. Since organizational processes and hierarchies have already been discussed in the previous section, this section will focus on introducing social networking principles as determinants of network structure; and in turn, ability factors influencing information and knowledge sharing behavior. The social networking principles discussed in the research include; time, distance and density; closure; reciprocity; brokerage; and homophily. A thorough definition and description of these social networking principles and their influence on information and knowledge sharing behavior within a social network is provided in Section 3.4.

Each of the previously mentioned social networking principles has a direct or indirect relationship to information and knowledge sharing behavior. Some of these connections are more transparent than others, such as the case with distance (physical separation and time); density (frequency of interaction); and reciprocity[16] (complimentary, corresponding exchange). To illustrate an example of the connections, Leonard and Sensiper (2002) argue that high network distance or low network density would make it nearly impossible to transfer tacit elements of knowledge (Leonard and Sensiper, 2002) since the individuals would not get a chance to interact frequently enough.

The networking principles and structures associated with *closure* help to understand information redundancy (Burt, 1992; Granovetter, 1973) and the effective use of norms and sanctions against hoarding behaviors (Coleman, 1988). Understanding the principles and structures relating to

[15] Network structure and/or social networking principles may be considered ability factors because the influence of the factor on the transfer is not dependent a persons' willingness to share; as is clearly the case with a separation of time or distance.

[16] Low reciprocity in a network relationship leads to high levels of information hoarding (based on Coleman, 1988)

brokerage (Burt, 1992; Granovetter, 1973; Obstfeld, 2005) help to reveal other factors leading to information and knowledge hoarding behavior such as; information and referral benefits, control benefits, or uniting benefits[17]. The principle of homophily makes interesting connections between information sharing and the observable similarity of the individuals in the transfer; though these connections are not quite as direct as those mentioned previously (McPherson, Smith-Lovin and Cook, 2001; Burt, 1992).

Most interestingly, the literature review revealed that it may be possible to use an understanding of network structure and social networking principles in order to predict and potentially manipulate trusting relationships in order to influence information and knowledge sharing behavior. If this is true then there is a clear testable relationship between *Network Structure* (an ability factor) and *Organizational Trust* (a willingness factor). These connections will be further explored in the next section.

3. Research Framework

3.1. Research Objectives and Questions

The main objective of this study is to examine knowledge sharing behavior within and across knowledge workers in an organizational setting. Understanding these behaviors allows organizations to structure and manage themselves in ways which will positively influence knowledge dissemination and potentially enhance their performance. Sharing knowledge enables the creation of new ideas, which are necessary for process and product innovations (Palmquist, 2004; Hall, 2001). Sharing knowledge also minimizes redundancy in knowledge production, diffuses best practices and enables problem solving (Husted and Michhailova, 2002).

Despite the apparent benefits, most companies struggle with sharing knowledge. Ernst and Young (Ruggles, 1998) surveyed 431 European and U.S. based firms and found that only 13% thought they were doing a good job of transferring knowledge inter-organizationally. Perhaps the primary reason for this low figure stems from an incomplete understanding, and the resulting mis-management of the factors involved in facilitating knowledge sharing both within the company and among its partners.

Motivated by this concern, this study aims to answer four interrelated questions about knowledge sharing in organizations:

1. *What factors influence knowledge sharing in organizations*?
2. *In what ways do these factors influence knowledge sharing*?
3. *In what ways can individuals or organizations influence these factors in order to enhance information and knowledge sharing*?
    a. For example, in what ways can organizations increase the level of trust in order to improve knowledge sharing?
4. *How do these factors interact*?
    a. For example, can network structure or social networking principles be used to determine levels of trust?

[17] Information and referral benefits, control benefits, and uniting benefits are discussed in Section 3.4.3.

Hopefully, an understanding of the factors that influence knowledge sharing, as well as their interrelatedness, will allow for a prediction of the nature and extent of knowledge sharing behaviors. Studying these knowledge sharing factors may also reveal the impact of alternative organizational hierarchies, structures, and knowledge sharing processes on knowledge sharing behaviors and subsequent organizational performance.

3.2. Research Focus: Narrowing the Determinants and Scope

Figure 6 represents an overview model of the factors identified in the literature review and discussed in the previous section. As with the preceding section on knowledge sharing factors, the factors have been organized using a distinction made by Duguid (2005) between the factors that relate to what can or can't be shared (ability factors) and those factors that relate to what will or won't be shared (willingness factors).

Given the complexity of the complete model, creating a study that investigates all of the factors summarized in Figure 6 is not feasibly, a decision had to be made on which one(s) to focus in on. Originally, the interest of the research was primarily on affective response but as a result of studying existing research results some interesting ties between affect and trust began to reveal themselves. One such connection involved using affect in an assessment of organizational trust (McAllister, 1995; Holste, 2003).

After organizing the factors and creating Figure 6 from the literature review, a further interesting potential relationship revealed itself between *Network Structure* (an ability factor) and *Organizational Trust* (a willingness factor)[18]. The social networking literature alluded to the possibility of influencing trusting relationships between members in a network through the use of alternate network structures and the manipulation of social networking principles (i.e. closure, brokerage, homophily, etc.). For an organization this could mean that it is possible to use an understanding of network structure and social networking principles in order to potentially influence trusting relationships among its employees in a predictable manner. Thus, an organization would be able to positively influence information and knowledge sharing both in terms of quantity and quality, through increased trust and the resulting increased yield per contact (discussed below).

[18] The relationship is depicted using the red arrow in Figure 6

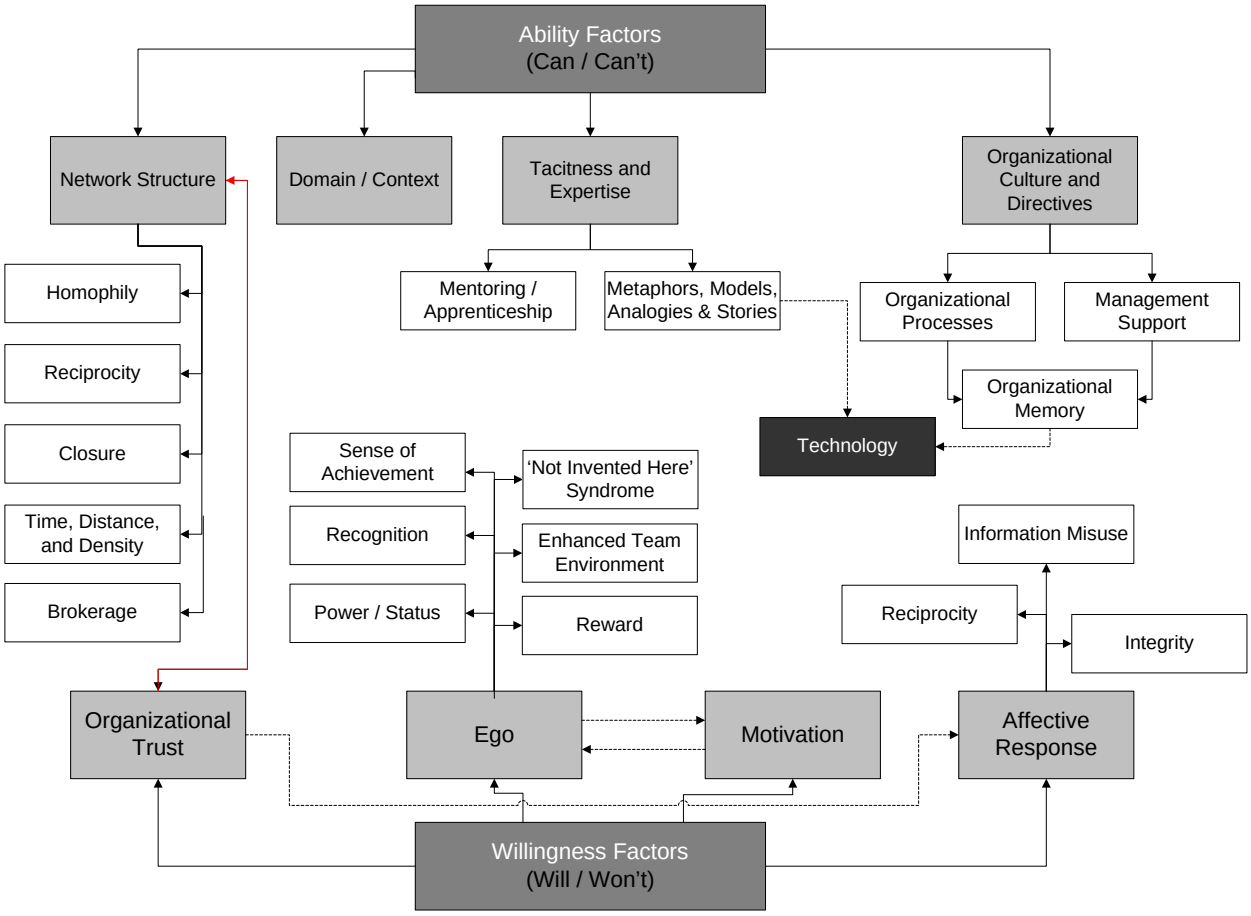

Figure 6: Interrelatedness of Motivators and Inhibitors to Knowledge Sharing
(Identified in the Literature Review and
Organized using a distinction made by Duguid, 2005)

Considering all the possible stakeholders involved, an organization can share knowledge across a potentially very broad network of different types of individuals and groups, both within and outside the organization. In order to narrow the scope of the study, the primary focus will be on a special type of social network within an organization called a Community of Practice (COP). An explanation of COPs and their value follows.

3.2.1. Social Network

Wasserman and Faust (1995), define a social network as consisting of "a finite set or sets of actors and the relation or relations defined on them" (p.20). A primary social network used to develop the arguments in the proposed research is called a Community of Practice. Relationships examined within the whole network (organization) will span Community of Practice members as well as their respective organizational units, making up additional social networks (for a network representation see Figure 8). The research will maintain a structural network view as opposed to a dyadic view, which exclusively examines networks from a dual actor/node perspective.

3.2.2. Community of Practice (COP)

Wenger, McDermott, and Snyder (2002), define a Community of Practice (COP) as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their

knowledge and expertise in this area by interacting on an ongoing basis" (p.4). COPs are based on a social theory of learning which postulates that social practices and group interaction results in collective learning. Practices reflect the pursuit of the community's goals and the attendant social relations that are necessary to support these practices are, in turn, supported by them (Wenger, 1998).

A Community of Practice is initiated through the collective development of a mutually negotiated shared practice (Wenger, 1998). For example, this might be a set of employees gathering to share information, giving and receiving advice, or trying to solve a job or industry related problem (Wenger, McDermott and Snyder, 2002; Wenger 1998, Orr, 1996). Through continuous interactions the COP develops its own practices, routines, rituals, artifacts, symbols, conventions, stories and histories (Wenger, 1998). The community also acts as, "a context in which the meaning of objects, problems, events and artifacts gets constructed and negotiated, and in which people live, work, communicate, and understand the environment and themselves" (Choo, 2006, p. 166).

COPs usually self organize and tend to originate on their own[19] (Choo, 2006). A person might be inclined to join because they might have something valuable to contribute, have something to learn, or both. As opposed to other 'project teams' or workgroups, COPs do not necessarily work together on a routine basis or follow a pre-defined schedule of activities. Instead they meet only when they find value in doing so (Wenger, McDermott and Snyder, 2002). COPs often have fluid boundaries which change dynamically (Choo, 2006).

3.2.3. The Value of Communities of Practice

Communities of Practice are valuable to their participants and their corresponding organizations because over time a common meaning and shared repository for their work is developed (Choo, 2006; Gherardi, 2001) resulting in the creation, refinement and sharing of knowledge. An example of this may be seen by reviewing Orr's work with copier technicians (Orr, 1996). This socially developed 'common meaning' represents, "a unique perspective of their topic, common knowledge, practices, and approaches" (Wenger, McDermott and Snyder, 2002, p. 5). Membership in the COP provides form, content, and context to this knowledge. Many times this is referred to as collective, accumulated or situated knowledge. It is this type of knowledge which is said to be produced, and resides in the group community. Therefore, the most often stated benefit of studying a COP is that they create and facilitate the dissemination of knowledge (Duguid, 2005; Brown and Duguid, 1998; Nonaka, 2002; Tsoukas, 2005a; Van De Ven and Johnson, 2006; Boer, van Baalen, and Kumar, 2002; Gherardi, 2001; Wenger, McDermott, and Snyder, 2002; Wenger, 1998; Choo, 2006).

Another similar benefit to the creation, acquisition or sharing new knowledge associated with COPs is the creation of a learning environment. Some organizational theorists (Blackler, 2002; Leonard and Sensiper, 2002; Wenger, McDermott and Snyder 2002; Wenger, 1998) have argued that COPs are particularly conducive to learning and the acquisition of new skills. Wenger (1998) refers to Communities of Practice as "shared histories of learning" (p. 73). The learning that takes place within the COP is closely related to actually becoming a practitioner; this includes associating contextual meaning, understanding the social structure of the practice,

[19] Without the intervention of a governing or authoritative body such as an organization

negotiating power relations, as well as finding implicit ways of working together. In return, the community becomes informally bounded by the value participants create through learning from each other (Wenger, McDermott and Snyder 2002). From an organizational perspective, facilitating and sustaining such communities, "creates a learning environment which raises the effectiveness and value of the organization" (Wenger, 1998 p.45).

Other benefits of Communities of Practice include the development of personal relationships, a common sense of identity, and accepted ways of interacting (Wenger, McDermott and Snyder 2002). What makes COPs unique and interesting to study is that the relationships and work practices are not reflected by, nor are they incorporated in formal policies, methodologies, organizational charts, and job descriptions; instead the actual practice and learning is informal, socially constructed, and quite impromptu (Wenger, 1998; Choo, 2006). Unlike organizationally structured project teams, COPs have no formal authoritative control measures. Instead, members of the community govern their interactions through self constructed and agreed upon norms and sanctions. Acts relating to information hoarding, falsification of data, or any other malicious actions toward the community are primarily dealt with within the community. Sanctions for such actions may include the development of a bad reputation, exclusion from accessing information, or even expulsion from the community. For this reason, trust is formative to the success of a COP, especially when knowledge is created and disseminated.

3.2.4. Trust and COPs

> *The emergence of self-directed teams and a reliance on empowered workers greatly increase the importance of the concept of trust (Golembiewski and McConkie, 1975; Larson and LaFasto, 1989) as control mechanisms are reduced or removed and interaction increases.*
>
> *In the use of self-directed teams, trust must take the place of supervision because direct observation of employees becomes impractical.*
>
> *(Mayer, Davis, and Schoorman, 1998 p.709)*

Having trust in any workgroup, especially one without authoritative control, is vital to the groups' success. When trust exists among members in a COP, efforts needed for information search and processing are minimized since the receiving party does not have to scrutinize the quality or veracity of the information (Zaheer, McEvily and Perrone, 1998). In turn, the existence of trusting relationships reassures the sender that the receiver will not misappropriate the information entrusted to them (Zaheer, McEvily and Perrone, 1998). In this example, trust reduces monitoring and safeguarding behaviors, which represent significant costs associated with any information or knowledge sharing transaction, and conserves cognitive resources (Uzzi, 1997), leading to more 'openness' in the exchange (Zaheer, McEvily and Perrone, 1998). Additional benefits of trust include timely access to information and referrals (Burt, 1992) as well as an enhanced ability to draw distinctions and come to decisions which are essential activities in constructing knowledge (Tsoukas 2005ab).

> *A group within which there is extensive trustworthiness and extensive trust is able to accomplish more than a comparable group without the trustworthiness and trust. (Coleman, 1988 p. S101)*

3.3. Predicting Trust

The most relevant benefit of trust to any organization is the enhancement of knowledge sharing and innovation. Faced with a reduction in the ability of its members to share knowledge and innovate, an organization is liable to exhibit underperformance as its resources, both tangible and intangible are not utilized in the most efficient and effective manner. Since trust can act as both a motivating and an inhibiting factor for knowledge sharing, organizations should work toward building a better understanding of the levels of trust between their workgroup members. One method by which to determine these trust levels is by using one of many empirical instruments to measure trust relationships. In their intensive review, McEvily and Tortoriello (2007) identify a total of 156 such measures and subsequently narrow them down to five based on an extensive review of their construct validity. McEvily and Tortoriello (2007) provide an explanation for their approach as follows:

> *The five measures share a common emphasis on confirmatory factor analysis involving the testing of a theoretically derived measurement model and the estimation and evaluation of competing measurement models (p.20)*

Of the five (See Table 4) only three (McAllister, 1995; Cummings and Bromiley, 1996; and Mayer and Davis, 1999) were found to be replicated by other researchers/studies.

Authors	*Measurement Instrument*
McAllister (1995)	Managerial Interpersonal Trust
Currall & Judge (1995)	Boundary Role Persons' Trust
Cummings & Bromiley (1996)	Organizational Trust Inventory
Mayer & Davis (1999)	Organizational Trust
Gillespie (2003)	Behavioral Trust Inventory

Table 4: Noteworthy Measures of Trust
(McEvily and Tortoriello, 2007 p.20)

From an organizational perspective, administering these instruments and conducting such studies is quite tedious and expensive. Organizational research can assist firms in trying to determine if there are more effective ways to predict levels of trust among group members without the use of such complicated and costly instruments. One possible method of gaining insight into these trusting relationships is by looking at agent characteristics, group composition and network structure. These types of data are readily available to the organization or at the very least, relatively inexpensive to attain.

In an attempt to discover a method for predicting trust in organizations, the proceeding sections summarize four network principles; creating hypotheses linking network structure and agent characteristics to trust among members in an organization.

The network principles discussed in relation to trust are summarized in Table 5:

Social Networking Principles			
Homophily	**Closure**	**Brokerage**	**The Small World Problem**
* Similarity Principle	* Obligations and Expectations	* Information and Referral Benefits	* Six Degrees of Separation
	* Norms and Sanctions	* Control Benefits	
		* Uniting Benefits / Tertius Iungens	

Table 5: Summary of Social Networking Principles

3.4. Social Network Principles and Hypotheses

3.4.1. The Principle of Homophily and related hypotheses

McPherson, Smith-Lovin and Cook, (2001, p.416) define homophily as, "the principle that contact between similar people occurs at a higher rate than among dissimilar people. ([i.e.] …cultural, behavioral, genetic, or material information that flows through networks will tend to be localized)." According to the authors, there are two distinct types of homophily: *status homophily*[20] and *value homophily*[21]. Noted causes of homophily include geography[22], family ties[23], organizational foci[24], isomorphic sources[25], and cognitive processes[26] (McPherson, Smith-Lovin and Cook, 2001). The authors found that race creates the largest contact differential although sex, age, religion, and education are also associated with large contact differentials.

In network terms, homophily implies that there is a positive relationship between the degree of similarity between two nodes (agents) and the strength of the tie (relationship) between them. In other words, greater similarity between nodes leads to stronger ties (relationships) between them. Research has also demonstrated the existence of a reciprocal causal relationship when the degree of similarity between agents increases as a result of the number of ties (relationships) between agents increasing A further, somewhat more subtle effect occurs when the existence of some types of homophily has a positive influence in the creation of other types of homophily (McPherson, Smith-Lovin and Cook, 2001). Another notable network effect of homophily is evidenced by what is termed 'selective tie (relationship) dissolution'. This phenomenon arises as a result of low homophily within a group leading to weakened ties (relationships) and hence a higher probability of subsequent dissolution.

It can be argued that there is a connection between homophily and a trustor's 'propensity to trust' a trustee, since agents who share characteristics are more likely to trust each other than agents who do not. Similarly homophily may be considered to influence the perceived trustworthiness of a trustee by a trustor. Burt (1992), in particular, argues for the existence of a direct connection

[20] Status Homophily is based on informal, formal and ascribed status. Includes ascribed characteristics (race, ethnicity, sex, age) and acquired characteristics (religion, education, occupation, behavior patterns)
[21] Value Homophily is based on values, attitudes, and beliefs
[22] Geography relates to geographic distance. More likely to have contact with those that are closer
[23] Family Ties refers to a family relation (biological tie). Likely to be the same race, ethnicity, and religion
[24] Organizational Foci relates to a focused activity which fosters the relationship (ex. school, work or voluntary organizations)
[25] Isomorphic Sources relates to occupied positions or roles (ex. workplace roles (status, seniority, functional division), family roles (wives), or political roles (senators))
[26] Cognitive Processes refers to perceived similarity. Ex. People who share similar knowledge domains

between homophily and trust, arguing that similar[27] agents are more likely to trust each other than those that are dissimilar. In Burt's (1992, p. 16) words, "the operational guide to the formation of close, trusting relations seems to be that a person more like me is less likely to betray me."

Using the previous findings on homophily, network structure, and trust, certain hypotheses may be made in relation to social networks in organizations (including Communities of Practice). These hypotheses are:

- Hypothesis 1: Higher levels of trust will be exhibited between members of a Community of Practice who share status homophily than between those who do not.
- Hypothesis 2: Higher levels of trust will be exhibited between members of a Community of Practice who perceive themselves as sharing value homophily than those who do not.
- Hypothesis 3: Communities of Practice whose members share status homophily will have a higher measure of overall trust than Communities of Practice whose members do not.
- Hypothesis 4: Communities of Practice whose members perceive themselves as sharing value homophily will have a higher measure of overall trust than Communities of Practice whose members do not.

Since trust is necessary for effective information seeking/retrieving behaviors, the principle of homophily may also be extended to information and knowledge dissemination. Therefore it may be hypothesized that:

- Hypothesis 5: Communities of Practice whose members share status homophily or perceived value homophily will be more effective in their information seeking/retrieving behavior than Communities of Practice whose members do not share such characteristics.
- Hypothesis 6: Communities of Practice whose members share status homophily or perceived value homophily will be more effective at knowledge dissemination than Communities of Practice whose members do not share such characteristics.

Before completing the discussion on homophily, it is worthwhile to note two complications that arise with the homophily principle. First, homophily varies in transparency, meaning that certain types of characteristics are easier to spot than others. For example, it is much easier to determine someone's sex than their religion. Even more difficult to determine are value homophily items that require one to guess at values and beliefs. A second notable difficulty with the homophily principle is that similarity is often associated with redundant information (Burt, 1992; Granovetter, 1973).

3.4.2. The Principle of Closure and related hypotheses

The second network principle discussed in this research was introduced by Coleman (1988) at the University of Chicago and is based on observations of activity within a closed network structure. Network closure may be viewed as the degree to which everyone knows everyone else in a network. In a closed network all the agents will know each other. A simplistic example of networks with and without closure is presented in Figure 7:

[27] Similar agents is defined as two agents who display high homophily

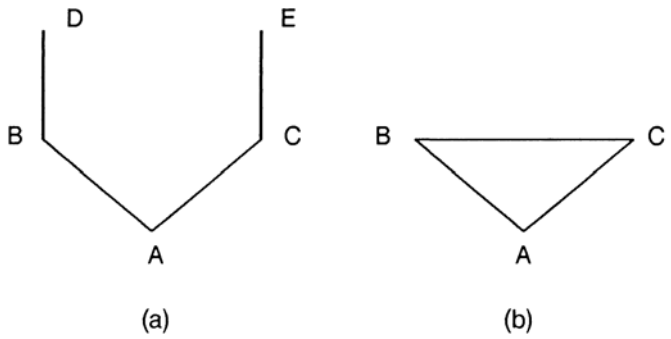

Figure 7: Coleman's (1988) Network without (a) and with (b) closure (p.S106)

Coleman (1988) argued that agents in a closed network structure were more likely to trust one another than agents in an open structure. He also claimed that in cases where trust is violated, a closed network structure provides the ideal environment for instituting sanctions and having effective norms.

Coleman (1988) believed that trustworthiness could be judged by whether or not obligations were reciprocated. He argued that in a closed structure, obligations and expectations would be repaid because a high number of outstanding obligations by one member could easily be transparent to the rest of the group. If the rest of the group felt as if that member was not reciprocating they would become less likely to trust them or continue to extend favors. The closed network structure creates an environment where reciprocity is encouraged and to some extent, enforced. Since all the actors in a closed network can see and judge the actions of their colleagues, members can develop reputations and accounts of trustworthiness over time.

> *"Closure of a social structure…is important [for] the trustworthiness of social structures that allows the proliferation of obligations and expectations" (Coleman, 1988 p. S107)*

Another network benefit of a closed structure discussed by Coleman (1988) is the ability to institute effective norms and sanctions. Norms are set in place as an attempt to encourage positive behavior or limit negative behavior. Sanctions are implemented to monitor or guide behavior or actions. Effective norms can only exist because agents know that sanctions may be instituted if the norms are violated (consequences). Therefore, effective norms may not exist in anything but a closed structure because in a closed structure group members can combine to enforce a collective sanction against the violating member (Coleman, 1988). "The consequence of closure is…a set of effective sanctions that can monitor and guide behavior." (Coleman, 1988, p. S107)

Using the previous findings on network closure and trust, certain hypotheses may be added in relation to social networks in organizations (including Communities of Practice). These hypotheses are:

- Hypothesis 7: Overall levels of trust will be greater in a closed social structure than in an open one
    - See Figure 8: Overall trust of (A,B,C,D) > Overall trust of (F,B,A,G)

- Hypothesis 8: There is an inverse relationship between trust vested in an individual member of a social network and the number of sanctions that have been imposed on that member.
    - Trustworthiness of a member decreases as the number of sanctions imposed increases
- Hypothesis 9: Closed social networks will have fewer imposed sanctions than open social networks
- Hypothesis 10: Low levels of perceived or actual reciprocity by members of a closed network will correspond with low levels of trust between those members and the non-reciprocating member(s)
- Hypothesis 11: Low levels of perceived or actual reciprocity in a closed network will lead to its destruction or 'opening'[28]

Extending Coleman's ideas of network closure to information and knowledge dissemination produces two additional interesting hypotheses. They are:

- Hypothesis 12: Low levels of perceived or actual reciprocity between individuals will correspond to high levels of information hoarding
- Hypothesis 13: Sanctions imposed on individuals will limit knowledge sharing

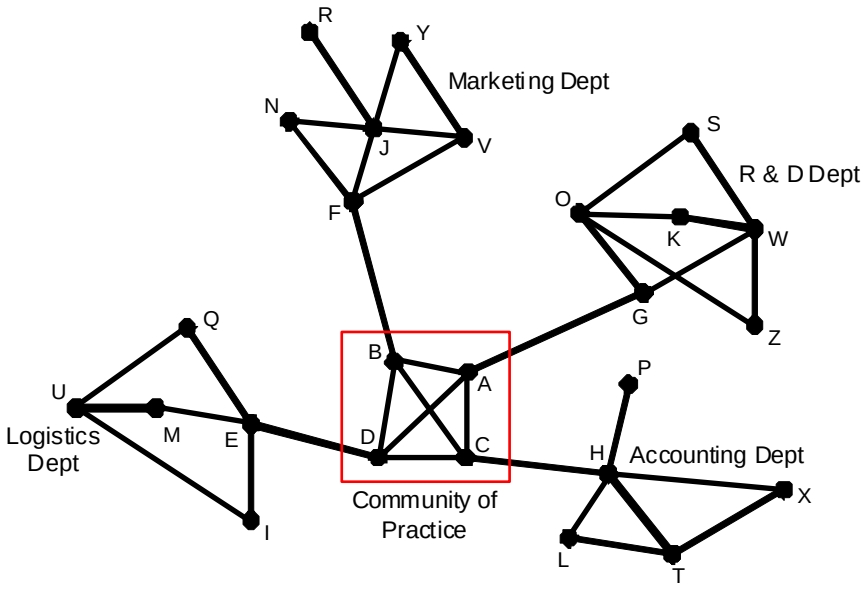

Figure 8: Community of Practice Example Network

Prior to completing the discussion on closure, it is noteworthy to mention that information within a closed structure tends to be redundant (Burt, 1992; Granovetter, 1973). Using redundant information can lead to the same types of problems as those mentioned in the closing section of homophily (i.e. lack of innovation, lack of knowledge creation, lack of exposure to opportunities, and lack of exposure to referrals).

[28] Hypothesis 11 can only be investigated through the use of longitudinal data

3.4.3. The Principle of Brokerage and related hypotheses

The concepts of closure and brokerage[29] seem as if they are diametrical opposites, though if the network is structured effectively both may be used in order to gain a competitive advantage. Communities of Practice seem to be naturally forming examples of having both advantages. The Community of Practice and its members reap the benefits of a closed structure (A, B, C, D in Figure 8). Additionally, each member brokers a relationship between the collective entity (COP) and their other organizationally determined functional unit (A-G, B-F, C-H, and D-E in Figure 8). As a broker, each member fills what Burt (1992) calls a structural hole[30]. Being in a situation to fill these structural holes puts the broker in a position of power and provides them with three distinct types of benefits: *Information and Referral Benefits* (Burt, 1992); *Control Benefits/Tertius Gaudens* (Burt, 1992); and *Uniting Benefits/Tertius Iungens* (Obstfeld, 2005). Which strategy the broker chooses ultimately might determine the level of trust within the COP and across the functional units. The choice of strategy may also determine the groups' productivity and greater good for the corresponding organization.

3.4.3.1. Information and Referral Benefits

It has been previously argued that homophily and closed structures can be conducive of redundancy[31] since people have the same access to the same types of information. Conversely, non-redundant contacts offer a higher exposure to diverse sources of information (Burt, 1992; Granovetter, 1973). Following this logic reveals the first benefit of brokerage, where a larger more diverse network provides opportunities for greater access to valuable non-redundant information and referrals (Burt, 1992).

> *Players with a network optimally structured to provide these [information] benefits enjoy higher rates of return to their investments, because such players know about, and have a hand in, more rewarding opportunities. (Burt, 1992 p.13)*

The information and referral benefits achieved by each broker and their respective Community of Practice are high because each individual member (A, B, C, or D in Figure 8) has outside contacts that are non-redundant to the group (E, F, G, H in Figure 8), who posses timely new information and referrals[32]. Given that all the members truthfully share this information, the collective entity (A-B-C-D) then is able to harness the information benefits of the greater sparse network (A through Z). The information benefits achieved by the entire community (access to 26 sources) greatly outweigh the cost of maintaining the limited number of relationships (4 for each COP member). In network terms, yield per primary contact is high, while still taking advantage of the total number of contacts in the network (high total yield).

---

[29] Brokerage explains a social networking principle where actors broker connections between otherwise disconnected segments of the network (actors/nodes) in order to create social capital (Burt, 2000)

[30] Burt (1992) defines a structural hole as a "separation between nonredundant contacts [or a] relationship of non-redundancy between two contacts"(p.18)

[31] Redundancy is described in terms of network benefits. For example: similar contacts for referrals and information for decision making

[32] Each cluster in the example network (i.e. Marketing Dept., Logistics Dept., etc.) should be considered as one source of information and referrals since the information and referrals the members are likely to have (within each cluster) is the same (with few exceptions)

In order to yield these information and referral benefits, trust must exist between the sender and receiver. Trust or a sense of trustworthiness is much harder to assess in this type of network structure because there is not social closure. There are fewer direct consequences (sanctions) against an actor who hoards or distorts information and no one person can develop a reputation over time (Coleman, 1988). This creates additional difficulties because for information to be useable, it must be deemed as credible. In a non-redundant network the information is much harder to confirm. Information can be considered credible only if the source (sender) is considered credible by the receiver. For this to occur, the receiver must deem the source (sender) as trustworthy (Burt, 1992). The same is true from the sender's perspective where they must trust the receiver or deem them as trustworthy (in that they will not misuse the information given) for the receiver to gain timely access to the information or referral (Burt, 1992). For the receiver, this trust translates into a reduced effort for finding non-redundant referrals and information; two essential elements in knowledge creation and innovation.

> *With a trustworthy primary contact, there is little loss in information benefits from the cluster and a gain in the reduced effort needed to maintain the cluster in the network (Burt, 1992, p.21)*

Using the previous arguments on the information and referral benefits of brokerage allows us to add three additional hypotheses in relation to social networks in organizations (including Communities of Practice). These hypotheses are:

- Hypothesis 14: Communities of Practice will be more effective in their information seeking/retrieving behavior when their members exhibit high levels of trust with their respective functional units
- Hypothesis 15: A large number of network referrals will correspond to a high level of trust between the referring parties
- Hypothesis 16: High information benefits achieved by members of the Community of Practice will correspond with high levels of trust between the benefiting member and their corresponding external functional unit
    - To rephrase, using the example network (Figure 8): high information benefits achieved by A, B, C, or D will correspond to high levels of trust between A-G, B-F, D-E, or C-H

Extending Burt's information and referral benefits to information and knowledge dissemination produces one additional hypothesis:

- Hypothesis 17: Communities of Practice will be more effective at knowledge dissemination when their members exhibit high levels of trust with their respective functional units (high trust between A-G, B-F, D-E, or C-H in Figure 8).

3.4.3.2. Control Benefits

A second class of benefit (*control*[33]) identified by Burt is based on the work of Georg Simmel (1923) who identified the tertius (third) role in relationships. Specifically, Burt (1992) discusses being in the position of a tertius gaudens or 'the third who benefits'. Tertius gaudens, "describes an individual who profits from the disunion of others" (Burt, 1992 p. 31) and is traditionally based on a 'divide and conquer' mentality[34]. Burt (1992) presents two tertius strategies, both of which create control benefits for the broker.

The first control (tertius gaudens) strategy is being the third agent between two or more actors seeking the same relationship (Burt, 1992). This view is similar to a standard economic view of competition or two people bargaining for the same thing. This type of control strategy can best be framed by Porter's (1979) supplier power[35] where two or more buyers bid against each other, benefiting the seller.

The second control strategy involves being the third agent between actors in two or more relationships with conflicting or opposing demands (Burt, 1992). In this type of brokerage, the tertius agent looks to create tension and conflict between the other actors in the relationship, in order to gain an advantage. This tension is brought about by the broker deliberately creating uncertainty.

> *Where there is any uncertainty about whose preferences should dominate a relationship, there is an opportunity for the tertius to broker the negotiation for control by playing demands against one another. (Burt, 1992, p. 33)*

Community of Practice relationships are naturally structured in a way where members are given an opportunity to exploit these strategies for control benefits and personal gain (i.e. creating conflict between COP member requests and those from their own organizationally assigned functional unit). In fact, these control benefits profit the tertius member more than the COP or the organization as a whole. It may even be argued that an active play on behalf of the broker to exploit the network for control can lead to situations where information between units is being monitored, filtered, and hoarded. The situation may also end badly for the tertius broker if the agents who are being played off against each other become aware of their predicament. If this becomes the case the jaded agents can combine efforts to force the tertius broker to agree to their demands.

Using Burt's arguments on the control benefits of brokerage, one additional hypothesis may be made in relation to social networks in organizations (including Communities of Practice) and trust:

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[33] Control benefits and information benefits are closely related. For example, screening information exhibits control of that information. Also, having more control puts one in a position where they can access and yield more information (Burt, 1992).

[34] A military-based strategy to divide groups into smaller sub-groups

[35] Porter's (1979) buyer power can represent a similar relationship where two or more sellers bid against each other benefiting the buyer.

- Hypothesis 18: High control benefits achieved by members of the COP will correspond with low levels of trust between the benefiting members and their corresponding external functional unit.
    - Using the example network (Figure 8): high control benefits achieved by A, B, C, or D will correspond to low levels of trust between A-G, B-F, D-E, or C-H.

3.4.3.3. Uniting Benefits

The last benefit of brokerage discussed in this research was argued by Obstfeld (2005) and is called tertius iungens (YUNG-gains); meaning "to unite" or "to form". "The tertius iungens orientation is a strategic, behavioral orientation toward connecting people in one's social network by either introducing disconnected individuals or facilitating new coordination between connected individuals" (Obstfeld, 2005, p.102). The best way to explain tertius iungens (or uniting benefit) is to describe it as a strategy that directly contradicts or opposes Burt's arguments for tertius gaudens (control benefit).

To illustrate this point, control benefits encourage a buyer to play sellers against one another for the best price. Uniting benefits, on the other hand, enable buyers and sellers to find each other to create a mutually beneficial exchange. In a tertius iungens situation the non-partisan broker creating the connection only produces an agreement between the two new parties and then withdraws. The broker acts as only an arbitrator or a referral mediator.

Unlike control benefits, which tend to benefit only the tertius, uniting benefits can be advantageous for the entire social network. From a broker's perspective, the uniting behavior creates an opportunity for delayed reciprocity on the part of the benefiting parties. An act of arbitration, mediation, or referral on the part of the tertius may create an outstanding obligation on the part of the benefiting participants. Also, actors with high tertius iungens orientations are found to be more likely involved in innovation (Obstfeld, 2005), an activity often conducted in COPs. For the Community of Practice and the organization, uniting behaviors create new ties and structural holes (Obstfeld, 2005) which open information channels and create opportunities for knowledge exchange, innovation, and other determinants of competitive advantage.

Using Obstfeld's arguments on the uniting benefits (tertius iungens) of brokerage, two additional hypotheses may be made in relation to social networks in organizations (including Communities of Practice) and trust:

- Hypothesis 19: Agents with high tertius iungens orientations will be rated as more trustworthy by their network peers than those with a tertius gaudens orientation.
- Hypothesis 20: High levels of overall trust must be present (both among members in the COP and their external contacts) for tertius iungens activities to take place.

3.4.4. The Small World Principle and related hypothesis

The final network principle discussed in this paper is based on Milgram's (1967) small world experiment conducted at Harvard, which examined the interconnectedness of humans in the world. In the study, Milgram investigated the answer to the question 'What is the probability that any two people, selected at random, would know each other?' Even though the study (Milgram, 1967) suffered from both selection and non-response bias, Milgram did present two interesting

viewpoints on what he called the *"small-world problem"* (also known as *six degrees of separation*). The first says that:

> *Any two people in the world, no matter how remote from each other, can be linked in terms of intermediate acquaintances, and that the number of such intermediate links is relatively small [about six degrees of separation]*
>
> *The second view holds that there are unbridgeable gaps between various groups and that therefore, given any two people in the world, they will never link up because people have circles of acquaintances which do not necessarily intersect. (Milgram, 1967, p.63)*

In a follow-up study conducted by Dodds, Muhamad and Watts (2003) involving 60,000 email users, the authors concluded that even though it may be true that a connection exists between targets, there is little guarantee that the information finds its intended target. This is true because remote agents do not have sufficient incentive or motivation to continue 'constructing' the chain. In order to be motivated they must trust the person making the request. Trusting a person becomes increasingly more difficult when degrees of separation increase, especially after the third degree (Dodds, Muhamad and Watts, 2003). This may arise for a variety of reasons. The greater the degree of separation, potentially the lesser the homophily and/or the less knowledge the agent will have of the other agents characteristics. Thus, even though you can access the person, there is no guarantee they will fulfill your request. It may also be the case that the remote agent is not able to continue constructing the chain because they do not have the ability (i.e. they do not know anyone that can come closer to the target).

Extending the findings of Milgram (1967) and Dodds, Muhamad and Watts (2003) one final hypothesis may be made in relation to social networks in organizations (including Communities of Practice) and trust:

- Hypothesis 21: There is a non-linear inverse relationship between levels of trust and degrees of separation

4. Methodology

4.1. Social Network Analysis

In order for one to better understand how to use Social Network Analysis (SNA) as a research methodology, it is necessary to first understand some fundamental concepts in network analysis. The distinction between a social network view and a non-network explanation of a process arises as a result of the inclusion of concepts and information on social relationships among the units in the study. Social network analysis focuses on relationships among social entities (typically referred to as actors), and on the patterns of these relationships and what may be implied by them. A social network consists of a finite set or sets of actors and the relation or relations among the actors or sets of actors. The existence and nature of this relational data is a critical and defining feature of a social network. (Wellman, 1988; Wasserman and Faust, 1995; Granovetter, 1973; Freeman, 2000)

Fundamental aspects in most definitions of SNA are the concepts of an 'actor' and a 'relation'. Actors or social entities are, "discrete individual, corporate, or collective social units" (Wasserman and Faust, 1995). Examples of actors may include people in a group, functional units within an organization, corporations in a particular sector, or nation-states in the world economy.

Traditionally, a study that applies an SNA approach concerns itself with the examination of relationships between similar actors within a particular group. In this case, a group is defined as a bounded set of actors on which relationships are measured. Further, Wasserman and Faust (1995) state that a group consists of "a finite set of actors who for conceptual, theoretical, or empirical reasons are treated as a finite set of individuals on which network measurements are made."

A relation(ship) within a SNA is a "collection of ties of a specific kind among members of a group" (Wasserman and Faust, 1995). These ties may be any relationship existing between the social units. There are two properties of relations that are important for understanding their measurement: (a) whether the relation is directional or non-directional, and (b) whether the relation can be represented by a binary value (e.g., existence, non-existence) or a many valued function which may be discrete or continuous (very strong, strong, weak etc. or with strength measured on a scale from 0 to 10, say) (Wasserman and Faust 1995). Some common relational ties and relationships identified by Wasserman and Faust (1995) are included in Appendix 2.

The different types of networks are usually categorized by the number of unique actors (mode) and the ties among them. Wasserman and Faust (1995) define the mode of a network as, "the number of sets of entities on which structural variables are measured". (p. 35). One-mode networks focus on a single set of actors, where two-mode networks focus either on two distinct sets of actors or a set of actors and a set of events (affiliation network) (Wasserman and Faust, 1995; Scott, 2000).

The study of one mode networks involves taking measurements on a single set of actors. According to Wassserman and Faust (1995) these actors may take the form of people, subgroups, organizations, or aggregates/ collectives. The relations measured in a one-mode network represent 'specific substantive connections or what Knoke and Kuklinski (1982) called "relational contents". These relational contents appear in various types and are measured between pairs or actors. Some examples appear in Appendix 2.

In contrast, the study of two-mode networks involves measuring the relationship among pairs of actors from two different actor sets where at least one relation is measured between the actors in the two sets. Another type of two-mode network, called an *affiliation network*, measures a set of actors with respect to their attendance at or affiliation with, a set of activities or events (Wasserman and Faust, 1995; Scott, 2000). For this type of network, one mode is represented by the actor and the second mode by the event (social occasion). Events are defined on the basis of membership or attendance in a voluntary organization or social event. Examples of such networks may be corporate boards, university committees, or fans at a sporting event. According to Faust (2005, p.118),"some [affiliation networks] are quite informal social gatherings; whereas others are well-defined assemblages [official membership lists]…some situations are fleeting

one-time events, whereas others are recurrent." The actors' participation constitutes a social relation among collections of actors. If multiple events occur, the social occasions themselves become linked together through the common participants. It is only through membership in these collectives that the individual actors are then indirectly linked to each other.

Faust (2005) points out three defining characteristics of affiliation networks:

1. Relationships are studied between Actors and Events
2. Affiliation Networks are non-dyadic. Actors may belong to numerous events and events may have numerous actors but there is not necessarily a complete overlap between the two sets.
3. There is a duality of perspectives in the relationship between actors and events:
    a. From the actors perspective, participation in the event links actors together
    b. From the event perspective, the actors membership links events together

    Together these two different perspectives comprise a *joint* perspective, "simultaneously linking actors through events and events through actors." (Faust, 2005 p. 119).

4.1.1. Egocentric vs. Whole Network

When utilizing SNA it is common to study networks either as a whole or in egocentric form. Whole network analysis involves the study of an entire network as if from an aerial view; this approach permits the researcher to view the social system as a whole, as well as the parts that make up the system. According to Wellman (1988) this allows analysts to, "trace lateral and vertical flows of information, identify sources and targets, and detect structural constraints operating on flows of resources." The whole network approach examines actors analytically bounded as collectives. Whole network studies look at and make conclusions based on the entire network from a global level.

Whole network studies provide rich information but in most cases are not methodologically feasible or analytically appropriate due to their size and the amount of data collection and the extent of access required (Granovetter, 1973; Wellman, 1988). For this reason many social analysts have focused their studies on egocentric or personal networks.

Egocentric networks begin with specific target actor(s) and are concerned with how other actor relationships form which are respectively directed to and from the focal actor(s). In an ego-centered network, each individual actor is sampled and each of their relationships with other actors is established either through self reporting or observation.

4.1.2. Data Sets and Variables

According to Wasserman and Faust (1995) social network data contains two types of variables: structural and composition. Relational data is categorized and defined through the use of *structural variables* which measure the existence and nature of ties between pairs of actors. Examples of such relational data may be business transactions, friendships, or in the case of this research trust or information. In order to examine the actors themselves, the researcher must

combine relational data, with what Scott (2000) calls *attribute data* and Wasserman and Faust (1995) call *composition variables*. This data type refers to the specific and unique attitudes, opinions, and attributes that characterize the actors themselves (rather than their ties). Composition variables are defined and measured at the level of individual actors, and may include demographic or geographic data (Wasserman and Faust, 1995). Lastly, a researcher might examine affiliation data, found in the study of affiliation networks. Affiliation data refers to the specific attributes of an 'event' in a two-mode network.

4.1.3. Network Boundary

According to Scott (2000, p. 54), "the determination of boundaries in a research project is the outcome of a theoretically informed decision about what is significant in the situation under investigation." In cases where the actors constitute a small closed set and can all be identified, network boundaries and target populations are easy to determine. An example of such a small manageable set may be employees in a corporation or students in a particular academic faculty. On the other hand, for studies in which the boundary of the network is difficult or impossible to determine, the task of selecting a target population for study becomes more challenging and is, to a not insignificant extent, dependent on the nature of the research question(s) that are to be addressed.

Wasserman and Faust (1995) suggest defining the boundaries based on the actors' relative frequency of interaction, or the intensity of ties among members. Laumann, Marsden, and Prensky (1989) offer two different approaches to setting boundaries in study using SNA. The first, which they refer to as the *realist* approach, allows members to determine the boundary themselves either explicitly by identifying all the members of the group or by providing the necessary criteria for membership of the group. The second, which they refer to as the *nominalist* approach, allows the researcher to set the boundary based on theoretical concerns. For example, if a researcher is interested in studying how organizations participate in information exchange with academic institutions, the researcher may choose to select the top 20 Fortune 100 companies to study. These companies may not consider themselves exemplary in there sharing of information and at the same time, if given the chance they may not have selected the other 19 companies to be included in the list. However, in this case the list has been constructed by the researcher to provide a test of a particular theory or to facilitate providing an answer to a particular research question.

A third approach called *expanding selection* developed by Doreian and Woodard (1992), allows the researcher to utilize a combination of the realist and nominalist approaches. This approach has similarities to snowball sampling in that it begins with an initial list of actors in the network, and then allows for additions to the network as long as the new actor has more than one link (two or more) to the existing identified network (Marsden, 2005).

When a network boundary is truly indefinable or encompasses an unmanageably large network, the researcher may select to conduct the study using a sample of the target population. Sampling is not common in SNA, and for good reason. Burt (1983 as quoted in Scott, 2000) estimated that the amount of relational data lost through sampling is equal to (100 - k) per cent, where *k* is the sample size as a percentage of the population. This means that a 10 per cent sample involves the

loss of 90 per cent of the relational data. In spite of this very significant data loss, in larger network studies sampling may be the only option.

4.1.4. Data Collection

Questionnaires are the most common data collection method used in social network analysis, despite the fact that they rely on self reporting with all the attendant accuracy and validity concerns. Questionnaires are especially useful when the actors are people and the relational ties being studied are ones that the actors can report on (Wasserman and Faust, 1995). With these studies, researchers simply ask respondents to identify the nature of their ties to the other actors in the network. Although similar information may be gathered through actors maintaining diaries, questionnaires are clearly less time consuming and may provide similar data; though completeness of the data may be of concern. When questionnaires are not feasible, interviews may be used; either face-to-face or over the telephone. This was the case for Galaskiewicz (1985, as quoted in Wasserman and Faust 1995) when he interviewed CEO's who were much more likely to agree to an interview over an impersonal questionnaire. Wellman (1979) also used interviews in his study of social support in East York, Ontario.

Another method for data collection is observation. In this method the researcher observes interactions among actors and records information like the number of minutes of interaction, the topic of conversation, or even the mood of the actors. Observation can be used to supplement or confirm information gathered through questionnaires, or to build relational data. For example, Roethlisberger and Dickson, 1961; Kappferer, 1969; and Thurman, 1980 all constructed their studies' relational ties based on their impressions gathered from observations over extended periods of time. This method has also been widely used to study relatively small groups of people who have face-to-face interactions.

Some network analysts retrieve archival records which may have recorded past interactions. For example, researchers concerned with academic knowledge dissemination routinely turn to citations. Other archival records may include, "journal articles, newspapers, court records, [and] minutes of executive meetings" (Wasserman and Faust, 1995). These types of inquires are common in longitudinal studies where the researcher may be concerned with examining a process changing over time.

4.1.5. Validity, Reliability, and Accuracy

Wasserman and Faust, (1995) warn that by having people report on their own interactions, the accuracy of this self-reported data may be called into question. One way to combat this concern is to verify, or at least compare, information collected with actual observations of the actors' interactions. Also if the actors in the study are groups, such as organizations, the information on ties collected from representatives of the organization should be checked. It is also difficult to judge the reliability of data since it may be difficult to retest a personal assessment made at a given time. Since relationships and ties change over time, a retest may show different clusters and relationships. Wasserman and Faust (1995) suggest using alternative question formats and methods to triangulate data at the time of collection in order to obviate this problem.

4.2. Organizational Network Analysis

Organizational Network Analysis (ONA) can be defined as the application of SNA to an organizational setting (Krebs, 2004). The study is concerned with providing a more accurate view of a company's social, information and knowledge-sharing dynamics (Bonabeau and Krebs, 2002). The technique maps knowledge and information networks uncovering interactions within and across the boundaries of the organization. Since knowledge and information flow along existing pathways in organizations, ONA provides a method for understanding those pathways and may potentially suggest ways of improving the flow of knowledge and information along these pathways. Rather than organizational charts showing who reports to whom, ONA network diagrams show; who knows what and whom, who works most often with whom (Bonabeau and Krebs, 2002), as well as who trusts whom.

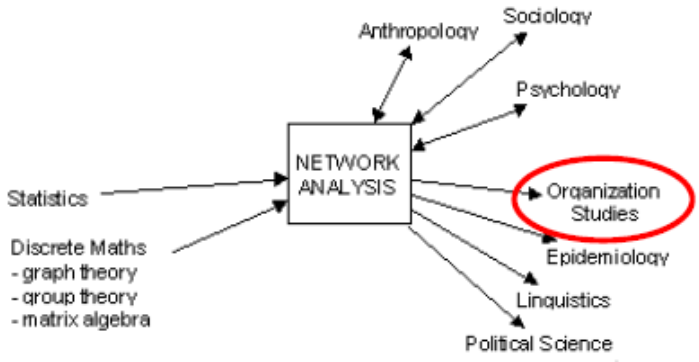


Figure 9: Social Network Position in Academic Economy (Borgatti, 2000)

ONA has been used to explore organizations from a number of different perspectives. For example, it has been used to identify patterns of interaction in an enterprise; identify information bottlenecks and knowledge brokers; improve the flow of knowledge and information; acknowledge thought leaders and key information brokers; assemble and launch large and distributed project teams; retain people with vital corporate knowledge; increase social capital (the sum of the relationships among people, norms, values and shared meaning in an organization) and increase innovation, productivity and responsiveness (Anklam, 2003) .

The methods used in conducting an ONA are quite similar to those used in SNA. Data collection methods may vary but can include any of those mentioned above (survey, questionnaire, observation, interview, etc.). If surveys or questionnaires are used, Cross and Prusak (2002) suggest pretesting them on a small sample of employees to ensure that the instrument is not viewed as an unwanted intrusion. It is also important in an organizational setting to ensure that confidentiality and privacy are established. Once data is collected network maps are drawn and analyzed. Where there is any conflicting data, it may be necessary to re-examine the data and, possibly, collect further data through re-interviewing key actors once the map has been created. The interviews further explore the nature of the conflicts and help more clearly enunciate the context within which the data should be interpreted (Anklam, 2003).

4.3. Motivation for Selecting Social Network Analysis

Contrary to standard social or behavioral science methods which ignore relational data, SNA uses network models to build theories about relational processes and structures. Capturing network structure, relational and composition data allows the researcher to pose or test theories

concerning the relationships among them and other theoretically relevant concepts such as, in this research study, trust. Examining these interrelationships hopefully sheds light on how particular types of structural/relational data (i.e. trust) and composition data (i.e. demographic data) influence network structure and more importantly, influence information and knowledge sharing. SNA is one of the only methods that allows the researcher to examine relationships among units and facilitates the development of an understanding of individual or group action within the context of these relationships.

In addition, SNA allows the researcher to determine the overall structure of a network in terms of network linkages as well as to understand and model the regularity (density) of actor interaction. This approach therefore allows the researcher to theorize on and subsequently determine how network structure (i.e. closed, open) influences relational data (i.e. trust, information shared).

5. Research Design

Based on the review of SNA provided above, the following section will focus on how the proposed research study will be designed. In particular, the manner in which data will be framed, measured, collected and analyzed will be discussed. Specific variables that will be measured and hypotheses that will be tested will also be identified.

5.1. One-Mode vs. Two-Mode

Selecting the number of modes to study is a central decision in constructing the rest of the study. In other words, the research design may vary considerably based on this decision. In order to consider more than one approach toward this study a primary mode distinction must be made:

- Approach 1: Structure the study as a one-mode network
- Approach 2: Structure the study as a two-mode affiliation network

If the first approach is selected the proposed study's focus will be on relationships between a single set of actors (i.e. employees of a knowledge intensive firm). Using this approach, the relational data measured will focus on two classes or types of relational contents: *Individual evaluations* (where ties represent strength or presence of Trust) *and Transfer of Non-Material Resources* (where ties represent information/knowledge transmitted or received). In addition to the above relational information, data reflecting actor attributes will be gathered and compared using varying characteristics of the actors (see composition variables).

If the second approach (two-mode affiliation network) is employed, one mode of the network will be represented by the actor and the second mode by the COP 'event' or meeting, linking them together. Using this approach allows for a dual perspective where the actors are connected through the COP gatherings (events) they participate in and the events themselves are linked by the actors through their membership or participation.

5.2. Egocentric vs. Whole Network

For the purpose of this research a combination of an ego-centric and a whole-network perspective will be utilized. The use of a joint approach is justified as a result of their potential interrelatedness, and hence the ability of both approaches to yield relevant data to this research

study. To support this combined approach Marsden (2005) argues that both approaches can act as complementary viewpoints on the same data.

> *Egocentric and whole-network designs are usually distinguished sharply from one another, but they are interrelated. A whole network contains an egocentric network for each object within it (Marsden, 2002). Conversely, if egos are sampled "densely" whole networks may be constructed using egocentric network data.* (Marsden, 2005 p. 9)

Thus, this research will work towards employing both designs depending on the question being asked. For example if the question is interested in strength of trusting relationships or network density, a *'dense' whole network* (defined as the core members of the Community of Practice and the actors they interact with from organizationally distinct functional units) may be constructed using an egocentric design and egocentric data. This approach would involve surveying actors identified as members of the COP and reconstructing a 'whole' network using the relational egocentric data collected. An equally relevant alternative approach using whole-network design would examine egocentric relational data based on whole network structure (open or closed). In this case the network is viewed as a whole and then egocentric relational data is examined within that network (i.e. judging overall trust in a closed vs. open network as measured through the sum of the levels of trust associated with individual actors).

5.3. Network Boundary

Setting the boundary for the study is a different task than setting a network boundary for the COP within the network. From a whole network standpoint the boundary will be set using Laumann, Marsden and Prensky's (1989) *positional* approach, which is based on formal membership criteria such as employment at an organization.

Using the positional approach, this research will focus on the employees of medium sized companies (more than 50 employees) working in knowledge intensive industries. The firms selected for study must employ knowledge workers and be involved in some recognized knowledge management initiative. Examples of knowledge management initiatives may include information management systems, competitive intelligence systems, knowledge management systems or portals, or any knowledge management programs (including training programs and retreats). Ideal firms would be for profit and work in business consulting, legal or financial services, or research and development.

Focusing in on a COP adds the burden of having to construct a second network boundary, specifically identifying a boundary of the COP. This may be challenging as community members may change over time. Using a two mode affiliation network may yield membership lists which greatly differ from those constructed by existing and long standing members. Once an initial set of undisputed members of the COP is created, those members can be surveyed to add additional names to the list. As indicated earlier the research will make use of an expanded selection method which involves starting with an initial list of actors in the network, and then allows for additions to the network as long as the new actor has more than one link (two or more) to the existing identified network (Marsden, 2005).

To identify the initial list of 'undisputed' members of the COP, a number of other methods are discussed.

5.3.1. Identification of Community of Practice Members

5.3.1.1. Name, position, or resource generators

Marsden (2005) discusses three viable methods to reconstruct a network which accurately represents a target COP. The first method, called a *name generator,* identifies an actor's colleagues in a COP by asking free-recall questions of the actor (i.e. name the members of the innovation team). The second method, called a *position generator,* asks respondents whether or not they have relationships with particular social positions (i.e. name the project leads). The third, and likely most appropriate, method developed by Van der Gaag and Snijders (2004) is called the *resource generator.* Also an ego centered approach; the resource generator asks respondents to identify anyone having specific capacity (i.e. domain information or knowledge) or possession (i.e. money). Though this method does not enumerate specific social ties, it can be useful in identifying members in a COP.

5.3.1.2. Cognitive Social Structure

A cognitive social structure questionnaire asks respondents to report on the perceived ties of other actors in the network set; as opposed to responding on their own ties and relationships. Following Freeman, Freeman and Michaelson (1988; 1989), this method may be used to ask respondents to construct subgroups of people who they believe form a COP within the context of the larger organization.

5.3.1.3. Archival Network Data

According to Marsden (2005), network studies frequently use information gathered from existing archives. This data traces relationships longitudinally and is relatively inexpensive to search, especially in electronic form. Burt and Lin (1977) suggested that social networks may be reconstructed using journal articles, newspapers, court records, or executive meeting minutes. Other archival data which may show promise in reconstructing a network set and identifying a COP may be: board membership lists, project documentation, company blogs, archived email, instant messaging logs, company newsletters, knowledge bases, portals, competitive intelligence systems, and case tools.

Since the membership of a COP can be considered to be relatively bounded, some record of past interaction should exist (i.e. a membership roster, project sign up, or schedule). Any of the previously mentioned archived records would greatly assist in at the very least constructing an incomplete list of COP members. It is noteworthy that in using archived data it is important to understand the conditions under which the archives were produced and scrutinize their validity (i.e. how did the original authors define the relationships, under what conditions did this object become part of the archives). Archived data is also most commonly used in affiliation networks.

5.3.1.4. Observation

Observation is another method by which COP members may be identified. Simply attending these meetings will identify the current members. Observing patterns of interaction may be more difficult as an agent's observed behavior may differ from their true feelings (Webster, 1994).

Nevertheless, physically attending COP meetings and following those members back to their respective functional units will at the very least create a partially complete network list.

5.3.1.5. Sampling

The study will try not to examine samples of larger populations as most network studies provide the most reliable and tractable data when they are focused on well-defined, completely enumerated sets of actors (Wassermann and Faust, 1995).

5.4. Measurement

5.4.1. Unit of Observation

The unit of observation is the entity on which measurements are taken. According to Wasserman and Faust (1995) the unit of observation in an SNA study may take the form of an actor, a pair of actors, a relational tie or an event. In the case of this study, the unit of observation will be individual actors who will be asked to report on ties from themselves to other actors who are members of the target social network (ex. a Community of Practice).

If the study is presented using the alternative *Two Mode - Affiliation Network* approach, one mode of the network will be represented by the actor and the second by an 'event' or COP meeting.

5.4.2. Modeling Units

A modeling unit is the level at which network data is studied, and according to Wasserman and Faust (1995) may and often is different than the unit of observation used in the gathering process. For example, in a one-mode network the research may gather relational data from an actor's perspective and then choose to reconstruct and analyze the network by modeling dyads, triads, sub-groups, or entire networks. In order to select the proper modeling unit, one must first consider the property that the researcher is interested in studying. For example, to study trust reciprocity (If A trusts B, does B trust A) the modeling unit of choice will be the dyad. Based on the hypotheses being tested this study will employ dyad, subgroup and network unit modeling.

5.4.3. Relational Quantification

As discussed above, ties or relations in a network are generally categorized as being directional or non-directional and dichotomous or valued. This study will make every attempt to use directional valued relations. A directional relation implies an origin and destination and a valued relation is expressed through some value, which may imply tie strength, frequency, or intensity.

5.5. Variables

If the study focuses on the one-mode network approach, it will warrant the use of structural variables in the form of individual evaluations (where data represents strength or presence of Trust[36]) and transfer of non-material resources (where data represents information/knowledge transmitted or received). This one-mode approach would also employ two types of composition variables, the first capturing traditional demographic characteristics including ascribed characteristics such as race, ethnicity sex, and age as well as acquired characteristics such as

[36] Trust will be determined using one of two instrument, for samples see Appendix 3

religion, education, and occupation. The second set of composition variables would measure values, attitudes, and beliefs. If the two-mode affiliation network approach is used, affiliation data related to the COP meeting will also be recorded (i.e. attendance, time and data, topics discussed, action points, documents shared, minutes, etc.)

5.6. Variables and Hypotheses

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Compositional Variable: 1. Traditional demographic characteristics including: ascribed characteristics such as race, ethnicity sex, and age as well as acquired characteristics such as religion, education, and occupation. 2. Values, attitudes, and beliefs

- Hypothesis 1: Higher levels of trust will be exhibited between members of a Community of Practice who share status homophily than between those who do not.
- Hypothesis 2: Higher levels of trust will be exhibited between members of a Community of Practice who perceive themselves as sharing value homophily than those who do not.
- Hypothesis 3: Communities of Practice whose members share status homophily will have a higher measure of overall trust than Communities of Practice whose members do not.
- Hypothesis 4: Communities of Practice whose members perceive themselves as sharing value homophily will have a higher measure of overall trust than Communities of Practice whose members do not.

Structural Variable: Information / Perceived Knowledge Dissemination (Surveyed)

Compositional Variable: 1. Traditional demographic characteristics including: ascribed characteristics such as race, ethnicity sex, and age as well as acquired characteristics such as religion, education, and occupation. 2. Values, attitudes, and beliefs

- Hypothesis 5: Communities of Practice whose members share status homophily or perceived value homophily will be more effective in their information seeking/retrieving behavior than Communities of Practice whose members do not share such characteristics.
- Hypothesis 6: Communities of Practice whose members share status homophily or perceived value homophily will be more effective at knowledge dissemination than Communities of Practice whose members do not share such characteristics.

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

- Hypothesis 7: Overall levels of trust will be greater in a closed social structure than in an open one
    - See Figure 8: Overall trust of (A,B,C,D) > Overall trust of (F,B,A,G)

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Number of Sanctions imposed (Surveyed or Observed)

- Hypothesis 8: There is an inverse relationship between trust vested in an individual member of a social network and the number of sanctions that have been imposed on that member.
    - Trustworthiness of a member decreases as the number of sanctions imposed increases

Composition Variable: Number of Sanctions imposed (Surveyed or Observed)

- Hypothesis 9: Closed social networks will have fewer imposed sanctions than open social networks

Structural Variable: Trust and Reciprocity (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples. Reciprocity (surveyed or observed))

- Hypothesis 10: Low levels of perceived or actual reciprocity by members of a closed network will correspond with low levels of trust between those members and the non-reciprocating member(s)
- Hypothesis 11: Low levels of perceived or actual reciprocity in a closed network will lead to its destruction or 'opening'

Structural Variable: Information / Perceived Knowledge Dissemination; Reciprocity (Surveyed)

- Hypothesis 12: Low levels of perceived or actual reciprocity between individuals will correspond to high levels of information hoarding
- Hypothesis 13: Sanctions imposed on individuals will limit knowledge sharing

Structural Variable: Information / Perceived Knowledge Dissemination; Trust (Survey and trust or trustworthiness measurement instrument; see Appendix 3 for examples)

- Hypothesis 14: Communities of Practice will be more effective in their information seeking/retrieving behavior when their members exhibit high levels of trust with their respective functional units

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Number of Referrals (Surveyed)

- Hypothesis 15: A large number of network referrals will correspond to a high level of trust between the referring parties

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Information Benefits (Surveyed or Observed)

- Hypothesis 16: High information benefits achieved by members of the Community of Practice will correspond with high levels of trust between the benefiting member and their corresponding external functional unit

- To rephrase, using the example network (Figure 8): high information benefits achieved by A, B, C, or D will correspond to high levels of trust between A-G, B-F, D-E, or C-H

Structural Variable: Information / Perceived Knowledge Dissemination; Trust (Survey and trust or trustworthiness measurement instrument; see Appendix 3 for examples)

- Hypothesis 17: Communities of Practice will be more effective at knowledge dissemination when their members exhibit high levels of trust with their respective functional units (high trust between A-G, B-F, D-E, or C-H in Figure 8).

Structural Variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Observed or reported control benefits (Surveyed or Observed)

- Hypothesis 18: High control benefits achieved by members of the COP will correspond with low levels of trust between the benefiting members and their corresponding external functional unit.
    - Using the example network (Figure 8): high control benefits achieved by A, B, C, or D will correspond to low levels of trust between A-G, B-F, D-E, or C-H.

Structural variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Iungens/Gaudens Orientation (Surveyed or Observed)

- Hypothesis 19: Agents with high tertius iungens orientations will be rated as more trustworthy by their network peers than those with a tertius gaudens orientation.

Structural variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

Composition Variable: Observed or reported Iungens behavior (Surveyed or Observed)

- Hypothesis 20: High levels of overall trust must be present (both among members in the COP and their external contacts) for tertius iungens activities to take place.

Structural variable: Trust (Determined using a trust or trustworthiness measurement instrument; see Appendix 3 for examples)

6. Hypothesis 21: There is a non-linear inverse relationship between levels of trust and degrees of separation

6.1. Data Collection

6.1.1. Questionnaires

This study plans to employ a questionnaire using the *roster method* as opposed to a *free recall* one where respondents are given a complete list (see identification of members; section 5.3.1.) of actors in the actor set. Additionally, actors will not be given any constraints on how many ties to

report on. The data will be *free choice* as opposed to *fixed choice* (i.e. name 3 people you are friends with). If possible, actors will be asked to report on as many actors in the user set that apply to the question. Lastly, both a *ratings and complete ranking* design will be used based on the structural variable. For example, in measuring trust a ratings design will be used where a value will be determined for each actor and their corresponding alter ties. For measuring information sharing, a rankings design might be more appropriate where, for example, actors are given flash cards containing the names of the participants in the network set and they are asked to arrange them in the order of most disseminated to the least.

6.1.2. Observation

Observational methods may also be used to supplement or confirm the information gathered through questionnaires. If the alternative two-mode affiliation network design is used, observational methods can also be useful in recording affiliation variables.

6.2. Measurement Accuracy, Validity, and Reliability

Much of the data in the proposed study relies on information gathered through questioners and surveys. This collection method opens the possibility of issues concerning informant accuracy (see Bernard, Killworth, and Sailer, 1982). To account for these accuracy issues, secondary data will be gathered through observation and archival data.

To assure validity, pre-existing rigorously tested and verified instruments will be used whenever possible (i.e. Mayer and Davis, 1999 or McAllister, 1995 for measuring trust). Both of the previously mentioned instruments have been used in numerous studies, have high construct validity, and are two of the top five (156 reviewed in total) recommended trust measurement instruments reviewed by McEvily and Tortoriello (2007).

To address reliability, the study will be conducted on numerous social networks including two or three Communities of Practice, either in the same organization or at a similarly structured second organization. The results will then be compared and contrasted to assure reliability. This method is similar to the test-retest approach discussed in Wasserman and Faust (1995). Wasserman and Faust (1995) also suggest using rating or full rank order questions and using groups with more intense or intimate relations.

7. Research Contribution

The primary value of this study is to help researchers and practitioners better understand knowledge sharing behavior in organizations. The research intends to explore and evaluate various determinants of the knowledge sharing process in knowledge-intensive organizations. These determinants may include any factors that either motivate or inhibit knowledge sharing behavior. Of specific interest is the influence trust and network structure has on the knowledge sharing process. Social networking principles will be used to test possible connections between network structure, trust, and knowledge sharing.

This research contributes to the study of trust within organizations by:

- Providing another research setting and validity test for one or more of the preexisting instruments for measuring trust (i.e. Mayer and Davis, 1999; McAllister, 1995)

- Providing empirical evidence on the relationship between trust and knowledge sharing (with the expectation that such a relationship exists)
- Retesting existing social network principle findings on trust (i.e. Coleman, 1988, Burt, 2002; McPherson, Smith-Lovin and Cook, 2001) in a different context (within and across member of a COP)

This research further contributes to the study of knowledge in organizations by expanding the knowledge relating to motivating and inhibiting behaviors associated with knowledge sharing. This research also benefits the target organization(s) by helping them better understand their employees' knowledge sharing behaviors, trust for one another, and helping them identify their COPs (if they are not already transparent). The organizations can potentially use this information to enhance the trusting relationships that exist between appropriate employees and thus encourage the sharing of information and knowledge, improving the performance of the organization.

8. Appendix 1: Knowledge

8.1. Knowledge Definition Components

8.1.1. Activity

8.1.1.1. Activity and Action

Dictionaries provide definitions for the terms *activity* and *action* that indicate that the two terms have essentially the same meaning (i.e. "a specific deed, action…" Webster's, 2007) or make a distinction based on objective (i.e. where activity is "an action taken in pursuit of an objective", Oxford, 2007). The latter distinction is not entirely sound since exploratory activities may have no intended objective. For example, children may invent an activity (e.g. the action of spinning in circles) with no intended objective in mind. If one accepts the 'pursuit of objective' distinction then one must conclude that only after the child returns to the activity for the objective of 'fun' does spinning seize to be an action and become an activity. Therefore for the purpose of this research, activity and action will be considered synonymous.

The notion of knowledge as action-orientated was advanced by Polanyi (1966) who argued that all knowing requires skillful action[37]. According to Spender (1996b, p. 54) Polanyi was also one of the first to discuss knowledge as, "a form of abstraction that can only be known, evidenced and communicated through action". This perspective is now commonly accepted in some extended form by numerous social scientists and most knowledge management theorists including Nonaka and Takeuchi, 1995; Choo 1998; Davenport and Prusak 1998; Leonard and Sensiper 2002; Suchman 1987; Wigg 1997; Tsoukas, 2005a, 2005b; Blackler, 2002; Spender, 1996b; Bartol and Srivastava, 2002; Habermas, 1971; Van De Ven and Johnson, 2006; and Elliott and O'Dell, 1999.

8.1.1.2. Activity and Practice / Process

Tsoukas (2005a, p. 118) refers to knowledge as, "a process for incorporating new experiences and information." For Nonaka (2002, p. 438) knowledge is "a dynamic human process of justifying personal beliefs." This view of 'knowledge as process'[38] is also shared by Latour (1987); Thompson and Walsham (2004); Spender (1996b); and Blackler (2002).
Gherardi (2001) propagates a similar pragmatic theory of knowing where practice connects 'knowing' with 'doing'. For Gherardi (2001, p. 136), "knowledge consequently does not arise from scientific 'discoveries'; rather, it is fabricated by situated practices of knowledge production and reproduction, using the technologies of representation and mobilization employed by scientists."

The terms practice and process are commonly used interchangeably in the organizational science and knowledge management literature when defining knowledge. As opposed to colloquial usage of action, process and practice imply some degree of standardization and specialization. In this respect, both processes and practices are comprised of a set of actions (action oriented and action dependent), and have a methodical/standardized objective. If such a characterization is accepted then process and practice may be used synonymously with activity, a common practice in activity theory (Leont'ev, 1978; Blackler, Crump, and McDonald, 2000).

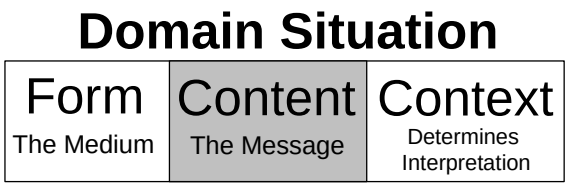
[37] Using Oxford's definition of activity one can infer that Polanyi's 'skillful action' may be viewed as activity since it implies objective action

[38] A view that examines knowledge as process may also be referred to a as a 'practice based theory of knowing' (Blackler, 2002; Thompson and Walsham, 2004)

Perhaps the clearest illustration of the concept of activity in knowledge is represented in the following quote from Blackler (2002), "Rather than thinking of knowledge as a thing that people possess, it is more helpful to analyze knowing as something that people do" (p. 63).

8.1.2. Domain Situation

The second part of the proposed knowledge definition refers to knowledge as being ***situated*** within a socially constructed ***domain***. This section will focus on the idea of domain situation; the theory that it is socially constructed will be discussed in the next section. To better understand the concept of domain it is best to divide the idea along three separate but interrelated dimensions. Thus, all domains consist of: *form*, *content*, and *context*. A specific agent's knowledge state will be influenced by a unique and personal construction and representation of these three dimensions.



8.1.2.1. Form

The first of these dimensions is form. Form represents the structure of and channel through which information is being communicated. Form can consist of physical objects such as textbooks, maps, prototypes, or architectural models. Form may also take a more conceptual meaning, such as the example when discussing language, metaphor, analogies, or mental models (Vygotsky 1978; Tsoukas, 2005a; Blackler, 2002; Toulmin, 1999). These more conceptual representations of form are commonly referred to as 'instruments' (Vygotsky) or 'cultural tools' (Tsoukas) in the same way that a map may be. Using McLuhan's (1962) famous axiom[39], form is synonymous with medium.

8.1.2.2. Content

Content, the second dimension, refers to the specifics or meaning derived from a particular domain. To state it another way, the content is the data encrypted in the form. Using an example from Toulmin's (1999 p.59), "language has a definite meaning only when it is related to a given constellation of practical activities…we understand the meaning of the word strike only if we are familiar with the game of baseball." Using an example of a mathematics textbook it may be argued that algebraic concepts (content) are learned or understood by the students through the use of algebraic equations, metaphors, and analogies (form). Using McLuhan's (1962) axiom, content is synonymous with message.

8.1.2.3. Context

The final dimension of domain situation is context. Context refers to how other domains influence and support meaning and understanding in the domain in question. Context helps to determine interpretation. Thompson and Walsham (2004, p.735) define context as, "the relationally situated ingredients through which knowing occurs." Form may remain constant throughout various contexts yet the content or meaning may and often does change throughout

[39] "The medium is the message" from McLuhan's *The Gutenberg Galaxy*

contexts. Again we may use the example of the game of baseball. If the expressions "stealing" or "striking" are taken out of the "playing baseball" context their meaning dramatically changes. "Playing Baseball… provides the background against which the word strike has this meaning. The shared intelligibility of any utterance requires it to have a standard place in a specific practical context (Toulmin, 1999 p.60)."

The appropriate interpretation of the form depends on the nature of the context as well as the nature of the community within that context (Duguid, 2005; Leonard and Sensiper, 2002). According to Nonaka (1994 p.30), "what makes sense in one context, can change or even lose its meaning when communicated to people in a different context". To effectively interact with the domain in question Duguid (2005) suggests that the agent must learn to decode from the perspective of that domain and community. This idea is consistent with Wittgenstein (1953) who argues that meaning and practical implication depend on their use and on the framework in which they exist. Wittgenstein (1953), Spender (1996a), Thompson and Walsham (2004) would argue that the meaning of all knowledge is tied up within the context of its development. This also supports Lave (1993) and Blackler's (2002) argument that knowledge may not be divorced from context and transmitted as simply abstract data (form).

According to Bell (1973) we use theory in order to generalize from one context to another. It is this generalizing and use of theory that help us to exercise judgment (especially in a foreign domain). Since all agents will have different 'relationally situated ingredients' or different influencing (meaning supporting) contexts it is clear why no two agents can share exactly the same meaning. If the agents do not share the same codes, according to Boisot (2002 p.72), they will operate with 'different conceptual schemes'. These incompatibilities between the agents will cause distortion and rejection of new knowledge.

To truly interpret meaning within a domain an agent is forced to understand that domain's interrelated contexts[40]. For example, in order to understand the meaning of "the fastball struck out the third baseman" the agent must understand both the context of playing baseball as well as understand the context use of the English language. This same phrase uttered at a baseball game in Japan may not have the same interpreted meaning since the examples only share one of the two minimum required contexts to interpret meaning from that statement.

Being able to act prudently and correctly within any particular domain is learning to make distinctions and connections to the contexts influencing that domain; what Aristotle called phronesis (practical wisdom) (Tsoukas, 2004a; Wenger, 1998; Van De Ven and Johnson, 2006). In most cases this requires one to be a member or have an understanding of the community in which the domain operates[41]. This sentiment is echoed in Lave and Wenger (1991, p. 97) definition of community as implying "participation in an activity system about which participants share understandings concerning what they are doing…the social structure of [their] practice, its power relations, and its conditions for legitimacy".

The addition of context to the proposed domain situation model differentiates from McLuhan's technologically deterministic "medium is the message" in that all three axes have to exist to

[40] This will largely be influenced by the community
[41] This concept will be further explored in the next section on social construction and cultural knowledge

situate knowledge. The three dimensions are not unrelated. Instead form is combined with context to create content. An agent's existing prior stock of knowledge (known contexts or existing domains) will also heavily influence their ability to act and interpret the appropriate meaning.

8.1.3. Social Construction

Social construction theory[42] as it applies to knowledge finds its roots in early Russian Psychology (Leont'ev, 1978; Vygotsky, 1978) and Economics (Marx, 1932). Influenced by Marx, Vygotsky (1978) and his colleagues argued that human consciousness is both shaped by social experiences and mediated by culturally established tools. Marx (1932; Third Manuscript) argues, "The eye has become a *human* eye, just as its *object* has become a social, human object – an object made by man for man". Using Leont'ev the argument is elaborated:

> *Isolated activity cannot be understood apart from social ties... Entering into contact with each other, people formulate a language that serves to represent the objects, the means, and the very process of work itself. [W]ords, the language signs, are not simply replacements for things, their conditional substitutes. Behind philological meanings is hidden social practice, activity transformed and crystallized in them; only in the process of this activity is objective reality revealed to man. (Leont'ev, 1978 p.18)*

This premise of socially constructed consciousness is foundational to the work in activity theory and is so influential that it is found in their definition of consciousness itself:

> *Man is born into the world of objects created by previous generations, and is formed as such only in the process of learning how to use them to a definite end. The mode of his relation to reality is not determined directly by his bodily organisation (as in the case with animals), but by the habits of practical activity acquired solely through communication with other people.[43] (Tolman, 1988 p.16)*

Influenced by this viewpoint, many theorists have turned toward social construction and activity theory to understand and define knowledge and theorize on how it is created and disseminated. In general, the social construction viewpoint defines knowledge as, 'the social practice of knowing' (Boer, van Baalen, and Kumar, 2002). Gherardi (2001, p.133) argues "learning and knowing are mediated by social relations...knowledge resides in social relations…[and] knowing is part of a surrendering to a social habit." Nonaka (1994) claims that knowing is something that emerges through continuous dialogue among practitioners. In fact, Nonaka's (2002) 'socialization'[44] refers to a process of creating knowledge through shared experience.

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[42] Social Construction Theory is defined using Spender (1996a) as "the idea that the individual's consciousness and thinking are fashioned socially" (p. 69)

[43] Extract taken from Tolman's (1988) *The basic vocabulary of Activity Theory*. Original text appeared in Frolov's (1984 p.81-82) *Dictionary of philosophy.*

[44] Socialization is borrowed from Nonaka's proposed model for knowledge creation; the SECI model.

Shared experience and context[45] are closely interrelated. Individuals learn to exercise judgment through a process of socialization, which is based on a socially constructed shared context (Tsoukas, 2005a). New knowledge is socially constructed *by* and becomes meaningful *to* the community within which it was constructed (Boer, van Baalen, and Kumar, 2002). To rephrase, abstract formulations ultimately depend on collective, socially accepted definitions (Tsoukas, 2005a; Polanyi, 1966; Toulmin, 1999; Blackler, Crump, and McDonald, 2000; Nonaka and Takeuchi, 1995; Spender, 1996). This is what Wittgenstein (1953) called 'forms of life' (Lebensformen), or what Grant refers to as 'common knowledge' (Choo and Bontis, 2002).

Social constructionists understand knowledge to be a product of a collective; something that is developed communally, over time (Brown and Duguid, 1991;1998;2000; Blackler, 2002; Leonard and Sensiper, 2002). The, "outcome of people working together, sharing experiences, and constructing meaning out of what they do" (Choo, 2000 p.395). Some of these theorists (Leonard and Sensiper, 2002; Polanyi, 1966; Tsoukas, 2005a) argue that 'personal knowledge' exists in collaboration with 'collective knowledge'. In other words, that each member socialized within the collective encompasses the knowledge of the collective. Other theorists (De Carolis, 2002; De Long and Fahey, 2000; Boer, van Baalen, and Kumar, 2002; Boisot, 2002; Spender, 1994; Brown and Duguid, 1998) believe that this socially constructed 'collective' knowledge resides (or is embedded) in and is the possession of the collective itself (independently from the individuals comprising the collective). This latter perspective suggests that knowledge supersedes any one individual and is 'greater' than the sum of the individual knowledge within the collective.

8.1.4. Developmental Capacity (Personal Ability and Capacity)

A fourth component in the proposed definition of knowledge is personal developmental ability and capacity. It is important to note that if developmental capacity is to be acknowledged, one must first accept Polanyi and Prosch's (1975) belief that *all knowledge is personal* and subjective; despite the fact that it is constructed socially. Though these two concepts seem as if they are polar opposites this section will reason three arguments for how these may work concurrently.

"All knowing is personal knowing"(Polanyi and Prosch, 1975, p.44). "All knowledge is personal knowledge" (Tsoukas 2005a, p.126). Knowledge has an active, subjective nature which at a fundamental level is created by the individual (Nonaka, 2002, p.440). Human judgment is manifested at both a historically collective level as well as at an individual level. According to Tsoukas (2005ab) and Polanyi and Prosch (1975); to know something is to realize a 'skillful accomplishment' (Tsoukas, 2005a, p.127).

This 'skillful accomplishment' is mediated through personal human judgment (Tsoukas, 2005ab). Knowing is based on a personal exercising of reason (Spender, 1996b). According to Tsoukas (2005b, p.144) personal judgment is involved when 'applying abstract representations of the world' and making assessments of the existing gaps within these representations. A personal judgment is not guided by strict rules, instead it is a skillful exercise of our body and mind (guided by our senses) (Polanyi, 1966; Polanyi and Prosh, 1975; Tsoukas, 2005b). "The

[45] Context is discussed in greater detail within Domain Situation

individual develops a feel for and a capacity to make intuitive judgments about the successful execution of the activity." (Choo, 2000 p.395)

Bell (1973) and Boisot (1998) take a similar approach arguing that knowledge can be conceptualized as a set of probability distributions or organized statements of facts/ideas which guide reasoned judgment and orient actions. Tsoukas (2005a p.126) describes this personal judgment as being associated with the prefix re- (re-order, re-arrange, and re-design). He goes on to argue that judgment involves the personal ability to draw distinctions; to divide the world into 'this' and 'that'. Despite our ability to do this, all judgments, ideas, and probability distributions within one domain will enviably encounter messiness and complexity once introduced into another domain. Therefore, according to Tsoukas, exercising judgment involves, "the ability of an individual to draw distinctions and the location of the individual within a collectively generated and sustained domain of action" (Tsoukas, 2005a p.120). For example, a medical student must both be a part of the medical domain and be able to draw distinctions/make judgments within that domain.

The previous point illustrates nicely the second reason all knowledge is personal. An individual's context, used in making judgments, will always be unique. Being able to select the relevant categories for abstraction (drawing distinctions) requires the individual to have prior knowledge of the context/domain in question (Boisot, 2002). Knowing involves a configuration of context (Thompson and Walsham, 2004), a unique integrated set of particulars for which each agent is subsidiarily aware (Tsoukas, 2005a). Knowing involves continuous interaction with the outside world (Nonaka, 2002) yet each person's representation and understood context of that world will differ (Polanyi, 1966). A differential equation cannot alone predict an unknown function of a variables; it is our application and use of differential equations in engineering, physics, and economics which allows us to make reasoned judgments and create new knowledge.

If knowing is personal and requires agents to understand how to exercise judgments based on historically situated and collectively constructed contexts, then one may reason that biological and developmental capacity can impact/influence our cognitive ability to process new information, draw distinctions, and understand relevant concepts. Brain functions influence conceptual skills and cognitive abilities. Changes to the brain may influence an individual's relationship to knowledge, as in the case with brain damage. Similarly, changes to physical make up or motor functions, may also impact an individual's ability to instrumentalize, practice, or disseminate knowledge.

8.1.5. Potentiality

The final component of the proposed knowledge definition is *potentiality*, which is introduced here. The reference to *potentiality* is often alluded to in the literature but rarely explicitly stated. The concept of potentiality is difficult to frame since it has multiple facets. One way to view the *potentiality* of knowledge is by examining its dependence on the rest of the definition. In other words, the domain, social construction, and developmental capacity are partial determinants of the potential value of knowledge. Any variance in the partial determinants will cause some utility change in the agent's state of knowledge or change the extent to which knowledge has effect. Perhaps this is best explained through example.

Two students who score the same on a test (getting the same answers right and wrong) may be considered equal in ability but are quite different in capability for further learning. It is naïve to think of these students as having the same states of knowledge. According to Boisot (2002, p.73), "no two agents possess identical mental schemas, they will therefore assimilate and accommodate new knowledge in different ways…external data that different agents receive may be identical, what actually gets absorbed by each as knowledge will differ."

Take, for example, two driver's education students sitting down at the wheel of a car for their first lesson. Neither student has ever driven a car, though Student A is an avid gamer who enjoys playing first person driving simulators. Student B, who does not own a video game console, instead made sure they memorized the rules of the road handbook provided in class. Student B also pays close attention in class and is attentive to drivers when they are the passenger. During their first hands-on lesson each student will process new data differently partially due to the differences in their prior experiences[46]. Student A may relate their driving experience to a stock of knowledge primarily formed out of video game experiences where Student B may relate to a reference from the handbook. Boisot (2002, p. 68) argues that, "two agents can never achieve identical dispositions to act and hence identical knowledge states." Even though the stimuli (data, information, object) was identical the day of the drive (instructions, supervision, car, driving conditions), Student A and B will achieve different knowledge states. Further, the different knowledge states may vary the extent to which the knowledge has effect (or value), as expressed through action. This is primarily due to their different existing states of knowledge and the way the agents interpret the meaning of new stimuli. Even though the two students may have some knowledge state resonance, because of the differences in how they process data and their prior experiences, they will never reach identical knowledge states. Similar ideas have been echoed by Cohen and Levinthal's (1990) absorptive capacity[47] and Vygotsky's (1978) zone of proximal development[48].

Potentiality is also expressed through the ever changing and evolving nature of knowledge itself. Knowledge undergoes construction and transformation in its use (Blackler, 2002). When new stimulus (information) is introduced, existing knowledge states undergo consolidation or modification. Knowledge is both constructed (created) and destroyed (forgotten or made obsolete) during this process (Boisot, 1998, 2002). This constant transformation makes knowing a 'continually emergent process' (Thompson and Walsham, 2004 p. 735). Knowledge is situated and hence it will inevitably change since the situation around the agent is constantly evolving and developing (Blackler, 2002). The changing situation around the agent will then alter the situated knowledge he/she possesses or applies, and so on in a cyclical fashion. Blackler (2002, p.59) refers to this type of knowing as mediated where, "changes associated with new information…transform[s] the contexts of action." Spender (1994) argues that this circular process of 'learning' continues as long as there is activity. Theoretically this could be never-ending. In discussing organizational knowledge creation Nonaka (2002) mirrors similar sentiments arguing that knowledge creation is a "never-ending, circular process" (p. 451). Since

[46] This concept will be further explored in the domain situation and social construction sections below.
[47] A theory used to measure a firm's ability to value, assimilate, and apply new knowledge
[48] A theory expressing the distance between a person's actual developmental level as determined through independent problem solving and their potential development as determined through problem solving under guidance or in collaboration with more capable peers

knowledge is constantly changing and evolving the potential knowledge state of the actor at any given time may be of more or less value to the firm and is always in flux.

For some activity theorists this idea of potentiality is not new. Vygotsky, Luria, and Leont'ev all write extensively on the potential of human cognition. In his discussion of organizational transformation (organizational knowledge creation/learning) Engeström (1999) refers to potentiality with his concept of expansive learning cycles. He argues, "Miniature cycles of innovative learning should be regarded as *potentially* expansive. A large-scale, expansive cycle of organizational transformation always consists of small cycles of innovative learning." (Engeström, 1999 p.385) Extending this idea, it may be argued that any instance of a knowledge state (commonly referred to as a piece of knowledge) is only a fraction or "small cycle" of knowing (where knowing is a large scale expansive cycle). Potentiality is present in knowing because these small cycles will have varying, constantly evolving degrees of effect (or value) on overall knowing.

To examine knowing or knowledge from an activity theory standpoint one must accept that knowing is constantly developing in non-static activity systems. Knowledge is created or destroyed as contradictions and tensions emerge between the elements within the activity system (Blackler, 2002; Babič and Wagner, 2006). As more activity systems interlink and more information is introduced to the agent, his/her potential to alter their existing knowledge state in a valuable way increases.

9. Appendix 2: Social Network Analysis

Evaluation of one person by another
Transfers of material resources
Association or affiliation
Behavioral interaction
Movement between places or statuses
Physical connection (a road, river, etc.)
Formal relations (for example authority)
Biological relationship (kinship or descent)

Table 6: Relational Ties Identified by Wasserman and Faust (1995, p. 18)

Individual evaluations: friendship, liking, respect. Usually measurements of positive or negative affect of one person for another [focus of the early sociometricians].
Transactions or transfer of material resources: lending or borrowing; buying or selling
Transfer of non-material resources: communications, sending/receiving information
Ties representing the messages transmitted or the information received
Interactions: physical interaction of actors or their presence in the same place at the same time.
Movement: physical (migration from place-to-place), social (movement between occupations or statuses)
Formal roles: those dictated by power and authority, boss/employee, teacher/student, doctor/patient. Common in a management setting.
Kinship: marriage, descent

Table 7: Types of Relations identified by Wasserman and Faust (1995, p.37)

9.1. Visualizing Social Networks

Once all the data has been collected, verified, and stored in matrices the researcher can begin constructing the network drawing. Even though many software packages are capable of drawing and manipulating the data into network diagrams, it is important for the user to understand the history and design considerations of these diagrams. This section will briefly discuss the history of such visualizations and offer researchers important structural explanations.

According to Freeman (2000), SNA visualizations have been around since the 1930s; when ad hoc graphic images were produced by hand (See Figure 10). In the early 1950s, the use of standard computational procedures became apparent and these were used to produce images. In the 1970s, computers produced machine drawn images automatically and in the 1980s, personal computers gave rise to the development of color images to distinguish network characteristics. Since the mid to late 1990s, browsers and the World Wide Web opened up the option for researchers to interact and manipulate their network drawings. These advances have made it easier for researchers to infer conclusions and study ever larger networks.

Figure 10: Moreno Hand Drawn Social Networks
(Moreno, 1934 as quoted. in Freeman, 2000)

Current technology gives rise for the use of color and animation in SNA. Browsers can now support users in interacting with the social network drawings and intuitively help them process the layout through the variance of color, manipulation rights, and dimensional space (2.5D vs. 3D). Despite these new flexibilities there are fundamental similarities which are consistent among all social network visualizations. Moreno (1934, as quoted in Freeman, 2000) introduced these basic ideas:

1. Use of graphs in visualization (line and point)
2. Graphs must be directed showing relationship characteristics
3. Use of color to distinguish relationships and nodes
4. Varied shapes of points (communicating characteristics of actors)
5. Variations in the locations of points could be used to stress important structural features of the data.

In 1953, Moreno (as quoted in Freeman, 2000) added the widely used feature of 'no crossing lines' as a general rule for constructing diagrams (sociograms). In 1938, Lundberg and Steele (as quoted. in Freeman, 2000) introduced the use of nuclei of a network as those actors with 'high sociometric status'. Lundberg and Steele's example of this is seen in Figure 11 and represented in 3D in Figure 12.

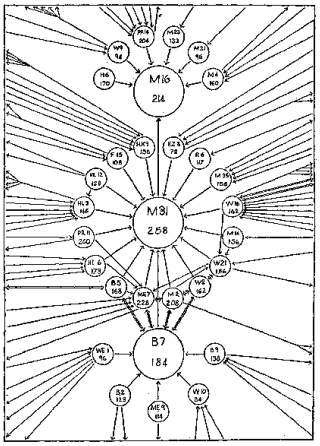

Figure 11: Lundberg and Steele's nuclei centered visualization, 'Lady Bountiful'
(As quoted. in Freeman, 2000)

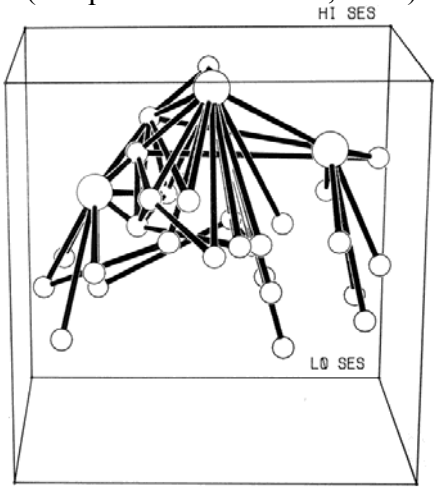

Figure 12: 'Lady Bountiful' visualized by ORTEP in 3D
(Chapin 1950, as quoted. in Freeman, 2000)

Most computer generated SNA visualizations get their form (organization, structure) from rules pertaining to 'spring embedders'. Spring embedders are based on the notion that any two points (nodes) may be pushing and pulling on one another. Two closely related points that represent actors will pull on each other, while those who are different will push one another apart. The rules to judge the differences and similarities are usually flexible and based on its application.

10.Appendix 3: Instruments

10.1. Sample Instruments used for Measuring Trust and Knowledge

10.1.1. Mayer and Davis (1999) Organizational Trust Instrument

This measurement instrument was designed to operationalize the integrative model of organizational trust proposed by Mayer, Davis and Schoorman (1995) and elaborated on in Section 2.3.1.4. The instrument was designed to be relevant to a variety of organizational relationships (McEvily and Tortoriello, 2007) but Mayer and Davis (1999) use the instrument to study employees' trust in top management. This instrument will have to be slightly adapted for use in this study.

Organizational Trust Instrument
Instructions: Think about [company name]'s top management team [names listed in parentheses for clarity]. For each statement, write the number that best describes how much you agree or disagree with each statement
Trustworthiness (Ability) 1. Top management is very capable of performing its job. 2. Top management is known to be successful at the things it tries to do. 3. Top management has much knowledge about the work that needs to be done. 4. I feel very confident about top management's skills. 5. Top management has specialized capabilities that can increase our performance. 6. Top management is well qualified.
Trustworthiness (Benevolence) 1. Top management is very concerned about my welfare. 2. My needs and desires are very important to top management. 3. Top management would not knowingly do anything to hurt me. 4. Top management really looks out for what is important to me. 5. Top management will go out of its way to help me.
Trustworthiness (Integrity) 1. Top management has a strong sense of justice. 2. I never have to wonder whether top management will stick to its word. 3. Top management tries hard to be fair in dealings with others. 4. Top management's actions and behaviors are not very consistent.* 5. I like top management's values. 6. Sound principles seem to guide top management's behavior.
Trust 1. If I had my way, I wouldn't let top management have any influence over issues that are important to me.* 2. I would be willing to let top management have complete control over my future in this company. 3. I really wish I had a good way to keep an eye on top management.* 4. I would be comfortable giving top management a task or problem which was critical to me, even if I could not monitor their actions.
* = reverse coded Scale (1 = disagree strongly to 5 = agree strongly)

10.1.2. McAllister (1995) Managerial Interpersonal Trust Instrument

This instrument was designed to measure a focal manager's trust in a specific peer. McAllister (1995, p. 25) defines *interpersonal trust* as, "the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another". Two dimensions of interpersonal trust are conceptualized: *Cognition-based* trust (competence, responsibility, reliability, and dependability are the criterion used to judge the trustworthiness of another). "*Affect-based* trust consists of the emotional bonds between individuals and relate to expressions of care and concern for the welfare of another. Cognition-based and affect-based trust are conceptualized as related but distinct dimensions of interpersonal trust." (McEvily and Tortoriello, 2007, p.21)

Managerial Interpersonal Trust Instrument
Cognition-based Trust
1. This person approaches his/her job with professionalism and dedication.
2. Given this person's track record, I see no reason to doubt his/her competence and preparation for the job.
3. I can rely on this person not to make my job more difficult by careless work.
4. Most people, even those who aren't close friends of this individual, trust and respect him/her at work.
5. Other work associates of mine who must interact with this individual consider him/her to be trustworthy.
6. If people knew more about this individual and his/her background, they would be more concerned and monitor his/her performance more closely.*
Affect-based Trust
1. We have a sharing relationship. We can both freely share our ideas, feelings, and hopes.
2. I can talk freely to this individual about difficulties I am having at work and know that (s)he will want to listen.
3. We would both feel a sense of loss if one of us was transferred and we could no longer work together.
4. If I shared my problems with this person, I know (s)he would respond constructively and caringly
5. I would have to say that we have both made considerable emotional investments in our working relationship.
* = reverse coded Scale (1 = strongly disagree to 7 = strongly agree)

10.1.3. Holste (2003) Instrument for measuring willingness to share and use knowledge

Utilizing survey data collected from 202 managers and/or professionals, Holste's study found a statistically significant relationship between affect-based trust and the willingness to *share* organizational knowledge. He also found a statistical relationship between cognition-based trust and the willingness to *use* organizational knowledge. Affect-based and cognition-based trust were measured using McAllister (1995). Knowledge was divided into explicit and tacit and measured using the following instrument:

Instrument for measuring willingness to share and use knowledge
Willingness to share explicit organizational knowledge 1. I would take the initiative to provide this individual with tools I have developed in connection with my work that I believe would be useful to him/her. (Choo, 2000) 2. I would take the initiative to provide this individual with lectures/presentations/sermons I have prepared that I have prepared that I believe would be useful to him/her. (Haldin-Herrgard, 2000) 3. Assuming I had permission to do so, I would take the initiative to provide this individual with data/databases/spreadsheets I am maintaining that I believe would be useful to him/her. (Choo,

2000; Clarke and Rollo, 2001; Epstein, 2000)
4. Assuming I had permission to do so, I would take the initiative to provide this individual with printed or electronic copies of documents and/or manuals I have produced that I believe would be useful to him/her. (Smith, 2001; Wong and Radcliffe, 2000)

Willingness to use explicit organizational knowledge

1. I would eagerly receive and use tools developed by this person, if relevant to my work. (Choo, 2000)
2. I would eagerly receive and use lectures/presentations/sermons prepared by this person, if relevant to my work. (Haldin-Herrgard, 2000)
3. I would eagerly receive and use data/databases/spreadsheets developed by this person, if relevant to my work. (Choo, 2000; Clarke and Rollo, 2001; Epstein, 2000)
4. I would eagerly receive and use printed or electronic copies of documents and/or manuals produced by this person, if relevant to my work. (Smith, 2001; Wong and Radcliffe, 2000)

Willingness to share tacit organizational knowledge

1. If requested to do so, I would allow this individual to spend significant time observing and collaborating with me in order for him/her to better understand and learn from my work. (Choo, 2000; Clarke and Rollo, 2001; Davenport and Grover, 2001; Scott, 2000)
2. I would willingly share with this person rules of thumb, tricks of the trade, and other insights into the work of my office and that of the organization I have learned. (Haldin-Herrgard, 2000; Wong and Radcliffe, 2000)
3. I would willingly share my new ideas with this individual. (Epstein, 2000)
4. I would willingly share with this individual the latest organizational rumors, if significant. (Epstein, 2000)

Willingness to use tacit organizational knowledge

1. If relevant to my work, I would welcome the opportunity to spend significant time observing and collaborating with this individual in order for me to better understand and learn from his/her work. (Choo, 2000; Clarke and Rollo, 2001; Davenport and Grover, 2001; Scott, 2000)
2. If relevant to my work, I would welcome and use any rules of thumb, tricks of the trade, and other insights he/she has learned. (Haldin-Herrgard, 2000; Wong and Radcliffe, 2000)
3. I would eagerly receive and consider any new ideas this individual might have.(Epstein, 2000)
4. I would tend to believe organizational rumors shared by this individual and would use such knowledge as appropriate. (Epstein, 2000)

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