Fostering a Community of Practice for Industrial Processes

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Abstract A Community of Practice (CoP) is a framework for the facilitation of knowledge management and involves groups of individuals who engage in the process of collective learning around a specific topic. Recent advances in computer technology and Web 2.0 applications now allow for virtual communities to be established which permit interaction and collaboration between individuals across organisational boundaries and geographical locations. The Use-it-Wisely (UIW) project aims to design and develop a cross-industrial virtual community to support the operating environment of manufacturing organisations. Successful implementation of a virtual community has the potential to strengthen the competitive advantage of the industries involved, securing domestic employment and providing products and services that are capable of adapting to the organisational goals. This chapter provides a general overview of the literature on CoPs and virtual communities. It discusses the development of the concept of CoPs, and considers how this relates to knowledge management lifecycle and learning theories. This is followed by a discussion on the use of CoPs and virtual communities as a knowledge management strategy for the manufacturing industry, including multinational companies and Small and Medium-sized Enterprises (SMEs). The chapter finishes by discussing the essential elements for creating and maintaining a self-sustainable virtual community to enable information sharing and decision support across and between the organisations. This includes the factors required to foster a successful virtual community concerning the purpose, content, context, conversations, connections and technology, and the risks and challenges that could lead to the failure of a CoP to be sustained.

Keywords Knowledge management · Community of practice · Virtual community · Industrial manufacturing

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1 Introduction

Knowledge management has emerged as a major factor for sustainability in the increasingly evolving and competitive marketplace of today's modern manufacturing industry (Pan and Leidner 2003; Patel et al. 2012). Numerous knowledge management principles have been proposed over the years (Davenport 1996; Allee 1997; Studer et al. 1998; Luen and Al-Hawamdeh 2001), including research that has linked the concept of communities of practice (CoP) with organisational knowledge management (Lave and Wenger 1991; Brown and Duguid 1991; Wenger 1998; Wenger and Snyder 2000; Storck and Hill 2000; Wenger et al. 2002; Ardichvili et al. 2003; Dubé et al. 2006; Eckert 2006; Du Plessis 2008; Scarso and Bolisani 2008).

Wenger et al. (2002) defined CoPs as, “*a group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis*”. It is through the process of regular interaction that members gain knowledge (Du Plessis 2007), for example, engineers working on a problem, university students studying together or managers sharing organisational information (Wenger 2009). This shared involvement over time, allows members of the community to develop opinions, ideas and ways of performing that deepens their knowledge and expertise on a particular subject or process, as they participate in practices and develop a common history (Gunawardena et al. 2009).

In the past, the size and scope of a CoP has been determined by geographical boundaries. However, recent advances in computer technology and Web 2.0 applications now allow for virtual communities to be established. Virtual communities are a specific type of CoP that uses a web-based platform to provide an environment where geographically distributed members can interact, and share information, knowledge and expertise (Rothaermel and Sugiyama 2001). This allows them to overcome the geographical limitations of traditional CoPs and although, members of a virtual community may participate in telephone conferences and face-to-face meetings, most interaction will involve the posting or viewing of information through web-based technology (Andrews 2002).

The ability of virtual communities to enable collaborations over time and across organisational boundaries provides the flexibility required for the strategic management of knowledge within industrial manufacturing. Interaction between the members includes distribution of news through events, announcements, and publications; problem solving opportunities from question and answer postings and best practice forums; and communication mediums such as discussion groups (Koh et al. 2007). Virtual communities have the potential to access information from different devices, and through interaction with other members, data or virtual objects (Hibbert and Rich 2006). The management of knowledge using the concept of virtual communities has the potential to increase the overall productivity and innovation of the organisation (Chiu et al. 2006).

One of the objectives of the UIW-project is to design and develop a knowledge management strategy to support the operating environment across industrial manufacturing organisations. The development of a cross-industrial virtual community, to support complex industrial activities in response to new products or the upgrading of existing products, has the potential to strengthen the industrial position of the organisations involved, securing domestic employment and providing products and services that are capable of adapting to the organisational strategy.

2 General Overview of Communities of Practice

This section aims to provide a general overview of CoPs and virtual communities by examining the literature relating to learning theories, knowledge management and its relevance to manufacturing industries. The section starts with a summary of the development of the concept of CoPs and how this supports the management of knowledge. This is followed by a discussion of the relevance of virtual communities for the manufacturing industry, including multinational companies and Small and Medium-sized Enterprises (SMEs).

2.1 *The Development of the Concept of Communities of Practice*

Individuals have engaged in the process of collective learning through sharing of experiences and knowledge for many years (Hoadley 2012). However, it was Jean Lave and Etienne Wenger who first used the phrase “*community of practice*” (Cox 2005) and introduced CoPs as a new approach to workplace learning for novice apprentices (Lave and Wenger 1991). Their studies focused on informal interaction and investigated how new workers are socialised into working practices and learn their job through legitimate peripheral participation. Legitimate peripheral participation is explained by Lave and Wenger as *legitimate* because all individuals accept the position of the novice apprentice as a potential community member, *peripheral* because the novices are initially on the edge of the community until trust is established and *participation* because it is through participating in the practice that they acquire knowledge (Cox 2005).

Lave and Wenger’s findings showed that novice apprentices learnt the required knowledge mainly from informal social interaction, practice and participation. The authors concluded that learning was a continuous and active engagement, situated in context and social interaction (Lave and Wenger 1991). This was in contrast to the cognitive learning theory, which involved knowledge being conveyed by experts to learners through formally planned methods and was the dominant theory

of that time (Cox 2005). This new approach suggested that learning is more than the acquisition of knowledge, and includes peripheral participation and active involvement in the practice (Lave and Wenger 1991). However, this approach only considered the transfer of existing knowledge and did not consider CoPs as a platform for innovation, problem solving or as a potential driver of change (Østerlund and Carlile 2003).

In the same year as Lave and Wenger proposed their new approach, Brown and Duguid (1991) also used the phrase “*community of practice*”. This work was based on data from Julian Orr’s earlier studies of Xerox photocopier repairmen and aimed to show how informal groups generate solutions to work-related problems (Brown and Duguid 1991) although, Orr did not use the phrase “*community of practice*”, preferring to use the term “*occupational community*” (Cox 2007). The study observed how knowledge was better created and transferred through the sharing of experiences and collective problem solving activities, compared to the more traditional learning processes of expert instruction and manuals. Brown and Duguid suggested that knowledge and learning, were embedded in social practices and extended the concept of CoPs to include them as a tool for resolving work-based problems (Brown and Duguid 1991), as opposed to Lave and Wenger’s concept that focused only on the reproduction of existing knowledge (Cox 2004).

Although the term “*community of practice*” was used by both Lave and Wenger (1991) and Brown and Duguid (1991), a rigorous formal definition was not offered. This was mainly due to the different interests and viewpoints of the studies and those involved (Cox 2005). However, Wenger (1998) finally defines CoPs as, “*a group that coheres through sustained mutual engagement’ on an ‘indigenous’ (or appropriated) enterprise, and creating a common repertoire*”. Wenger expanded on the initial concept of CoPs (Lave and Wenger 1991), from a theory of learning to a knowledge management strategy and discards the concept of legitimate peripheral participation in favour of social identity and trajectories of participation (Wenger 1998). The study focused on the formation and management of CoPs across organisational boundaries to enhance performance, and states that it is through the common understandings of an activity involving large amounts of interaction and problem solving, that relationships are built and CoPs are established (Wenger 1998).

Over time, the interpretation of a CoP moved from a descriptive concept (Lave and Wenger 1991) to a more prescriptive application provided by Wenger et al. (2002), who redefined CoPs as, “*groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis*”. Wenger provided a guide for the formation and management of CoPs to enhance performance and drew together ideas put forward in previous works while focussing on the value of the CoP as a knowledge management tool for innovation and problem solving, where the purpose is to learn and share knowledge and not specifically with accomplishing a common task (Cox 2005).

2.2 *Communities of Practice and the Management of Knowledge*

Complex knowledge, that is critical to the ability of an organisation to adapt in a fast-paced globalised marketplace, is becoming increasingly specialised and tacit in nature (Hinton 2003). Tacit knowledge is considered to be a valuable source of context-based information, but is stored and composed in the minds of individuals, so is difficult to obtain and develop (Hildreth and Kimble 2002). Duguid (2005) explains the difference between explicit knowledge and tacit knowledge, as *knowing what* and *knowing how*, respectively. Optimal performance within an organisation requires the transfer of knowledge between tacit and explicit knowledge. Novice workers need to be able to convert explicit knowledge (theory) into tacit knowledge (practice) and experienced workers need to convert their tacit knowledge (information within their head) into explicit knowledge for training and learning purposes (Duguid 2005). The process for the successful transfer between tacit knowledge and explicit knowledge is not fully understood, but is a critical resource for organisational innovation (Stephenson 1998).

CoPs have the potential to support the knowledge management process by creating a link between learning and performance (Wenger et al. 2002). This can make a significant organisational impact, by allowing managers to connect tacit knowledge to organisational processes and strategically steer innovation towards industrial growth (Du Plessis 2008). Studies have shown that workers are five times more likely to turn to a co-worker and obtain tacit knowledge about an activity, compared to obtaining knowledge from an explicit source such as a manual (Davenport and Prusak 2000). In addition, members of a CoP have reported an increase in communication, less dependence on physical proximity, and accessibility to new knowledge, which can result in open discussions and brainstorming activities, leading to new capabilities (Ardichvili et al. 2003). This sharing of tacit knowledge for manufacturing processes has the potential to increase learning trajectories and reduce workplace errors, resulting in overall organisational benefits.

A central theory for the ability of CoPs to exploit tacit knowledge is the theory of situated learning (Hoadley 2012). Situated learning describes a method of knowledge acquisition that is '*situated*' in context and interactions between individuals, professions, or pursuits (Lave and Wenger 1991). Brown and Duguid (1991) provided an example of learning by photocopy repairmen, which was situated in the context of problem solving and showed knowledge as being co-constructed, through the sharing of experiences, allowing individuals to better understand their job (Cox 2005). A number of studies have suggested that tacit knowledge, can best be transferred in the context of situated learning processes and social practices (Brown and Duguid 1991; Lave and Wenger 1991; Cox 2005; Hoadley 2012), with a number of theories suggesting that knowledge can only exist in social context and interactions, and is not in the possession of a single individual (Hoadley 2012). This implies that CoPs provide a natural environment for the existence of knowledge.

2.3 *Communities of Practice and Industry*

Knowledge lifecycle refers to the creation, distribution and collection of knowledge and the influence that it has on the working environment (Du Plessis 2008). Effective and efficient industrial knowledge management throughout this lifecycle facilitates collaborative work and innovation for large multinational companies and SMEs either locally or across organisational boundaries (Patel et al. 2012). However, the structure of modern multinational organisations, which can consist of many dispersed teams that span across organisational boundaries, can often impede the effective recovery, transfer and reuse of knowledge, especially when the company operates at a global level, across geographical distances and with distinct cultural and language differences (Scarso and Bolisani 2008).

The recognition that knowledge is a critical element that needs to be managed strategically, has led to the intentional formation of virtual communities to manage knowledge between different teams, departments and locations and involve groups of co-workers that exchange information to overcome complex work-related challenges (Ardichvili et al. 2003; Dubé et al. 2006; Du Plessis 2008; Scarso and Bolisani 2008; Wenger 2009). Each member of the CoP has the potential to bring a unique skill set and contribute to a greater body of knowledge that is available indefinitely and can be called upon even when they leave the community (Wenger et al. 2002). This provides the organisation with significant knowledge input for creative innovation and development of strategic capabilities, while keeping up with current progress in such areas as state-of-the-art technology, customer demands and market changes (Du Plessis 2008). In addition, knowledge transfer and learning activities associated with CoPs offer these organisations a complementary alternative to more traditional training methods (Wenger 2009).

One of the first industrial CoPs to be developed was applied to Xerox photocopy repairmen when the organisation saw the value of the informal exchange of information concerning working activities (Brown and Duguid 2001). In response to their observations, the company created a virtual community that allowed these interactions to be shared across their global network, saving the organisation time and money (Cox 2005). Following this, Shell Oil Company formed a virtual community to facilitate knowledge sharing among different teams, while Daimler-Chrysler Automobile Company designed a virtual community for problem sharing activities (Cox 2005). Since then, the concept of virtual communities have been employed by a number of multinational organizations (Eckert 2006) such as Hewlett Packard, British Petroleum, Chevron, Ford, Boeing and IBM to support workflow processes and the dissemination of case-histories through the use of meetings, forums, document repositories and libraries (Scarso and Bolisani 2008). This results in an environment where knowledge that is created, shared and collected, can influence the development of innovations, increase market responsiveness, improve performance and provide a flow of information linked to the organisational strategy (Du Plessis 2008).

Adapting to the rapid change in processes, systems and economies is also essential for SMEs within the manufacturing industry, as their product will often be more specialised and their profit margins smaller, compared to multinational organisations (Desouza and Awazu 2006). Virtual communities are a good method for introducing knowledge management processes and principles into SME organisations, which may often find it difficult to structure a knowledge management infrastructure (Du Plessis 2008). SMEs can utilise CoPs for controlling the knowledge management lifecycle, ensuring that knowledge generates value through which innovation can take place and also as a communication tool especially if their communication strategies are inadequate (Desouza and Awazu 2006). Virtual communities can support SMEs in the prediction of work activities and provide them with current information on market trends and technological advancements (Du Plessis 2008).

There are unique challenges for SMEs in the development of virtual communities. SMEs deal with information that can be very specialised and they do not manage knowledge in the same way as larger organizations therefore, scaling down knowledge management in practices found in multinational organisations to suit SMEs, is not appropriate because of financial and resource constraints. This requires that SMEs be more creative in working around these limitations in order to manage knowledge (Desouza and Awazu 2006). A significant number of SMEs do not have the network infrastructure, technological tools, ability or economics to establish a virtual community. In addition, their computer-based systems may be more basic with limited functionalities or slower speeds for data retrieval when compared to larger organisations (Du Plessis 2008). The impact is that staff must keep up with changes in the rapidly changing industrial manufacturing markets, without the assistance of the necessary tools and equipment (Du Plessis 2008). However, one solution to the financial and resource constraints of an SME is to participate in a cross-industrial CoP where a number of industries can contribute to the development of the site, the resources and the content of knowledge.

2.4 Communities of Practice and Cross-Industrial Knowledge Flow

Cross-industrial virtual communities have the potential to traverse structural boundaries and promote knowledge flow between different organisations or from different areas of industry. Cross-industrial knowledge flow can highlight current principles and processes that can be transferred between industries such as novel approaches, techniques, tools and methodologies (Du Plessis 2008) and promotes the development of a common body of industrial knowledge between different industries by the sharing of information without the members necessarily needing to work together (Wenger et al. 2002; Hinton 2003).

The benefit of cross-industrial virtual communities include

- sharing of network technology and tools
- division of economic commitments
- working with others to improve processes and innovation
- collaboration with others that may have the relevant skills needed
- development of experts and expertise through collaboration (Du Plessis 2008).

However, industrial organisations are currently only doing this to a limited extent in certain areas, such as technical exchanges, joint ventures, and research and development partnerships. (Du Plessis 2008). The rarity of cross-industrial virtual communities is due to industries' knowledge being part of the asset that sets them apart from other organisations when competing for contracts. Industries protect their knowledge and are not disposed to share it, unless there is some kind of reward or incentive in place. In addition, cross-industrial virtual communities also face additional barriers such as cultures, customs, language and time constraints that inhibit individuals from engaging in knowledge exchange (Wasko and Faraj 2000).

Ultimately, it is the strength of relationships between co-workers that determines the operational potential of an organisation, with innovation, productivity and staff satisfaction, relying on the strength of these relationships. (Du Plessis 2008). CoPs have the ability to assist in the building of social networks including the strengthening of relationships, and the establishment of values and norms providing a platform for knowledge life-cycle management (Du Plessis 2008).

3 Form and Function for a Successful Virtual Community

This section aims to provide a broad guideline for creating and maintaining a self-sustainable collaborative virtual community. It discusses the requirements that need to be considered for an initial framework that enables information sharing and decision support across and between organisations. The section starts with a summary of the structure of all CoPs (including virtual communities) and how this supports the management of knowledge, followed by a discussion on the challenges for a successful virtual communities are explained including guidelines concerning the purpose, content, context, conversations, connections and technology that should be employed for the general development of the UIW-virtual community.

UIW's cross-industrial virtual community aims to support a framework for cross-industrial knowledge management. It not only faces the same limitations of any other CoP, but also specific challenges that facilitate knowledge exchange across different industries. Developers of the community not only have to deal with communication, motivation and leadership issues but also take into consideration the different interests and expectations of the community and the interoperability of the communication technology, that each industry employs (Koh et al. 2007).

3.1 Structural Characteristics of a Community of Practice

While CoPs including virtual communities, come in many forms, three structural characteristics have been identified as being central to the framework of all CoPs. These are a domain, a community and a practice (Wenger et al. 2002). Within this structural framework, major factors for a successful community include a clear and focused purpose, high quality content, correct context, meaningful conversation, relationship-building connections and high performing technological tools (Wenger 2009). The structural characteristics of a CoP are discussed first, followed by a review of the major factors.

The first structural characteristic is the domain. The domain represents the shared interest that unites the members of the community (Wenger 2009). Relevant domains of knowledge where experiences of the individual members can be communicated include particular hobbies or interests or work-related activities such as research projects, business activities, technological advancement, training and educational methodologies (Wenger et al. 2002). The domain can be local or global, with some communities meeting face-to-face, while others mostly interact online. It is not a community grouped by geographical location such as a neighbourhood or workplace, but is defined by membership and commitment to the domain and to the development of a shared understanding, resulting in the creation of personal meaning and strategic knowledge (Gunawardena et al. 2009).

The community defines all the members that interact and learn from each other. As the members of a community interact, they build relationships through dialogue and conversation, resulting in an environment of trust, from which they can learn from each other (Wenger 2009). It is not a community grouped by shared characteristics such as age, gender, ethnicity or religion but is a system of knowledge, beliefs, behaviours, and customs, which serve as the basis for further interaction (Gunawardena et al. 2009). The community can be small or large, often with a central group and many peripheral members and may contain individuals from the same organization or from different institutions (Wenger 2009).

The practice is a result of sustained mutual engagement in the community over time, with members being jointly responsible for the development of knowledge and learning (Wenger 2009). The time spent building relationships and collaborating is vital in the development of a practice and also allows for the repetition of circumstances, situations, and events, resulting in a commitment to the engagement for shared knowledge. This provides the conditions for setting down new cultural norms and conventions within the practice and the development of a common history (Eckert 2006).

The multi-industrial element of the Use-it-Wisely virtual community requires the consideration of these structural characteristics. The domain has to be general enough to encompass the different industries and their external stakeholder partners while being specific enough to encourage a commitment to the community, allowing personal meaning and strategic knowledge to be formed. The community

needs to develop trust and confidence within and between the industries, so that relationships can be built and members can learn from each other. Finally, the practice needs to be flexible enough to cover all the industries and provide an environment that develops new cultural norms, conventions and a common history.

3.2 Major Factors for a Successful Virtual Community

Although the number of virtual communities has increased, there appears to be a limited consensus within the literature on the factors which underlie a successful practice. However most of the research agrees that the success of a virtual community relies on its members having both the opportunity and the motivation to participate and contribute knowledge (Rothaermel and Sugiyama 2001; Ardichvili et al. 2003; Koh et al. 2007; Wenger 2009). The factors for any successful CoP, including the UIW-virtual community are dictated by the community itself and usually evolve over time. However, major factors for consideration in the initial design stage of a virtual community include the purpose, content, context, conversation, connections and technology.

3.2.1 Purpose

All the shared ideas, interests and common goals of the members of a virtual community constitute its purpose. A shared purpose is essential for a successful collaborative environment because it unifies everything that occurs within the virtual community. Furthermore, clarity of purpose is also important because it creates energy and interaction, generating trust and connections between the members (Hoadley and Kilner 2005). However, it can be difficult to reach a consensus that clearly defines the shared purpose, especially when members come from different professions or industries (Koh et al. 2007). Establishing and developing good community leaders and leadership roles that can identify and act upon the needs of the members, is important for the generation and clarity of a shared practice (Koh et al. 2007). Nevertheless, even when a shared purpose is clearly defined, the actual purpose will evolve through the content, conversations, and connections, of its members, with every contribution either reinforcing or disrupting the stated purpose (Hoadley and Kilner 2005).

For the UIW-virtual community a clear, focused and shared purpose will increase interaction and collaboration. However, the different requirements from the industry partners may hinder the chances of establishing a specific shared purpose. Initially, a more general purpose may be more appropriate, which over time, may be defined more clearly by its members as they form connections, establish trust and share knowledge.

3.2.2 Content and Context

The content of the virtual community refers to the contributions the members make in relation to their experiences, understanding and development (Eckert 2006), while context refers to the known information about the origin of the knowledge posted and how it has been previously applied (Hoadley and Kilner 2005). Both are vital for a sustainable virtual community.

The continuous delivery of good quality content is important because it supplies a basis for conversation and attracts new members by communicating a clear purpose (Hoadley and Kilner 2005). Generating quality content is a major challenge when establishing a virtual community, but the reasons why members contribute content is not clear, although a number of processes have been proposed that can assist in its generation (Ardichvili et al. 2003). Requesting specific contributions from members will stimulate content as individuals are more inclined to contribute when they are asked (Hoadley and Kilner 2005). Reviving conversations that have been posted about a particular topic into, for example, a new format or from a new point of view can stimulate new objectives and ideas and generate fresh content (Hoadley and Kilner 2005), and introducing an evaluation system that filters out redundant or obsolete postings based on periodic examination, ensures that high value content is maintained (Koh et al. 2007).

Posting is central to the quality of the content but viewing is just as important. Koh et al. (2007) reported that there was an increase in viewings when the content of a virtual community were perceived to be valuable or useful. Therefore collecting and displaying good quality content, which is updated regularly, is important for promoting the viewing activity of community members (Hoadley and Kilner 2005). Posting and viewing are so important for the development of a sustainable virtual community that they must always be taken into consideration when any changes are made (Koh et al. 2007). A key finding in the study by Koh et al. (2007) was that postings were influenced by offline events while viewing was influenced by the quality of the technological infrastructure and the usefulness of the community. The size of a community can be an important element in the sustainability of a community because the amount of a community's posting and viewing is related to the number of members (Koh et al. 2007). Therefore, it is essential at the formation of a virtual community to actively recruit and include community members. However, there are limitations to the amount of time people can devote to a community and as the commitment and energy of members decreases, so does the quality of the content (Koh et al. 2007).

Providing the right information context to enable members to learn more effectively is also an important factor for a productive virtual community. Context helps a community member know the source of a piece of knowledge and how it has been applied in the past and might consist of information about the author and their situation, including details, cross-references, and stories (Patel et al. 2012). Knowing the context of a piece of information contributes to the applicability and understanding of the members of a community in the communication (Hoadley and Kilner 2005). When conversations reinforce a community's purpose in their

content, the result is a clearer context for everyone involved. In addition, when members are connected through a relationship, they gain access to context about contributions to the community. However, the challenge for virtual communities is to situate the knowledge context through conversation and connections among members who are geographically distributed (Hoadley and Kilner 2005).

Posting and viewing are major factors in the sustainability of any virtual community and the UIW-virtual community needs to establish good quality content presented in the right context at an early stage of development. This will provide a basis for each of the industries to connect and converse, to build trust and learn from each other.

3.2.3 Conversation and Connections

Conversation and connections are the fundamental elements for establishing confidence and trust among the members of a virtual community. Conversation in a virtual community, relates to any communication including electronic interaction such as video conferencing, text messaging and emails that relay knowledge. Connections relate to the relationships made within a virtual community that enable members to build relationships and share knowledge (Hoadley and Kilner 2005). Both the conversation and the stability of the connections made are primary factors for a productive virtual community.

The transfer of knowledge is most easily generated through conversation. Conversation offers a personal connection to members of a community and supplies the content for the domain and the context for the information. Without efficient forms of conversation, community members from differing geographical locations will not benefit from the knowledge transfer processes (Jin et al. 2010). The challenge within a virtual community is to generate dialogue that elicits meaningful conversation, which is focused and relevant to the community's purpose (Hoadley and Kilner 2005). Effective conversation can be stimulated by social presence, however within virtual communities the dominant communication channel is the exchange of text messaging, which is low in social presence (Fulk et al. 1990). To overcome this challenge it is important to support community members with relevant graphical and video interfaces such as video-conferencing and avatar chatting and to integrate ways to strengthen social identity by linking offline meetings to online activities (Koh et al. 2007).

Making connections within a virtual community involves forming relationships between members to facilitate the transfer of knowledge (Jin et al. 2010). Stable relationships contribute to a culture of trust in which members feel safe to contribute knowledge content, challenge assumptions and propose unconventional ideas (Hoadley and Kilner 2005). In a virtual community, the lack of social connections can often result in an evolution of the site into either an online document repository or a chat room. Having a clear purpose so that members are aware that they all share a common interest, quality content and conversation that facilitates

dialogue, all reduce barriers so that connections can be made. In addition, linking member profiles with their knowledge contributions facilitates connections, as other members contribute to the conversation (Hoadley and Kilner 2005).

Providing an environment that allows connections and conversations between the members of the UIW-virtual community is a fundamental element that can facilitate interaction and collaboration. Interactions between the members from different areas of industry can promote diverse relationships and comprehensive processes that can lead to innovative practices. However, there are many barriers to generating conversation and establishing connections over geographical distances and between differing industries including language, culture, background and organisational principles.

3.2.4 Technology

The advancement of web-based technology has facilitated the integration of knowledge and networks of individuals, to such an extent that they have transformed the concept of CoPs, allowing them to effectively become virtual. New web-based applications break down the geographical barriers of traditional CoPs, with virtual communities extending over a variety of contexts and geographical areas (Wenger et al. 2009). The ability of virtual communities to transverse geographical distances allows for communication and interaction between members of differing cultures, disciplines and backgrounds, who can work from anywhere with mobile or internet coverage (Wenger et al. 2009).

Web 2.0 is the term that describes the second generation of development for the World Wide Web (Hossain and Aydin 2011). It refers to the transition from static HTML Web pages to more dynamic user-generated tools, resulting in increased collaboration and communication speeds. By utilizing the different tools made available by Web 2.0 technologies, knowledge sharing and communication capabilities of virtual communities is enhanced (Hossain and Aydin 2011).

The rise of Web 2.0 technologies has provided the tools to shape the scale and scope of the UIW-virtual community, providing new sources of knowledge on real world activities. This allows the members to situate themselves within the context of the knowledge and link it to the practices performed in everyday life. However, technological advances can only be effective if the correct applications for the right situation are applied in a structured and systematic way (Boulos et al. 2006).

Every virtual community encounters technological challenges and a wide range of user requirements that cannot be met, which can restrict community activity. In addition the diversity of technological skills among members creates further challenges (Koh et al. 2007). A rapid system response time is a necessary requirement in any virtual community, along with user-friendly interfaces and system reliability, all of which facilitate the relationships within the community and the level of activity (Koh et al. 2007).

3.3 *Current Collaborative Tools*

The rapid increase in the use of Web 2.0 applications includes a number of on-line platforms that have characteristics that align with the concept of virtual communities. These include Social Network sites such as Facebook, Twitter, Flickr and Google+, Apps, Wikis, and blogs. Their ease of use and speed at which they can distribute information, makes them powerful tools for obtaining knowledge (Boulos et al. 2006).

By definition all virtual communities are Social Networks, in that they involve making connections and establishing relationships between the members of the community. The members of Social Network sites form social relationships despite geographical distances and can obtain, interact, contribute and reshape knowledge in a way that is consistent with the norms and standards of their social group (Office of Educational Access and Success 2012) although, virtual communities are distinguished by having a domain as a source of identification, which is not a requirement of a Social Network (Jin et al. 2010). However, social networks can provide a valid and appealing tool that could be incorporated into a virtual community either directly or indirectly as a link, to form connections and stimulate conversation.

Web Apps are mobile applications that use HTML-based software to provide interactivity through portable devices such as smartphones and tablets (Godwin-Jones 2011) and support the idea of ‘*anytime, anyplace*’ learning (Corbeil and Valdes-Corbeil 2007). Recently developed Apps, such as Instagram (www.instagram.com) and WhatsApp (www.whatsapp.com), support photo and video sharing and mobile communication networks (Gachago and Ivala 2015). These apps make connections between broad ranges of motivated individuals and have the potential to establish a collection of knowledge. They are affordable and easy to use and the speed at which they can circulate knowledge, due to their mobile nature (Newman et al. 2012), makes them ideal tools for virtual communities.

A Wiki is a web-based platform whose members can contribute to articles and share dialogue using simple editing tools while contributing to the development of a collection of knowledge (Boulos et al. 2006). The best example of a Wiki is Wikipedia, an online encyclopaedia that can be used a source for obtaining knowledge, allowing members to obtain expert knowledge and engage in learning, although they do not provide the opportunity to establish relationships as social network sites and specific Apps (Office of Educational Access and Success 2012). The ability of Wikis to facilitate the development and transfer of knowledge makes them a potentially valuable inclusion into a virtual community (Office of Educational Access and Success 2012).

A Blog is a contraction of the term ‘*Web Log*’, and is an on-line journal that offers an information-sharing environment using multimedia technology. Blogs feature posting tools, archives of previous posts presented in reverse chronological order, and standalone Web pages with their own unique URL address, to provide an information-sharing tool for deliberation and discussion around a specific topic.

A single user can write them or they can be written by a group of individuals, with entries usually containing dialogue, images and links to other Web sites (Boulos et al. 2006). While the specificity of the topics often results in a limited number of contributors the ease at which Blogs facilitate the linking of knowledge to a potentially global audience through the World Wide Web (Boulos et al. 2006), makes them ideal features to include within a virtual community.

Social networks, apps, wikis, and blogs have the potential to be effective tools for the UIW-virtual community. They are all simple to implement and use, and many are Open source or free of charge, which may be one reason for their popularity (Boulos et al. 2006). Although, none of these tools constitute a virtual community, the context to which they are applied has the potential to facilitate the transfer of knowledge, providing opportunities for virtual collaboration from a wide range of members, who have different needs and preferences of communication. The integration of these applications as part of a framework for learning within the UIW-virtual community has the potential to improve the knowledge sharing experience by facilitating interaction and collaboration (Boulos et al. 2006).

4 Conclusion

The development of the UIW cross industrial virtual community stems from the requirement to engage a wide range of potential members. These include designers, engineers, trainers, managers, directors, support staff, affiliated organisations and customers, that need support in different areas such as community development, communication, collaboration, and sharing of practices. This chapter has identified and described six elements that need to be considered when developing the UIW-virtual community: a clear purpose, quality content, situated context, meaningful conversation, stable connections, along with a stable, high-speed IT infrastructure and web-based tools that promote discussion. Intertwined within these elements are a number of factors that also need attention, including good community leadership and member roles, viewing and posting activity, size, technological tools and applications and offline interaction to strengthen connections. In addition, it is also important that the platform is secure, easily maintained, and easy to use. Nonetheless, virtual communities are only sustainable when they provide benefits that surpass the costs of membership in relation to time. It is important for all members to be proactive at the beginning of a development to establish communication and interest. This may be time consuming especially when recruiting and instructing new members.

This chapter has taken into consideration the requirements of the UIW-project and suggested a potential guide to facilitate the first step towards understanding the basics factors for a successful virtual community platform. However, virtual communities evolve in a natural way over time and cannot be forced into an organisational structure. Changes will take place as the individuals, goals and

objectives change within the community. In addition, a change in industrial culture, economic climate or organisational strategy, will also contribute to the evolution of the virtual community (Du Plessis 2008).

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