

Engineering Management
Field Project

Implementing Communities of Practice in a Consulting Engineering Company

By

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Spring Semester, 2014

An EMGT Field Project report submitted to the Engineering Management Program and the Faculty of the Graduate School of The University of Kansas in partial fulfillment of the requirements for the degree of Master's of Science.



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Date accepted: 4/9/14

Acknowledgements

I would like to thank my company for allowing me to perform this research and for their support in helping me complete my degree. I want to thank my R&D project manager for his guidance and encouragement throughout the process. I would also like to thank the employees who helped start the CoP and the members who participated in it. Without the help and enthusiasm of these fellow employees, this project could not have been as successful as it was.

Next, I would like to thank my committee members Tom Bowlin, Mike Kelly, and John Bricklemeyer for aiding in my field project. I would especially like to thank Tom for his guidance and support in all aspects of the field project.

Finally, I would like to thank my wife and kids for having patience and giving me the time to work on this project. I would most especially like to thank my wife for her continued support throughout my graduate work and field project.

Executive Summary

This research project took the Community of Practice (CoP) concept and applied it to the author's place of work, Kiewit Power Engineers (KPE). The purpose of this project was to determine if Communities of Practice (CoPs) could improve knowledge management (KM) and provide value to KPE.

All elements of starting and operating a CoP were reviewed through literature research and used to guide the implementation of CoPs within KPE. A survey of KPE employees was taken for measuring interest in the CoP concept and work groups were used to consult with fellow employees on how to start and operate a CoP within KPE. Finally, a trial CoP was created and observed for four months to see how it would function and if it could provide value.

The trial CoP established a charter and operating guidelines to function by. Meetings were held regularly to discuss sub-committee progress and technical topics related to the domain area. The trial CoP sub-committees showed continual progress on their tasks geared toward improving KPE processes. The post-meeting surveys showed that members were gaining knowledge through the technical discussions and that members thought the CoP was valuable and wanted to continue participating in it.

The trial CoP established that CoPs could function within KPE, improve KM, and provide value to the company as well as the employees who participate.

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Introduction

Communities of Practice (CoPs) can be defined as an informal group of people, who share a passion for the same subject area, have a means of sharing their knowledge with each other, and who share their knowledge with the intention of improving their practice. CoPs can be found within any organization, but they often go unrecognized due to their lack of size, structure, and tangible value.

Members of a CoP participate voluntarily in exchange for furthering their knowledge and developing their skills within a topic area they have great interest in. An organization that properly manages CoPs will allow members the freedom to operate while accessing and using the knowledge and tools the CoP produces. Furthermore, an organization that can integrate them into their structure and business strategy can benefit greatly from them. Similarly, an organization that doesn't recognize their existence or chooses to ignore them can miss the opportunity of creating a great asset out of CoPs.

This research project focuses on establishing CoPs within Kiewit Power Engineers (KPE), an engineering consulting firm for which the author works as a structural engineer. The author focuses on establishing CoPs as a way of improving knowledge management (KM) within KPE. KM is the process of creating, capturing, translating, storing, and distributing knowledge.

Organization

The author believes that KM is a very important part of KPE, it is not adequately being performed, and that CoPs could improve it. CoPs could tie together the different KM

tools currently being used into one system, providing a center of expertise for the different core areas of knowledge within KPE. CoPs could improve and develop the standard tools and best practices that employees need for their daily work. Through standardizing workflows and design methods, CoPs could also improve the efficiency of KPE employees. Finally, they could find innovative solutions through collaboration and research.

The author recognizes other potential benefits of implementing CoPs. The author sees CoPs as a way to unify a growing organization and learn from the varying experience of new employees. Additionally, they could give experienced employees a place to share and capture their knowledge for the professional development of younger, less experienced employees.

CoPs could also help unify departments since employees are primarily located by project instead of by discipline. CoPs could bring employees from different projects together to share lessons learned, discuss an area of work they share a passion for, and build relationships.

The author recognizes, through research and familiarity with KPE's business, that establishing and sustaining CoPs will be a challenging task. Throughout the literature review, the difficulty of managing CoPs in order to gain value from them while also allowing them the freedom they need to sustain membership and growth was presented as the main challenge to using CoPs. In fact, the difficulty of building and sustaining CoPs is one of the main reasons they aren't more prevalent (Wenger and Snyder 2000, 140). The nature of KPE's business also makes establishing and sustaining CoPs difficult.

KPE performs mostly large projects that have fast-paced schedules and are of high importance to the company since they are the main source of revenue and future business. This makes it difficult to get volunteers to work on something that is not project related and does not have hard deadlines to meet. For this reason, CoPs will need management support in order to develop and sustain participation.

Despite the challenges, the potential benefits the author sees in CoPs lead to the initiative to implement them at KPE. Equally important, the author believes that KPE would be open to change if convinced that the CoP model could improve the organization.

Research Objectives

The objectives of this research are to:

- Determine if CoPs can be developed and sustained at KPE.
- Evaluate the internal processes within a CoP to determine how to maximize their efficiency and output.
- Determine if CoPs can improve KM at KPE.
- Measure the value CoPs can provide KPE.

These objectives will be met through the original research of company surveys, work groups, and a trial CoP. The literature review will supplement this research by applying concepts and lessons learned from a variety of sources to the CoPs being implemented and studied.

Literature Review

In order to meet the research objectives, the literature review focuses on all aspects of developing and maintaining CoPs, as well as understanding the benefits they provide and the different challenges they face. This includes research on how to manage, measure, and structure CoPs to be effective.

CoP Benefits

The most recognized aspect of CoPs discussed by all of the literature sources is the enormous potential they have to positively impact an organization. The benefits found within the literature review are summarized below:

- Influence business strategy
- Increase employee efficiency
- Accelerate professional development
- Capture and store knowledge and best practices
- Develop and distribute best practices
- Generate innovative solutions
- Blur organizational boundaries
- Develop network of practitioners
- Improve talented employee recruitment and retention
- Stimulate knowledge sharing
- Increase problem solving
- Increase shared learning
- Improve customer inquiry response time
- Foster employee relationships

Most of these benefits stem from the impact CoPs can have on KM and how improving KM can have a substantial impact on an organization. The importance of CoPs to KM is discussed throughout the literature. As one source said: “One of the most critical components in a modern knowledge management system (KMS) is the community of practice” (Yu et al 2009, 733). The importance of knowledge to almost any organization

is also well established. In “Cultivating Communities of Practice,” it is simply put: “Knowledge has become the key to success. It is simply too valuable a resource to be left to chance” (Wenger et al 2002, 6). To understand how a CoP can produce these benefits to an organization, the relationship between KM processes and CoPs must be examined.

Process

From the literature research, two theories were found that incorporated CoPs into their model for KM within an organization. Both of these theories centered on the knowledge conversion process known as the Socialization, Externalization, Combination, and Internalization (SECI) method. This method is used to create knowledge and is utilized within CoPs, which naturally do this through their focus on KM.

The SECI method is the process of converting between explicit and tacit knowledge to create new knowledge. Tacit knowledge is an unspoken, unwritten type of knowledge that everyone has based on their personal experiences, insights, intuition, and internalized information. This type of knowledge is best accessed through discussion with peers and is difficult to document. Conversely, explicit knowledge can be documented in formal and systematic language (Andrawina and Kurniawati 2012, 190). An example of tacit knowledge would be an individual who has a shorthand method of performing a calculation learned through repetition and stored in memory, while explicit knowledge would be a written out step-by-step guide to performing the calculation. The interaction between tacit and explicit knowledge is known as the knowledge conversion process and the four modes of conversion are defined below (Andrawina and Kurniawati 2012, 190):

- *Socialization* is the conversion of tacit knowledge to tacit knowledge.

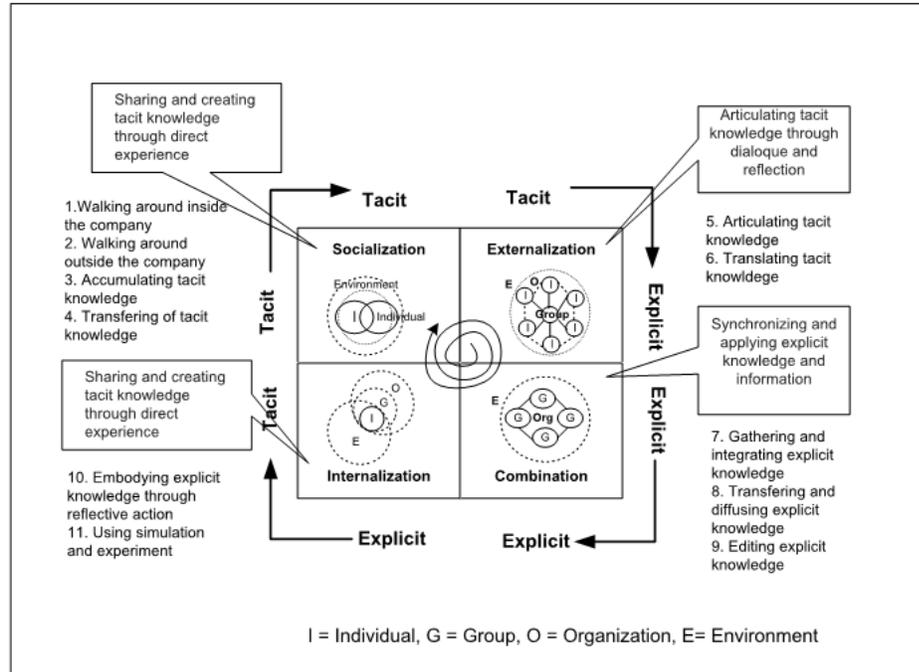
(e.g., discussing the calculation method with a peer)

- *Externalization* is the conversion of tacit knowledge into explicit knowledge through articulation so that others can share knowledge.
(e.g., writing down the calculation method and explaining it to a peer)
- *Combination* takes place when individual pieces of explicit knowledge are connected to create systematic sets of explicit knowledge.
(e.g., combining the calculation method with other needed steps to create a workflow for solving a problem)
- *Internalization* is the process of embodying explicit knowledge into tacit knowledge and closely related to “learning by doing”.
(e.g., taking the written workflow and applying it to one’s work to gain experience solving the problem and thereby learning)

The process is well shown in Figure 1 (Andrawina and Kurniawati 2012, 190):

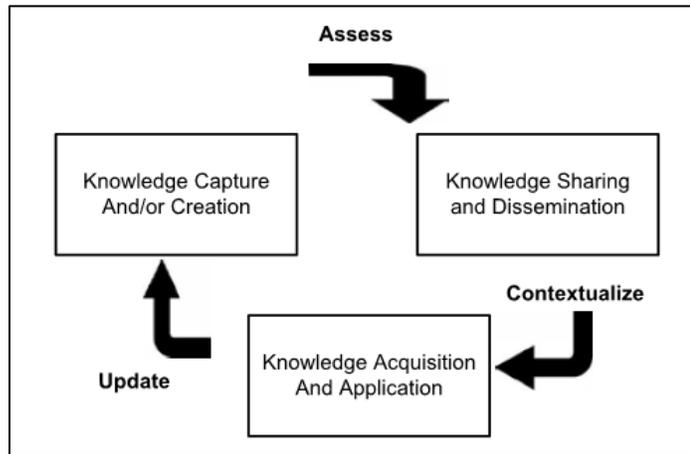
Figure 1

SECI Process



The knowledge creation process through the SECI method, along with sharing and application, are the three key elements to KM as depicted in Figure 2 (Andrawina and Kurniawati 2012, 190):

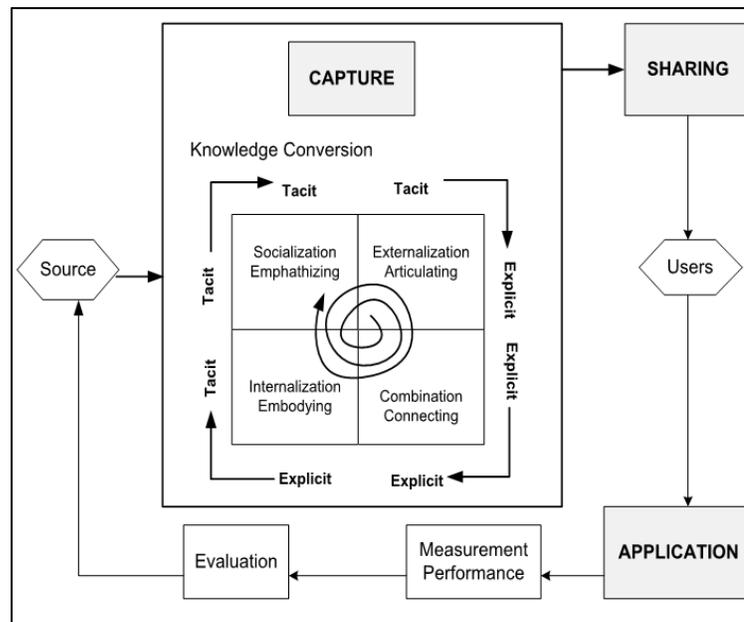
Figure 2
KM Elements



The KM cycle shown in Figure 2 is the framework for the conceptual model of a CoP framework shown in Figure 3 (Andrawina and Kurniawati 2012, 190):

Figure 3

CoP Conceptual KM Model

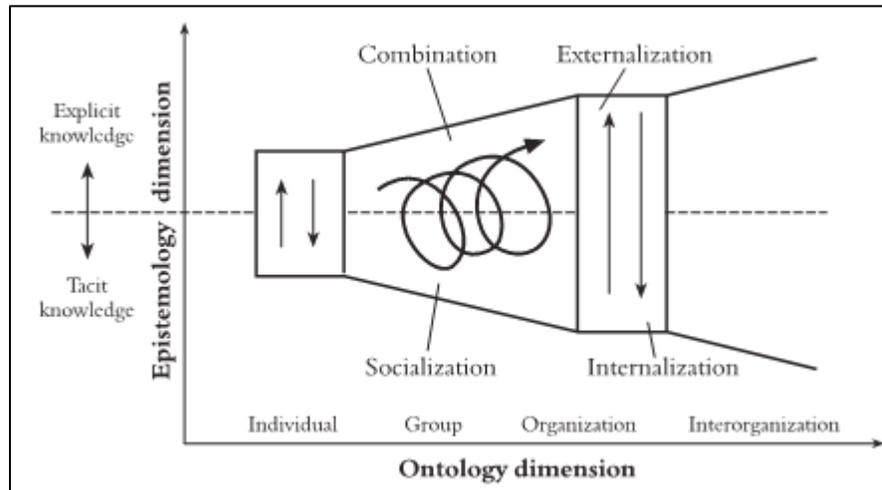


According to this conceptual model by Andrawina and Kurniawati, a CoP contains all aspects of the KM cycle within its framework. Provided that this concept is correct, CoPs could become an essential element to KM within an organization, and if developed around the organizations main business areas, could become essential to an organization's business.

Andrawina and Kurniawati go into detail for each stage of the SECI method as it would be performed in a CoP, providing example activities and performance indicators (see Appendix A). Although they do a good job of detailing the process of capturing knowledge through the SECI method, they neglect to look at how a CoP is involved in the sharing and application elements of the KM process. Without addressing these two main areas of the KM process, their CoP model remains unverified.

A different portrayal of the SECI method is presented in Figure 4 (Nanaka 1994, 20). This figure does a better job of showing what level the knowledge creation is taking place, from between individuals to even outside the organization.

Figure 4
SECI Knowledge Flow



Another model for the KM process within an organization incorporates the SECI method as well and builds on its theory for knowledge creation. This advanced theory, known as the *knowledge chain model*, identifies the five major (primary) knowledge manipulation activities as: acquisition, selection, generation, internalization, and externalization (Yu et al 2009, 736). Supporting the primary activities are the secondary actions of measurement, control, coordination, and leadership (Yu et al 2009, 736). CoPs could perform all five of the knowledge manipulation activities, and therefore, this model could be viewed as a process for CoPs.

Structure

The structure of every CoP should contain three key elements. These are: a *domain* of knowledge, a *community* of people who care about the domain, and a shared *practice* that

they aim at developing within their chosen domain (Wenger et al 2002, 27). These three key elements are covered in detail by Wenger et al in “Cultivating Communities of Practice.” Other sources briefly cover the structure of CoPs, but they either reiterate in less detail what Wenger et al discuss or don’t cover the whole CoP structure.

The *domain* can be thought of as the main topic area or body of knowledge that the CoP will focus their efforts on. It is the interest in the domain that brings members to join the CoP and to commit their time to the CoP activities. The domain is also important because it sets a boundary for the CoP. By focusing on an explicitly defined area of knowledge, such as a specific type of engineering design work, it creates a boundary of discussion for the CoP to help focus the efforts of all the members on their chosen domain. If a CoP doesn’t represent a defined domain it will lose its purpose for forming.

The second key element of structure for a CoP is the *community*, the group of members who all share a passion for the domain. However, sharing an interest is not enough for a CoP to become effective. The members must trust and respect each other to generate the atmosphere of sharing knowledge needed for a CoP to be effective in developing their *domain* and *practice*. Wenger et al define it well in saying: “The community creates the social fabric of learning” (2002, 28). This clearly points to the community as being what holds the CoP together and makes it effective.

The final part of the CoP tripod is the *practice*, which can be thought of as the physical knowledge outputs from discussion and tasks performed within the domain. These are things that the CoP produces for performing work inside the domain such as best practices, design tools, lessons learned, and innovative solutions. According to Wenger

et al: “Whereas the domain denotes the topic the community focuses on, the practice is the specific knowledge the community develops, shares, and maintains” (2002, 29).

After discussing the three elements of *domain*, *community*, and *practice*, Wenger et al claim: “When they function well together, these three elements make a CoP an ideal knowledge structure – a social structure that can assume responsibility for developing and sharing knowledge” (2002, 29). In their “Community of Practice Design Guide”, Cambridge et al present the use of a charter as a way to articulate CoP structural elements such as the mission, vision, goals and membership norms (2005, 5).

Since CoPs are very similar in makeup to many other types of groups (such as work groups and project teams) within an organization, a good way to define them is through comparison to those other groups. A comparison is shown below in Figure 5 (Wenger and Snyder 2000, 142):

Figure 5
CoP vs. Other Groups

A Snapshot Comparison

Communities of practice, formal work groups, teams, and informal networks are useful in complementary ways. Below is a summary of their characteristics.

	What's the purpose?	Who belongs?	What holds it together?	How long does it last?
Community of practice	To develop members' capabilities; to build and exchange knowledge	Members who select themselves	Passion, commitment, and identification with the group's expertise	As long as there is interest in maintaining the group
Formal work group	To deliver a product or service	Everyone who reports to the group's manager	Job requirements and common goals	Until the next reorganization
Project team	To accomplish a specified task	Employees assigned by senior management	The project's milestones and goals	Until the project has been completed
Informal network	To collect and pass on business information	Friends and business acquaintances	Mutual needs	As long as people have a reason to connect

Figure 5 does a good job of differentiating CoPs from other types of groups, but what makes them different was best said by the World Bank: “A CoP is different from a work team in that the shared learning and interest of its members keep it together. It is defined by knowledge rather than by an individual task, and exists because participation has value to its members” (2013, 3).

Management

While the internal structure of a CoP is rather straightforward, the way CoPs fit into the structure of an organization can be very complex. Throughout the literature review, the management of CoPs surfaced as the most complex part of using CoPs within an organization and also as a main component of their effectiveness and survival. From review of the literature, management effort related to CoPs fell into the three main categories of *Empowering, Valuing, and Supporting*.

A recurring theme throughout many sources is the belief that CoPs must be empowered (given the power) to manage themselves. Kirkman et al saw empowerment as having four dimensions: *potency*, the belief of potential effectiveness; *meaningfulness*, the caring for tasks and activities; *autonomy*, belief of freedom to make decisions; and *impact*, the feeling that their tasks make significant contributions (2011, 1236). Kirkman et al viewed empowerment as a “key driver of effectiveness” and showed that there was a “significant direct relationship” between empowerment and CoP effectiveness in the organization they researched (2011, 1240). Going even further, Kirkman et al also showed that CoP-oriented external leadership had a “significant direct effect” on CoP empowerment (2011, 1241). This leadership consists of “facilitating and encouraging

members to manage their own task-related activities, coaching and facilitating high-quality interpersonal exchanges, aligning efforts with broader organizational goals, and securing valuable resources” (Kirkman et al 2011, 1237). Kirkman et al does a good job of presenting the empowering of CoPs in a different way by saying key parts of a community such as leadership, task missions, and structure should be emergent rather than being predetermined by the organization (2011, 1235).

Empowering a CoP can also be done by using a *seeding structure* as compared to a *controlling structure* (Thompson 2005, 162). Thompson defines a *seeding structure* as a structure that doesn't attempt to directly control people's action, but instead to merely influence future interactions (2005, 162). The CoP is influenced through the use of *boundary objects*, defined by Thompson as “artifacts, documents, terms, concepts, and other forms... around which CoPs can organize their interactions” (2005, 152).

Thompson concluded that *seeding structures*, “can be productive and may even be necessary” for CoPs (2005, 162). On the other hand, *controlling structures* which attempt to impose direct control over CoP members' behaviors “are bound to fail” in their attempt to “impose structural constraints on an emergent social dynamic” such as CoPs (Thompson 2005, 163).

The next key to managing CoPs within an organization is recognizing their value. One part of this is integrating CoPs into the business by forming them around topic areas key to the organization and using them to help make business decisions. As Wenger and Snyder mention, “CoPs are vulnerable because they lack the legitimacy – and the budgets – of established departments. To reach their full potential, then, they need to be integrated into the business and supported in specific ways” (2000, 144). Another way an

organization can recognize the value of their CoPs is by assigning them a *core status*, indicating the CoP has the potential to make a large impact on the organizational performance (Kirkman et al 2011, 1237).

Besides recognizing the CoP, an organization can also place value on the members who participate in CoPs by rewarding and recognizing them individually. Yu et al studied an organization who provided incentives to “encourage the establishment of a knowledge-sharing atmosphere” (2009, 740). Ruikar et al also researched a company who established a “culture which encourages participation (in CoPs), disapproves repeat mistakes, and supports active learning” (2008, 443). The company also rewards good KM practices through recognition and promotion, and assesses their employees on their professional development (Ruikar et al 2008, 444).

The third element of managing CoPs is supporting them. Wenger et al discusses three different types of support for CoPs. The first type is a *support team* whose main purpose is to “lay a foundation on which CoPs can build for the future” (Wenger et al 2002, 206). The support team, according to Wenger et al, would be responsible for developing a plan for launching CoPs, coaching community members, addressing any technical issues, communicating with executive managers, and informing the different business groups about the importance of developing the CoPs (2002, 207-208).

In addition to the support teams, there are *champions* and *sponsors*, which are typically senior managers, who provide support and direction for the development of CoPs so that they can maximize their value to the organization (Wenger et al 2002, 214). *Champions* believe in the potential of CoPs and aggressively support them through providing

guidance, visibility, legitimacy, or any other method while *sponsors* typically only provide limited support, such as funding (Wenger et al 2002, 214).

Wenger et al summarizes the required management approach best when they present managing CoPs more as a cultivation process in their book “Cultivating Communities of Practice”. By using the term *cultivating* as opposed to *managing* they are implying that an organization should take the approach more of a grower than of a director. An organization should nurture CoPs and monitor their growth as opposed to telling them what to do and how they should do it. Wenger et al points out that while CoPs need to have a degree of informality and independence to steward knowledge, organizations need to cultivate them for the benefit of CoP members and the company (2002, 12).

Cultivation includes “valuing the learning they do, making time and resources available for their work, encouraging participation, and removing barriers” (Wenger et al 2002, 13).

The overarching theme found within the literature review is that it is a difficult task determining exactly how much direction and oversight to give CoPs. Trying to impose too much control could destroy the CoP dynamic while too little control could lead to unproductive CoPs. As Wenger et al says: “Cultivating communities of practice in an organizational context is an art” (2002, 14).

Measuring Value

The literature points to measuring the value of CoPs as a key element to gaining management support and for managing CoPs. Yu et al claims that KM managers need effective and quantitative methods to determine the value generated from a knowledge

management system (KMS) and to create strategies for improving the KMS. Yu et al states: “measuring the performance of CoPs is the key to measuring the performance of a KMS” (Yu et al 2008, 733). Wenger et al says that management wants to know the return on investment (ROI) and how the CoP is helping the organization achieve their strategic goals (2003, 172).

According to Wenger et al, you can't simply count things like participation rates, documents produced or other static measures to determine the value of a CoP (Wenger et al 2003, 168). Wenger et al believe that the value of a CoP can be best measured by collecting stories systematically. Stories track the flow of knowledge from the initial activity that generated the knowledge to the knowledge gained from the activity to how the knowledge was used to create value (Wenger et al 2003, 168). The systematic method can be *bottom-up* where you track a CoP activity to see what impact the knowledge has on a business processes or it can be *top-down* where you identify business needs and then determine what CoPs can do to support those needs (Wenger et al 2003, 170). In a separate article, Wenger and Snyder say: “the best way for an executive to assess the value of a CoP is by listening to members' stories, which can clarify the complex relationships among activities, knowledge, and performance” (2000, 145). Wenger et al takes measuring CoP value a step farther by offering a guide to calculating ROI (2003, 177). This can be found in Appendix B.

Since counting items is not an accurate reflection of CoP value, a way to collect information on the effectiveness of CoPs can be done through surveys and interviews. A couple sources point to interviews as a good method for collecting stories while other sources show that surveys can provide multiple types of data. In their assessment of an

organization's CoPs, Kirkman et al used surveys to gauge the CoPs on performance and knowledge-sharing metrics (2011, 1240). Yu et al also surveyed participants of a CoP to measure the value of different knowledge processes (2009, 738).

Yu et al presented the knowledge value added (KVA) theory for measuring value by stating that the value gained from a KM process is the knowledge output minus the knowledge input. Yu et al divides KM activities into either *knowledge-sharing* or *problem-solving* and states that both types contain two stages of involvement: the Raw Knowledge Creating Process (RKCP) performed by the initiator of the activity and the Knowledge Value Adding Process (KVAP) performed by the responders to the activity (Yu et al 2009, 737). The RKCP stage converts knowledge per the SECI method to add value while the KVAP stage generates value when the respondents apply what they learned (Yu et al 2009, 737). By measuring the knowledge gained within these two stages, the KVA can be calculated for each activity (every i^{th} case) using the equation:

$$KVA_i = \frac{\overline{A}_i \times \overline{B}_i}{100} \text{ and for multiple KM activities using the equation: } KVA_{total} = \sum_{i=1}^n KVA_i$$

where \overline{A}_i and \overline{B}_i are mean values derived from survey (100-point scale) results on the RKCP and KVAP processes respectfully (Yu et al 2009, 739). A sample survey is shown in Figure 6 (Yu et al 2009, 746).

Figure 6

Sample Survey for Measuring Value

Topic:	How to measure the quality of curtain wall after construction? QC items such as perpendicularity conformance, amount of rebar and penetration depth.
RKCT rating:	Select the most appropriate term that best characterizes the topic (check one of the following terms) — non-significant (the posed problem is of no significance to the CoP) — low significance (the posed problem is relatively low significance to the CoP) — <input checked="" type="checkbox"/> medium significance (the posed problem is of medium significance to the CoP) — high significance (the posed problem is of high significance to the CoP) — most significant (the posed problem belongs to the most significant problems to the CoP)
Numeric rating:	Give an estimate of the numeric score that best represents the term you selected above. — <u>50</u> (Please assign a numeric score within [0, 100])

Yu et al recognizes that their Knowledge Value-Adding Model (KVAM) isn't complete because it doesn't account for financial metrics (Yu et al 2009, 744). They state: "It is impossible to single out the contribution of a KM endeavor to financial revenue" (Yu et al 2009, 744). Yu et al explains by saying: "The KM activities of a generic CoP may not result in significant time and man-hour savings (and thus cost savings), but will trigger a knowledge creation process that may contribute to solving problems in the future" (Yu et al 2009, 744).

Stages

There are stages of development for each CoP as well as stages of development for an initiative to create a network of CoPs within an organization. Wenger et al listed the stages of development that each CoP will go through as shown below (2002, 69):

- *Potential* – During this stage, the CoP is formed, leaders are chosen, and the structure (domain, community, and practice) is defined. The CoP should also decide on their *primary intent* (main strategic goal) for the CoP. There can be four different intents (Wenger et al 2002, 73):
 - a) To help each other solve everyday work problems in their discipline.
 - b) To develop and disseminate a set of best practices.
 - c) To develop and steward the tools, insights, and approaches needed by members in field assignments.

d) To develop highly innovative solutions and ideas.

While a CoP can serve more than one purpose, they tend to focus on one of these four more than the other (Wenger et al 2002, 73).

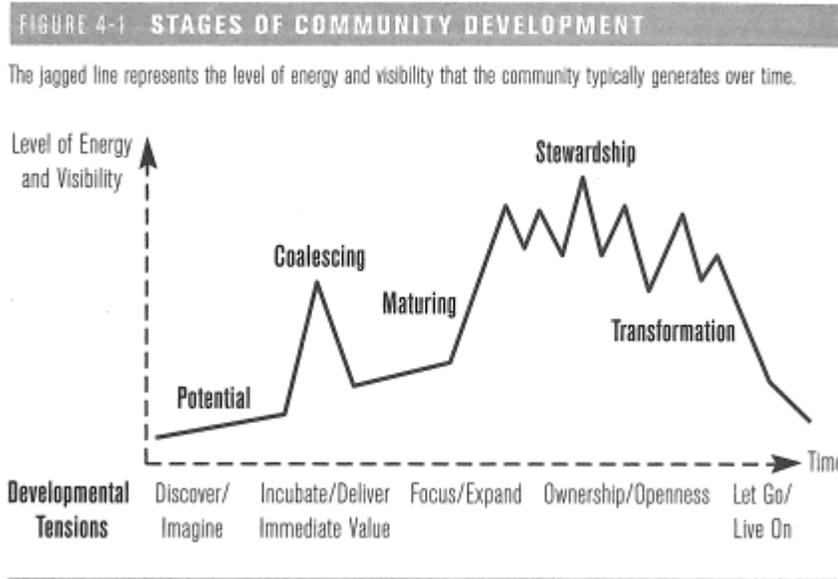
- *Coalescing* – During this stage, the CoP is officially launched through events and activities that bring the members together to build relationships and foster trust with each other. The CoP should decide what knowledge needs to be shared, how to share it, and how to bring value to the organization (Wenger et al 2002, 83).
- *Maturing* – During this stage, the CoP sets its boundaries and defines its role within the organization. The CoP actively organizes their knowledge and shows its value to the organization. The CoP should maintain its focus on their domain while adding members (Wenger et al 2002, 97).
- *Stewardship* – During this stage, the CoP should focus on maintaining relevance to the organization, keeping members engaged, and staying on the cutting edge of their practice. The CoP should seek new challenges and for more influence on business decisions. The CoP continues to incorporate new members and develop new leadership. (Wenger et al 2002, 104).
- *Transformation* – During this stage, the CoP ceases to be what it originated as. It can fade away by losing all members, terminate per management directive, turn into a social club, split into multiple CoPs, or become institutionalized by transforming into a department or center of excellence within the organization (Wenger et al 2002, 109).

Wenger et al states: “A community’s development, like an individual’s, is rarely smooth.

It frequently involves painful discoveries, difficult transitions, and learning through hard-won experience” (2002, 69). Figure 7 shows the stages in relation to time versus level of energy and visibility (Wenger et al 2002, 69).

Figure 7

Stages of CoP Development



The stages (or life cycle phases) of CoP development were also addressed by Cambridge et al in their “Community of Practice Design Guide”. Cambridge et al defined their stages as (2005, 2):

- *Inquire* – “Through a process of exploration and inquiry, identify the audience, purpose, goals, and vision for the community.”
- *Design* – “Define the activities, technologies, group processes, and roles that will support the community’s goals.”
- *Prototype* – “Pilot the community with a select group of key stakeholders to gain commitment, test assumptions, refine the strategy, and establish a success story.”
- *Launch* – “Roll out the community to a broader audience over a period of time in ways that engage newcomers and deliver immediate benefits.”
- *Grow* – “Engage members in collaborative learning and knowledge sharing activities, group projects, and networking events that meet individual, group, and organizational goals while creating an increasing cycle of participation and contribution.”

- *Sustain* – “Cultivate and assess the knowledge and “products” created by the community to inform new strategies, goals, activities, roles, technologies, and business models for the future.”

Cambridge et al addressed each stage in detail through providing key questions to explore as well as supporting activities.

Although the naming differs, the two different sets of CoP stages are similar in structure and primary points of development. This is expected as Cambridge et al used the book from Wenger et al as their primary source for developing their design guide. However, Cambridge et al does a better job of specifically defining the stages and outlining the activities needed to support each stage.

Wenger et al also described phases for an initiative based on establishing multiple CoPs to manage knowledge. These phases were similar to the phases individual CoPs go through and are described in order below (Wenger et al 2002, 196):

- *Prepare* – Create a plan for launching, identify gaps in knowledge, and link the initiative to the organization’s business strategy to ensure core competencies are addressed. Create a *technological infrastructure* for managing documents, supporting communication, and establishing a presence in the organization (Wenger et al 2002, 197).
- *Launch* – Launch CoPs in “places where there is energy on the part of potential members and enough organizational significance to draw some attention.” The choices for launching are (Wenger et al 2002, 198):
 - a) *High-visibility vs. low-visibility* – “Highly visible promotion effort” vs. “build momentum and interest through early results and word of mouth.”
 - b) *Top-down vs. bottom-up* - Managers choose domains for CoPs vs. organization supports CoPs that show initiative.
 - c) *Parallel vs. sequential* – Launch multiple CoPs at one time or stagger the launch ‘to capitalize on lessons learned’.

Wenger et al states: “Of course, the best launch approach in practice will combine elements from each set of option” (2002, 200).
- *Expand* – Once the initiative is established with several CoPs producing value along with an experienced support team and management support, then more

CoPs can be launched to cover all of the key knowledge areas. As the initiative expands it must be integrated into a “functioning knowledge system” (Wenger et al 2002, 201). The introduction of new CoPs should not be forced, it should occur naturally as the initiative gains momentum and the interest grows among employees (Wenger et al 2002, 195).

- *Consolidate*– The organization integrates CoPs into everything it does and aligns the CoPs with “business strategies, measurement systems, and human resource (HR) policies designed to reinforce knowledge development goals” (Wenger et al. 2002, 203).
- *Transform* – The initiative transforms the organization in two ways. First it transforms the organization to the point that CoPs “become more than an integral way of running the business; they become the focal structure”. Second, the CoPs “do not merely transform how the business operates; they transform it continuously” (Wenger et al 2002, 205).

As Wenger et al describes all these phases, the recurring main point is that the CoPs should be integrated with the business of the organization. Wenger et al states (2002, 191):

“At the community level, the design philosophy is about eliciting the passion and participation of members. At the organization level, it is about combining this passion with the resources and power of the organization to create value far beyond what a community could achieve otherwise.”

Challenges

Managing CoPs is presented as the main challenge throughout the literature with many sources focusing on it as their main topic. One aspect that makes CoPs difficult to manage is their informal nature. From his research, Thompson concludes: “neither organizational management nor CoP leaders are able to do more than nurture a fragile dynamic that consists of continued voluntary participation but resists forms of control” (2005, 164). Wenger and Snyder similarly say: “The organic, spontaneous, and informal nature of communities of practice makes them resistant to supervision and interference” (2000, 140). Wenger et al mentions the need to “choreograph the dance between the

informal professional passions and aspirations of practitioners and the organization's formal operational requirements" (2002, 193).

Managing CoPs is also made difficult by obstacles. The biggest obstacle is the difficulty in measuring the value of CoPs. Wenger and Snyder say that leaders have a hard time understanding the value of CoPs because the "effect of their activities are often delayed" and because "results generally appear in the work of teams and business units, not in the communities themselves" (2000, 145). Other obstacles a CoP can face are IT systems that don't support them, promotion systems that don't recognize CoP contributions, and "reward structures that discourage collaboration" (Wenger and Snyder 2000, 144).

Another challenge to management is that every CoP is different in how it operates and what it needs. This means there is no perfect mix of tools that fits every CoP (World Bank 2013, 7). Wenger et al points out that the right design elements are "discovered through iterative action-reflection cycles, not by executing a detailed blueprint" (2002, 191).

Motivating members to participate and make contributions is another big challenge to using CoPs. A hindrance to participation can be the reluctance to share one's knowledge which can be considered a valuable asset that differentiates an individual from their peers (Ruikar et al 2008, 438). Ruikar et al notes that a lack of motivation "can weaken the fabric of a community which relies on the willingness of the individuals to share knowledge" (2008, 443). In summarizing their research, Ruikar et al discussed the challenge of motivation and management of CoPs:

"It is clear that the challenge is to motivate individuals to participate in these communities in order to achieve organizational benefits and at the same time

contribute to the individual's professional development. From an organizational perspective, therefore, the key challenge is to provide an environment that is conducive to nurturing and developing such communities as opposed to merely creating them" (2008, 445).

Another hindrance to participation can be CoPs competing for an employees' time.

Kirkman et al says that empowerment is one method for motivating members to work on CoP tasks "even when there are competing demands placed upon them by their formal job responsibilities" (2011, 1242).

In addition to the challenges above, there are many things that can go wrong with a CoP.

Wenger et al listed disorders that could arise within the three key elements of a CoP:

- *Domain* – "Domain-related disorders often occur when the community or the organization fails to make a clear connection between the domain and the needs of the business, or when the needs of the business dominate to the point that the perspectives and interests of members are ignored" (Wenger et al 2002, 144). Related disorders are: *arrogance, imperialism, narcissism, marginality, and factionalism* (Wenger et al 2002, 143). These should be addressed by taking care of the relationships between the CoP and the rest of the organization and establishing how the CoP affects the business (Wenger et al 2002, 144).
- *Community* – Disorders related to the relationships within the CoP. "Having a community may create a toxic coziness that closes people to exploration and external input" (Wenger et al 2002, 144). Related disorders are: *cliques, egalitarianism, dependence, stratification, disconnectedness, and localism* (Wenger et al 2002, 146). These are best treated by bringing in new people and mentoring them, sharing responsibilities, limiting the size of the CoP, and staying in touch with other CoPs (Wenger et al 2002, 147).
- *Practice* – Efficiency leads to communication barriers with outsiders and creates boundaries for members (Wenger et al 2002, 147). Related disorders are: *over documentation, amnesia, dogmatism, and mediocrity* (Wenger et al 2002, 149). These can be avoided by: "making enough time to participate actively; balancing joint activities with the production of artifacts; initiating exciting knowledge-development projects; benchmarking the practice of other communities; challenging members to help teams with leading-edge issues; and valuing members participation" (Wenger et al 2002, 149).

Wenger et al also addressed the issues that could arise with multiple CoPs. These were presented as *stickiness* and *leakiness* (Wenger et al 2002, 151). *Stickiness* refers to the difficulty in transferring knowledge across the boundaries of shared practice to other CoPs. *Leakiness* refers to letting knowledge past organizational boundaries due to the efficiency of knowledge transfer within a shared practice. Both issues are related to managing the boundaries of CoPs. Wenger et al states: “The key remedy is to pay close attention to boundaries, both to avoid the problems they raise and to take advantage of the opportunities they present” (2002, 153).

The last area that could present issues to a CoP is the organization they are in. The first set of issues is from organizational dysfunction. These issues are: irrational politics between business units, a short-term focus on tangible outcomes, and an anti-learning culture (Wenger et al 2002, 155). The second set of issues is magnified by a focus on CoPs. These issues are *rigidity* and *structural complexity* (Wenger et al 2002, 155). *Rigidity* refers to the reluctance to change the way things are done due to an established norm. CoPs can either be a place for *rigidity* to prosper and grow or it can “create a potential for organized change far beyond the individual capacity to change” (Wenger et al 2002, 157). *Structural complexity* refers to the complexity within an organization based on multiple centers of power being involved in decision making. CoPs can decrease the “centrality of power” by adding “centers of power based on knowledge” thereby increasing the complexity of decision making (Wenger et al 2002, 158).

Summary

The literature review provides insight into the multitude of benefits of CoPs as well as the many challenges an organization can face in implementing them. Most sources focus on one or two specific aspects of CoPs, such as measuring their value, managing them, motivating members, or how to structure them. Wenger, McDermott, and Snyder cover all aspects of CoPs in their book “Cultivating Communities of Practice” and are portrayed as the experts on CoPs as their work is referenced multiple times throughout the other literature. In total, the literature review provides more than one viewpoint on all of the main topic areas and provides a foundation for building CoPs at KPE.

Research Procedure

The original research for this project encompassed a few different methods for gathering the information needed to implement CoPs in the KPE workplace. The research methods included a survey of KPE, work groups to discuss strategy, and a trial CoP for observation and analysis. The research also included evaluating the use of KPE's Research & Development (R&D) program as a method for implementing CoPs.

Prior to and throughout the time period that original research was being conducted, review of literature resources was performed to aid in the research. Information retrieved through the literature review was used to shape the original research to obtain maximum value of the collected results.

R&D Program

The R&D program was chosen as the channel through which to implement CoPs because it provided a method of introducing the idea to employees and managers. This program takes employees ideas through an approval process involving fellow employees and an executive committee consisting of upper management. The program offered support of the project by providing a project manager and updating management on the progress of the project. The project also received an allotment of working hours to use for executing the project as it progressed in development. Once successful in developing the project, the idea champion (author) gained approval and support from management to implement a trial CoP.

Company Survey

A survey of the entire company was the first step. The survey served the two main purposes of introducing the company to the concept of CoPs and collecting employee's opinions on the idea of developing CoPs at KPE to improve KM. The survey itself had two different parts.

The first part asked general questions about the survey participants and then asked specific questions regarding current KM practices at the company. The general questions at the beginning were asked so that survey responses could be classified by type of respondent whether it is their years of experience or area that they worked in. The next set of questions was aimed at retrieving employee views on the current methods of KM within KPE. These questions gauged the effectiveness and possible improvement of the current methods of KM.

The second part of the survey was preceded by an explanation of CoPs. This definition was developed through reviewing the multitude of different CoP definitions found within the literature review. The definition and additional description that best fit what the CoPs at KPE would resemble was used to introduce employees taking the survey to the concept of CoPs and an overview of their structure. The introduction to CoPs was followed by ten questions focused on gaining the employee's perspective on the impact CoPs could have on KM at KPE. These questions were used for determining if employees viewed CoPs as a potential solution to KM issues and what the level of participation in CoPs might be.

Work Groups

This category of research involved all open discussion with fellow employees regarding the creation of the CoPs within our company. These discussions focused on many topics from the CoP structure to their discussion topics. The early discussions with management and core members of the trial CoP were used for relaying what the purpose of the CoPs would be, their potential benefits, and how they would be structured. These discussions were also used to gain different viewpoints on the concept of CoPs and how they could work best at KPE. The work groups provided additional questions to guide further research within the literature review.

Trial Community

The final form of original research was the trial CoP developed within KPE. The trial CoP will be used to determine many things:

- How to form a CoP within KPE.
- How to format meetings and communicate between members.
- Best discussion topics for meetings.
- How to determine, assign, and carry-out tasks.
- If employees will participate actively in CoP meetings and activities.
- If the CoP can provide value to KPE and how to measure it.
- If CoPs can improve KM within their domain.

Results

The results of this research start at the first introduction of the CoP concept to KPE and continue through all of the research performed. The information gathered from the literature review is interwoven with the original research performed within KPE, showing how it impacted the different phases of research. The culmination of the research is a recommendation to KPE on whether or not to implement the CoP model.

R&D Program

The R&D program proved to be a great method for implementing CoPs at KPE. After review and acceptance of the CoP concept by the R&D panel (which consists of fellow employees), the author was allowed to present the concept to an executive committee of upper management (see Appendix C for presentations). The initial literature review provided the key information needed to present on CoPs. This led to approval from the R&D panel and upper management to further explore the CoP concept at KPE.

The support from the R&D appointed project manager was also very beneficial. The project manager offered valuable guidance and perspective throughout the development of the CoP project. This included review of documents and presentations, assistance in managing work group and trial CoP meetings, and valuable advice to aid in the development of the CoP concept to fit KPE. The manager of the R&D group provided guidance on what the executive committee would be looking for in the presentations and supporting documents. This guidance helped the author shape the presentations to the executive committee's expectations for the best portrayal of the CoP project, helping to gain project approval.

Company Survey

The company results were performed first to get the opinion of KPE employees on current KM practices and the implementation of CoPs. The complete survey results can be found in Appendix D. The survey had 257 participants, approximately a 49% response rate, which was aided by a gift card presented to one participant by the R&D group. The experience level and department area of participants was well distributed (question #1 - #2). The majority of participants came from the larger departments, showing that they were well represented in the survey.

Of those surveyed, 86.3% thought that managing the knowledge within KPE was very important to overall success, and all participants thought it important (#3). When asked if KPE adequately manages knowledge (#4), 69.7% felt that some improvement was needed and 26.8% felt that much improvement was needed. These results established that employees believed KM to be of significant value and that it needed to be improved. This favors the implementation of CoPs, since one of its primary benefits is improved KM.

The survey questions concerning current KM tools being used at KPE (#5 - #6) showed that employees thought they needed improvement. First, 70.6% of respondents felt some improvement and 25.0% felt much improvement was needed on keeping toolboxes complete and current. The second question regarding a KM tool asked how much the KPE Wiki needed to be improved to become a useful and reliable source. Of those that responded: 30.3% thought much improvement was needed, 56.6% thought some

improvement needed, and 11.6% thought little improvement needed, leaving only 1.6% believing no improvement was needed.

The next set of questions (#7 - #10) asked employees about participating in KM activities that typical CoPs engage in without mentioning the term CoPs. This was done to gauge how employees felt about KM activities independent of CoPs. This also served as a good tool for measuring how well CoPs were defined, as the responses to these questions should be similar to the responses on CoP questions.

When asked about meeting with fellow employees to build relationships while discussing a topic they all share an interest in (#7), 33.1% of respondents definitely would and 49.6% probably would. When asked if they had valuable knowledge to share with fellow employees to help them with their daily work (#8), 26.8% felt they definitely did and 60.6% responded they most likely did. Conversely, 65.7% of respondents felt they definitely could and 32.3% felt they most likely could learn from other employees sharing their knowledge (#9). The final question of the first section (#10) asked employees if they had areas of expertise or high interest in that they would enjoy discussing with fellow employees on a regular basis to improve their own knowledge base, solve problems, or develop new ideas. Responses were 28.2% definitely did, 34.5% most likely did, 31.8% possibly did, and 5.5% did not have any such areas of interest or expertise. These responses showed that the majority of KPE employees who responded were interested in KM activities and would participate in them.

The second part of the survey (#11 - #20) was preceded by an explanation of CoPs that included a definition from the literature review that best reflected what CoPs would be at KPE and a short description on CoP structure and topic areas. This is shown below:

Communities of Practice can be defined as “Groups of people who come together to share and learn from one another ... are held together by a common interest in a body of knowledge, and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices” (World Bank 2013, 2).

Communities of Practice can span disciplines, be project based, have defined time spans or continue indefinitely. They consist of volunteers who join the community because of their interest in the topic. Topics can be any area of business which has enough interested employees to form a community. Topics can be based on a technical design area, design program, project type, management task, or administrative area. Everyone can participate in Communities of Practice regardless of their job type or position.

Following the explanation, 27.3% of respondents definitely and 64.3% most likely think that CoPs could improve the KM at KPE (#11). For the open-end response, there were several good comments, some of the best (most informative) are shown below:

- “You can write a multi-volume book on anyone's job, but not every detail necessary to perform the work will be captured. Organic thought will be required to perform satisfactorily even at the lowest levels of responsibility. Bringing together like minds and establishing the relationships will facilitate real, dynamic knowledge transfer that will fill in the major gaps that wiki, toolboxes, etc will never fill.”
- “As long as a work product and knowledge sharing is required as part of the program, then yes. If there isn't a program structure that facilitates the sharing of knowledge, it's just a group of people sitting around talking.”
- “With employees cross training employees, we integrate what we've learned throughout the business.”

When KPE employees were asked if they would benefit from participating in a CoP (#12), 29.1% of respondents definitely and 63.4% most likely think they would. Some of the best open-end responses are shown below:

- “If it's a productive group with an objective we're collectively working toward. I'm concerned without clear guidelines; these groups won't accomplish the intended purpose. Group leaders would require training on how to manage discussions, and groups.”
- “If these are well thought out and taken seriously, everyone stands to benefit. This is a great professional development opportunity.”
- “If a picture is worth a thousand words, a relationship with a subject matter expert is worth a thousand wiki pages.”
- “There is always room for improvement, technology is constantly advancing. Keeping ahead of our competition will secure us a role in the market place.”

The survey then asked employees if they thought CoPs could improve, speed-up, or enhance professional development at KPE (#13). The response was 29.6% definitely thought so and 61.5% thought they most likely could. Some of the best open-end responses are shown below:

- “You can only learn so much from a book. If the wiki could cover everything, we would hire new grads that perform on the same level as a 20 year industry veteran.”
- “YES! Better guides and standards would allow professionals to learn the "KPE way" of doing things and create a great learning tool for younger professionals.”
- “The topic of the community of practice would have to be relevant to what the person is currently working on. It would not do as much good to be involved in a meeting, but not touch back to that for another 6 months or year. It could be helpful though, if you kept good enough notes.”
- “Absolutely - it's similar to a structured mentoring program with more experienced and new people included...both are able to learn from it.”

Of the KPE employees who responded (#14), 18.9% definitely would and 62.2% probably would participate in a CoP through regular meetings. Some of the best open-end responses are shown below:

- “Our project schedules do not allow for much work outside of the project.”
- “I would most likely be an irregular participant based on project schedules and specific meeting topic.”
- “Why would I not want to improve my means/methods? Of course I would participate.”

- “If the topic was applicable to my day-to-day or that of my team it would be beneficial if done appropriately, managed the right way and with the correct participants.”

When asked how often they would be willing to participate in CoP meetings (#15), 63.3% said monthly, 23.5% said every two weeks, 6.6% said weekly, and 6.6% said they wouldn't participate. For the time of day to hold meetings (#16), 50.7% of respondents preferred lunch time with food provided, 24% preferred during regular work hours in the morning or afternoon, 23.1% preferred early in the morning with breakfast provided, and 2.3% preferred meeting in the evening after work. On the question (#17) of how many CoPs they would participate in: 48.5% said one, 30% said two, 11.5% said three or more, and 10.1% said they wouldn't participate.

The next two questions (#18 - #19) asked for ideas on CoP topics and a creative name for CoPs at KPE, these had 74 and 68 responses respectively. The final question (#20) asked for any additional comments regarding CoPs at KPE. Some of the best open-end responses are shown below:

- “So often a lot of great discussions happen and do not get documented or if they are, it is not easy to find the information later. It would be good to get some organization with regard to how to share and incorporate training into what is being discussed. General knowledge to one person may not be general knowledge to another person.”
- “Must provide clear program structure and roles and responsibilities of members; a method of sharing COP knowledge with COP members and company wide, COP charter, each COP would need a facilitator who does not need to be a SME, gain senior management buy-in and publicize successes.”
- “A true Collaborative Leader will need to influence those around him/her, innovate by helping to shape the company strategy, impact processes and performances, and finally inspire those around him/her. This will require some training for our staff to become engaged. Once a employee is engaged, you are getting his/her full attention.”

- “This sounds like a great idea. One of the differences I have noticed between here and (company name omitted for privacy) where I once worked is that the knowledge base at KPE isn't as wide, and experts on different areas aren't identified or developed. I think this will help that greatly.”
- “I think this is a great idea that will speed up the development of young engineers (those with less than 15 years of experience).”
- “I think it's a great idea, to utilize our resource of experience to improve on our processes.”

The question responses from the first and second part of the survey show that KPE employees think KM is important (98%), it needs to be improved (96%), and that CoPs can improve KM at KPE (91%). Additionally, employees think they would benefit from participating in a CoP (93%) and most would participate in at least one (90%). However, the majority (81%) were unsure if they would participate in a CoP and most were only willing to meet on a monthly basis (63%). Therefore, despite CoPs being seen as beneficial to the organization and individual, employees are hesitant to participate and commit any significant time to them. The reason for this hesitation is shown in the open-end responses. These point to project responsibilities as the reason why employees wouldn't have time to participate actively and continuously in CoPs.

This reaffirms that the main challenge for CoPs at KPE will be motivating employees to actively participate in a developmental (either individual or organizational) activity that takes time away from their project work. This also falls in line with what the literature review revealed.

Work Group

The work group discussions took place after the R&D executive panel approved the creation of one trial CoP within the author's structural department. The discussion in work groups bridged the gap between the theoretical plan presented to the R&D panel and the actual trial CoP to be created. Meetings with various people were used to align the CoP concepts with the culture of KPE to create a more detailed plan for launching and operating the trial CoP. The general purposes of the meetings are described followed by a detailed description of the issues discussed and the final decisions.

The first meeting was with the structural department manager to get his support and guidance for creating and running the trial CoP. From the literature review, it was understood that getting management support was crucial for validating the CoP and obtaining resources. The author also recognized that the department manager would have a good feel for what design area the trial CoP should focus on as well as what employees should be asked to lead the CoP.

The first work group meeting consisted of the department manager, SME's chosen by the department manager, R&D project manager, and the author. These work groups focused on how the trial CoP should be formed, how it should be operated, and what should be expected out of it. These work groups started large and then were reduced to just a couple SME's to lead the CoP. The SME's then recommended three additional engineers and one designer/drafter to serve as the CoP core. Then, this core group along with the author and the R&D project manager went through the final details on how to structure the CoP and choose the rest of the members.

The meetings along with emails were used to discuss many critical areas in forming the trial CoP. The items discussed and decided on are broken into the main categories of: *domain area, incentives, member selection, division of responsibilities, and structure.*

Choosing the *domain area* for the trial CoP was the biggest area of contention among the work group participants. Originally seen as being a relatively simple decision, it was agreed upon by the author and department manager during the initial meeting that steel design would be the domain. This was due to steel design being a main area of design within the structural department and the fact that there were a few SME's which had already been working on a training class for the domain. It was decided that these SME's would make a good core to lead the CoP as it should guarantee that at least one would be at each meeting to lead the discussion. It was also discussed that the CoP could be used to develop training classes as one of its tasks.

However, during the first work group meeting many different opinions surfaced on what the *domain area* of the CoP should be. While some thought the domain of steel design was too broad because of all the different topic areas within it, others thought the domain shouldn't be limited and the CoP should be able to discuss anything related to structural engineering.

Another issue that evolved with the discussion on the *domain area* was getting the participants to focus on establishing the one CoP and not expand into future CoPs. Creating just one CoP limited membership, thereby excluding most of the structural department. This feeling of excluding too many people, led to participants wanting to expand the membership and expand into more CoPs although only one CoP was allotted.

Starting with just one CoP also changed the method for CoP creation. It was argued that the *domain area* shouldn't be chosen but instead let the CoPs form naturally and apply for formation via a charter submittal. This form of natural creation agreed with what was found in the literature review, which pointed to CoPs being "organic, spontaneous, and informal" and that managers "cannot mandate communities of practice" and should instead "provide an infrastructure in which communities can thrive" (Wenger and Snyder 2000, 140). However, this ignores the fact that the infrastructure in which CoPs can thrive has to be created first. In fact, Wenger et al point out that the launching of CoPs can be done sequentially "in order to capitalize on lessons learned from each new community" (2002, 199).

Since this trial CoPs purpose was to determine if CoPs would work at KPE and how they will work, this was seen as building the infrastructure for future CoPs and therefore didn't have to follow the model of letting them form naturally. Thereby, instead of having CoPs evolve naturally from employees self-creating the CoPs, it was decided that the CoP *domain area* should be pre-chosen and then volunteers selected. This also avoided the dilemma of having employees create multiple different CoPs with domains of varying importance and having to choose only one to act as the trial CoP. Finally, the author also felt selecting one out of many would discourage employees from participating in the future and that pre-selection would ensure a domain important to KPE was selected. Therefore, the author stayed with steel design as the *domain area* due to the importance of the area and the SME's already being in place.

Member selection was tied directly to the *domain area*, so once it was decided to pre-select the domain it narrowed the options for how the members of the trial CoP could be

chosen. The options were to hand-pick the remaining members, pick from a pool of volunteers, or do a combination of both. It was originally decided that the department manager and SME's would hand-pick all of the members based on their personal experiences with fellow structural engineers. However, the author felt this would exclude too many possible candidates and that the trial CoP might not be well accepted by employees who never had the chance to volunteer and be considered for the CoP.

Therefore, the work group proceeded to do a combination of selecting employees they know would serve the CoP well and asking for volunteers to pick from. First, the employees nominated to join the group were introduced to the CoP concept and asked if they wanted to participate. Once they all accepted, the trial CoP now had a core group of six engineers (author included) and one designer. After the core was assembled, the remaining CoP members were selected by using a department survey (see Appendix E) to find interested structural engineers. The core members then picked out the engineers that appeared to best fit the CoP based on their experience, passion for the domain, and current project work. The selection revolved primarily around what each volunteer could bring to the CoP as the core members were looking for technical expertise and experience that would aid in developing and improving the practice of steel design. In the end, five more engineers were selected for a total of twelve members. The number of members was limited to ensure the CoP could fit into a typical conference room and with the understanding that additional members could always be added later.

On the discussion concerning *incentives*, or motivation factors, for recruiting members to the CoP there were a few main factors the work group identified. The first one was the opportunity the trial CoP would provide younger engineers to increase their professional

development through exposure to technical discussion and experts opinions. The second factor was providing employees the opportunity to improve the practice of steel design for the greater good of the department. Finally, the trial CoP would provide members a higher degree of recognition from the department manager for volunteering and carrying out tasks to improve the department.

For the *division of responsibilities* within the CoP, the discussion focused on who should be chosen to lead the CoP. The work group decided, as a whole, that the leader should be chosen by the CoP members through nominations and voting. It was discussed that it would be best if the CoP members selected a mid-level engineer who wasn't currently in a leadership position, but wanted to develop leadership skills. Selecting an engineer not currently in a leadership role should ensure the leader could dedicate more time to running the CoP than an engineer who had a lot of responsibilities already.

The *structure* of the CoP was discussed throughout the work group meetings as a point of focus. This was mostly in relation to defining how the CoP would work with department management. The author had to continually stress that the CoP should not be assigned tasks. It was important for the author to establish this because limiting management control and direction was presented as a key to CoP survival and effectiveness throughout the literature.

Another discussion point on *structure* dealt with how the meetings should be formatted. It was generally agreed upon that part of the meeting would be dedicated to working on tasks specifically geared toward improving steel design documents within the department. The other part of the meeting would be left up to the CoP members, giving

them the freedom to discuss or partake in any activity related to the domain area. This could include sharing lessons learned, discussing a magazine article, exploring innovative solutions, or listening to a guest speaker.

The last part in relation to the *structure* was having the CoP create a charter. The work group agreed that a charter should be developed that would detail the CoP topics, goals, member roles, and any other information needed to define what the CoP would be doing and how they were going to do it. It was suggested that the charter should be used as an application for approval by department management to start a CoP. The author believed the application process would be more applicable when multiple CoPs were trying to form and therefore did not see the trial CoP needing to submit a charter for approval.

Overall, the work groups proved to be a great resource for working out the details of how the CoP should work within Kiewit and more specifically how the trial CoP should be started and operated.

Trial CoP

The trial CoP started once the final members had been selected and the first meeting had been set. These results cover the first four months of the trial CoP. The general progression of the meetings is covered first and then followed by detail discussion on the main points of discovery concerning CoP operation and value.

The first meeting started with the author welcoming everyone to the CoP, describing the purpose of the CoP, and covering a few key concepts on CoPs. The author also stressed the importance of being respectful to other members in order to build the trust needed for good technical discussion. Next, all of the members introduced themselves by describing

their experience, current work, and expectations for the CoP. The author felt that introductions would help build relationships, get everyone familiar with each other's experiences, and establish what everyone felt about the CoP.

The first order of business was determining the leader, co-leader, and meeting minute recorders. This was done through nominations and private voting. Private voting, as opposed to public hand-raising, was determined to be the best method to prevent early dissention between members.

The meeting progressed to choosing a name for the CoP, methods for sharing information between members and the department, and possible tasks for the CoP to do for an early victory. The meeting ended with the CoP breaking up into small groups that were each responsible for generating a mission and vision statement for the CoP before the next meeting. This was an important step for the CoP to take in the first meeting because it established the use of sub-committees and the expectation for members to perform work outside of the meeting.

During the next couple meetings the CoP established the basis for the charter, which included the mission and vision statements. Using these statements as a guide, the CoP progressed to determining goals and selecting the initial tasks to perform in order to meet the goals seen as top priority. Once it was agreed that these tasks would be done using sub-committees, the committees were formed by members volunteering based on the task they most wanted to participate in.

Once the sub-committees were formed, the meetings focused solely on sub-committee updates as they would consume the entire hour-long meeting. After a couple weeks of

this (the fifth week overall), it was decided that the meetings needed an additional element of technical discussion so that the meetings weren't just sub-committee updates. To incorporate the technical discussion, the meetings were extended by half an hour to a total duration of 1.5 hours. Additionally, the meeting frequency was changed from weekly to every other week. The members agreed that since the CoP structure and responsibilities were well established, meetings could occur less frequently. This was also seen as a way of providing the sub-committees a week in between meetings to meet for carrying out their tasks. The meeting format and frequency remained the same throughout the remainder of the trial period.

Throughout the four months the trial CoP was being researched, there were several discoveries concerning the operation, management, and value of the CoP.

Operation

The author took several ideas found within the literature review and applied them to aid in operating the trial CoP. One of those ideas was the use of a charter that included a mission and vision statement. Creating a mission and vision statement gave CoP members a chance to really look at what they wanted to accomplish and once finished, united them behind a common purpose. Although these statements did fade into the background once the CoP started to focus on the tasks at hand, they should serve as a reminder to the members what their ultimate goals are when it comes time to select their next task. The charter also provided a place to record information relating to the CoP such as the CoP name, member names, roles, and goals.

In unison with the charter, operating guidelines were created for defining procedures. Indeed, reading the literature on CoPs can lead to the conclusion that there shouldn't be any defined structure because it will restrict the freedom needed for active participation and creative interaction. However, the trial CoP decided that there needed to be defined procedures not for controlling members but rather for circumstances that required them. A good example of this is the voting procedure which specifies the number of people required to have a vote and the percentage of votes needed for something to be approved. Another good example is the procedure for changing or creating a department standard, such as a specification or typical detail drawing. This needed to be clearly outlined so the CoP could ensure that quality documents that were ready for production were being developed.

Besides the voting and document creation process, the operating guidelines define the communication methods, meeting structure, membership management, and communication with management. The complete *Charter & Operating Guidelines* for the trial CoP is shown in Appendix F.

As outlined in the operating guidelines, communication outside of the meetings happened primarily through email with all working documents being stored in a common location on a network drive. One method of communication the CoP didn't have, but members felt would have been useful, is a place to hold continual discussion threads on any technical topic. Email doesn't work well with multiple people because a participant's comments can get lost if more than one person responds at once or if everyone is not copied on each reply. Another option was a social tool KPE had where discussion threads could be held, but it didn't fit the purpose of having a dedicated tool for technical

discussion to be kept, sorted, and saved. This would have been a great tool for continuing discussion between meetings and even getting input from structural engineers outside of the CoP.

Communication with the rest of the department was considered crucial for acceptance of any document the CoP produced. The members wanted to make sure that the rest of the department didn't think that the CoP was operating in a bubble. For this reason, monthly updates were given at department meetings on what the CoP was working on. Also, once the CoP finished a document, the rest of the department was given the chance to review and comment on it before finalizing it as a standard. The CoP recognized that revising a standard served very little purpose if the people who were going to be using it didn't understand why it was being revised and didn't have a chance to offer their input.

One of the most important discoveries the CoP made early on was that tasks could be performed quicker and more efficiently if done within small sub-committees (2-4 people). The members quickly realized that the more people who were involved in discussing an issue and making a decision, the longer it takes to come to a conclusion. The CoP agreed that sub-committees should take on the tasks and complete them to the best of their ability and once they had a finished product they would open it up for CoP review and discuss any conflicting views if necessary. The sub-committee could also bring important issues to the CoP meetings for discussion during the time allowed for sub-committee updates. If the issue required in-depth explanation and discussion it could be addressed during the latter part of the meeting reserved for technical discussion.

Another important part of the CoP operation was having a member to represent the structural drafters who the structural engineers could work closely with to produce design drawings. The drafter, who was part of the original core group, offered valuable input on discussions that dealt with modifying drawing deliverables and also performed the drawing modification needed to complete the sub-committee tasks. Since this cross-department input proved valuable, the CoP is going to look into adding a construction counterpart to gain a constructability viewpoint on the domain area.

A final part to the CoP operation was recognizing that training needed to be incorporated into the process of reaching any goal the CoP wanted to achieve. The members all agreed that simply producing a new or revised document wasn't going to have the type of impact needed to truly add value to KPE. This has been showcased by many past task groups within KPE who have spent time and energy creating or revising a design tool only to see it filed away on a network drive or company webpage and not reach its full potential value. The CoP recognized they needed to train employees on any document they publish to make sure fellow structural engineers not only use it, but use it as intended.

Management

A major point of emphasis throughout the literature review was the need for management to give CoPs the power to make its own decisions in regards to what tasks they would perform. This was portrayed as a major motivation factor for getting employees to participate in CoPs and to carry out their tasks. When the trial CoP was going through the process of determining goals and selecting tasks to perform, a second reason for

management to relinquish their power of task assignment was discovered. The reason being: if the CoP is formed with volunteers passionate for the domain area, then the members will know what tasks need to be performed to make the most substantial impact to the company.

If the CoP is formed with engineers who are working inside the domain area on a daily basis, as the trial CoP was, then those engineers know what tools they use regularly that need to be improved the most. They will also be familiar with what impact improving a certain tool will have on the work within their department. Additionally, the types of employees who volunteer for a CoP do so because they want to advance the practice within that domain area to its maximum proficiency. Therefore, once they collaborate and agree on what tool needs the most improvement, they won't shy away from this task but instead will pursue it with the passion that led them to volunteer for the CoP in the first place.

For the same reasons, if management is expanding into different areas of work, they should bring their business plan to the CoP for advice on what areas would need to be improved or changed in order to handle the new kind of work.

Additionally, it might not be enough for management to not direct CoP tasks; they may also need to be kept out of the meetings. In the trial CoP, the department manager decided, without suggestion from any CoP members, not to attend meetings because he didn't want the CoP to be influenced by his presence. He felt that the CoP members would be more comfortable discussing items and making decisions without him there. This action was seen as giving the CoP an additional degree of freedom, as employees

can be uncomfortable and hesitant to make comments in the presence of management, especially if they are contradicting something the manager said or is known to believe.

The freedom a CoP has to control what it does and how it is done can also be an obstacle because employees are used to being provided a structure for carrying out any work related tasks. The author found that the leaders of the CoP were constantly asking whether or not the CoP was operating the right way because they struggled with the abstract definition for CoPs. It had to be explained that there was no defined right or wrong way to operate a CoP; the methods for creating value are up to each individual CoP. As a way of outlining the expectations the author had for CoPs within KPE, four main goals were identified that each CoP should meet. These are:

- *Provide Value to KPE* – Improve something KPE does or the people who do it.
- *Improve the Practice* – Within the domain area, improve the tools used on a daily basis to perform work.
- *Expand the Knowledge* – Within the domain area, capture and spread the knowledge of employees, build a center of expertise within the CoP, and share knowledge across boundaries such as project teams.
- *Enjoy the Journey* – The members should enjoy building relationships, learning, sharing, and building tools to improve the domain area they are passionate about. If the enjoyment isn't there, participation will wane, and the CoP will become less valuable to KPE.

One of the major reasons for the success of the trial CoP was the strong leadership it had from the beginning. The leaders, one primary and one co-leader, really cared about the success of the CoP and wanted to make sure they were running the CoP correctly as mentioned above. The need for strong leadership within the CoP was also mentioned throughout the literature review. Wenger et al stated: "A number of studies have found that the most important factor in a community's success is the vitality of its leadership" (2002, 80). Within the trial CoP, the leaders pushed fellow members to devote more

time to CoP tasks and recognized the ones who did so. They also did a good job of getting everyone involved within the meeting. This was important as there were members who were less vocal and wouldn't provide their opinion unless called upon. This will probably be true for any future CoP within KPE and therefore it will be important for each CoP to carefully choose their leader.

Since management is not supposed to direct CoPs on what to do or how to do it, one of the biggest impacts they can have is providing incentives to increase employee participation. However, since this was a trial CoP with the main purpose of seeing if CoPs would work, the participants weren't exposed to the primary incentives from management in the form of encouragement, recognition, or reward. The trial CoP wasn't advertised or promoted by management nor were rewards offered to employees in return for completing CoP tasks. The department manager did support the trial CoP and gave CoP members the chance to present on what they were doing during department meetings, but there wasn't any management support from outside the department.

Instead, the main incentives, or motivation factors, for volunteering and participating in the trial CoP were driven by the passion of the employees for the domain area. This incentivized engineers to volunteer because they would be given the chance to improve the practice and participate in high level technical discussions on the domain area they were passionate for.

The other incentive for employees to participate, or at least attend meetings, was the benefit of receiving a free lunch. The offering of lunch corresponds directly with the fact that the best and often only time to get everyone together was during the lunch hour.

This is generally because it is the only time free of project meetings which would take precedence over the CoP meeting. The free lunch wasn't advertised as an incentive but instead was seen as a way of thanking an employee for sacrificing their free time during the day to improve the company. As one of the group members pointed out, the cost of lunch for twelve people is probably less than the hourly rate for any of the experienced engineers in the CoP. Therefore, KPE would be getting twelve hours of experienced engineer consultation for the cost of one.

Even without executive management providing incentives and KPE being really busy for half of the trial period, participation within the CoP was very good for the most part. Meeting participation was very good, with all members attending unless they were out of the office on business or personal time. Participation outside of the meeting within the sub-committees was also very good as shown by the continual progress the sub-committees made between meetings. The one area of participation that wasn't to the desired level was when members were asked to review other sub-committees documents. While some members would always review the documents and comment, there were a few members who didn't take the time to aid in the development of documents they weren't directly associated with producing. This can most likely be attributed to them either being too busy or not being interested in what the other sub-committees were doing. No direct action was taken towards these members during the research period. Instead, the leaders recognized the members who contributed and passively requested more participation from those who didn't.

Value

As with any company program, CoPs need to show they are producing value in order for management to justify using resources to support them. Even though CoPs require little to no monetary resources, they still use employee's time to complete their tasks. To justify taking employee time away from projects that generate income for KPE, it was important for the trial CoP to show value.

The most tangible source of value came from the sub-committees who were working directly on tasks chosen for their end-value benefit to KPE. Taking into consideration that it took about a month to establish the structure of the CoP and that the trial took place around the Christmas holiday, the sub-committees only had two and a half months of work on their task. Considering this, as well as the fact that all of the members kept the same responsibilities for the projects they were working on, the sub-committees added considerable value compared to the time spent. The value shown by each of the four sub-committees is summarized below:

- *Charter & Operating Guidelines* – Since part of the trial CoP was to define how CoPs would operate at KPE, a sub-committee of two members was formed to generate and put in writing the methods and procedures a CoP should follow. This document went through two review cycles in the CoP and was published three months into the trial.
- *Handrail Details* – This sub-committee consisted of three engineers and one drafter. They took an outdated drawing that showed typical handrail connections and updated the connections to make the fabrication and installation of handrail easier. This included checking calculations to verify material strengths, consulting with fabricators, and adding user notes to the drawing to ensure correct use of the connection details. The drawings went through one round of CoP review and were being released for department review four months into the trial.
- *Steel General Notes* – This sub-committee consisted of three engineers and took on the task of improving the general notes drawing that defined steel

requirements. They expanded the notes to cover more detail and broke them down into multiple sections to make it easier to read and find information. They also changed the method of editing general notes by placing them in a word document with user notes. This will make it quicker for engineers to edit the document and for drafters to produce the general notes drawing as they will be able to import the word document into the drawing. This had been through one cycle of CoP review four months into the trial.

- *Training* – This sub-committee consisted of three engineers and the R&D project manager who is a training manager at KPE. First, they identified and trained engineers on how to train. Then, they broke down the basics of steel design into six different areas to train structural engineers on. They have a complete course outline, set-up their method of training, and have identified their target audience to this point, four months into the trial.

A source of value that is harder to measure is the value CoP members get from participating in the meetings and sub-committees. In these settings, members share their lessons learned with each other that clearly results in knowledge transfer. The part of the meeting that appears to have the greatest impact is where one of the members presents a technical topic for discussion. The technical discussions are lively and create an atmosphere of collaborative problem solving where CoP members can share their experiences and knowledge with the other members.

The knowledge gained from members during these technical discussions is impossible to accurately assess without directly asking the members what they learned. To gather this information, the author sent a survey to the members after each meeting asking a few simple questions. The survey was kept short to encourage participation and at least one reminder was sent out to ensure at least 75% of the meeting attendants responded. The survey asked the members how valuable each topic (including technical sub-committee updates) was from a technical standpoint.

From the survey results, the technical discussions associated with the sub-committee updates typically resulted in the members only receiving *Some Value (You got something from discussion, but nothing significant)*. However, the technical topic proved to be more valuable with most members typically responding that they got either *High value (You learned a lot from discussion, learned something new that can definitely help you)* or *Great value (You learned immensely from discussion and can apply to current work)*.

The survey also had an open-end response section that asked members what they learned during the meeting, and if they had a story of applying something they learned in the CoP to their daily work. This was done as a way of getting members to remember what they learned by typing it out and also to measure the value of the knowledge learned by seeing how it was applied to their daily work. This was derived directly from the literature review where Wenger et al point out that “The best way to assess the value of a community of practice...is by collecting stories” (2002, 168). The surveys did collect a lot of information from members on what they learned and how they applied it. However, the stories are rarely detailed enough to determine the value that was produced. Therefore, although the survey provides a good mechanism to collect stories, an interview should be conducted of whoever submitted the story to understand the value that was created for the company.

At the meeting corresponding to about three and a half months into the trial, the post-meeting survey (see Appendix G) included additional questions asking members how they felt about participating in the CoP. Eight out of thirteen members (~62%) responded “*It is great (A lot of value and you enjoy participating)*”, three members (~23%) responded “*It is good (Definitely value and you will keep participating)*”, and two

members (~15%) responded “*It is okay (There is some value and you're indifferent on participating)*”.

The survey also included an open response question asking “Is there anything the CoP could do better or failed to do?” A few of the best open-end responses are shown below:

- “I believe having some help to accomplish the sub-committee tasks would be great. A dedicated person to help run calcs and design details would vastly increase the speed at which these tasks are accomplished.”
- “We can do more to include the rest of department, construction, contract employees and other disciplines in our meetings/review process.”
- “More involvement (comments, etc.) is mandatory for the CoP to be effective. This will evolve as the CoP grows.”

The final survey question asked “Is there anything the CoP has done well and should keep doing?” A few of the best open-end responses are shown below:

- “I feel that the CoP creating or improving on department standards is the right thing to bring the department to a higher level of excellence and by refining old standards, we can ensure current codes are met as well as increase work productivity.”
- “This is one of the only examples of organized, proactive improvement I have seen, so that is good. I think we just need to keep refining how it works.”
- “I think that we are starting to get into the swing of things. We should keep on with the current methodology.”

From the survey responses and comments, it is clear that most of the members want to continue participating in the CoP and they think it is adding value to KPE. The members believe the CoP is performing needed tasks and that the CoP structure is working.

However, the comments also point to some possible issues with the CoP operation.

One possible issue is the feeling that the CoP is too exclusive to the rest of the department and it needs to get more people involved. This could be the result of only

one CoP being available for a department of eighty-plus people. The author believes that if there were three or four more CoPs available, giving the chance for over half of the department to be involved, the CoP wouldn't feel so exclusive.

The other main theme for the comments on CoP improvement revolved around making quicker progress on CoP tasks. One part of this is increasing the participation of members outside of the meeting. As mentioned in the literature review, this is one of the biggest issues CoPs can face. If KPE moves forward with creating more CoPs, it will need to be examined how different motivation factors affect participation. As mentioned earlier, the trial CoP received very little support from management, so it would be important for management to provide more support if the CoPs are implemented at KPE. The other part to making quicker progress is getting non-CoP members to aid in any busy work required to complete a task. This is something that will also need to be explored to see if the CoP can get non-members to perform tasks without giving them the benefit of participating in meetings.

Conclusion

This research project started with the author believing that KPE could benefit from implementing CoPs. The key concept being that CoPs are a great KM tool and that KPE needed to improve how they managed knowledge. To determine if KPE could benefit from CoPs, the author conducted a literature review, surveyed KPE employees, consulted with fellow employees, and piloted a CoP for four months. The whole process was done through KPE's R&D program, which allowed for management input and approval of each stage.

For evaluating the effectiveness of improving KPE through implementing CoPs, the original objectives will be reviewed.

Determine if CoPs can be developed and sustained at KPE. The trial CoP was developed with a surplus of willing participants and functioned well for the four months of research. At the end of four months, the trial CoP had an established meeting structure and sub-committees for performing tasks. The lessons learned from forming the trial CoP can be used to slowly grow the number of CoPs. From there, the continued sharing of lessons learned to improve how the CoPs work will ensure future CoPs can be successful. With the addition of more CoPs, a group of CoP coordinators should be formed to monitor CoP progress, help solve problems that CoPs encounter, and to communicate with management.

To sustain the momentum of the CoPs, management will need to provide motivation for the members to participate in order to replace the natural energy generated by a new initiative. This natural energy is due to the excitement of trying something new and will help the CoPs get off to a good start. However, it can't be maintained and will need to be replaced by management motivating employees through incentives, encouragement, and recognition. This motivation by management needs to be combined with the domain passion and member empowerment that make CoPs enjoyable. Without these motivation factors, the CoPs can't compete for employees time with projects that get a lot of management attention.

Following these general steps along with using the review of literature as a guide, the growth and sustainment of future CoPs within KPE can be accomplished.

Evaluate the internal processes within a CoP to determine how to maximize their efficiency and output. The processes within a CoP were discussed in the literature review along with how a CoP should be structured. This information was used to shape the structure of the trial CoP around a domain, community, and practice. The domain was selected based on an area of knowledge within the structural department that was important to KPE and had significant interest. Choosing the correct domain helps to ensure that the tasks performed will be of significance and that there will be an adequate number of volunteers to form the CoP. Selecting the right people for the CoP is critical to making sure the technical knowledge of the domain is in place to improve the practice.

The operation of the trial CoP revealed many things about processes of a CoP. It was discovered that providing guidelines for voting, task progression, and meetings can make the meetings and task work more efficient. It was also discovered that using sub-committees for task work was much more efficient than having the entire CoP work on a task. The addition of a technical discussion part of the meeting worked well to increase the flow of technical knowledge between CoP members.

While task progression showed continual progress, the methods for increasing participation need to be further explored so that tasks can progress quicker and with more input. Another area that needs to be improved is the collection and distribution of knowledge that is shared during the technical discussions. This should be improved to ensure that the rest of the company can have access to that knowledge through some form of documentation.

Determine if CoPs can improve KM at KPE. Since CoPs are based on a specific area of knowledge, they will clearly have an impact on KM if operated correctly. This was shown with the trial CoP. Except for the generation of CoP guidelines, everything the trial CoP did had an impact on KM within KPE. The technical task groups were taking their technical knowledge and using it to improve standards. Once improved, their next step was to collect knowledge in the form of comments on the documents they released for department review. The process set up for changing a document is based on managing the knowledge of everyone who uses it and retrieving knowledge from experts outside the company to produce a document that improves KPE the most.

The other sub-committee within the trial CoP was working on training. This task had a similar format, except that the members were collecting knowledge and formatting it into a delivery method for sharing knowledge. The training will take the experts knowledge within the CoP and share it with the rest of the department, including fellow experts. Once shared, the training sub-committee can gather knowledge in the form of comments or personal conversations and either improve the training or transfer it into additional training. This training will improve the knowledge base of all structural engineers, becoming an effective method for transferring knowledge between experts and less experienced employees to enhance their professional development.

Finally, the technical discussions are a great method for passing technical knowledge between CoP members. This knowledge can be captured and transferred into tools that the all of KPE can have access too, possibly sharing this knowledge with hundreds of employees.

Measure the value CoPs can provide KPE. The ability to roughly measure the value of CoPs was established through the post-meeting surveys and analysis of task progression. The post-meeting surveys do a good job of showing how meaningful the technical topics are to the participants, but they fail to fully show how the knowledge gained results in monetary value to KPE. For this, interviews would need to be conducted and stories analyzed to determine how knowledge learned in a CoP converted into saving KPE money through less work hours and/or material quantities. Similarly, the progression of meaningful tasks shows that the CoP is improving the tools used in daily work, but fails to show a monetary value without researching the impact these tools have on engineering efficiency, reduced quantities, or construction cost. Without these monetary figures that provide clear evidence of value, the value of a CoP is a matter of opinion.

The author's opinion, through literature research and experience, is that the knowledge gained will be applied by the members either in the near or distant future and result in saved time and/or material quantities. Based on the tasks the trial CoP performed and the author's experience with KPE, the author believes these completed documents and training will save design time, materials, and construction time once they are implemented. It is also clear that the trial CoP members believe their tasks have value; otherwise they wouldn't be spending their time working on them.

However, regardless of opinions and monetary analysis, the real value of a CoP is impossible to measure. Tracking how something learned or how an improved process impacts a company over a multitude of years can't be done. Analysis can't trace how the knowledge gained from a CoP member is transferred to other employees and used by

them or how changing a standard detail can impact the design of an entire system and subsequent systems tied into it.

In the end, the best way to measure the value of a CoP is to monitor its progress, ask the people involved, and ask the people affected by what the CoP is doing. Based on the trial CoP progress, what the employees said in the original survey, and what the trial CoP members said in their post-meeting surveys, CoPs can definitely provide value to KPE.

Suggestions for Additional Work

There has been a lot of research performed on CoPs as evidenced by the number of sources found during the literature review. The information on CoPs found within the literature review covers almost all facets of how to start and operate CoPs, including best practices and methods for measuring their value. However, the abstract structure of CoPs means there is no defined methodology for setting its membership, running meetings, choosing and completing tasks, communicating inside and outside the CoP, and many other details of CoP operation. In truth, this is the nature of CoPs. They should be shaped to fit an organization's structure and needs in order to successfully implement them. Therefore, the additional research that needs to be performed is directly related to how CoPs will function within a specific company.

Although the research into CoPs at KPE has taken many necessary steps towards making them successful, there is still a lot of additional work that needs to be done. This lies in four main areas: capturing lessons learned of the trial CoP, learning through growth, learning through additional research, and expansion into other parts of the company.

Capturing the lessons learned within the trial CoP will consist of restructuring the charter and operating guidelines so that any new CoP started within KPE can take it and modify it as required to fit their needs. In addition to this, a manual for starting a CoP should be developed to capture what worked well for the trial CoP in choosing its domain, building the membership, and defining the elements within the charter.

After the operating guidelines and start-up manual has been created, new CoPs can be started following these. Once started, there will need to be a method in place for

monitoring their progress, sharing lessons learned between them, and capturing this information into the guidelines and manual for future CoPs. Part of this growth will also be addressing issues that the trial CoP was encountering. The main issue will be how to increase participation among members. Different motivation techniques will need to be looked at, such as private meetings with members to encourage more participation, replacing members who aren't participating, and asking for management to encourage participation.

Additionally, in order to justify the use of employee time for CoP tasks, there will need to be a consistent method established for validating the value of the CoPs. This could be done by either showing how completed tasks improve KPE or by shaping CoP tasks to meet company needs. It would also be beneficial to do a case study where CoP stories and completed tasks are analyzed to gauge the monetary value the CoP produced.

Finally, as the number of CoPs grows, there will need to be a method for breaking down domain boundaries so that CoPs work together towards common goals and to make sure there aren't CoPs working on the same thing from different directions. It should also be explored to see if a CoP based around a design system (i.e. an entire pipe rack) with members from multiple disciplines can operate to produce similar value as traditional CoPs (based on a design area with members from one discipline).

In addition to learning from the CoPs in operation within KPE, there should be additional research done to find best practices from other organizations. This would include reviewing the literature that discusses what companies are doing in regards to incentivizing employees and incorporating CoPs into the organization structure. Further

investigation could be done by contacting CoP leaders in other companies to interview them on what they are doing or invite them to review how KPE's CoPs are operating.

The final step of additional research would occur after CoPs had been well-established within KPE. At that point, it could be researched how to implement CoPs into other divisions within the Kiewit organization. KPE is one of a few engineering divisions within Kiewit, which has multiple construction divisions spread over the entire country. First, the implementation of CoPs could be tried in the other engineering divisions. If this proved successful, then CoPs could be explored within the construction divisions. The construction divisions would probably require a change in the CoP structure due to the different structure within construction companies. To implement CoPs in construction, the use of virtual (internet based) CoPs would have to be explored along with any unique challenges that would introduce.

Ultimately, CoPs can be used in almost any organization if given the proper structure and resources needed to operate. Their very nature is simple and allows them to be molded to fit the needs and structure of any organization. They only need two things: a business area employees are passionate about and employees willing to participate. Regardless of the business area chosen, there will always be something that needs to be improved or maintained.

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Yu, Wen-der, Pei-Lun Chang, Shuen-Ho Yao, and Shen-Jung Liu. “KVAM: model for measuring knowledge management performance of engineering community of practice.” *Construction Management and Economics* (August 2009): 733-747. Taylor & Francis, Web 20 Mar. 2013. <http://www.tandfonline.com/doi/abs/10.1080/01446190903074978>

Appendix A CoP SECI Stages

(Andrawina and Kurniawati 2012, 192)

A. Step Socialization

Table I shows the activities and performance indicators for socialization step.

TABLE I. ACTIVITY AND PERFORMANCE INDICATORS FOR CoP SOCIALIZATION STEP

Modes Conversion : Socialization	
From	To
Tacit	Tacit
Individual	Individual
Sharing and creating tacit knowledge through direct experience	
<ol style="list-style-type: none"> 1. Walking around inside the company 2. Walking around outside the company 3. Accumulating tacit knowledge 4. Transferring of tacit knowledge 	
Activity	Performance Indicators
Exploring tacit knowledge owned by the employees in each CoP (CoP optimalization, shrinkage, Commerce Response Time, and the Public Service Integrity (ILP).	<p style="text-align: center;">People</p> <ol style="list-style-type: none"> 1. Numbers of CoP's members 2. Number of knowledge workers 3. Number of CoP leader who join the sharing session
Exploring tacit knowledge of the internal (employees, members of the CoP) and the external users.	<p style="text-align: center;">Process</p> <ol style="list-style-type: none"> 1. Availability of business processes to identify best practices solution of the faced problems proposed by the CoP's members
Identify problems that occur between business units	
Identify the problems experienced by customers	
Identify issues related to the corporate partners	

B. Step Externalization

Table II shows the activities and performance indicators for externalization step.

TABLE II. ACTIVITY AND PERFORMANCE INDICATORS FOR CoP EXTERNALIZATION STEP

Modes Conversion : Externalization	
From	To
Tacit	Explicit
Individual	Group
Articulating tacit knowledge through dialogue and reflection	
<ol style="list-style-type: none"> 1. Articulating tacit knowledge 2. Translating tacit knowledge 	
Activity	Performance Indicators
Documenting the results of internal tacit knowledge exploration (the CoP members)	<p style="text-align: center;">People</p> <ol style="list-style-type: none"> 1. The number of content documented by members of the CoP in a month 2. Number of content or documents uploaded by the knowledge worker in a month
Documenting problems that occur between business units	<p style="text-align: center;">Process</p> <ol style="list-style-type: none"> 1. Availability of problem and solution documentation
Documenting problems faced by the customer	
Documenting problems faced by the corporate partners	

C. Step Combination

Table III shows the activities and performance indicators for combination step.

TABLE III. ACTIVITY AND PERFORMANCE INDICATORS FOR CoP COMBINATION STEP

Modes Conversion : Combination	
From	To
Tacit	Explicit
Group	Organization
Systemizing and applying explicit knowledge and information	
<ol style="list-style-type: none"> Gathering and integrating explicit knowledge Transferring and diffusing explicit knowledge Editing explicit knowledge 	
Activity	Performance Indicators
Documenting every individual knowledge which has chance to become organizational knowledge	<p>People</p> <ol style="list-style-type: none"> Numbers of Good Idea <p>Process</p> <ol style="list-style-type: none"> Availability of individual knowledge document
Combine individual knowledge as best practice	<p>People</p> <ol style="list-style-type: none"> Numbers of Good Practices
Determine best practice	<p>Process</p> <ol style="list-style-type: none"> Availability of local best practice
Examine the chosen best practice to make it organizational knowledge	<p>People</p> <ol style="list-style-type: none"> Number of CoP member who involve in examination process <p>Process</p> <ol style="list-style-type: none"> Availability of business process to examine the best practice Availability of organization best practice document

D. Step Internalization

Table IV shows the activities and performance indicators for internalization step.

TABLE IV. ACTIVITY AND PERFORMANCE INDICATORS FOR CoP INTERNALIZATION STEP

Modes Conversion : Internalization	
From	To
Tacit	Explicit
Group	Organization
Sharing and creating tacit knowledge through direct experience	
<ol style="list-style-type: none"> Embodying explicit knowledge through reflective action Using simulation and experiments 	
Activity	Performance Indicators
Confirm the best practice to related unit	<p>People</p> <ol style="list-style-type: none"> Number of knowledge worker involved
Develop new business process to disseminate the best practice into organizational knowledge	<p>Process</p> <ol style="list-style-type: none"> Availability of new business process socialization

Appendix B

Guide to Calculating ROI

(Wenger et al 2003, 177)

BOX 8-3 CALCULATING ROI

SOMETIMES SENIOR MANAGERS and team leaders want a direct calculation of the return on investment in communities. It is a good idea to underestimate the value—intentionally and visibly—while overestimating the costs. When people approximate a numeric value, such as time saved, cost avoided, or additional revenue, we ask how much of that value they can attribute directly to their participation in the community. What are the chances that value would have been realized anyway? Then we ask how certain they are about that number. When reporting these results, we multiply the estimated value by the percentage attributable to the community and by the certainty expressed (also as a percentage).

numeric value * share of community * degree of certainty = reported savings

So, a \$2 million savings, half of which the person estimates came from participating in the community, where they feel 80 percent confident in their estimate, would translate to:

$$\text{\$2M} * 50\% * 80\% = \text{\$800,000}$$

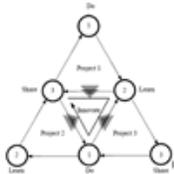
When calculating the costs of the community, we take all direct costs and add to them an estimate of average indirect costs. We are as generous in our cost estimates as we are conservative in our claims of value added.

Such conservative calculations will generally produce a very positive ROI for a healthy community. But being carefully and visibly conservative helps skeptics and finance people trust that you are not inflating the value of the community.

Appendix C

R&D Presentations

Original Presentation to R&D Panel

<p>Kiewit R&D Presentation</p> <p>Communities of Practice</p> <p>By: Matt Flint</p>	<p>Communities of Practice</p> <p><u>AGENDA</u></p> <ul style="list-style-type: none">•What they are•What they can do•Who participates•What makes them work•Application to KPE•KPE Communities•Benefits to KPE•Summary
<p>Communities of Practice</p> <p><u>They are:</u></p> <ul style="list-style-type: none">•Something that already exists in every organization•System of Relationships•Membership based on participation•People with common sense of purpose•People who need to know what others know•Often unrecognized, ignored, or taken for granted•Key tool of Knowledge Management	<p>Communities of Practice</p> <p><u>What they do:</u></p> <ul style="list-style-type: none">•Improve knowledge management•Encourage knowledge creation & sharing•Capture, store, & share knowledge•Build good relationships•Blur project boundaries by sharing lessons learned•Increase collective learning 
<p>Communities of Practice</p> <p><u>Who participates:</u></p> <ul style="list-style-type: none">•Employees from different groups/departments•All levels of experience•People from any area – Eng., HR, accounting, etc.•Employees who need help or guidance•People who want to learn from others•People with knowledge to share•Members of other COP's	<p>Communities of Practice</p> <p><u>What makes them work:</u></p> <ul style="list-style-type: none">•Trust & Good relationships•Willingness to share information•Incentives to share knowledge•Motivation by providing benefits•Assessment of employees on prof. development•Management support through providing budget and promoting knowledge management

Communities of Practice

Application to KPE:

- Toolbox & Wiki Development
- R&D idea development
- Problem solving
- Lesson learned sharing
- Training new employees
- Professional paper or presentation development

7

Communities of Practice

KPE Communities:

- Job type, General interest, Project type
- Pipe Rack Design
- GE or Siemens Design
- California Projects
- Combined cycle projects
- Seismic Design
- Materials – Concrete, grout, steel
- Deep Foundations
- Scheduling/Planning
- Budget management

8

Communities of Practice

Benefits at KPE:

- Bridge departments, projects, and business areas
- Better knowledge management
- Professional development
- Unifying company
- Design standardization and improvement
- Sharing lessons learned
- Avenue for training and sharing

9

Communities of Practice

Summary:

- Identify Issue – Insufficient knowledge management
- Effect – Less-efficient design, knowledge not fully shared, slower employee development
- Proposal – Establish Communities of Practice
- Potential Resources – conference rooms, lunch or breakfast food, management support
- Who benefits – everyone in communities, KPE, Kiewit customers, toolboxes and Wiki pages

10

REFERENCE

- Ruikar, K., Koskela, L., and Sexton, M. (2009), "Communities of practice in construction case study organisations, Questions and insights", *Construction Innovation*, Vol 9, No.4, pp.434-448

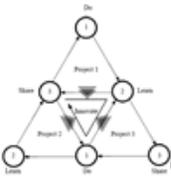
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QUESTIONS?



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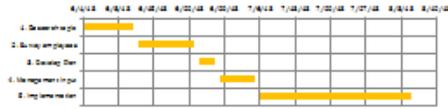
First Presentation to R&D Executive Committee

<p style="text-align: right;">Kiewit</p> <p style="text-align: center;">Communities of Practice</p> <p style="text-align: center;">Executive Committee Presentation October 22, 2012</p>  <p style="text-align: right;">1</p>	<p style="text-align: right;">Kiewit</p> <p>COMMUNITIES OF PRACTICE</p> <p>AGENDA</p> <ul style="list-style-type: none"> • Introduction • Problem & Solution • Opportunity • Team & Model • Budget & Schedule • Promise • Reward Statement <p style="text-align: right;">2</p>
<p style="text-align: right;">Kiewit</p> <p>COMMUNITIES OF PRACTICE</p> <p>INTRODUCTION</p> <ul style="list-style-type: none"> • What are Communities of Practice (COP)? <ul style="list-style-type: none"> • Already exist • Everyone can participate • Key tool of knowledge management <ul style="list-style-type: none"> ➢ Creation and sharing ➢ Capturing and storing ➢ Increase collective learning • Builds relationships • Blurs project boundaries • Improve professional development <p style="text-align: right;">3</p>	<p style="text-align: right;">Kiewit</p> <p>COMMUNITIES OF PRACTICE</p> <p>Problem</p> <ul style="list-style-type: none"> ➢ Knowledge management is currently incomplete in the method of sharing knowledge among employees and capturing all of the knowledge in the organization. <p>Solution</p> <ul style="list-style-type: none"> ➢ Create Communities of Practice throughout all areas of the company to share, capture, and store the knowledge of our employees. <p style="text-align: right;">4</p>
<p style="text-align: right;">Kiewit</p> <p>COMMUNITIES OF PRACTICE</p> <p>Opportunity</p> <ul style="list-style-type: none"> ➢ Increase employee knowledge ➢ Reduce repeat mistakes ➢ Capture knowledge for future <p>At Kiewit:</p> <ul style="list-style-type: none"> ➢ Toolbox & Wiki growth/improvement ➢ R&D idea development ➢ Sharing lessons learned ➢ Problem solving ➢ New employee training  <p style="text-align: right;">5</p>	<p style="text-align: right;">Kiewit</p> <p>COMMUNITIES OF PRACTICE</p> <p>Team & Model</p> <ul style="list-style-type: none"> • Idea Champion (Myself) <ul style="list-style-type: none"> ➢ Research current best practices ➢ Conduct survey of employees ➢ Draft Plan for implementation ➢ Guide implementation • Project Manager (Elizabeth) <ul style="list-style-type: none"> ➢ Assist in survey development ➢ Guidance in drafting plan ➢ Oversee implementation • Department Managers/Management <ul style="list-style-type: none"> ➢ Provide insight into plan ➢ Implement Communities of Practice <p style="text-align: right;">6</p>

Budget

- > My time ~ 200 hours
- > Elizabeth's time ~ 50 hours
- > Department managers time ~ 50 hours

Schedule



7

7

Promise

Develop Communities of Practice that benefit the company by improving knowledge management through linking the communities with the current tools of knowledge management:

- > Lessons learned
- > Toolboxes
- > Wiki
- > Checklists

Ultimately create a complete, smooth-running system of knowledge management.

8

8

Reward Statement

Permission to use this research and implementation for my KU masters degree field project.

And some Kiewit gear.



9

9

Questions



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Second Presentation to R&D Executive Committee

Communities of Practice

Executive Committee Presentation
May 26, 2013



1

COMMUNITIES OF PRACTICE

AGENDA

- Survey Results
- Further Define
- Structure
- Measuring Value
- Example
- Plan for Implementation

2

COMMUNITIES OF PRACTICE

Survey Results

- Part 1 Summary (General KM questions)
 - > 86% - Managing knowledge within company is Very important
 - > 96% - We need to improve knowledge management within company
 - > 87% - They have valuable knowledge to share
 - > 98% - They could learn from fellow employees sharing knowledge
- Part 2 Summary (COP KM questions)
 - > 92% - COP's would improve knowledge management at KPE
 - > 92% - Would benefit from participating in COP
 - > 81% - Would participate in COP's through regular meetings
- Overall Impression
 - > Employees believe it could be beneficial
 - > Biggest issues is time and structure

3

COMMUNITIES OF PRACTICE

Further Define

- Communities of Practice are a Virtuous circle:



- COP Main Benefits
 - > Decreased learning curve
 - > Improved response time
 - > Reduce rework & double work
 - > Spawn new ideas

4

COMMUNITIES OF PRACTICE

Structure

- Seeding Structure
 - > Provide Boundary Objects
 - > Don't directly control, merely influence
 - > Empowerment
 - > Support Communities
 - > Community Charter



5

COMMUNITIES OF PRACTICE

Measuring Value

- Performance Indicators
 - > Attendance & Quality of participants
 - > Wiki & Toolbox Contributions
 - > Ability to solve problems
 - > Meeting Notes
 - > New R&D ideas
- Surveys
 - > Multiple types
 - > Gauge value of meeting according to members
 - > Rating on different measures provides real data
 - > Measure knowledgesharing and problem solving

6

Example Community of Practice**Ductwork Design**

- New design area creates need for community
 - Gather experienced engineers
 - Develop design method
 - Build knowledge base
 - Prepare for projects - Wiki and Toolboxes
- New projects create sharing opportunity
 - Share lessons learned and best practices
 - Modify design method
 - Solve problems
- Impact company
 - Improve efficiency
 - Create Knowledge center
 - Generate R&D ideas



7

7

Rough Plan for Implementation

- Departments assist in selecting 3-4 areas per dept.
- Get commitment from Subject Matter Experts (SME's)
- Ask for volunteers
- Create communities with varied experience levels
- Provide communities with guidance
- COP starts with Charter acceptance
- Expand COP's based on success

8

8

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- Thompson, Mark. "Structural and Epistemic Parameters in Communities of Practice." *Organization Science* 19.2 (2008): 151-164.
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- "Communities of Practice: A Strategy for Sharing and Building Knowledge." National Center for the Dissemination of Disability Research (NCCDD) Technical Brief Number 11 (2002).
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9

Questions

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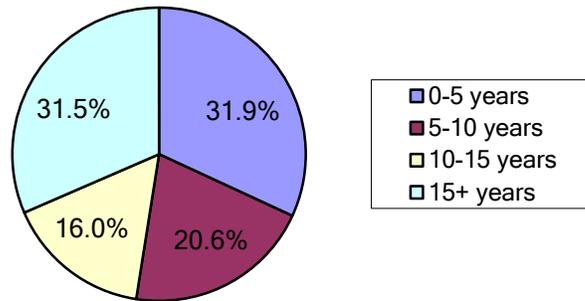
Appendix D

Company Survey Summarized Results

Part 1

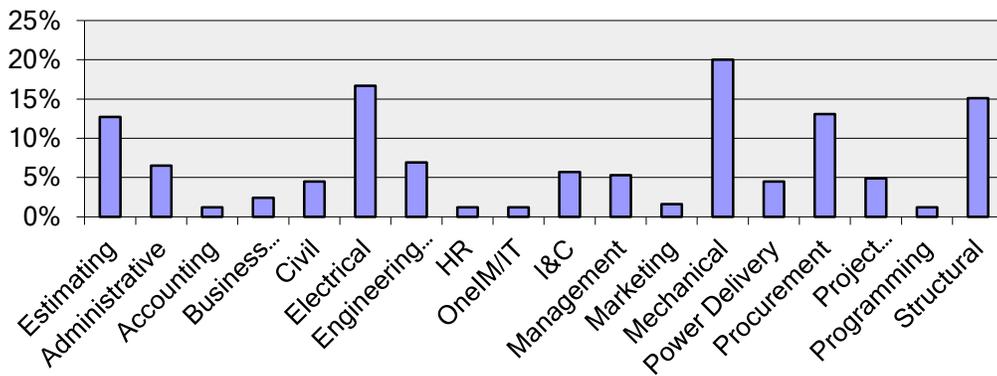
Question 1

How many years of industry experience do you have?



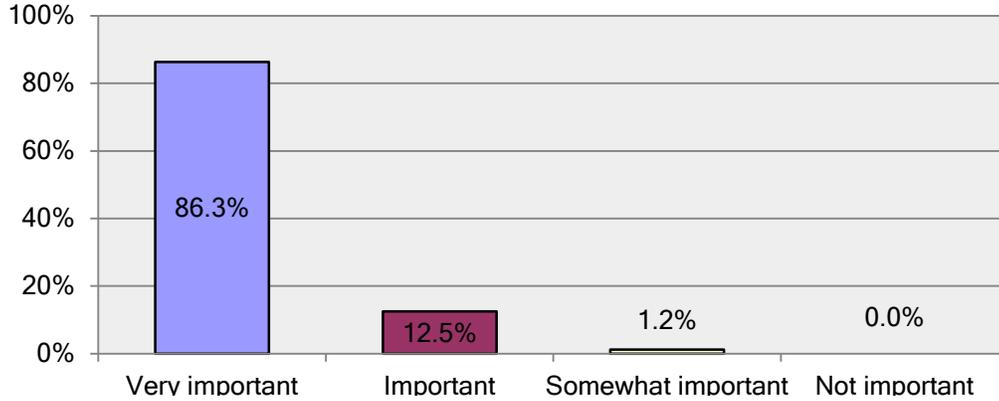
Question 2

What department are you currently a part of?



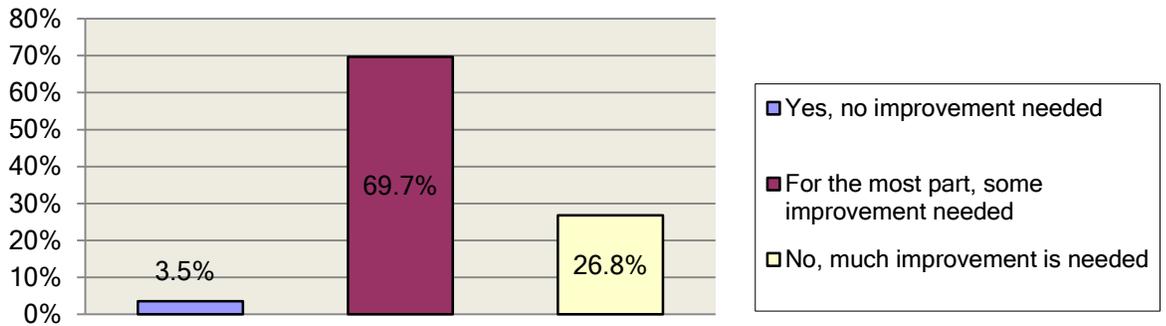
Question 3

How important is managing (capturing, storing, and sharing) the knowledge within our company to our overall success?



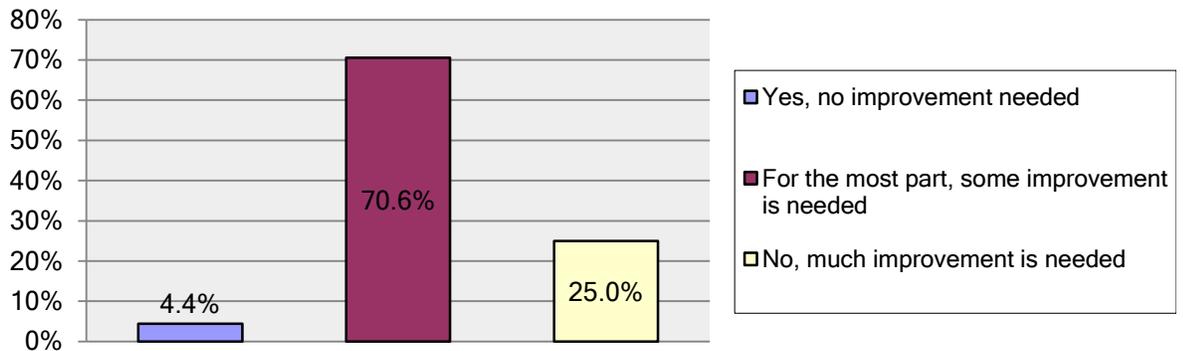
Question 4

Do you feel we adequately manage the knowledge within our company?



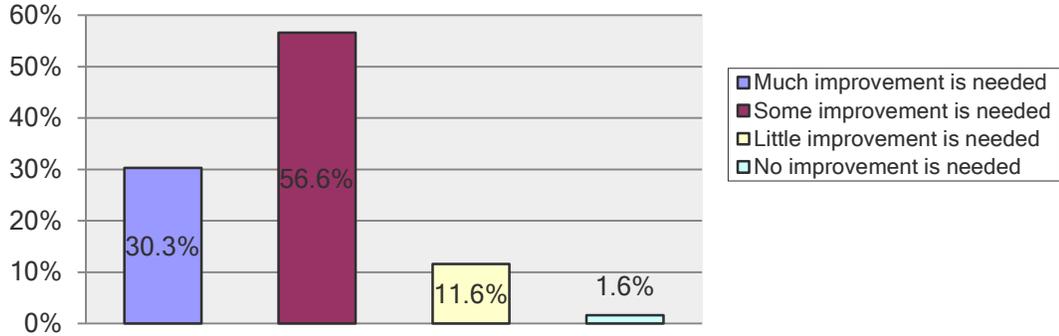
Question 5

Do you feel our toolboxes are complete and kept current?



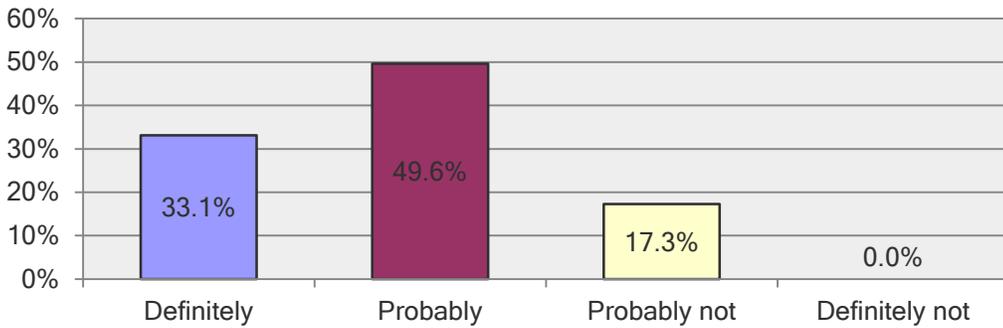
Question 6

How much does the Kiewit Wiki need to be improved to become a useful and reliable resource?



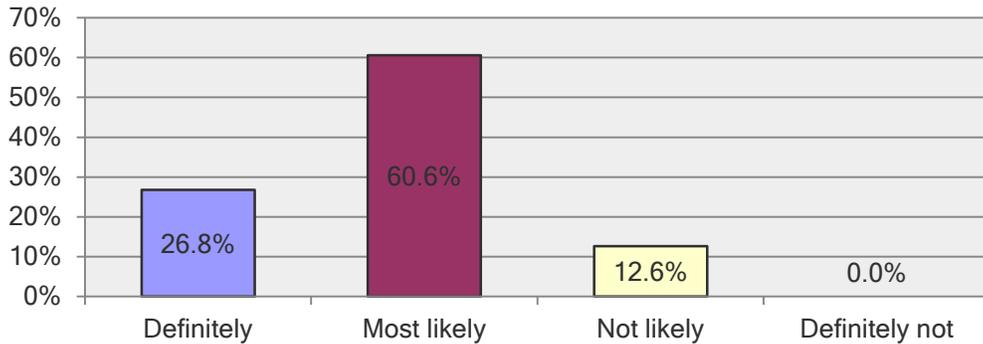
Question 7

Would you like to get to know more fellow employees and build relationships through collaboration in a group environment where you discuss topics that you are all interested in?



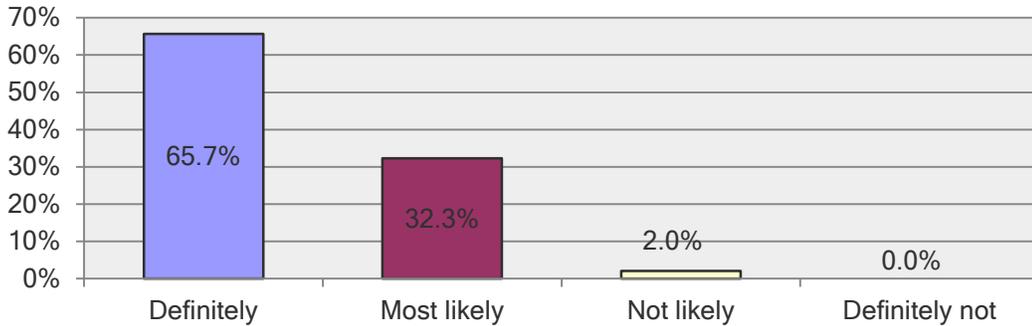
Question 8

Do you feel that you have valuable knowledge (lessons learned, best practices, subject expertise) you could share with other employees to help them with their daily work?



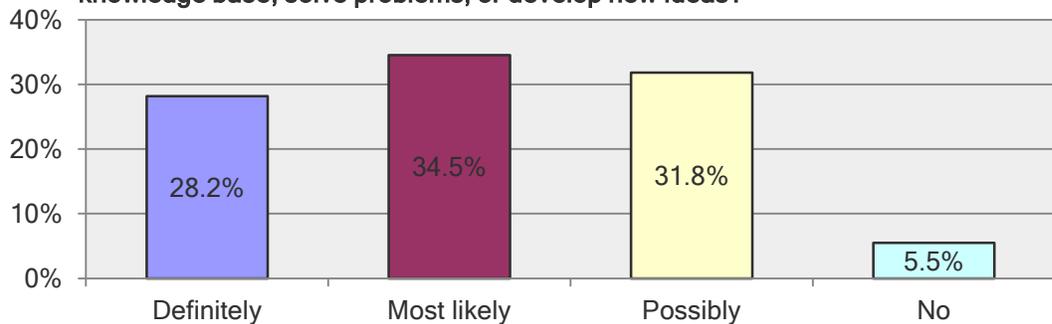
Question 9

Do you feel that you could learn from fellow employees sharing their knowledge?



Question 10

Do you have areas of expertise or areas you are highly interested in that you would enjoy discussing with fellow colleagues on a regular basis to share or improve your knowledge base, solve problems, or develop new ideas?



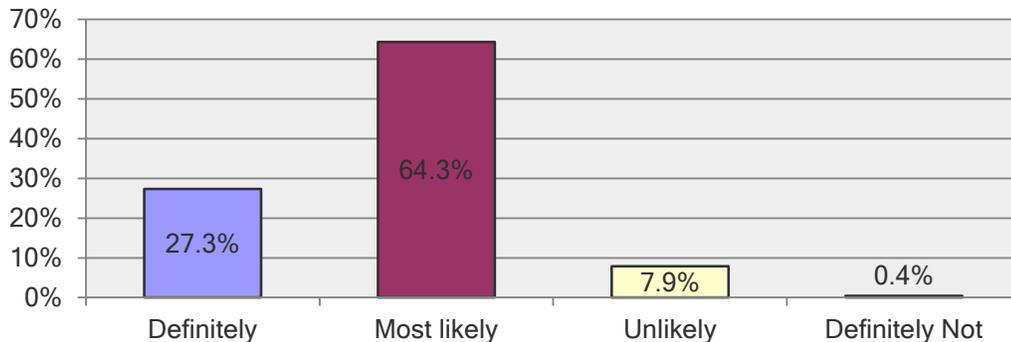
Explanation of CoPs

Communities of Practice can be defined as “Groups of people who come together to share and learn from one another ... are held together by a common interest in a body of knowledge, and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices” (World Bank 2013, 2).

Communities of Practice can span disciplines, be project based, have defined time spans or continue indefinitely. They consist of volunteers who join the community because of their interest in the topic. Topics can be any area of business which has enough interested employees to form a community. Topics can be based on a technical design area, design program, project type, management task, or administrative area. Everyone can participate in Communities of Practice regardless of their job type or position.

Question 11

Do you think Communities of Practice could improve the knowledge management at KPE?

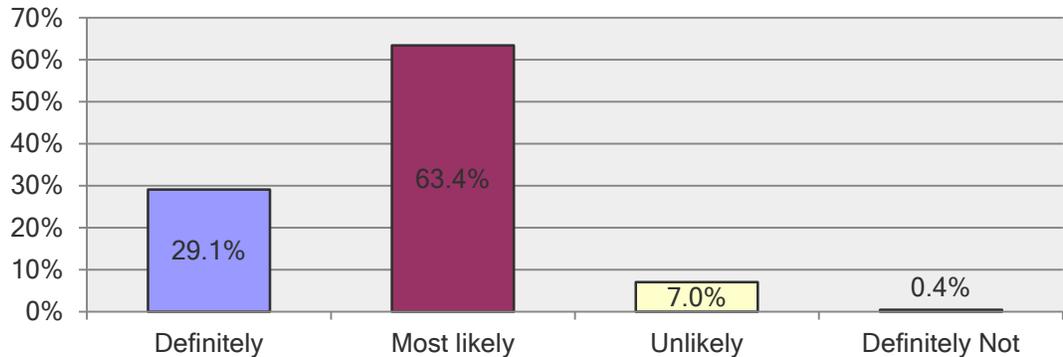


Question 11 Comments:

- You can write a multi-volume book on anyone's job, but not every detail necessary to perform the work will be captured. Organic thought will be required to perform satisfactorily even at the lowest levels of responsibility. Bringing together like minds and establishing the relationships will facilitate real, dynamic knowledge transfer that will fill in the major gaps that wiki, toolboxes, etc will never fill.
- As long as a work product and knowledge sharing is required as part of the program, then yes. If there isn't a program structure that facilitates the sharing of knowledge, it's just a group of people sitting around talking.
- The people most likely to seriously participate in the Community of Knowledge on a given topic are probably already doing so informally, building those connections and sharing knowledge. The CoK may accelerate the dissemination somewhat but I don't believe that the impact will be significantly more than current knowledge management.
- With employees cross training employees, we integrate what we've learned throughout the business.

Question 12

Do you think you would benefit from participating in a Community of Practice?

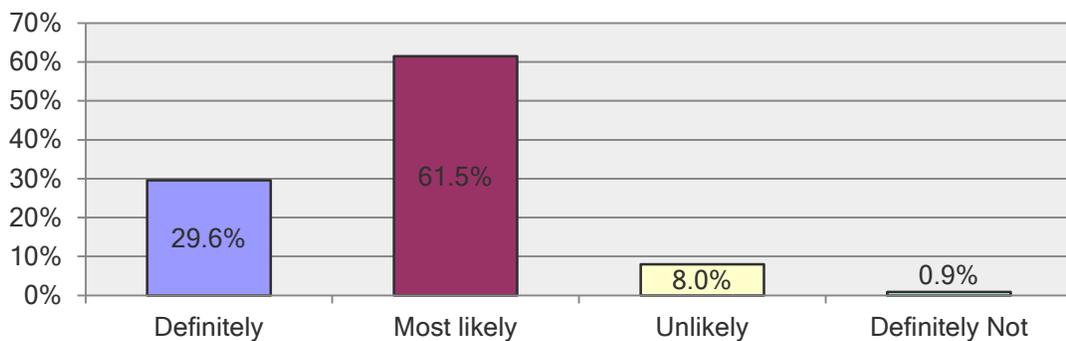


Question 12 Comments

- If it's a productive group with an objective we're collectively working toward. I'm concerned without clear guidelines; these groups won't accomplish the intended purpose. Group leaders would require training on how to manage discussions, and groups.
- If these are well thought out and taken seriously, everyone stands to benefit. This is a great professional development opportunity.
- If a picture is worth a thousand words, a relationship with a subject matter expert is worth a thousand wiki pages.
- Everyone can benefit from something like this, it's like a mom and apple pie idea, how can anyone be against collaboration and sharing ideas?
- There is always room for improvement, technology is constantly advancing. Keeping ahead of our competition will secure us a role in the market place.

Question 13

Do you think Communities of Practice could improve, speed-up, or enhance professional development at KPE?

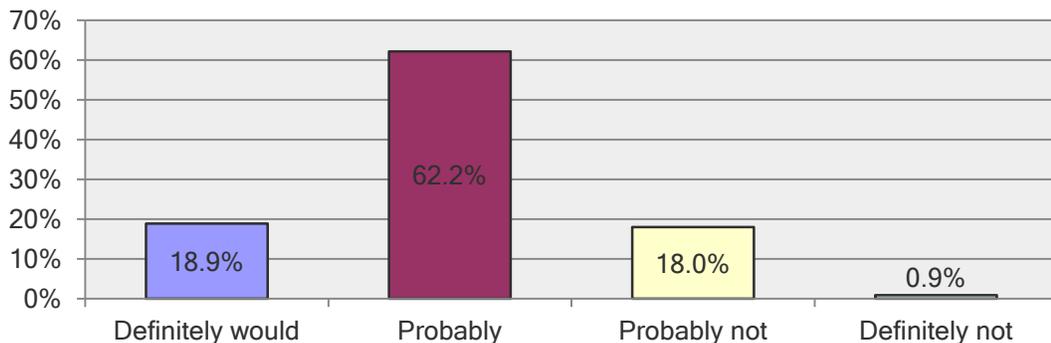


Question 13 Comments

- You can only learn so much from a book. If the wiki could cover everything, we would hire new grads that perform on the same level as a 20 year industry veteran.
- Similar to the practice of having someone check your work, having a fellow coworker (or coworkers) as my "expert" to lean on would be very beneficial.
- YES! Better guides and standards would allow professionals to learn the "KPE way" of doing things and create a great learning tool for younger professionals.
- The topic of the community of practice would have to be relevant to what the person is currently working on. It would not do as much good to be involved in a meeting, but not touch back to that for another 6 months or year. It could be helpful though, if you kept good enough notes.
- Absolutely - it's similar to a structured mentoring program with more experienced and new people included...both are able to learn from it.

Question 14

How likely are you to participate in a Community of Practice through regular meetings?

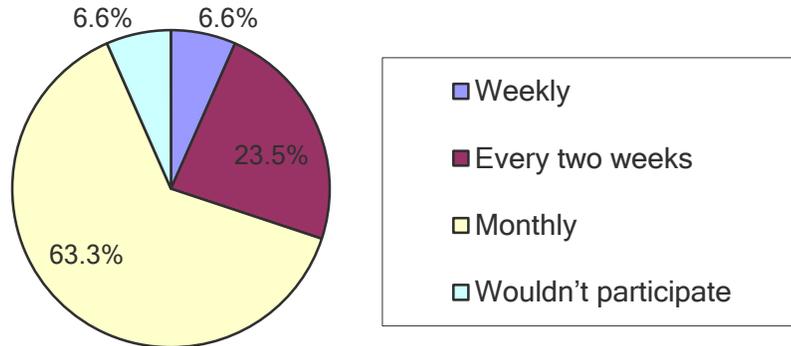


Question 14 Comments

- I do not feel the correct people would be in attendance to do something with the information.
- I would attend, though I would like to attend a community that is pertinent to the work I do. Let's not hold meetings for the sake of holding a meeting.
- Our project schedules do not allow for much work outside of the project.
- I would most likely be an irregular participant based on project schedules and specific meeting topic.
- Why would I not want to improve my means/methods? Of course I would participate.
- If the topic was applicable to my day-to-day or that of my team it would be beneficial if done appropriately, managed the right way and with the correct participants.
- If I had extra time, I would probably participate.

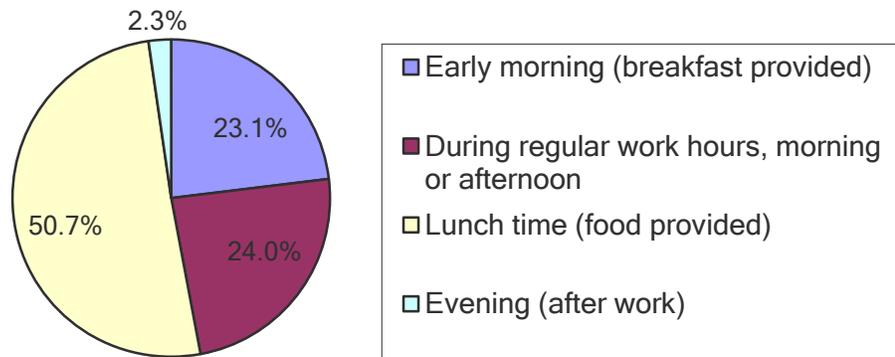
Question 15

How often would you be willing to participate in such meetings?



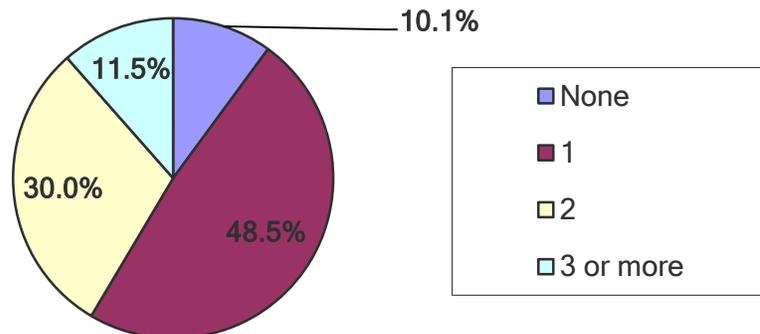
Question 16

What time of day would you prefer to have a Community of Practice meeting?



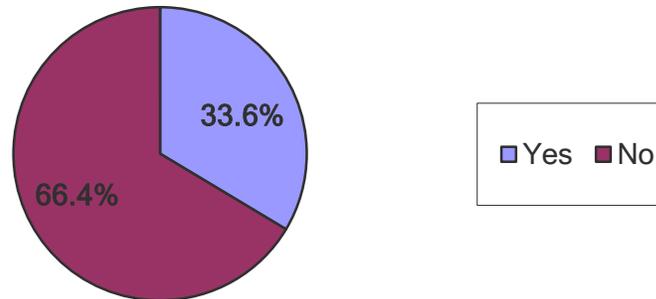
Question 17

How many Community of Practice teams do you see yourself participating in?



Question 18

Do you have a specific subject area that you would like to see as a Community of Practice?



- 74 responses

Question 19

Do you have a creative name for Communities of Practice at KPE?

- 68 responses

Question 20

Do you have any additional comments regarding Communities of Practice at KPE?

- So often a lot of great discussions happen and do not get documented or if they are, it is not easy to find the information later. It would be good to get some organization with regard to how to share and incorporate training into what is being discussed. General knowledge to one person may not be general knowledge to another person.
- Must provide clear program structure and roles and responsibilities of members; a method of sharing COP knowledge with COP members and company wide, COP charter, each COP would need a facilitator who does not need to be a SME, gain senior management buy-in and publicize successes.
- This sounds like an interesting method to try and enhance the knowledge base and creativity of our employees, and I think it can be successful. The one thing that needs to be kept in mind as we are developing new processes and methods is to ensure that the people who are going to use them in day-to-day work have the understanding and ability to discuss and defend the new process/method to others that might not be as familiar with or ready to accept the new method.
- A true Collaborative Leader will need to influence those around him/her, innovate by helping to shape the company strategy, impact processes and performances,

and finally inspire those around him/her. This will require some training for our staff to become engaged. Once an employee is engaged, you are getting his/her full attention.

- This sounds like a great idea. One of the differences I have noticed between here and where I once worked is that the knowledge base at KPE isn't as wide, and experts on different areas aren't identified or developed. I think this will help that greatly.
- I think this is a good idea, but we need to be careful not to overload the company with initiatives like this. We already have the R&D initiatives, we are already asking people to develop our toolboxes on their own time, and now we are going to start a new initiative to share ideas on how to do our work together. I think we should focus this on getting people to adopt and work on our toolboxes to get them completed so that everyone can benefit from people's knowledge in a concrete way, instead of just talking about it at a breakfast or lunch.
- I think this is a great idea that will speed up the development of young engineers (those with less than 15 years of experience).
- I think it's a great idea, to utilize our resource of experience to improve on our processes.
- Lessons learned data bases are good but not used effectively. Communities of practice would enhance the usefulness of lessons learned through dialogue and would also serve as an "ideas" sounding board.

Survey Facts

- Survey was conducted from February 13th thru February 20th, 2013
- 257 employees participated out of an estimated 526 employees surveyed for an approximate 49% response rate (a chance to win a \$50 gift card was used as incentive).
- 313 comments on question's #11-14 & #18-20. Comments shown above were selected based on a value-added (quality of response) basis.

Appendix E

Department Survey

Steel COP Department Survey

At the beginning of this year a survey was sent out regarding Communities of Practice. This R&D project has progressed to a point of conducting a trial community within our structural department. The trial community will be based around the area of Steel Design.

The Steel Community of Practice will focus on knowledge sharing as its' primary goal. Senior engineers will lead the community in discussion on topics based in the area of steel design. The community will share problems, experiences, and best practices with each other while developing and improving upon design tools for the structural department. Examples of these design tools are the Kiewit Wiki, toolboxes, and design spreadsheets. The community will develop the tools needed for design as they explore a certain design area. The general process will be to Identify a Need => Document => Examine => Develop a Process/Tool => Share.

A core group of senior engineers and an experienced designer/drafter representative have already been identified to lead the community. We are looking for 4 more dedicated engineers with 0-10 years of experience to complete the group. Community members are expected to attend the meetings every 2 weeks and carry out tasks as required. Any work for the community should be part of the regular work week (no requirement to work on your own time) and will be considered work for the department. We are looking for engineers who can make at least a 3 month commitment to the community.

This is a great opportunity to develop your engineering skills and knowledge quickly while helping our department create standards and tools for our daily design work.

Thanks for taking your time to answer this survey.

1. How many years of experience do you have as a structural engineer?

0-4 years

5-10 years

10+ years

2. What project or business area (i.e. estimating) are you currently working for?

3. Do you want to participate in the Steel Community of Practice?

Yes

No

If yes, please provide your name

4. What are your current and upcoming design tasks for your project/business area?

5. How many hours per week could you dedicate to the Steel Community of Practice?

0-3 hours

4-7 hours

8-12 hours

12+ hours

Other (please specify)

6. Please tell us why you want to be part of the Steel Community of Practice.

7. Please tell us why you would be a valuable member to the Steel Community of Practice.

**8. Do you have a suggested name for the Steel Community of Practice?
(No rules to name besides being work appropriate)**

9. If you don't currently want to participate or are not chosen to be a community member, would you be willing to give a presentation to the community?

Yes

No

Presentation topic

10. If you didn't want to participate in the Steel design Community of Practice, would you want to participate in a Community of Practice in a different design area?

Yes

No

11. What design areas (in addition to Steel design) would you like to see a Community of Practice developed for?

A screenshot of a text input field. The field is empty and has a thin black border. At the bottom of the field, there is a horizontal bar with a black and white checkered pattern. On the left side of this bar, there is a left-pointing arrow. On the right side, there is a right-pointing arrow. Above the right side of the field, there are two small square buttons, one above the other, with upward and downward arrows respectively.

Done

Survey Summary

- Survey had 47 respondents
- 27 people wanted to participate in the CoP (“Yes” to question #3)
- 81% of 37 responses said they could dedicate 0-3 hours per week to the CoP (#5)
- 27 people wanted to participate in a CoP that was based on a different design area than the trial CoP (“Yes” to question #10)

Appendix F

Trial CoP Charter & Operating Guidelines

STEEL COMMUNITY OF PRACTICE

“Steel CoP”

CHARTER & OPERATING GUIDELINES

February 2014 - Revision 0

1.0 Vision Statement:

“Build a culture of cutting-edge steel design.”

2.0 Mission Statement:

“Build a dynamic core of knowledge and resources for efficient, high-quality steel design.”

3.0 Roles

The following Community of Practice (CoP) roles will be decided by majority vote. Terms shall not exceed 1 year.

- Leader “Sheriff” –Responsible for approving agenda prior to meeting and for leading and facilitating meeting discussion. Responsible for guiding community to follow the developed vision and mission statement. Responsible for touching base with members outside of meeting to get input on CoP proceedings, status, and possible improvements. Responsible for communicating with management for any resources or support the CoP needs.
- Co-leader “Major” – Responsible for assisting Sheriff in leading CoP and assumes leader role if Sheriff is absent.
- Secretary “Dispatch” – Responsible for creating agenda, taking attendance, and recording meeting minutes. Two members may concurrently hold this position to share the duties.
- Designer Representative “Sergeant” – Responsible for representing the designers/drafters within the department and providing valuable insight from a designer perspective on anything related to drawing deliverables.

- Standard Member “Trooper” – Responsible for supporting the CoP as needed.

Current Roles for Members

Sheriff	
Major	
Dispatch	
Sergeant	
Trooper	

4.0 Goals:

The Steel CoP goals are classified into four different time periods:

- Short Term: 0 – 60 days
- Mid-Term: 60 – 180 days
- Intermediate: 180 – 365 days
- Long-Term: 2 years +

The goals are also classified according to their priority which is based on their importance to the department and project needs. Goals shall be reviewed and updated every 4 months.

- High Priority: Of highest importance, something that needs to be corrected and will have the greatest positive impact to the department.
- Intermediate Priority: Of medium importance to the department, something that needs to be corrected and will have a significant impact to the department.
- Low Priority: Of lowest importance, something that should be corrected and will benefit the department, but not significantly.

Contract Documents		Training			Calculation Templates		
0	A						
1	A						
1	A						
0	A						
2	B						

- Key:

0 = Short Term	A = High Priority
1 = Mid Term	B = Intermediate Priority
2 = Intermediate	C = Low Priority
3 = Long Term	

5.0 CoP Communication:

Email will be used to:

- Invite employees to be a guest to a SteelCoP meeting.
- Make announcements to the structural department.
- Receive comments & suggestions
- Communication between members – sending out weekly agenda and meeting updates.

Wiki will be used to:

- Display member information.
- Display information and resolution to Tech Topic discussions.

Portal will be used to:

- Store CoP documentation (meeting minutes, charter, etc.).
- Store CoP documentation released to the department for comment.
- Provide a link to published documents.
- NOT to store in-progress documents.

M: Drive will be used to:

- Store CoP documentation (Backup to Portal)
- Store in-progress documents
- Store miscellaneous information

Blubeam will be used to:

- Create review sessions and track comments on documents that are being released to department review.

Pulse will be used to:

- Send out updates, notifications, and reminders to Kiewit personnel outside of the CoP

Survey Monkey will be used to:

- Collect votes on CoP matters when voting can't take place in-meeting
- Measure value of weekly meetings to CoP members and to collect stories of members applying what was learned in CoP

6.0 Process:

The Steel CoP will follow this process for choosing, revising, and approving department documents:

- 1) Document will be selected based on priority and completion time period as shown in the goals list in Section 4.0.
- 2) Volunteers from within the Steel CoP will be selected to build a sub-committee for carrying out any tasks related to updating, correcting, or creating the document.
- 3) Sub-committee will be responsible for identifying and requesting necessary resources.
- 4) Sub-committee will carry out tasks and report progress to rest of CoP on a regular basis.
- 5) On decisions deemed to be critical by the sub-committee, the committee will present options to CoP for a vote (see voting rules below).
- 6) Once finished, sub-committee will present document to the CoP for comment for a minimum of two weeks.
- 7) Upon end of comment period, sub-committee will review and make any final changes.
- 8) Upon finishing revised document, sub-committee will present to CoP to vote on acceptance of document.
- 9) Upon acceptance, document will be released to the rest of the department for comment for a minimum of two weeks.
- 10) Upon end of department comment period, sub-committee will review and make any final changes they deem necessary. As part of review, sub-committee should prepare a “Response to Comments” document to ensure all comments are addressed.
- 11) If anybody within department has a strong opinion on document, they may be brought into Steel CoP as a guest to discuss.
- 12) Upon finishing revised document, sub-committee will present the response to comments and document changes to CoP to vote on final approval of document.
- 13) If required, a review period for the CoP may be allowed and/or a special meeting may be called to discuss the document.
- 14) Upon approval by the CoP and the Department Manager, the document will be officially published to the Kiewit Portal in the same location as other department documents (not on CoP Portal page).

7.0 Voting

Voting for any document process item or significant decision relevant to the CoP (as determined by Leader) will follow the process below.

- 1) Motion to vote by a CoP member.
- 2) A second motion to vote by a CoP member.
- 3) Sub-committee who controls document or person who made proposal for voting will submit a “Survey Monkey” survey to the whole CoP to vote. If all members are in attendance, the voting may take place in the meeting if all members agree to do so (i.e. a consensus).

- 4) Each person may have 5 minutes to present their opinion on the subject matter. If significant issues are found, the voting should be tabled for later and the issues resolved outside of the meeting. Opposing opinions should not be saved for right before voting; they should be voiced and resolved prior to a measure coming to vote.
- 5) Those voting against a measure shall explain why through the survey comment field or in the meeting. These comments shall be recorded for further discussion if the measure fails.
- 6) 3/4 of the CoP membership base must vote for it to be considered a valid vote.
- 7) Measure will pass by a 2/3 majority vote of the voting members.
- 8) Results of vote will be discussed in the next meeting and if said measure fails to pass, steps shall be discussed as to what needs to be done before measure is placed for re-vote if needed.
- 9) Steps 1 – 6 repeated until document is passed.

8.0 Meetings

The CoP should meet a minimum of once per month to discuss the area of steel design. The meeting should last a minimum of one hour and preferably 1 ½ hours. The agenda for the meeting will be developed and distributed the day before the meeting. Any agenda items will need to be submitted to the Secretaries two days before the meeting, including all sub-committee updates with any discussion items with estimated time. If members cannot attend a meeting, they should alert the CoP leader and co-leader as soon as they know. The leader or co-leader may cancel or reschedule a meeting if they deem too few members can attend.

Meeting will follow this general guide:

- 0-15 minutes – Community issues (charter, goals, meeting schedule, etc.)
- 15-60 minutes – Sub-committee updates
 - Progress
 - Issues faced
 - Questions/Desired Input from CoP
 - Action items for sub-committee
- 60-90 minutes – Technical topic discussion

CoP members shall follow these rules:

- Stay engaged.
- Contribute to discussion.
- Respect everyone’s opinion.
- Abide to agenda time constraints for each topic. If further discussion is needed, note it in the meeting minutes and either discuss outside of meeting in sub-committees, or privately or add it to the agenda for next

meeting. Results of any outside discussions should be reviewed during the next meeting.

- Take notes – you don't remember what you don't write down.
- Complete post-meeting survey within one week after meeting.

Meetings can contain any of these main topic areas:

- Charter content
- Sub-committee progress updates
- Lessons learned – current & past
- Technical presentations
- Wiki-page review
- Innovative solutions – Pre-R&D idea generation
- Review of department standards or tools
- Problem solving – member presents technical project issue for guidance

9.0 Membership

The Steel CoP shall consist of Kiewit employees committed to the development of the Kiewit Structural Department in the practice of Structural Steel Design. Typical membership terms shall last 6 months – 2 years. However, it will be left up to the discretion of each member to decide when they will leave the CoP.

Membership to the CoP is:

- Voluntary
- By Invitation Only
- A Privilege
- Open to all Kiewit personal, including contract employees
- Not Permanent – typical term will last from 1-2 years
- Between 6 and 14 members

Members are chosen based on:

- *Passion for domain (steel design)* - Members should show a passion for wanting to share their knowledge, learn more about the domain, and improve their practice.
- *Experience* – The CoP should consist mainly of engineers with a lot of experience within the domain and are able to discuss highly technical topics. Varying backgrounds are preferred to bring different viewpoints to the discussion. Two to three less experienced engineers should be included in the CoP to bring a different viewpoint as well as to enhance their professional development.
- *Willingness to make time for CoP* – Time is required to make progress on CoP initiatives.

- *Desire to improve Department / Company* – As this is the overarching goal and purpose of CoPs, the members should show this desire.
- *Project*– It is desired to have several projects represented within the CoP as a way to share lessons learned on individual projects.
- *Current Work* – It is desired that CoP members are currently working in the area of steel design so they can apply what they learn and can share their work with the CoP.
- *Designer Status* – The CoP should have at least one designer (preferably two) to provide a designer viewpoint and to assist in any sub-committee projects that require drafting.

Members of the CoP are expected to:

- Attend meetings
- Stay engaged
- Contribute to discussions
- Perform tasks outside of meeting
- Be liaisons to the department / company
- Share what they learn
- Measure the value of the CoP

Adding New Members

- The CoP should have a completed charter, typical meeting agenda, and established sub-committees before adding new members.
- New members should be added from the group of employees who showed interest in the original survey regarding membership to the CoP.
- New members may be admitted to the CoP by way of vote.

Membership Transition

- Members shouldn't transition out of the CoP until they have stayed a minimum of 6 months unless they no longer desire to participate or unforeseeable events occur (i.e. field assignment) that prevent them from actively participating.
- Turnover of membership should be kept to fewer than 50% within a 3 month period to maintain the established CoP culture and vision.
- Members transitioning out may recommend a replacement and the replacement may be admitted to the CoP by way of vote.

Membership Removal

- In the circumstance that a member is not performing as expected, the Community Leader should review the expectations with the member and give them the chance to remove themselves from the CoP or to improve their performance

- If after 2 months, the member does not improve their performance, the Community Leader may call a meeting of CoP members to vote on the future of the CoP member in question
- Removal of the member requires a **consensus** vote by the active CoP members.
- As an alternative, the member may declare himself inactive or be declared inactive by the CoP members by way of vote.
- Inactive members may maintain their member status for a period of 6 months before being asked to give up their spot in the community
- There can only be two inactive members at a time
- Inactive members don't have any voting rights on CoP decisions

10.0 Management:

Leader and Co-leader of CoP should talk with Department Manager and/or Assistant Department Manager a minimum of every two months to discuss:

- CoP projects
- Potential resources needed
- Performance of CoP members
- Potential topics for CoP to take-on
- CoP performance

Leader and Co-leader of CoP should meet with a representative of the CoP R&D initiative a minimum of every two months to discuss the CoP:

- Status
- Performance
- Membership
- Issues being faced
- Lessons learned
- Future

Appendix G

Trial CoP Post-Meeting Survey Summary from 1/22/2014

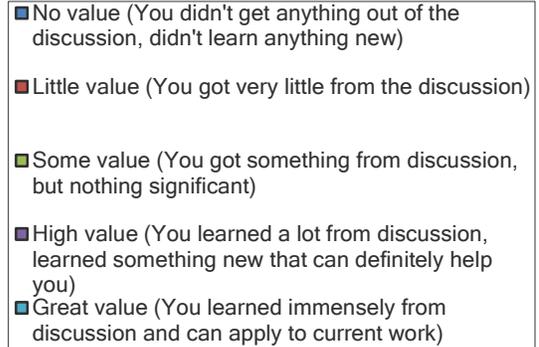
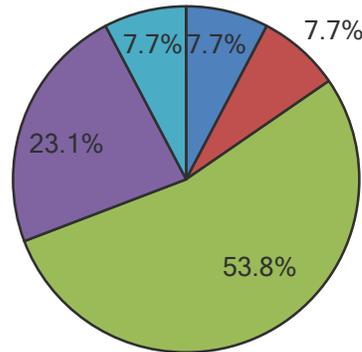
Question 1

Name

- 9 responses

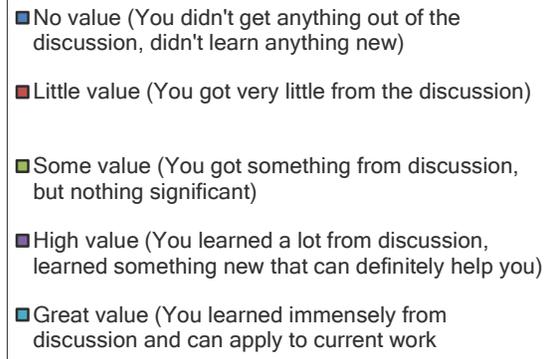
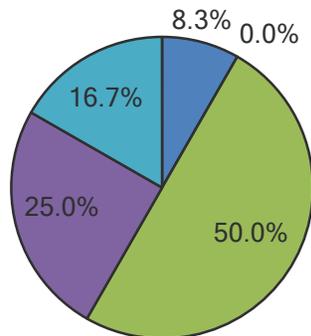
Question 2

Topic: Handrail Details Select the most appropriate description of your view on the discussion from a technical standpoint:



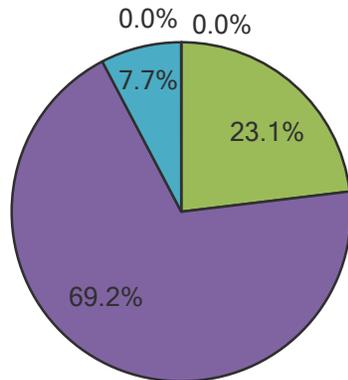
Question 3

Topic: General Notes Select the most appropriate description of your view on the discussion from a technical standpoint:



Question 4

Topic: Special Inspections - Is paying the third party inspector a conflict of interest and how do we correct this issue? Should inspection requirements be addressed in the general



- No value (You didn't get anything out of the discussion, didn't learn anything new)
- Little value (You got very little from the discussion)
- Some value (You got something from discussion, but nothing significant)
- High value (You learned a lot from discussion, learned something new that can definitely help you)
- Great value (You learned immensely from discussion and can apply to current work)

Question 5

What did you learn during the meeting? Be descriptive and list everything you can think of, no matter how small.

- 8 responses

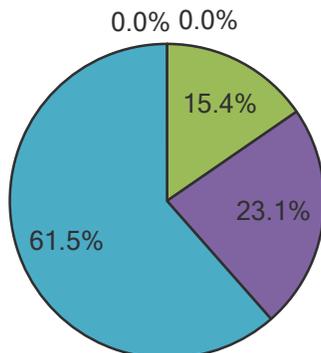
Question 6

Tell your story. 1) What activity or discussion from COP (sub-group or full) led to new knowledge? 2) What knowledge was gained? 3) How was the knowledge used to create value?

- 4 responses

Question 7

To this point, how do you feel about participating in the CoP?



- You wish you hadn't (You find no value in participating)
- It is not what you expected (There is little value and you wouldn't sign up to do it again)
- It is okay (There is some value and you're indifferent on participating)
- It is good (Definitely value and you will keep participating)
- It is great (A lot of value and you enjoy participating)

Comments

- “I am frustrated with the participation of everyone. We are all busy and maybe that is the problem; we are all shoe-horning this work into our already busy schedules.”
- “Some members are actively engaged while others appear to be passive audience members.”

Question 8

Is there anything the CoP could do better or failed to do?

- “I believe having some help to accomplish the sub-committee tasks would be great. A dedicated person to help run calcs and design details would vastly increase the speed at which these tasks are accomplished.”
- “I still feel like what we are doing is too exclusive of the rest of the department.”
- “We can do more to include the rest of department, construction, contract employees and other disciplines in our meetings/review process.”
- “More involvement (comments, etc.) is mandatory for the CoP to be effective. This will evolve as the CoP grows.”
- “People should come on time, prepared, and follow through on commitments.”

Question 9

Is there anything the CoP has done well and should keep doing?

- “I feel that the CoP creating or improving on department standards is the right thing to bring the department to a higher level of excellence and by refining old standards, we can ensure current codes are met as well as increase work productivity.”
- “Yes, keep it going. This group adds value to the company.”
- “This is one of the only examples of organized, proactive improvement I have seen, so that is good. I think we just need to keep refining how it works.”
- “They are updating standards that are in dire need to be updated.”
- “The current tasks are a good direction for the group.”
- “Sub-committees is a great way to work on tasks. Tech topics are beneficial.”
- “I think that we are starting to get into the swing of things. We should keep on with the current methodology.”
- “There is baby steps at ever meeting showing some accomplishment, But it is slow.”