COMMUNITY BEHAVIORS AMONG ENGINEERING COMMUNITIES OF PRACTICE AND THEIR RELATIONSHIP WITH LEADERSHIP

Jacqueline Saldana
and
Mary R. Lind
North Carolina A&T State University
lindm@ncat.edu
336-334-7189

ABSTRACT

The existence of leadership dynamics such as embedded leadership roles, mentoring, and shared leadership produced increased motivation, trust, expert and referent power, empowerment, self-efficacy, dyadic relationships, and empathy. Simultaneously, the existence of defective leadership dynamics contributed to the demoralization and decreased performance of CoP members.

Keywords: Communities of practice, invisible college, reflective cooperation

INVISIBLE COLLEGES

Theories about groups of individuals who meet to produce solutions and knowledge in response to common interests, problems, and passions exist before Wenger (2000) proposed the theory of CoPs. Scholars tried to define communities of practitioners as invisible colleges (Price, 1966; Crane, 1972), epistemic communities (Adler and Haas, 1992), and learning communities (Marshall & Peters, 1985). Theoretical frames for each of these concepts share characteristics that Wenger identified as part of he social structures of CoPs.

Price (1966) and Crane (1972) theorized about groups of scholars and researchers collaborating through informal communication channels to share specific interests and goals usually related to scientific advancement. Price (1966) suggested the idea of invisible colleges as organizational strategy to produce and steward organizational knowledge. Invisible colleges relate directly with groups of intellectuals in the 16th century Europe sharing scientific knowledge to address common concerns, and which became a platform for the foundation of the Royal Society of the United Kingdom. Price conducted bibliometric studies to prove that groups of practitioners with similar interests develop naturally tendency to collaborate through social interaction; activity that influences group cognitive intelligence (Goel, Johnson, Junglas, & Ives, 2010). Members in invisible colleges organize by choice of specialty and direct activities to specific community goals within conditions of closeness, communication, and dissemination of ideas (Casey & McMillan, 2008).

Crane (1972) theorized further the concept of invisible colleges as process of social diffusion for scientific knowledge through the publication of the book Invisible Colleges: Diffusion of Knowledge in Scientific Communities. Crane discussed communities of practitioners from the perspective of knowledge diffusion, or and explanation of how "…particular forms of social

organization among scientist produce particular kind of knowledge…" and the …"rate at which knowledge is produced …" (Mason, 1973). Crane's identified four stages for the dissemination of scientific knowledge, (a) the initiation of a paradigm (little or no social scientific organization within reciprocal interactions), (b) the establishment of a paradigm, specialty, or subject matter, in which groups of collaborators engage informally in invisible colleges social structures and networks, (c) the ideation of solutions, and (d) the emergence of a crisis state, in which participants identify anomalies that can lead to scientific novelties. Before Crane, Kuhn (1996) exposed ideas about the diffusion of scientific knowledge and the role of anomalies in the emergence of scientific discoveries. The presence of anomalies of unexpected results can lead to new discoveries. The presence of anomalies that do not fit with existent paradigms can serve to identify and anticipate new scientific discoveries.

Invisible colleges' theories (Price, 1966; Crane, 1972) show parallelisms with Wenger's CoP concept (2004). Both invisible colleges and CoPs can trace part of their theory ideas of (a) social diffusion of knowledge (Crane, 1972; Khun, 1996) and Schon's (1989) reflective practices theories. Invisible colleges, like CoPs, exhibit social networks, centered leadership, peripheral groups of collaborators, and connectedness that overcomes geographic and spatial segregation (Zuccala, 2005). Invisible colleges emerge during critical times in which the need for immediate expertise is necessary to advance science or to share resources to overcome mutual challenges, although they can acquire certain visibility when they get organized (Zuccala, 2005). Kogan (2000) reported that academic identity blossoms within the structure of invisible colleges. Academic systems sustain emergence of knowledge by discovery, testing, and intellectual self-confidence. In 1993, Wolek and Sanchez reported the lack of interest in academic communities to engage in invisible college activities. Open interviews at Villanova University showed a decreased interest from professors in getting involved on invisible college activities for academic research.

EPISTEMIC COMMUNITIES

Adler and Hass (1992) defined epistemic communities that emerge independently from governmental spheres and have direct influence on policy-making. Epistemic communities are professional networks composed of subject matter experts (SMEs) with competence over specific domains (Adler, 1992). Epistemic communities share normative beliefs, value-base social dynamics, analysis to solve problems, shared notions of validity of knowledge, shared practice domain, and a set of common practices. Epistemic communities comprise of members developing professional identity, sharing knowledge, networking, and mentoring younger professionals (William & Lee, 1985). Epistemic communities follow a social exchange of three distinctive activities, (a) assessment of uncertainty, (b) interpretation of the conditions, (c) and institutionalization of new practices.

Adler and Haas (1992) reported that a classic example of epistemic community is the first group of experts that raised concern about the polluting quality of chlorofluoro-carbons (CFCs) after 1972. Observations form an ecological epistemic community alerted about the damage of CFS' over ozone and its future effect in global warming. Efforts culminated in the 1989 Basel Convention, resulting in worldwide commitment to reduce CFCs. Most countries have enacted public policy to protect the environment from the dangers of CFC (e.g., United States Clear Air

Act of 1990). Adler and Haas associated the role of epistemic communities to policy innovation and how these disseminate new practices. Dulop (2009) clarified that learners in epistemic communities seek knowledge from multiple derivations to build solutions at their own pace. Epistemic communities negotiate knowledge, perception of risks, and procedural lawfulness (Stauffacher & Moser, 2010)

A fundamental question of epistemic communities is: Where attention and knowledge originates (Scharmer, 2007). Epistemic communities produce knowledge collectively, defining rules, setting boundaries, and imposing conditions about what is legitimate knowledge (Kinsella, & Whiteford, 2009). Members of an epistemic community serve as gatekeepers of knowledge, validating knowledge from the standpoint of a bigger community of SMEs by applying standards of credibility. Brown (1990) emphasized how epistemic communities use professional rhetoric to build knowledge paradigms. Epistemic reflexivity, on the other hand, refers to the process of critical reflection for which individuals inquire about wider institutional and technical processes (Kinsella, & Whiteford, 2009). When members of epistemic communities adopt strategies as result of inquiry and advocacy to solve problems consistently, organizations can call to these methods best practices. Epistemic communities share with CoPs a character of situatedness in the way individuals respond practically to their historic situations producing knowledge to solve problems.

LEARNING COMMUNITIES

A learning community is a group of individuals who share a common practice and develop a right understanding in the appropriate context to learn from each other (Brower, 2003). Senge (as in Namjaidee, Manmart, Apichatwallop, & Peerasit, 2010) defined that the members of a learning community possess five characteristics, (a) mental models, (b) shared vision, (c) personal mastery, (d) collective learning, and (e) system thinking. Senge, among other instructors at the Massachusetts Institute of Technology, promoted the learning community model as a way to create knowledge sharing organizations (Kofman & Senge, 1993). Senge (1999) described the process of a learning community, first, as a shared vision that emerges from numerous places but last guides a learning vision. This shared vision drives thinking, acting, and sustaining dialogue to integrate diverse viewpoints. When members of a community build this shared vision, they develop a sense of empowerment that enables good decisions through the design of learning processes.

Senge (1999) adjudicated the origin of his philosophy to the work of Japanese firms with total quality management (TQM) systems, especially those related to thinking and acting at many levels, a learning collaborative style among high technology companies in Japan. In these, the increased integration of thinking and acting promoted an evolution in quality management evidenced by the works of Nonaka and Nishiguchi (2001) about knowledge creation in the organization and the way companies help channel workers' tacit knowledge into explicit or formal knowledge. For these Japanese thinkers, knowledge is not simply a cognitive construct but know-how inseparable from the pragmatism of action. As most employees carry their knowledge as a tacit concept, concepts related to subjective insights, hunches, and intuition become an important element to create new knowledge. In this sense, the organization is more similar to a living organism than a mechanic organization.

Senge (1999) emphasized that the beliefs and attitudes within the organization are important to build learning community. Espoused values, deep beliefs taken for granted, and the willingness to experiment are elements propitious to the creation of learning communities. However, genuine caring, and compassion should be also part of this organizational equation. Employees in contemporary organizations are too often full of skepticism as result of the many cases of unscrupulous acts and unethical behaviors (Gandossy & Sonnenfeld, 2004). Managers can create learning organizations by accepting the epistemic roots of common culture and transforming these beliefs and attitudes into collaborative methods for innovation. In learning communities, managers can use people's skills and capabilities to create a vision of future with the power to impulse significant change, advocacy, inquiry, and new shared mental models (Senge, 1999).

Learning communities have evolved into powerful creative networks successful in companies such as Toyota and in the work with high-politics situations, such as the leaders of the Guatemala Guerilla (Arthur, Day, Jaworski, Jung, Nonaka, Scharmer, & Senge, 2002). Learning organizations create a space of innovation similar to the Japanese concept of Ba, a shared contexts that arises from interactions and relationships (Nonaka & Nishiguchi, 2001). Learning communities see knowledge as an organizational element that cannot be managed (Scharmer, 2007). Learning communities operate under the assumptions of the (a) behavioral level of reality, (b) the behavioral level of social reality, and (c) the deep tacit level of knowledge. Theorists call this last one the "blind spot" (Arthur, et al., 2002, Scharmer, 2007), or a deeper space from which a systems of individuals can create new paradigms.

Learning communities opened the doors to organizational experimentation in knowledge creation and in identifying the sources of "not-yet-embodied" knowledge through more contemporary leadership theories such as the leadership from the inside out (Cashman, 1998) and the Theory U (Scharmer, 2007). These two modern concepts of knowledge creation involve sensing the beliefs of participants and differentiating between the traditional (conventional) analytical knowledge and wisdom awareness that emerges when individuals are motivated to develop a level of cognition in which knowledge emerges from interconnected associations as opposed to isolated contingent parts, and direct presentations as opposed to stored representations (Scharmer, 2007). This type of knowledge is open rather than determined and achieves a sense of unconditional value rather than conditional practicality.

COP THEORY

Theory of CoPs has foundation on Jean Lave's ideas of situated learning (1991). Situated learning proposed that organizational knowledge happens in circumstances of social interaction, in which the cognitive abilities of participants interrelate with group social structure, environmental context, and previous knowledge of participants (Goel, Johnson, Junglas, & Blake, 2010). Dynamics of situated learning involve practitioners, activities, cognition, meaning, knowing, and learning. Communities of practitioners bring a pre-existent socially and culturally structured world that becomes an analytical process of learning. Shared learning activities promote identity based on skills and expertise of participants.

Situatedness refers to the interaction of situation, agent, and cultural context (Rohlfing, Rehm, & Goecke, 2003). Lave (1996) proposed that learning is a process of interpretive view, in which

individuals negotiate meaning, language becomes a social activity (as opposed of simply the medium to transmit ideas), and personal interests appeal to cognition. Situatedness is not a physical location, but a relationship of individuals and their environment which, in turn, influences those individuals' process of learning and developing. Lave (1996) recommended the study of situated learning as a way to master apprenticeship among communities of practitioners. Situated learning offers an alternative to fertilized organizational learning by promoting social interactions that contributes to knowledge objectives, such as the case of the communities of practice (Contu & Willmot, 2003). Brown & Duguid (1998) developed theories on CoPs deriving interpretation from Orr's ethnography of copier repair technicians. Julian Orr (as in Budery, 1998) proposed that individuals from a same profession, such as communities of technicians, share characteristics inherent to their craft. This sameness provides cohesion to occupational communities. Through observation and interviews to equipment technicians in Xerox Corporation, Orr declared in 1996 (as in Budery) that technicians become work cultures in which individuals share similar interests and values. Participants in work communities can transcend their organizational settings and establish links with practitioners from other organizations. Groups of practitioners could rebel when organizations implement policies that attempt against the skill and expertise of the community.

Orr (as in Budery, 1996) differentiated working practices as canonical and no canonical. Canonical practices are those activities that appear in job descriptions, trainings, and manuals. Canonical practice is a roadmap to practice execution. The complexities of work environments, changing conditions, relations of power and authority, and conflicting opinions are some of the reasons that influence the organizational roadmap. Orr's work demonstrated that changes in environmental conditions can alter practice roadmaps dramatically as practitioners execute activities in disconnection with prescriptive work guidelines. Noncanonical knowledge, on the other hand, presents practices that emerge from new situations, outside the scope of organizational policies. The improvised solution to a new technical problem from personal or work experience represents an example of no canonical knowledge. Noncanonical knowledge encompasses the recollection of these impromptu activities and the sharing of experiences with other community members.

Consequently, industries related to knowledge markets such as engineering, technology, advanced electronics, computer software, biotechnology, and health care are using the power of professional collaboration as a knowledge management strategy with the objective of developing competitive advantage through the creation and transfer of knowledge (Snow, Matthews, Miles, & Coleman, 2003). Organizations that understand and promote learning structures in which professional groups co-create through the natural environment of networking develop learning loops, continual innovation, and quick adoption of practices (Stuart, 1995, 2006). Wenger (1994) proposed a social structure based on three main components of domain, practice, and community.

Professional communities of practice experience knowledge through collaboration, communication, symbolic language, and observation (Weisner & Silver, 1981). Groups of practitioners acquire knowledge through social exchanges in which they engage in participation, social structure (Goel, Johnson, Junglas, & Ives, 2010), and professional identity (Layzell & Chahal, 2010). Although Wenger (1994) recognized the similarities CoPs share with other community structures, he differentiated the CoP from all the others. According to Wenger,

"Cultivating communities of practice in strategic areas is a practical way to manage knowledge as an asset, just as systematically as companies manage other critical assets." (p. 6). Wenger proposed CoPs as professional groups responsible for stewarding industry knowledge. Fostering CoPs is an attempt to create "a new wave where the formal structures—those organized around providing products and services—are constantly changing to meet shifting market needs, while the informal, voluntary structures—those organized around knowledge—are more stable" (Wenger, McDermott, & Snyder, 2002, p. 20). Wenger's notion of CoPs (2001) explained how practitioners (i.e., professionals) who share a passion meet to produce relevant body of knowledge for specific industries. Organizations can use CoPs to congregate professionals (e.g., field specialists, subject matter experts [SMEs]) within a sole organization or different companies for collaboration. CoP members usually meet with a shared industry concern or problem to produce knowledge and solutions. Wenger et al. (2002) described organizational managers as those responsible for enabling groups of practitioners to produce industrial body of knowledge.

Wenger and Lave (1991) challenged organizations with the concept that acquiring knowledge is more than the accumulation of factual information. Knowledge is an epistemic experience in which personal preferences and organizational situatedness have a defining influence during the learning process. Organizational members with same interests, expertise, and craft become members of a community, develop collective culture, and participate in the acquisition, production, and dissemination of knowledge (Contu & Willmot, 2003). This process happens within the context of knowledge activities, shared practice, and cultural expression such as activities, stories, and artifacts. Individuals learning in communities of practice participate in social structures and social engagement as opposed to the sole processing of cognitive thinking or acquisition of abstract knowledge. Observations with different CoPs or apprenticeships such the Yucatan midwives, US Navy, Alcoholics Anonymous, and other trade workers (e.g., tailors, meat-cutters) drove these first theories on communities of practice.

Wenger and Lave (1991) theorized the concept of legitimate peripheral participation or circumstances of mutual participation. As community participants increase their expertise, they increase their participation on central activities. Legitimate peripheral participation explains relationships of apprentices and masters, different levels of expertise, and the development through time of cultural artifacts and identities that emerge from socio-practices inside a community of practitioners. Peripheral participation reflects community participants' trajectories or learning, identity, social forms, and relationships of power (Lawless. 2008). Peripherality is a movement throughout a community from low to high expertise and from discrete to more intensive participation and not a central location. Although CoPs represent multiple opportunities for participation, most members of CoPs remain passive participants, as observers and users of practices but without producing knowledge (Wenger et al., 2002). A lesser amount of members are active and involved directly to opportunities to conform epistemic realities.

Wenger et al. (2002) defined the basic elements of the CoPs as community, practice, and domain. Community refers to the informal structures in which members communicate and collaborate, practice refers to the negotiated enterprise for which members co-create working methods, and domain refers to the distinctive subject knowledge of industry or practice.

A meta-analysis of 84 research designs dated from 2000 to 2010, and representing 18 geographic areas in more than 20 industries (see Appendix A), demonstrated that professional CoPs manifest all of the behavioral dimensions described by Wenger et al. (2002). The areas represented in the meta-analysis with more frequency were the United States (35.7%), United Kingdom (17.9%), multinational companies (11.9%), and Canada (6%). Industries in the emergent CoP research with more frequency were education (39.3%), technology (17.9%), consulting firms (7.1%), and health care (4.8%).

Using as base the core and peripheral groups diagram described by Wenger et al. (2002, p. 57), figure 1 incorporates the elements of domain, practice, and community in relation to behaviors, leadership expressions, and external forces observed during this meta-analysis. Emergent literature demonstrated the influence of leadership in the developments and maturity of CoPs and the force that technology and institutionalization exercise over CoP behavioral dynamics. Wenger's notion about CoPs life cycle relates to its ability to steward knowledge. After this analysis, researcher obtained a deeper insight into what are specific behaviors and characteristic manifest as part of the development of professional CoPs in contemporary organizations, specifically in the dimensions of community, practice, domain, leadership, and CoP challenges.

Figure 1: COP Social Structure Observed from Meta-Analysis
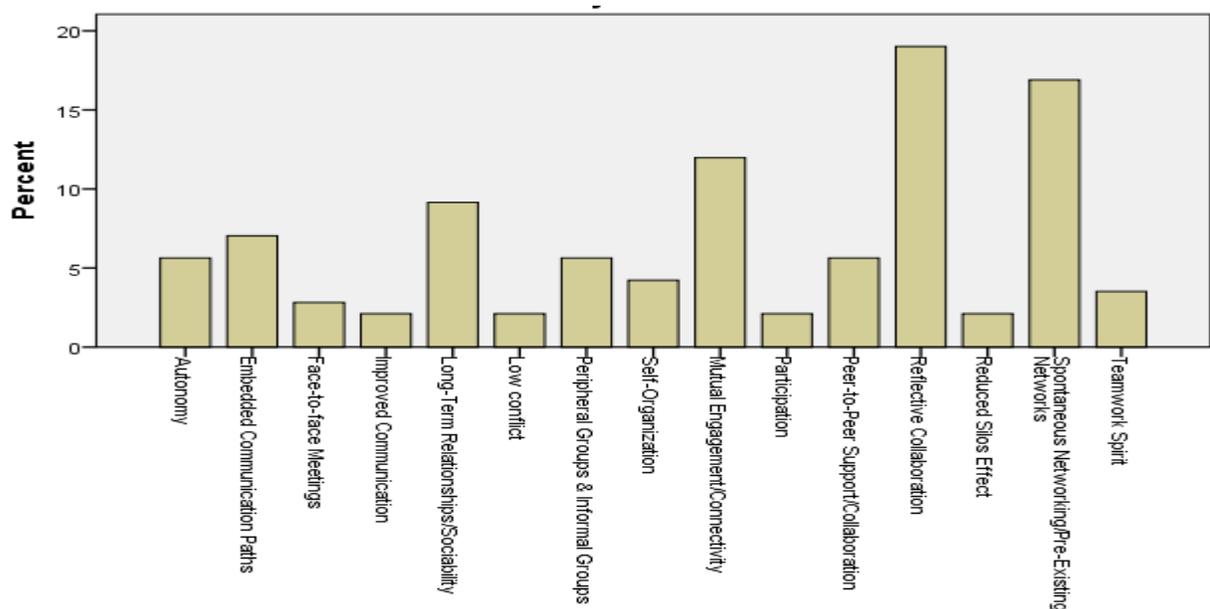

COMMUNITY BEHAVIORS
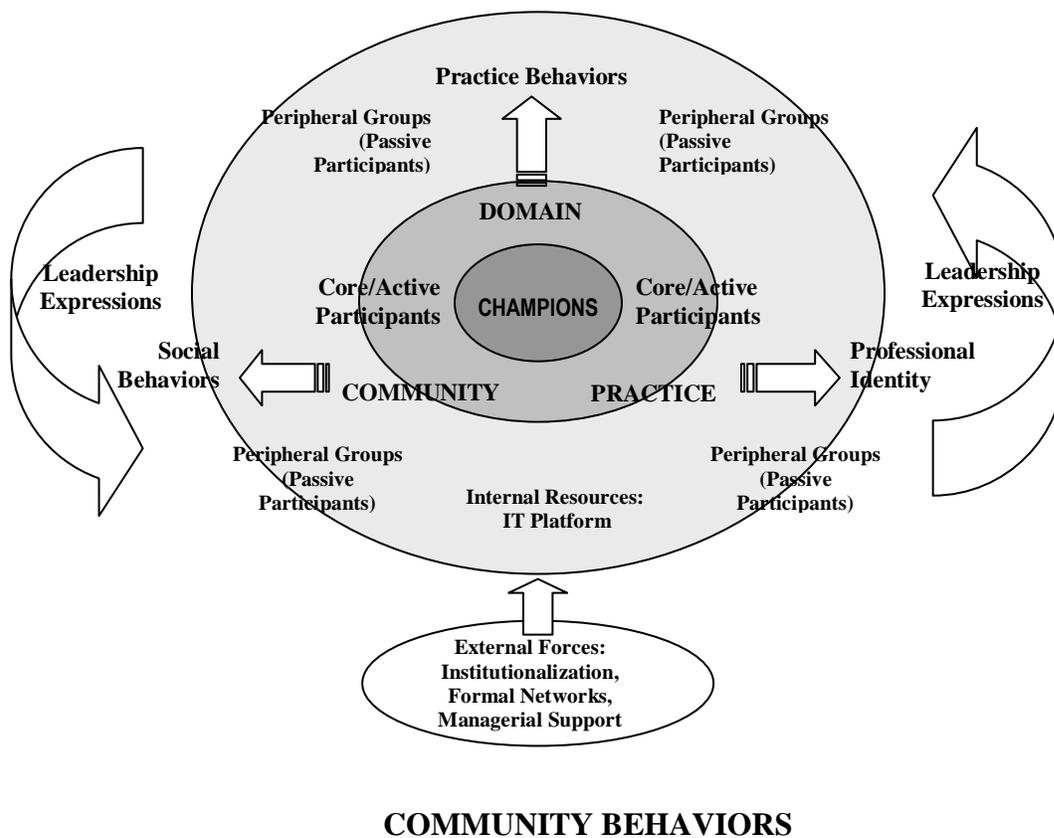
CoPs are loose and informal structures; self-managed groups related by collegiality and lack of business purpose even if organizations purposely establish these communities. The emergence of

today's global markets propitiates geographically dispersed communities, in which technology acquires special significance. Most contemporary CoP members share Websites, communicate regularly by e-mail, or use teleconferences to communicate. As CoPs increase membership, subgroups, and peripheral groups emerge and strong local identities emerge (Wenger et al., 2002). The community component represents the roles and activities a CoP performs regularly. The element of community serve as the social learning structure in which members build relationships, bring their individual perspectives, and help each other to solve problems. Is in the community that members embed roles and activities, legitimizing the role of the CoP through specific outputs and overlap with other fields.

During the analysis of 84 research designs, CoP members operating under real-life circumstances produced five main community activities (see Table 1): (a) reflective collaboration (19%), (b) spontaneous networking (16.9%), (c) mutual engagement and connectivity (12.2%), (d) long-term relationships (9.2%), and (e) embedded communication paths (7%). Additional community behaviors observed with less frequency were group autonomy, existence of peripheral and informal groups, and peer-to-peer collaboration (5.6% each), self-organization (4.2%), teamwork (3.5%), face-to-face contact (2.8%), and improved communication, low conflict, participation, and reduced silos effect (2.1% each).

From these community behaviors, reflective collaboration, and spontaneous networking are the community behaviors repeated with more frequency during the study of CoPs' main components (see Figure 2).

Figure 2: Community Behaviors Frequency (2010-2011)

REFLECTIVE COLLABORATION

Reflective collaboration is evidenced through behaviors observed in the emergent literature (see Table 2). Communities of practitioners in open source interactive systems have adopted

reflective collaborative approaches to explore how software developers perceive usability problems, process constraints, identify difficulties to process innovation within the open source culture (Bach & Carroll, 2010), and attain collective growth knowledge (Lee & Cole, 2003). Work experiences within open source practitioners demonstrated that CoPs can use reflective collaboration as tool to expand the scope of domain, establish a better framework to guide social capital, and understand decisions that involve power structure analysis.

Blanton and Stylianou (2009), on the other hand, found that reflective collaboration develops a stronger culture of professional development because practitioners had the opportunity to reflect routinely about how to use practice, artifacts, and discipline content. Reflective collaboration challenged educators to shift to an inward mental status, connect deeper with problems and solutions (Blanton & Stylianou, 2009), improve their practice and expertise (Kisiel, 2010; Wright, 2007), improve their use of available technologies (Murugaiah, Azman, (Ya'acob, & Thang, 2010), make new cognitive connections (Vavasseur & MacGregor, 2008), and learn informally and experientially (Viskovic, 2006).

Focus group interviews among music and art CoPs demonstrated that participants can both reflect and articulate experiences to find pluralistic viewpoints and facilitate social interaction that results in opportunities for innovation (Dabback, 2010). Reflective collaboration provides opportunity to develop a deeper insight about the different perspectives conforming traditional and novel practices. Moreover, practitioners can use reflective collaboration to develop awareness of CoP dimensions (e.g., negotiated enterprise, mutual engagement, shared repertoire) and development lifecycle (Carey, Smith, &Martin, 2009). Collective reflection supports also decision-making skills necessary to develop practices and policies to support shared enterprise. Leadership decision-making paradigms such as the Vroom-Yetton or the normative decision-making model (Nahavandi, 2009) address the importance of involving followership in the prescription of solutions as opposed to following a traditional unilateral leadership approach.

Reflective collaboration is also associated with the internalization or transforming explicit knowledge into tacit knowledge, promoting the emergence of a new spiral of knowledge and innovation (Noriko, 2007). In fact, reflective collaboration leverages the limitations of participatory learning approaches when these are forced to the workplace (Warhust, 2008). Gausfal (2008) stated that network reflection has the capacity to increase workplace cooperation and collective learning within educational management programs. Reflection should be part of those programs implementing deliberately CoPs because successful training among practitioners require from discussion, dialogue, and interchange of contrasting ideas (Lavoue & George, 2010). Reflection assists CoP leaders in gaining a holistic assessment of practitioners' contexts, values, and beliefs (Price, 2005). Approaching a group of practitioners to create nontraditional methods and improved production and safety is possible when those individuals are actively engaged in the process of deliberation (Machles et al., 2010).

SPONTANEOUS COLLABORATION AND NETWORKING

Spontaneous collaboration and networking (see Table 3) are critical aspects in the development of mature CoPs, along with type of expertise and interchange of knowledge and work (Vega & Quijano, 2010). Research (Zboralski, Salom, & Gemuenden, 2006) with 222 members of CoPs

in multinational companies (within knowledge-intensive markets) demonstrated that members in professional groups benefit from an enhanced network position that facilitates knowledge sharing and learning. Organizations today support strategically informal networks to capitalize on the benefits of CoPs by organizing informal networks and activities in which practitioners exchange practice information. Moreno (2001) described thematic interdepartmental networks as the most disseminated types of CoPs in the banking industry, which serve as professional and virtual connections to knowledge sharing worldwide. Spontaneous collaboration and networking also happened during content-related activities or meta-activities related to the organization of CoP structures (Zboralski, Salom, & Gemuenden, 2006).

Practice Behaviors

Practice represents working models, practices, and professional culture (Wenger et al., 2002). Practice organizes knowledge in a way understandable by community members, creating joint enterprise, stories, professional behaviors, and working methods. Nicholls (2006) stated that explicit and implicit knowledge lack value unless practitioners of a field develop shared methods to deliver such knowledge. The emergent literature of CoPs demonstrated that sense of common purpose and negotiated enterprise are main expressions of contemporary communities of learners (see Table 2). Wenger et al., (2002) described how practitioners develop an increased sense of "craft intimacy" (p. 122). Members from a same community of professionals share commonalities that increase their sense of belonging and develop feelings of common ground. Joint enterprise, on the other hand, happens in the context of common purpose. Negotiated joint enterprise motivates CoP members to participate and contribute to a mutual fabric of learning in which they set up knowledge edge and activities to build expertise (Keung, 2009).

Sense of Common Purpose

Among other authors (see Table 5), Price (2005) stated that sense of common purpose is the element of cohesion within CoP members who share understanding about a practice or subject matter field. Sense of common purpose in organizational structures provides workers with common meaning and familiarity necessary to increase participation and accountability (Adkins et al., 2010; Topousis, Murphy, & Holm, 2008). Allen (as in Bowen, 2010) emphasized that common purpose is an essential step for CoPs to emerge organically (Bowen, 2010). Studies with Six Sigma leaders demonstrated that groups could understand and fulfill expectations of effectiveness when members could articulate rationally their common goals, increasing their ability to share knowledge (Bowen, 2010).

CoP members developed deep sense of common identity by combining their personal, social, or professional concerns (Buckley & Du Toit, 2009) and through their mutual passion for a field of knowledge or professional enterprise (Hayes & Fitzgerald, 2009; McElya, 2011). Members of studied CoPs indicated that belonging to a community of practitioners nurtured among them feelings of belonging and made them "part of a family" that decides to remain in collaboration for long time (Hayes & Fitzgerald). Educators who work together for extended periods created a purposeful integration of members and community elements (Linehan, 2010; Wright, 2007) and feel more innovative and productive even if they operate with limited resources (Price, 2005), and regardless of participants' gender (Tomcsik, 2010).

Sense of common purpose increased feelings of accountability among CoP members, facilitating shared practice (De Palma & Teague, 2008). The willingness to work as part of the group becomes a driving sentiment from which members derive fulfillment and comfort (Tomcsik, 2010). De Palma and Teague recommended keeping dialogue alive as activity essential for CoP sustainability. Members of educational CoPs used dialogue to utter community affirmations reflecting the values and principles of those specific groups (Linehan, 2010) and to overcome the barriers of cultural distance (Yu et al., 2009). Simultaneously, participation, cooperation, and decision-making abilities decreased when common sense of purpose declined in professional CoPs, diminishing as well the quality of outcomes (Gausdal, 2008).

To maintain renovated common sense of purpose, CoP core members should consider that the vision of the community is a prevailing context in which CoP members become increasingly engaged in accomplishing collective goals. Members of the NCLB program used vision statements to create coherent work frames within complex educational systems (Linehan, 2010). A CoP with a well-aligned vision cultivate stronger relationships that contribute to expand knowledge sharing in different settings, build membership pride (McElya, 2011), and encourage collaborative learning (Mobanagan & Columbaro).

CoPs differ from other work groups on that the common goals are inherent to a group of participants with similar viewpoints and passions (Mobanagan & Columbaro, 2008). CoP members with increased commitment to the common purpose of the community become usually part of the core or central group (e.g., champions) that produces the majority of the work for the benefit of less active and peripheral groups within a same community (O'Kane). In this environment, knowledge transfer flows better between different active and peripheral groups and manifests in the patterns of mentoring relationships, peer-to-peer guidance, and collaboration that satisfies the cognitive needs of participants (Tomcsik, 2010; Vega & Quijano, 2010).

Negotiated Enterprise

The value of a CoP resides on the three dimensions of (a) mutual engagement, (b) a negotiated enterprise, and (c) a collection of negotiable resources (Carey et al., 2009). Negotiated enterprise encompasses developing a shared goal to work through shared methods, tools, and practices (Guldberg & Mackness, 2009). Members of CoPs negotiated informally sets of goals and objectives that determined the way they operated. Kisiel et al. (2007) reported that the negotiation of internal power dynamics is conducive to successful innovation. Emergent literature (see Table 5) demonstrated that negotiated enterprise manifests in professional organizations and workplaces. The continual negotiation of epistemic realities created knowledge momentum or the ability of maintaining updated expertise (Carey et al., 2009). CoP members are negotiating continually their identities while moving from the periphery to the core group of practitioners because identities of individuals are fluid; this is, are shaped and re-shaped through their lives (Guldberg & Mackness, 2009). Negotiated enterprise allowed redirecting CoP goals toward different or new contexts, giving participants the opportunity to see beyond the "here-and-now" perspective (Siebert, Mills, & Tuff, 2009).

Kisiel (2010) emphasized the importance of communication to promote interchange of ideas among members because CoP members would not be able to negotiate enterprise without

dialoguing about the nature of practice. Organizations promote professional socialization as forum for negotiated enterprise (Noriko, 2007). Groups of practitioners accomplished this negotiation through informal interactions such as retreats, meetings, discussions, and mentoring. O'Kane et al. (2008) reported that negotiated enterprise can be procedural and contextual. Research with groups of farmers (O'Kane et al.) demonstrated that CoP members not only negotiate objectives, they also develop and use discursive dialects for decision-making according to the CoP specific field and practice priorities.

Negotiated enterprise promotes active participation among key production staff members and creates dispersed-power structures (Anand et al., 2007). An industry can produce diversity of groups representing different industry's field specializations, each developing a unique negotiated enterprise (Kisiel, 2010; Mork et al., 2008). Groups of professionals in health care used negotiated enterprise to build a work context and a negotiated order of standards and enactments that allowed the group operating efficiently (Ferlie et al., 2005). Numerous teachers who received computer training (77%) stated that CoPs provided them with the opportunity to negotiate learning content (Kisiel, 2010). Negotiated enterprise influenced professional identity and learning trajectory (Guldberg & Mackness, 2009). Anand et al., (2007) identified knowledge creation paths among different groups of professional consultants, finding that diverse groups produced varied paths of negotiating shared objectives. CoP members often develop different combinations of boundaries at different times to provoke shifts in organizational lifecycles and innovation (Zietzma & Lawrence, 2010).

Domain

Domain, or area of expertise, deals with the CoP dimension related to structural ability to safeguard knowledge. Domain represents a topic, a work specialization, an industry, or a subject matter that matters a group of professionals. Groups of experts operating within socio-technical structures construct epistemic realities from logic, linguistics, contexts, and knowledge (Noriko, 2006). CoPs seem to be fertile ground for creative solutions and innovation.

Contemporary scholars of knowledge management (Nonaka & Nishiguchi, 2001) demonstrated that the creation knowledge structures are important to achieve innovation and competitive advantage through examples of global multinational enterprises that achieved efficient knowledge creation, overcoming challenges related to cross-border communication within geographically dispersed memberships. Evolved CoPs showed similar practice phases during their lifecycle development (see Figure 4), including situated learning (14.5%), information technology as enabler for knowledge sharing (10.1%), knowledge dissemination (7.7%), knowledge management processes (6.8%), best practices (6.3%), building new skills (5.8%), structured goals, and activities (5.3%), flexibility to learn and change (3.9%), facilitators and training (2.9%), and managerial support (2.4%).

CoPs exist as ancillary structures within organizations sustained by volunteer participation. Different levels of participation represent different positions of power but CoPs should be a representation of egalitarian cultures (Yan & Assimakopoulos, 2006). Wenger et al. (2000) warned that the dimension of domain could induce to defective CoPs when individuals demonstrate the legitimacy of the community through exclusivity and arrogance (Wenger et al.,

2000). Communities of practitioners can avoid this detrimental pattern of behavior by establishing strategic perspective and values, linking community activities to organizational goals, offering inspiring vision, practicing shared leadership in decision-making, exposing members to divergent perspectives, and making members accountable for community's reputation.

Creative Solutions, Innovation, and Knowledge Creation

Existing literature demonstrated abundant examples of how CoPs are fertile ground for creative solutions, innovation, and knowledge creation in numerous industries (see Table 7). CoP structures pose with the advantage of a collaborative learning environment in which inventors and end-users join to create, prototype, and test technical innovations (Abdullah, Sahibuasdin, Alias, & Selamat, 2005; Lavoue & George, 2010). The Linux kernel case study is an example of how a group of practitioners can create new products and test their effectiveness. Thousands of volunteers geographically dispersed developed and tested a high-quality software operating system within a community-based progressive knowledge creation network driven by peer-to-peer critic and error-trial efforts (Lavoue & George, 2010). CoPs allowed professional service firms to analyze new practices, identify critical generative elements, combine learning pathways to networks, and promote knowledge-based organizations (Anand et al., 2007, Jawitz, 2009). These innovative structures can offer a unique viewpoint regarding professional advancement in which participants can leverage inquiry and expertise (Ash, Brown, Kluger-Bell, & Hunter, 2009; Dabback, 2010) whereas breaking old practice paradigms to learn new practices (Bosa, 2008).

Organized CoPs can promote change in bureaucratic environments such as public health care by promoting entrepreneurial impetus and channeling it into modern tools, radical change, and refined techniques (Bosa, 2008; Elmualim & Govender, 2008). Empirical evidence from longitudinal studies in different industries (from call center organizations to complex innovation working environments) demonstrated that professional CoPs supported the identification of best practices and creative solutions to every day problems, enabling an environment of innovation and competitiveness (Corso et al., 2009) for private and public organizations alike (Gambarotto & Cammozzo, 2010). Goldstein and Butler (2010) concluded that CoP structures promote stakeholder-based cooperative models, equipping governmental agencies with more diversified collaborative planning tools. This is only possible within a work frame of open communication and participation. CoP structures in modern organizations challenge managerial enterprise to build organizations adept to nurture innovative perspective, positive attitude, and triple loop-learning (Gambarotto & Cammozzo, 2010).

Members in CoP structures establish learning experience boundaries using the principles of constructivism and hands-on training approaches, effective models for professional training (Hodgkinson-Williams et al., 2008). Monaghan (2007) and O'Kane et al. (2008) dwelled on how CoPs provide real-time context from multiple perspectives to expand learning experiences. CoP structures are effective to link knowledge with practice because members engage systematically in cooperation while sharing a repertoire of working methods that they can use cooperatively to innovate (Iverson & McPhee, 2008) in real life. This working environment has proven to be successful for members of a regulated field (such as special education) in establishing practice

standards, policies, and change (Linehan, 2010). Nevertheless, these collaborative networks seem to work better among individuals who come from the same culture, field of professional expertise, or similar thinking processes (Lee & Cole, 2003). South African countries are using the concept of CoPs to promote collaborative learning in local communities through higher education efforts (Buckley & DuToit, 2009; Hodgkinson-Williams et al., 2008; Jawitz, 2009).

Members of CoPs develop epistemic parameters that maintain collective meaning. Knowledge creation, creative solutions, and innovation happen in contexts rich in information and membership connectivity, all of which enhances knowledge capabilities (O'Kane et al., 2008). This means that organizations must design working environments recognizing the social aspect of knowledge creation in which members define knowledge strategy, link strategy with operational programs, leverage the different dimensions of CoPs, and give careful attention to organizational context. The challenge of modern management is to create these organizational structures free from the intervention of policymakers (Thompson, 2005), avoiding the constraints of traditional structures while maintaining production control.

Information Technology as Enabler of Domain

The study of CoP emergent literature demonstrated that the third most important element of domain is the role of information technology (IT) in enabling learning environments (see Table 8). Technology capacitated CoPs to track concept maps, document activities, and created visual language inherent to a content discipline (Akoumianakis, 2009). CoP archives of presentations, best practice case studies, and shared tools function as repositories for content knowledge and proved to be critical in knowledge stewardship (Guldberg & Mackness, 2009). IT bestows collaborative learning because it caters to groups of practitioners multiple communication outlets (e.g., chat rooms, wiki-spaces, blogs), especially useful for knowledge creation amidst groups of practitioners geographically dispersed such the armed forces (Adkins et al., 2010) and multinational companies (Anand et al., 2007). However, research (Akkerman, Petter, & De Laat, 2008; Kasper et al., 2008) revealed that some CoP members need face-to-face meetings to reinvigorate enthusiasm

Organizations from numerous industries design their own software to support CoP activities (Akoumianakis, 2009) or explore alternative technologies such as interactive digital television (De Melo et al., 2010) as communication platforms. Akoumianakis (2009) alerted that technology offers plethora of communication methods to intensify connectivity among members including instant messengers, virtual worlds, online games, multi-user domains, screening-sharing capabilities, and specific domain languages. Other virtual communication platforms are Web 2.0, Web crossing, and video conferencing technologies (Sarirete & Chikh, 2010). Technology creates a new order of CoP artifacts entitled to satisfy the needs for creation among different groups. Mastering these technology tools contributed to increased participation (Clark, 2010) and self-efficacy (Clark (2010; Murugaiah, 2010) among virtual CoP members. Corso et al. (2009) defined virtual tools as main motivators to maintain connectivity that boost membership participation, involvement, and commitment. Scarso et al. (2009) denominated the technological dimension as one of the four pillars of CoPs, along with the organizational, cognitive, and economic dimensions.

The use of technologies test the capabilities of organizations interested in establishing CoPs because community stakeholders will need from augmented, customized, and cost-effective technical support to maintain continual negotiated enterprise (Goldstein & Butler, 2010; Mizintseva & Gerbina, 2009). Guldberg and Mackness (2009) indicated how organizations involved in supporting CoPs can monitor members' participation to understand performance and offer variety of virtual environments. Hew and Hara (2007) studied electronic mailing lists to understand how literacy teachers shared knowledge through virtual communication, types of knowledge, and knowledge flow, discovering that lack of knowledge about technologies and competing communication outlets are main barriers to sustained participation. Mork et al. (2008) found that ability of community participants to access equipment and support are characteristics of successful cross-disciplinary practices. Early adopters of CoP technologies in teacher communities showed more ability to build online networks of professional learning whereas requiring more technical support over time (Riverin & Stacey, 2007).

Technology expands the capabilities of practitioners for which some school systems have made mandatory for teachers to have free access to Internet, technology tools, and communication technology training (Riverin & Stacey, 2007). The online delivery of professional CoPs is convenient because allows immediate access to other members, professional expertise, and advice, and cost-effective communication platforms (Vavasseur & MacGregor, 2008). However, the use of technologies supports practice but not the formation of CoP identity (Noriko, 2007). Vavasseur and MacGregor (2008) alerted organizations working with CoPs should not confuse professional identity with the building of technical skills. Findings of Norika research reflected that IT itself is not conducive to knowledge creation unless the elements of socialization, negotiated enterprise, and professional identity are present. Beyond modern IT systems, surveyed CoP members seek primarily for professional advancement, expertise, collegiality, and innovation opportunities.

COP Leadership Expressions

CoPs are self-organized structures that depend on the sense of ownership that members demonstrate in all core, active, passive, or peripheral members (Wenger et al., 2002). Some CoPs become institutionalized, becoming centers of excellence to communities that the organization keep in momentum to solve continually operational problems. CoP lacks of formal leadership structures although the emergent literature evidenced how the existence of leadership influences the performance of groups of practitioners (see Table 10). Research (Akkerman et al., 2008); with 15 CoPs in the European traveling industry evidenced that organizations can implement deliberate efforts to initiate and organize cohorts of practitioners in learning communities able to reach effective performance.

Additional leadership expressions observed in the emergent CoP literature (see Table 11) were motivation (12.2%), trust (10 .8%), visible apprenticeship or mentoring, embedded leadership roles, and shared leadership (9.4% each), referent and expert power (6.8%), recognition (4.1%), empowerment and self-efficacy (2.7% each), and dyadic relationships and empathy (1.4% each). Participants of CoPs often sustain long-term interactions conducive to cohesion, trust, communication (Katja, 2009), empowerment, motivation (Blanton & Stylianou, 2009), self-efficacy (Clark, 2010), dyadic relationships (Hayes & Fitzgerald, 2009), shared leadership

(Kasper et al., 2008), and supportive profiles of power (Weaver et al., 2009). Katja alerted organizations to cultivate CoP leadership support without destroying the self-organizing nature of groups of peers united by a common industry passion, a first quality necessary to promote innovation.

The idea of CoPs as decentralized structures clashes with the attempt of organizations to institutionalize these structures to foster KM cultures (Adkins et al., 2010). Adkins et al. recognized CoP leaders as "knowledge owners" (p. 48) or those individuals responsible for managing risk information by ensuring content accuracy. Knowledge owners or domain experts often are part of the core group of the CoP (those are smaller groups that carry big part of the CoP program), acting as facilitators, sponsors, or partners of knowledge objectives. As these CoP leaders initiated knowledge sharing, their pace determined the frequency of community interactions. Figure 5 expose the many dimensions in which leadership happened and manifested within CoPs.

Anan et al. (2007) reported that some individuals in CoPs take the voluntary role of leaders, creating purposefully organizational structures to embody people in new types of expertise, although the traditional CoP literature tends to avoid discussions about the role of leadership in CoP evolution. Nevertheless, organizations rely on identifying key professionals with close motives to knowledge goals when launching a new CoP. Case studies in the phenomenon of open source software, or the global development of groupware among technical volunteers acknowledged the contribution of founder leaders in establishing the vision and boundaries of knowledge creation (Back & Carroll, 2010; Lee & Cole, 2003).

The existence of prepared CoP leaders has been crucial for high-performance and success in existing CoPs globally (Bishop et al., 2008), especially in organizations that foster a culture of learning with support with resources. Research findings within the CoPs developing the software Oracle (Borzillo, 2009) established that CoP sponsors' roles exist in three domain approaches, (a) process, (b) technical, and (c) social. Sponsors are active in managing the processes to identify, manage, and validate best practices in environments of socialization through technology-driven communication media. Weaver et al., (2009) investigated what power influence relationships emerged from CoP participants and how these relationships influenced epistemic values. Findings of the study revealed that CoPs produce symptoms of Janusian leadership, described as the force of "two opposing thoughts as not only true, but complementary" (p. 314), similarly to dynamics of contradiction. The fluctuations of these leadership expressions influenced CoP roles, communication frequency, and collective sense-making. In general, leadership quality seemed to predict CoP quality, frequency of interactions, and levels of trust and motivation, although a lesser discussed element that contributed to CoP engagement existed in the role of appropriate managerial support (Katz, 2009).

The development of democratic CoPs happens within leadership complexities related to negotiation of relationships that is a vital component of collaborative learning (De Palma & Teague, 2008). Bowen (2010) described CoP leaders as seminal leaders associated to situational learning and described through the years by other authors (i.e., Bandura, Argyris, and Senge, among others) as essential component of social learning theory, double-loop, lower and higher level learning, cognitive attitudes and strategies, and adaptive and generative learning. In other

occasions, the passion or appetite for knowledge can infuse individuals with an entrepreneurial spirit that leads the community to adopt specific projects and ethos, exemplifying why organizations should handle carefully leadership recommendations and succession planning (Carey et al., 2009). Shin (2011) described the organizational intervention toward CoPs as light-touch supervision with allocation of appropriate resources, training, and support. Positive leadership influenced CoP membership efficacy levels, increasing collective sense of excellence (Vavasseur & MacGregor, 2008). On the contrary, studies about a KM CoP operating in 110 countries (Venters & Wood, 2007) exposed that degenerative learning structures influenced the ability of the community to achieve expanded knowledge creation capabilities.

COP Challenges

Wenger et al. (2002) portrayed CoPs as structures vulnerable to organizations' inability to build KM organizational cultures. Wenger et al. called to these organizational inabilities learning disabilities of the incapacity to steward knowledge. CoP theory expose that the main challenges for communities of practitioners are, (a) irrational politics (e.g., power struggles, ambition, control), (b) short-term focus (e.g., when objectives of the community accommodate to the needs of the organization, and (c) anti-learning cultures (e.g., excessive emphasis on individual task as opposed to collaborative learning and reflection). Despite that the CoP theory emphasized organizational environment elements as main challenges for community effectiveness, literature (i.e., 2010 to 2011) showed that the existence of multiple discourses among CoP members is a major challenge for contemporary organizations with a frequency of 19.4%.

Other challenges observed in the CoP literature (see Table 12) are lack of resources (15.5%); lack of participation and perceived hierarchical differences (9.7% each); cultural distance (6.8%); resistance to change (5.8%); internal politics or perceived biases and lack of goals (4.9% each); loose versus structured networks and active versus passive groups (3.9% each); conflict, lack of IT knowledge lack of roles, poor volunteer recruitment, and silos mentality (2.9% each); and competing communication channels (1%).

Content or field discourse is a common language and epistemic viewpoint among groups of practitioners' subject of discussion among contemporary CoP authors (see Table 12). O'Kane et al. (2008) exposed that traditional notions of discourse see this element of CoP communication as deep contextual dynamics that express more than what is explicitly said in words. CoP discourse acknowledges and reflects the passions and interests for like-minded people. When members of a group do not share the same discourse (e.g., scientific versus experiential or discursive) they are impaired of achieving in-depth discussion and anecdotal sharing (O'Kane et al., 2008). An informed strategy about a practice discourse supports increased membership engagement.

Manifestation of COP Elements and their Outcomes

Results of a COP emergent literature meta-analysis (2000-2010) evidenced the manifestation of the three elements identified by Wenger (2000) as main components of a CoP by the presence of behaviors and expressions in the three categories of community, practice, and domain (see Figure 7). The purpose of this research is to confirm the presence of CoP behaviors and

expressions with statistical significance within the emergent literature (e.g., academic research). Through a quasi-experimental design, this research will measure how expressions and behaviors of community (i.e., reflective collaboration, spontaneous networking), practice (i.e., sense of common purpose, negotiated enterprise), and domain (i.e., creativity, innovation, and knowledge creation) manifest among professional engineering communities of practice in different lifecycle stages (i.e., beginner, intermediate, advanced).

Community

Reflective collaboration and spontaneous networking appeared as variables of statistical relevance. The existing literature reported numerous cases in which practitioners engaged in reflective collaboration during the creation of knowledge. Reflective collaboration seemed to be important in expanding the scope of domain (Lee & Cole, 2003), developing professional development culture (Blanton & Stylianou, 2009), increasing expertise (Kisiel, 2010; Wright, 2007), connecting cognitively different community members (Vavasseur & MacGregor, 2008), and articulating a clearer vision (Dabback, 2010). CoPs that exhibited the use of reflective collaboration during the knowledge creation process emerged mainly from the disciplines of education (52.1%) and technology (19.1) and mainly from the United Kingdom (33%) and the United States (28.7%) (see Appendix B).

Spontaneous collaboration and networking, on the other hand, demonstrated to be central to the culture of mature CoPs (Vega & Quijano, 2010). The combined activities of spontaneous collaboration and networking allow CoP members to enhance knowledge sharing capabilities through trust and common values (Carey et al., 2009), synergy (Monaghan, 2007), and deeper assessment of circumstances (Warhurst, 2008). Contemporary leadership theories (Cashman, 1998; Scharmer, 2007) placed trust, synchronicity, and in-depth connections as core elements of organizational innovation. Spontaneous collaboration and networking appeared most commonly in the fields of education (47.8%) and consulting firms (17.4%) with more presence in the United States (29.6) and the United Kingdom (24%) (see Appendix B).

Practice

Sense of common purpose and shared enterprise manifested with statistical relevance among CoPs globally. The existing literature reported that CoP members manifest sense of common purpose while they create knowledge through a sense of craft intimacy in which practice commonalities emerge. A common ground for practice enhances knowledge creation because it provides CoP members with meaning, familiarity, accountability (Adkins et al., 2010), organic growth, and clear articulation of goals (Bowen, 2010). Sense of common purpose nurtures the identity of the community, enhancing collective feelings of fulfillment (Tomcsik, 2010), membership retention (Hayes & Fitzgerald, 2009), purposeful integration (Linehan, 2010), and decision-making abilities (Gausdal, 2008). Sense of common purpose manifested with more frequency in the fields of education (58.7%) and consulting firms (11.8%), appearing mostly in the United States (35.3%) (see Appendix C).

Negotiated enterprise contributes to organizational innovation because professionals with different viewpoints can collaborate to determine the way they operate, negotiate internal power

dynamics, and set goals and objectives (Kiesel et al., 2007). Negotiating enterprise engages CoP members in the co-creation of epistemic realities, knowledge momentum (Carey et al., 2009), professional identity (Guldberg & Mackness, 2009), new contexts, and vision of future (Siebert et al., 2009). CoP members in education (40%) and health care (20%) have experienced positive outcomes during negotiated enterprise dynamics, along with other CoP members in the United Kingdom (40%) and the United States (20%).

Domain

Creative solutions, innovation, and knowledge creation are domain expressions with statistical relevance among observed CoPs. CoP members operating in similar socio-technical environments channel their interactions into strategic perspectives and finding common solutions to common problems. The collaborative learning environment of professional CoPs builds expertise among members and nurtures knowledge stewardship through the existence of a professional networking environment in which multiple users can create, test, and evaluate processes, and inventions (Abdullah et al., 2005). Documented case studies, such as the creation of the Linux software (Lavoue & George, 2010) are examples of the level of creativity and innovation thousands of collaborators can achieve working in professional communities. CoP environments promote creativity and progressive knowledge by transforming traditional environments into entrepreneurial impetus and radical change (Bosa, 2008; Elmualim & Govender, 2008). Creativity, innovation, and knowledge creation manifested with higher statistical relevance in the fields of education (39.8%) and technology (17.2%) (see Appendix D). The outcomes of domain over creativity, innovation, and knowledge creation were evident in the United States (30.4%), the United Kingdom (17.6%), and South Africa (13.3%).

IT as Enabler of KM

A third most important element of the domain element was the role of IT in enabling knowledge creation. This is particularly important because IT seems to expand the capabilities of CoP members by serving as repository of industry best practices (Guldberg & Mackness, 2009). Communication enhances among community practitioners through the use of chat rooms, wiki-spaces, and blogs (Adkins et al., 2010), although parallel research (2000-2010) revealed that CoP members need face-to-face communication to reinvigorate enthusiasms and drive momentum (Akkerman, Petter, & De Laat, 2008; Kasper et al., 2008). Numerous organizations around the world design their own software to support CoP efforts (Akoumianakis, 2009) and others are exploring alternative technologies to stretch collaboration among community members (Melo et al., 2010). IT support encompasses a managerial challenge for organizations as these CoP members will need more technology services and support (Goldstein & Butler, 2010; Mizintseva & Gerbina, 2009). CoP members in multiple industries and countries enhanced their abilities to create knowledge with support of IT tools and communication outlets, with more relevance in the fields of education (35%), technology (17.2%), and more preeminence in the United States (39.5%) and multinational companies (17.2%).

Leadership Expressions

In spite of traditional theory that describes CoPs as self-organized relying from members to take ownership of activities; the emergent CoP literature demonstrated that deliberate efforts to seed community intention can enhance the capabilities of community members to manage knowledge (Akkerman et al., 2008). Leadership behaviors observed in the emergent literature include motivation, trust, apprenticeship, mentoring, embedded leadership roles, and shared leadership. Not only leadership enhanced the ability of CoP members to manage knowledge, it also enhanced effective leadership outcomes, such as self-efficacy (Clark, 2010), cohesion, and communication (Katja, 2009). Contemporary CoP authors (Katja, 2009; Wenger et al., 2009) reported that the challenge of organizations promoting communities of practitioners is to create supportive profiles of powers without destroying the self-organizing nature of the community. CoP members are mostly volunteers who accept a leadership role driven by passion and mutual interest on a topic. The industries of education (39.3%) and technology (17.3%) demonstrated how leadership influenced performance along with countries like the United States (34.5%), and United Kingdom and Multinational Companies (26.3% respectively) (see appendix E).

Conclusion

Wenger (2000) proposed a CoP theory similar to previous gremial groups, such as invisible colleges, epistemic communities, and learning communities. Invisible colleges are groups of scholars and researchers channeling their specific interests and goals into industry advancement, rooted on the 16th century scientific movement in Europe. In modern management, Price (1966) continued this line of thought with studies about practitioners collaborating to industry advancement through social interaction. Crane (1972) produced a book about the capacity of invisible colleges to diffuse knowledge. Kuhn's ideas (1996) about knowledge diffusion are well known in the scientific world, with practitioners identifying anomalies that led to scientific innovation. Invisible colleges share with CoPs some fundamental characteristics, such as core leadership, peripheral groups, and connectedness that overcome geographic and time zone barriers.

Epistemic communities are networks of professionals who possess specific domains and influence policy-making (Adler & Hass, 1992). Members of epistemic communities share professional beliefs and values related to domain competence. Epistemic communities take interest in the betterment of industry and society, promoting the institutionalization of new practices. Professional participants in epistemic communities aim to identify sources and methods to produce and manage knowledge. Like-minded professionals share common characteristics as they master similar practices and possess similar mental models, vision, and system thinking. Senge (1999) associated learning communities to Japanese TQM philosophies (i.e. Toyota), which attempted to transform organizations into collaborative learning spaces to capitalize on workers' tacit knowledge. Members of learning communities bring with themselves intuition and elements from epistemic understandings and personal experience. Contemporary leadership theories (Cashman, 1998; Scharmer, 2007) recommend intuition and personal mastery as nonconventional strategies to promote innovation.

Wenger et al., (2002) brought the concept of CoP to the attention of modern industries as learning and social structures able to steward knowledge. Theories of situated learning (Lave, 1991) inspired Wenger's vision of CoPs, in which organizations acknowledge that learning happens within a social context and from previous working experiences. The 1990s saw also a proliferation of CoP research in the works of Orr (as in Budery, 1998), and Brown and Duguid (1998). Research with technical groups demonstrated that situation and culture influence cohesion among practitioners. Cultural context provides to the members of the community a common ground for enterprise negotiation, social interaction, and common language and artifacts. As members of the CoP collaborate and communicate, a semantic environment evolves and promotes among members creative ideas to common problems. Wenger recommended organizations to exploit the capabilities of CoPs as if these are innovation assets. Knowledge is an epistemic experience and workers learn and produce better when the organizational culture supports a social learning environment.

 A fundamental characteristic of CoPs is the distribution of participant groups. At the core of the community, a smaller group of champions initiate activity whereas peripheral groups and passive participants demonstrate less participation but benefit from new ideas and knowledge. Regularly, level of expertise is the trigger to participation. CoPs rely on the experience of more knowledgeable members to direct activities. In general, members of the CoP develop professional identity and sense of common purpose. Wenger et al. (2002) defined the basic elements of the CoP as community, practice, and domain. A meta-analysis of 84 research designs dated from 2000 to 2010 and representing 18 different countries in more than 20 industries demonstrated that professional CoPs manifest a specific order of behaviors and characteristics in the dimensions of community, practice, domain, and leadership. CoP challenges are also a reflection of community evolution.

In the dimension of community, the behaviors observed with more frequency were reflective collaboration and spontaneous networking. Reflective collaboration is an effective strategy for innovation because it expands the mental capabilities of workers who can identify constraints and opportunities. Practitioners who reflect regularly about procedures and artifacts improve expertise, make new cognitive connections, and learn experientially. Spontaneous collaboration and networking is the ability of CoP members to interchange knowledge through different communication media. Organizations fostering CoP structures engage practitioners in informal networks and activities in which they exchange practice information and experiences, developing in return trust, motivation, and cohesion.

In the dimension of practice, the behaviors observed with more frequency were sense of common purpose and negotiated enterprise. Sense of common purpose represents a space of craft intimacy; in which practitioners share common meaning and familiarity and professional identity. Studies reported that sense of common purpose is necessary to build self-organization, values of accountability, motivation, and self-fulfillment. Elements such as vision, leadership, and clear expectations and goals contribute to solidify sense of common purpose. Negotiated enterprise emerges when practitioners deliberate about what methods, tools, and practice to use. The negotiation of epistemic understandings keeps momentum among CoP members or the ability to maintain updated expertise. CoP members accomplish negotiated enterprise through open communication and socialization.

In the dimension of domain, the behavioral characteristic observed with more frequency was the existence of creative solutions, innovation, and knowledge creation. CoPs demonstrated to be fertile ground for identification of problems, ideation of new processes, prototyping tools and methods, and validation of practice results. Case studies such as those related to open-source software (e.g., Linux) are examples of how CoPs can achieve technical innovation through collaborative trial-error approaches. Organized CoPs members could produce innovation in private and public organizational environments. The principles of constructivism and hands-on learning common within CoPs are similar to those related to real-time context to expand practice perspective.

It was evident during the literature meta-analysis the role of IT in the maturity and expanded capacities of contemporary CoPs. IT enables the domain element because it serves as repository of emergent knowledge, tracking device for progress, and multi-outlet communication media. Professional organizations design unique software and communication platforms to support the work of specific groups of practitioners. Technology intensifies connectivity among CoP members, although parallel research indicated that face-to-face interaction reinvigorates the enthusiasm of CoP members. The use of technologies to promote CoPs creates new challenges for organizations, which will be providing more services and support to the different CoPs' memberships.

In the dimension of leadership, the characteristic observed with more frequency was the influence of leadership over practice performance. The existence of leadership dynamics such as embedded leadership roles, mentoring, and shared leadership produced increased motivation, trust, expert and referent power, empowerment, self-efficacy, dyadic relationships, and empathy. Simultaneously, the existence of defective leadership dynamics contributed to the demoralization and decreased performance of CoP members. Contemporary CoPs confront challenges related to the existence of multiple epistemic discourses, or the implicit common language and practice philosophies that conforms the community of practitioners. The absence of a common discourse impairs the CoP to sustain in-depth discussion and collaboration. On the contrary, a cohesive discourse among members of a CoP demonstrated to increase collective engagement and created better integration of interrelated disciplines. Organizations promoting CoPs cannot underestimate the role of practice discourse in building an innovative and engaged community of practitioners.

The emergent CoP literature (2000-2010) identified education as the field with deeper CoP academic research penetration, followed by industries such as technology and consulting firms. Most of the CoP research in the last decade was published in the United States and the United Kingdom, followed by multinational companies. The manifestation of CoP elements and leadership dimensions inspired a graphic representing expressions and behaviors with statistical relevance during the completion o a meta-analysis. These expressions and behaviors of community, practice, and domain constitute study variables for a quasi-experimental design aiming to measure how these continue influencing global professional CoPs members. This study treats leadership as intervening variable, validating meta-analysis results that place leadership as a direct influence over CoP performance.

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