Structured Abstract:

Purpose – To demonstrate how to apply the Systemic Lessons Learned knowledge (Syllk) model to enable the organisation for the capability of an online Community of Practice (CoP).

Design/methodology/approach – The research method consisted of multiple spiral 'action research' cycles (plan, action, observe and reflect) within a government organisation. The initial planning stage consisted of interviews followed by two focus groups to identify the facilitators and barriers that impact the initial design of the Syllk model within the organisation. Established knowledge management practices were aligned with each of the Syllk elements to address the identified barriers and facilitate learning as the action cycles progressed. Online CoP initiatives were implemented with two action research cycles completed. Actions were observed, monitored, evaluated and reflected on using an after action review process.

Findings – The results from this research shows how the capability of a CoP can be 'wired' (distributed) across organisational systems, and how the Syllk model can be used to conceptually facilitate this. The research highlights the importance in understanding organisational knowledge facilitators and barriers and the associated practices to reflect and learn from past experiences.

Research limitations/implications – The paper demonstrates an application of the Syllk model, and that action research can benefit project and knowledge management researchers and practitioners.

Practical implications – This study contributes to practice by highlighting how to use the Syllk model to 'wire' an organisation for some know-how capability.

Originality/value – This study applies a conceptual model enabling management to understand how organisational know-how is distributed (wired) across various systems of an organisation for an online CoP.

Keywords:
Knowledge management; Communities of Practice; Lessons learned; Organisational learning; Project learning; Swiss cheese model; Action research

Article Classification:
Research paper

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1. Introduction

Governments and businesses need to successfully manage projects and day to day business activities, to learn from success and failure, and to capture, disseminate and apply lessons learned (Burr, 2009; GAO, 2002; Klakegg et al., 2015; Ministry of Defence, 2010; NASA, 2012). An organisation needs to consider its current knowledge and determine how to acquire and access additional knowledge (ISO, 2015). In practice organisational learning from projects rarely happens, and when it does it fails to deliver the intended results (Atkinson et al., 2006; Kerzner, 2009; Klakegg et al., 2010; Milton, 2010; Schindler and Eppler, 2003; Williams, 2008; Williams et al., 2012). Nevertheless, some organisations in the sectors of health care, nuclear power, rail and aviation have demonstrated their ability to apply lessons learned by way of Reason's (1997, 2000) Swiss cheese model. This model enables these organisations to conceptualise how safety and accident prevention know-how is not stored in one spot but rather distributed across a network of interconnected organisational faculties and systems.

In this paper, we demonstrate the application of a conceptual model, hereafter referred to as the Systemic Lessons Learned Knowledge model or Syllk (pronounced Silk) model (Duffield and Whitty, 2012; Duffield and Whitty, 2015), which is a variation of Reason's (1997, 2000) Swiss cheese model. Whereas the Swiss cheese model appropriately fits accident causation, the Syllk model is better suited to the organisation managing projects and day to day business activities. Put simply; in aviation, the Swiss cheese model enables lessons learned data to be collected from aviation events so that the aviation industry can improve the safety of how planes fly tomorrow. For organisations, the Syllk model will enable lessons learned to be disseminated and applied so that the organisation can improve its future project and day to day business delivery performance (Duffield and Whitty, 2015).

At the centre of this research is a government organisation that identified a need for a trial online Community of Practice (CoP). The trial focused on conducting a single online CoP in a controlled environment implementing a governance framework. The trial identified the barriers and success factors for conducting a successful online CoP within the organisation and the robustness, appropriateness and applicability of the governance framework for future ongoing online CoPs. The organisation considered that the application and implementation of the Syllk model would benefit the organisation to understand the

knowledge management (KM) lesson learned barriers and facilitators associated with an online CoP approach. The literature indicates that the KM Practices of an online CoP are effective ways to identify, disseminate and apply organisational knowledge and lessons learned (Egbu, 2004; Jugdev, 2012; Jugdev and Mathur, 2013; Lee et al., 2015; Milton, 2010; Williams, 2007). The Association for Project Management (2012, p. 82) states that a CoP "enables *project, programme and portfolio* (P3) professionals to be part of a virtual department that shares experiences and contributes to improving future practice".

The paper begins with a literature review that explores CoP and the Syllk model that leads to the research question, description of the study and the applied *action research* methodology. The findings are discussed within the framework of the literature. Finally, the limitations and challenges are identified, followed by speculation on other practical applications of the Syllk model and future research opportunities.

2. Literature review

The scope of the literature review is contained to what is already known about *CoP mechanisms* and the *Syllk model* as it pertains to organisational knowledge and lessons learned mechanisms by which organisations can acquire knowledge (a know-how capability) from past project experiences.

2.1. Organisational knowledge and Community of Practice

Since its introduction by Lave and Wenger (1991) in the context of situated learning, CoPs have been defined as groups of people who share their interests and problems creating new knowledge by practicing together, innovating in the workplace and reflecting on their collective learning (Brown and Duguid, 1991; Lave and Wenger, 1991; Wenger, 2000). A CoP is central to the functioning of any organisation. However, they are important to those that recognise knowledge as an asset (Wenger, 1998a). From an organisation perspective interconnected CoPs can each work on particular aspects of the company's functions to create, accumulate and disseminate knowledge in an organisation (Lee et al., 2015; Wenger, 1998a). Wenger (1998a, p. 6) reports that:

> They are nodes for the *exchange and interpretation of information* ... an ideal channel for moving information, such as best practices, tips, or feedback, across organizational boundaries … They can *retain knowledge* in 'living' ways, unlike a database or a manual ... Community of practice preserve the tacit aspects of knowledge that formal systems cannot capture. For this reason, they are ideal for initiating newcomers into a practice ... They can *steward competencies* to keep the organization at the cutting edge.

Through communities, employees can find the answers to the social and experience sharing needs that are difficult for organisations to satisfy. Communities can create the organisational environment to encourage employees to learn, share across the organisation boundaries (Corso et al., 2009), drive corporate strategies (Jassbi et al., 2015), engage and retain employees (Lee et al., 2015; Wenger and Snyder, 2000). O'Dell and Hubert (2011, p. 61) report that CoPs "are KM's killer application" through connecting employees, collecting content, retaining content, capturing ongoing discussions and are best suited to business and operational employees. A typical CoP goes beyond organisation "boundaries created by work flow, functions, geography, and time" (O'Dell and Hubert, 2011, p. 62).

Wenger (2000) suggest that a CoP should have the following elements: events, leadership, connectivity, membership, projects and artefacts. Events help to bring the community together with formal or informal meetings and problem-solving sessions. A CoP needs leadership and a coordinator who takes care of the community day-to-day needs. Leadership can be distributed across the community. Connecting community members and establishing relationships is important as is interacting with multiple media. A CoP needs to have a critical mass of members to maintain the interest and community focus. A CoP needs to have a learning project agenda to extend the community knowledge domain. Finally, a CoP must produce their artefacts such as documents, tools and stories (Wenger, 2000).

A CoP has different levels of participation as the members participate for various reasons. Typically a CoP has a coordinator and may have one or more members with leadership roles. Wenger et al. (2002) define three main levels of participation (core, active and peripheral). The first level is a *core* group of people who actively participate in discussions. They often lead learning projects, establish forums and topics for the community to discuss. The community coordinator and core group is the heart of the community and is usually only 10 to 15 percent of the whole community. The next level is the *active* group. These community members occasionally participate in the community forums, but without the regularity or passion of the core group and makes up 15 to 20 percent of the community. A large part of community members (65-75 percent) are *peripheral* and occasionally participate. Peripheral members keep to the sidelines watching the core and active members interact. They remain peripheral because they may feel that their input is not appropriate or carries no weight. A sense of belonging and the level of trust are key peripheral participation drivers (Hildreth et al., 2000; Johnson, 2001; Kimble et al., 2008; Zhao et al., 2012). Others may not have the time to contribute more

actively. Time pressure is a significant factor in low participation rates (Chou et al., 2015; Kim et al., 2011). Peripheral members "often gain their own insights from the discussions and put them to good use. They may have private conversations about the issues being discussed in the public forum. In their own way, they are learning a lot." (Wenger et al., 2002, p. 56).

Wenger (2002) also states that community members move through the three levels, where core members often watch from the sideline, and active members may be heavily focussed for a short period then drop back to the sideline. Peripheral members may go with the flow if they become interested in a discussion topic. "The key to good community participation and a healthy degree of movement between levels is to design community activities that allow participants at all levels to feel like full members. Rather than force participation, successful communities 'build benches' for those on the sidelines" (Wenger et al., 2002, p. 57). O'Dell and Hubert (2011, p. 67) suggest that one of the key success factors is to "secure and then maintain the support of managers, executives, and subject matter experts". A CoP should also be "seen as a legitimate way to spend time".

2.2. Online Community of Practice

For the purpose of this paper, we will call *online* a community of practice that does not have face-to-face meetings and interactions as its primary vehicle for connecting members. Online communities are typically geographically spread communities linking people across time zones and organisational units. They share ideas and insights, help each other, document procedures, and influence operating teams and business units (Wenger et al., 2002). Other favoured terms are virtual (vCoP) (Jassbi et al., 2015; Kimble et al., 2008; Mohamed, 2007; Zhao et al., 2012), distributed (Wenger et al., 2002), and web-supported communities (Baek and Barab, 2005). Woolis et al. (2008) suggest that online CoPs differentiate themselves from an organisations website in that CoP knowledge is actionable through interaction rather than pushing out information via the internet/intranet. Woolis et al. (2008) reports that online CoPs can maximise productivity of the employees of an organisation through better time management (saves meeting, travel time), human capital (sharing resources and generating dialogue), leadership development (engage leaders, allow leaders to emerge), practice and policy (identification, development and implementation of good and best practice) and outcomes (better, smarter, deeper, faster, sustainable outcomes) (Woolis et al., 2008, p. 61-62). Mohamed

(2007) reports how the World Bank global development gateway vCoP uses the internet as a tool to support vCoP content management and yellow pages KM activities.

The different time zones, culture and cross-division nature (online communities typically cross organisational boundaries) combined with a heavy reliance on technology make online CoPs different from the normal CoP in several important ways. Online CoPs need to devote much more time to reconciling multiple agendas and to build employee relationships and trust between members (Zhao et al., 2012). Wenger et al. (2002) identify the community as a learning social factory (Wenger, 1998b), a group of people who interact, learn together, develop trust and build relationships developing a sense of membership and mutual commitment. The shared experiences include the knowledge created and shared in the past and allows for future learning, for trusted relationships and circulation of explicit and tacit knowledge. The key challenge for a vCoP is the facilitation of participation. Hildreth et al. (2000, p. 30) state that "participation is central to the evolution of the community and to the creation of relationships that help develop the sense of trust and identity, that defines the community". Hildreth et al. (2000) and Johnson (2001) both report that online CoPs benefit from the face-to-face element. The face-to-face element develops the strong personal relationships and trust that is needed to support the CoP. Knowing each other provides the unity and common ground needed for active participation (Hildreth et al., 2000).

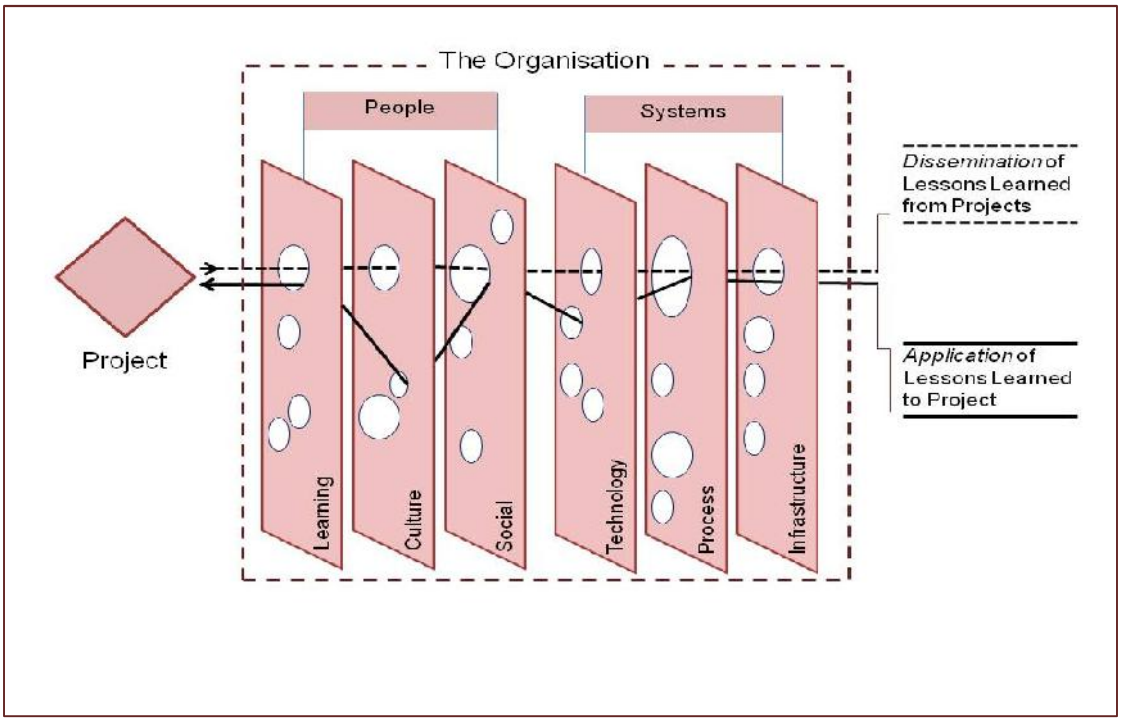
CoPs require effective web-based technologies with adequate support in both technical and how to use the technology for communication and collaboration (Jassbi et al., 2015; Johnson, 2001). When designing an online community; web-designers need to realise the potential of online professional development environments to avoid design issues that may impact CoP participation rates, as the realisation of a CoP is often not what is promised in theory (Baek and Barab, 2005). O'Dell and Hubert (2011, p. 67) suggest that for a formal CoP, technical requirements need to be identified rather than using "do-it-yourself collaboration capabilities built into an IT infrastructure (Microsoft SharePoint, for example)".

Social computing, Web 2.0 and the rise of social media are transforming KM and CoPs (O'Dell and Hubert, 2011). The term Web 2.0 was coined at a conference brainstorming session in 2004 by the O'Reilly Media group (O'Reilly, 2007). Web 2.0 technologies include social media platforms/networks, wikis, discussion boards, forums, webinars, file sharing, blogs and vlogs along with others and are open networks that lend themselves to online communication and collaboration. CoPs are the foundation of a mature KM

program and are an example of Web 2.0 technologies that can capture and transfer knowledge (O'Dell and Hubert, 2011). O'Dell and Hubert (2011) also found that the more an organisation operates in a virtual environment then employees will support web 2.0 tools that enhance social networks and identification of experts. Lee et al. (2015) found that Web 2.0 technologies are currently not effective in encouraging CoP participation.

2.3. A Systemic Lessons Learned Knowledge (Syllk) model

James Reason's (1997) work on safety, learning and just culture highlights many similarities with project management lessons learned (Duhon and Elias, 2008). Reason's (1997, 2000) Swiss cheese model conceptualises organisational accidents as a complex chain of active failures and latent conditions. High-reliability organisations use the Swiss cheese model to provide a basis for trend analysis and learning from incidents (Hayes, 2009; Hayes and Maslen, 2014). The Swiss cheese model has also been adapted by organisations with operational feedback to make improvements to management practices (Hayes, 2009).



Source: (Duffield and Whitty, 2015)

Figure 1. The Systemic Lessons Learned Knowledge model

In line with complex adaptive systems theory, the Syllk model (see Figure 1), represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the

organisation (Duffield and Whitty, 2012; Duffield and Whitty, 2015). Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the different modes of social and cultural learning, along with the organisational processes, infrastructure and technology that support them (Duffield and Whitty, 2012; Duffield and Whitty, 2015). The model replaces Reason's (1997) defence barrier layers (person, workplace, organisation factors (policies and procedures), and defences (technology, training and regulations)) with the organisational elements of learning, culture, social, technology, process and infrastructure. The reverse relationship refers to the fact that the open holes (facilitators) in each element represent the various facilitators (lessons learned practices) within each of those elements that need to be aligned to enable the effective dissemination and application of the lessons. Negative impediments (barriers) need to be overcome for effective lessons learned (Collison, 2006; Riege, 2005), and the Syllk model can assist in identifying these (Duffield and Whitty, 2012; Duffield and Whitty, 2015; Leal-Rodríguez et al., 2014; Virolainen, 2014).

The people elements of the Syllk model (social, culture and learning) are critical elements in the development of a CoP. Situated learning is a way to understand learning as a social event (Lave and Wenger, 1991). “Learning usually depends on the activities, on the context and on the culture in which it occurs as in the case of situated learning, it is the authenticity of the context in which the learning occurs that helps knowledge creation and allows each individual to apply it in new ways and to new situations”(Corso et al., 2009, p. 76). Leal-Rodríguez et al. (2014) have indicated how an earlier version of Syllk model supports the construct of information sharing and knowledge integration where information and knowledge are exchanged between an organisation and its suppliers, customers and partners. Virolainen (2014) highlighted that the Syllk model elements of people culture play an important role in learning from projects. Hedman et al. (2015) explain how the Syllk model shows that for organisations to learn, people and systems (processes and technology) needs to be working and that this combination is the best way of organisational learning. Duffield (2015) explores how the Syllk model enables organisations to learn from past experiences. Duffield and Whitty (2016) reported how the Syllk model enables management to conceptualise how organisational know-how for storytelling is wired (distributed) across various people and system elements of an organisation.

3. Research question

What is missing from the literature is a conceptual model for organisations that clearly and simply articulates how lessons learned and day to day business activity experiences can be distributed across organisational systems and people. With this in mind, and considering that some organisations such as aviation do effectively learn in terms of safety and accident prevention experiences, our overarching research question is:

[RQ] How can the Systemic Lessons Learned Knowledge (Syllk) model be used by an organisation to conceptualise (and enhance) its capability of an online CoP?

4. Research methodology

The term action research was pioneered by Kurt Lewin in 1946 toward social research that combined the generation of theory with changing the social system through the researcher acting on or in the social system. It is a way of both changing the system and generating critical knowledge about it through a continuous cycle of planning, acting, observing and reflecting (Lewin, 1946). Action research is a methodology that provides an efficient way of delivering a conscious change in a partly controlled surrounding. The action researcher enters a situation, attempts to deliver change and monitors the results (Collis and Hussey, 2009; Lewin, 1946).

4.1. Action research suitability to this research

Action research was selected as the most suitable methodology to answer the research question as the research is focused around business change management, organisational learning and project management. Avison et al. (1999) and McKay and Marshall (2001) both highlight the significant contributions that action research has had on information systems, people and organisations. Avison et al. (1999) found that action research type activities are related to lessons learned from particular projects, case studies, systems design and software engineering projects. Action research supports conducting research within a complex learning social organisation and will benefit both the organisation and the project management body of knowledge (Baskerville, 1999; Baskerville and Wood-Harper, 1996; Raelin, 1998; Susman and Evered, 1978; Zuber-Skerritt and Perry, 2002). Action research has also been used in project management research to implement organisational change (Sankaran et al., 2009), knowledge management systems (Mau, 2005; Orr, 2006;

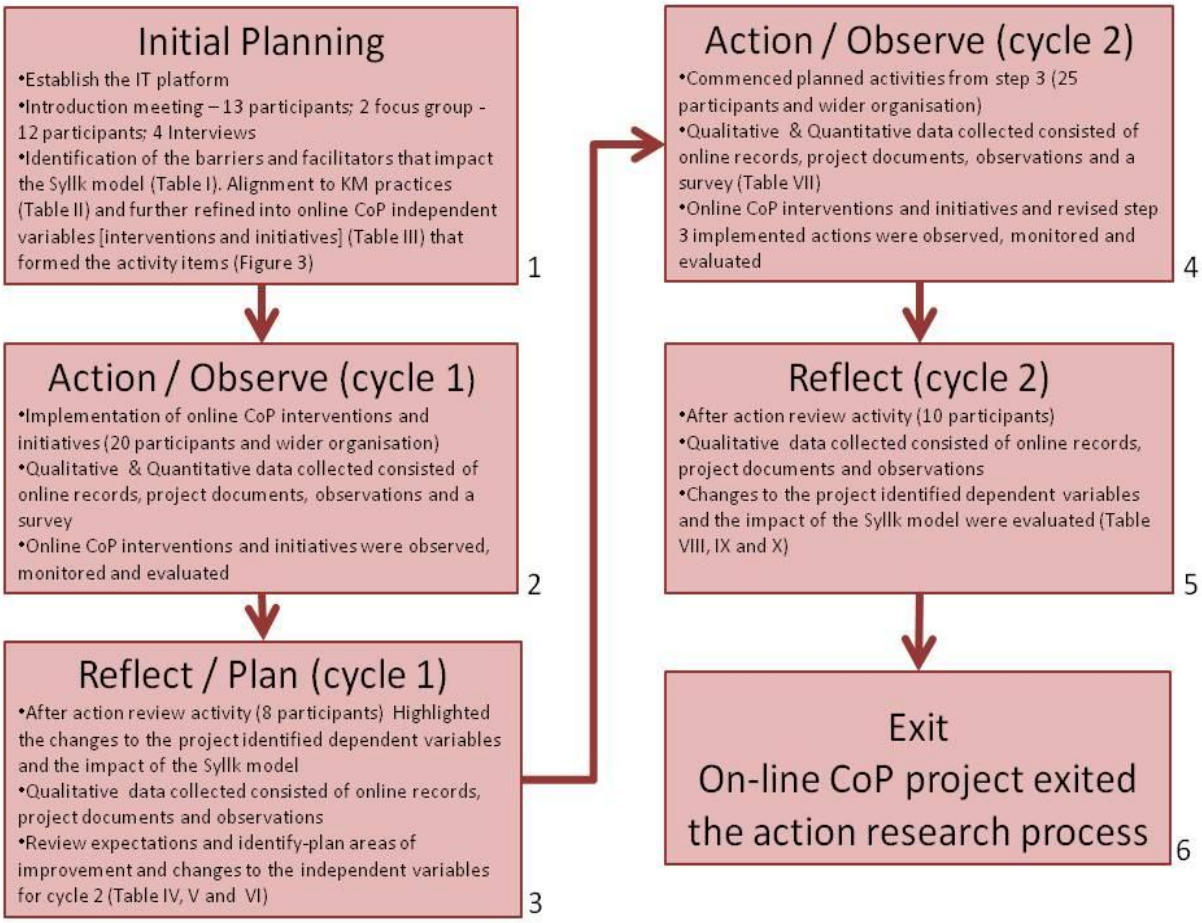
Sankaran, 2009; Sankaran et al., 2009; Walker and Sankaran, 2014; Walker, 2007) and storytelling (Boyce, 1996; Pässilä et al., 2013). Orr and Sankaran (2007) recognised a direct link with project management, action research, complexity and the development of reflective practitioners in a project environment. Ragsdell (2009) highlights the adoption of action research on knowledge management studies has the potential to address and overcome knowledge sharing barriers.

4.2. Problem-solving (action research) project

This study took place in an Australian government organisation. The organisation KM steering committee approved the trial of an online CoP as part of a (2014-2018) KM strategy. The trial online CoP was approved to operate in a controlled environment to assess the viability of online CoPs within the organisation and the practical applicability of the proposed online CoP governance framework. The trial was to provide a safe, trusted and collaborative digital workspace, which aligns with organisational policies and procedures so that staff can communicate and share knowledge with one another. The organisation identified that the intervention and implementation of the Syllk model would benefit the trial online CoP, and subsequently, the action research study was endorsed by the KM steering committee and executive management in November 2014. The trial online CoP project duration was for nine months.

4.3. The action research approach

The action research method applied to this study, consisted of two spiral action research cycles (6 steps) of the four stage process (plan, action, observe and reflect) adapted from Zubert-Skerritt in Altrichter et al. (2002), McKay and Marshall (2001), McNiff and Whitehead (2002) as shown in Figure 2.



Adapted from Zubert-Skerritt in Altrichter et al. (2002), McKay and Marshall (2001), McNiff and Whitehead (2002)
Figure 2. Action research steps applied to this study

4.4. Action research methods of analysis

During the action research cycles both qualitative and quantitative data was collected, analysed and interpreted using mixed method procedures (Creswell, 2009; Hesse-Biber and Johnson, 2013). Creswell (2009) describes this as a concurrent transformative approach where the research is using a qualitative theoretical perspective as well as using the concurrent collection of both qualitative and quantitative data. The approach involves triangulation of qualitative and quantitative data to best cover the information that provides evidence of the research findings.

The qualitative data collected during each action research cycle was evaluated using a general inductive approach to help in identifying the changes to the research variables (Thomas, 2006) and identifying lessons learned from the research (Mau, 2005). The general inductive analysis method (Thomas, 2006) has been used and adapted in some action research related projects (Day et al., 2006; Orr, 2006).

Qualitative data analysis software (NVivo 10) was used to facilitate analysing the large quantity of data that was collected (Cepeda and Martin, 2005). Specific analysis of the qualitative data can be enhanced by the use of specialist software (Bazeley, 2013). The software program enabled searches of collected data for words, phrases, expressions or statements related to the research question (Bazeley, 2013; Bazeley and Jackson, 2013). The research issues (results of reflection activities) guided data analysis as did the existing literature to enable the generation of valuable results (Bazeley, 2013; Miles and Huberman, 1994).

Qualitative research is often criticised based on the nature of the work, the design of the studies, analysis of the data, and the interpretation of the results (Cepeda and Martin, 2005). However, the use of careful research design, proper data collection tools, and good data analysis provide meaningful and insightful research outcomes. Rigour in action research refers to how data is generated, gathered, explored and evaluated, and how events are interpreted and questioned through multiple action research cycles so that early interpretations can be challenged and refined (Dick and Swepson, 1994; Melrose, 2001). Melrose (2001) states that triangulation of data increases qualitative rigor where data is collected from multiple sources to establish trends and patterns as is the case with this action research project. Data has been collected from several sources using appropriate methods from the same or different sources (for example focus groups, interviews, meeting records (hard copies and audio), project documents, diary entries and observations) and has been coded for themes and patterns. The data collected has identified changes to individuals, group practice, systems and the organisation as a result of the action research cycles. The challenge is using as much of the relevant data as is required to examine the predetermined research issues and generate meaningful explanations, expressed in words, that will create a clear understanding of the research outcomes (Cepeda and Martin, 2005). Deliberate and conscious reflection of any interpretations is essential in action research (Dick, 1993).

5. Findings

5.1. Step 1) Initial planning

The initial planning stage commenced with the selection of an information technology (IT) platform. An existing government collaboration platform was selected, and appropriate process and infrastructure was established. A trial online CoP introduction meeting was held with 13 participants. Four interviews with project stakeholders and senior participants of the online CoP were held. Two comments from the interviews

highlighted the application of the Syllk model and how organisational learning from an online CoP could be enabled across the organisation. One senior participant stated:

> The Syllk model says what are the barriers to an organisation learning the lessons from previous projects ... I guess that is how I see it. Do a whole design up, where you can actually get that information from over here to someone who is doing something similar and so they can go, Oh I didn't know you did that, what happened, how can I not make the same mistakes? That is how I look at it; it is almost reverse Swiss cheese. You want the holes to line up ... you are wanting the information to pass through.

The other senior participant stated:

> I found it interesting that you had the cheese model ... using the opposite to where we were using it, obviously the cheese model is when something, you know when all those holes, or when they get in line, they all, it causes the system to fail, where I guess in your case you actually want the system to you know all the holes to align so that it actually produces, so we use it in the opposite way.

The focus group activities were held with 12 participants and identified the barriers and facilitators that impact the Syllk model within the organisation (Table I). KM practices identified in the literature (APQC, 2012; Duffield and Whitty, 2015) were then aligned with each of the Syllk elements to facilitate learning and address the identified barriers (Table II). The KM practices were further refined into online CoP independent variables (interventions and initiatives) (Table III) to support the development of a trial online CoP project plan (Figure 3). Various meetings and activities took place with a focus on holding CoP team meetings, developing a process and engaging communications with the trial online CoP members.

Table I.

Facilitators and barriers [in terms of Syllk elements] to organisational learning through an online CoP

Syllk elements	Facilitators	Barriers
People Learning	Staff with a variety of skills and knowledge Willingness to share knowledge and expertise Have a dedicated education team People get something out of it Cater to different learning styles i.e. telling vs. discussion	Over-reliance on on-the-go job training Lack of funding for training outside of organisation Knowledge is power attitude – not wanting to share knowledge Support for training and personal development De-motivation and boredom Language, literacy and numeracy skills Time constraints Competing priorities Different levels of knowledge
People Culture	Passion for organisation mission Management/leadership support What to improve/develop A culture of supporting others' ideas and views Appropriate governance over material	Competitiveness 'Not my job' attitude Misunderstanding of job skills and how someone contribute to the end goal Negative feelings towards change Industry focus vs. organisation focus No appetite for lessons learned (institutional) Many teams think that they are the most important and do not want or have an understanding of other team roles Hierarchy – organisational position Control of the conversations Fear of being criticised for views/ ideas expressed Not wanting to share or part knowledge (i.e. knowledge is power) Busyness of staff may lead to resistance to adopting new methods of work General unwillingness of certain areas of the organisation to take new approaches / use newer technologies
People Social	Willingness to share/be open Much information shared between teams within divisions Informal communication channels Participation Attitude (willingness)	Working in silos Not a strong friendship culture CoP becomes a platform for whinging No trust Knowledge based on whom you know Little social club activity Informal communication is frowned upon Participation
Systems Technology	Fast, efficient and reliable online systems Learning management system as a concept Exploration of new technologies including mobile technology Ease of use Access across platforms (i.e. iPad, iPhone) - Mobility Ability to review who has read your postings (and if they 'liked' it) Spell checker Ability to 'graft' an off-topic sub-thread to an appropriate thread or create new thread	Multiple software tools that still aren't fit for purpose or don't interconnect Resistance to learning new technology Lack of understanding around how new technology could make the job easier Using the learning management system Software systems are not interfacing with each other Amount of time taken to implement software Support from IT for business areas No technology in lace to support online participation (yet) Slow connectivity Lack of training
Systems Process	Some processes are well documented Facilitation Clear guidelines, policies around the use of systems processes. i.e. legal protection, confidentiality issues Clarity and support of processes Moderation Governance	Lack of consistent procedures across the organisation Misguided or confusing processes Resistance to change or development No process to manage software/tools across the organisation People do not follow process even if documented and trained Ineffective change management – no follow through Resistance to new initiatives within IT when initiatives do not align to current or currently planned enterprise architecture
Systems Infrastructure	Good training/facility rooms Open floor plan and management open door policies Video conference facilities Has to be mobile – anywhere, anytime. i.e. Speed, bandwidth, accessibility Appropriate support	Geographic distance Unwillingness to adopt new infrastructure to support outcomes Video conferences – presentations not clear There is no list of infrastructure that is available for use within the organisation Lack of technology – i.e. upgrade of redundant systems No IT support

Table II.

KM practices addressing facilitators and barriers mapped to the Syllk elements

Syllk elements	KM practices (Independent variables)
People Learning	Stories and lessons, Storytelling Communities of Practice Skills & toolkits Learning histories Case studies
People Culture	Vision/Mission statement Tone from leadership teams Identifying and promoting champions Sharing understandings Exchanging ideas Building relationships Building communities Reward and recognition Link to organisation objectives Align culture and business Develop leadership Empowering staff
People Social	Social networks, relationships, Interactions Special interest groups Technical exchange Promoting conversation: communal knowledge areas, online conversation Communities of Practice Questions and answers Expertise list, knowledge matrix Stories and lessons Storytelling forums
Systems Technology	Intranet site Story, lessons learned repositories Knowledge libraries, portals web, wikis, intranets Publish and search technologies Search engines Blogs Social media What is new (post) Enterprise content management
Systems Process	Governance framework/process/templates Best practice directory Lessons learned After action reviews help to identify stories Employee development Conduct a knowledge network analysis
Systems Infrastructure	Promoting conversation Communal knowledge areas Intranet accessibility and availability Performance appraisals & Employee Development Toolbox assistance from experts Wireless

Table III.

Identified online CoP independent variables mapped against Syllk elements

Activity	Online CoP independent variables (Interventions & Initiatives)	Syllk element
A1	Initial planning A1a: Planning meetings with IT A1b: Establish IT platform	Systems: Technology Systems: Process Systems: Infrastructure
A1	Initial planning A1c: Initial meeting with trial community members A1d: Interviews A1e: Focus groups	People: Learning People: Culture People: Social Systems: Technology Systems: Process Systems: Infrastructure
A2	**Online CoP activity** Action research cycles 1 and 2 (based on AAR activity) Evaluation activities – AARs and surveys A2a: AAR/Survey A2b: Organisation communication A2c: Survey A2d: AAR	People: Learning People: Culture People: Social Systems: Technology Systems: Process Systems: Infrastructure
A3	Exit	

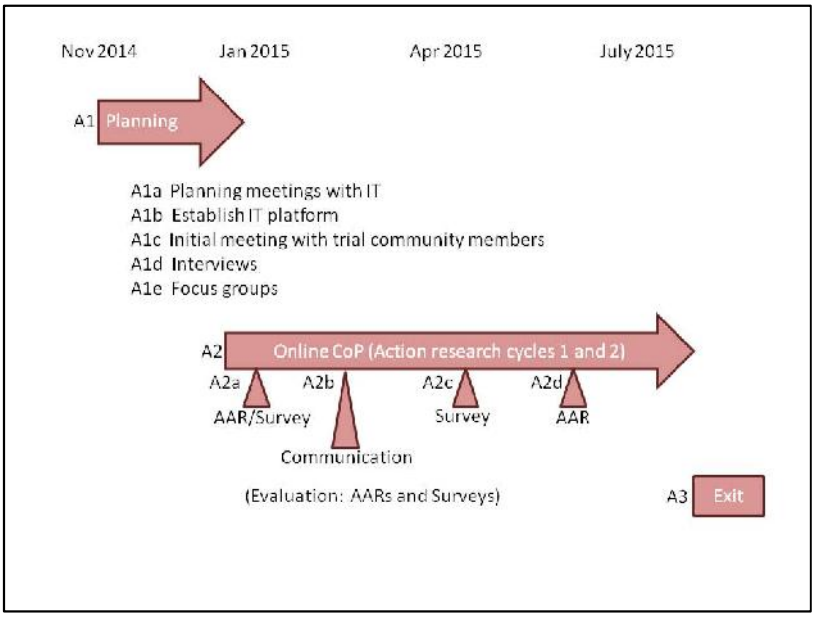


Figure 3. Trial online CoP project plan (activity items)

5.2. Step 2) Action and Observe (cycle 1)

The trial online CoP is seeking a positive user experience where staff are comfortable and confident in sharing their knowledge. Twenty (20) participants actively participated, contributed and absorbed knowledge, creating value to the organisation by way of improving communication channels to increase staff efficiency. The initial forum posts and topics were established to help the participants understand the trial and supporting research activity. Early engagement by core participants established some technical pages and forum topics. One relevant technical topic received 12 comments and some associated likes. Some forum topic posts highlighted the barriers identified in Table I.

5.3. Step 3) Reflect and Plan (cycle 1)

Tables IV, V and VI highlights the evidence of participant contribution during the action research reflection activity. The reflection activity used the KM after action review (AAR) process (Collison and Parcell, 2004). Eight (8) participants comments were captured from a survey and emailed documentation to reflect on both the study research variables and the Syllk model. There was evidence that some expectations were partially met. New and revised actions were then planned with a significant focus on CoP communications, CoP benefits, new CoP topics/pages, organisational involvement, time pressures and continual removal of identified barriers identified in Table I.

Table IV.

Cycle 1 – Dependent variables (outcome measures)

Dependent variables	Expectations	Evidence through reflection	Met Expectations
Captured organisational memory	Increase	The approach has been to have users generate the content but to get that there needs to be some level of interest initially. It might have been better to build some standard topics before opening for use thereby leading people to comment. Some people are more comfortable breaking the ice in these things than others. The opportunity for smaller contributions initially may lead them to greater input later.	Partial New pages/topics started.
		It is a good idea. However, it only works if participants from other business areas participate and get involved in the discussions. I cannot see the benefit. I would rather get up and go and talk to my colleagues when I have reason to. The community is pretty small and is dominated by a team that already communicates regularly.	Additional areas invited to join.
User satisfaction	Increase	Not as yet. Yes to a certain extent. Unfortunately, the content was not relevant to me per say. However, the concept is workable. The community is easy to use/navigate. I think it will be hard to get people to participate without being prompted with discussion topics.	Partial Regular updates/topic prompts sent out.
		I think it needs to be better understood and, therefore, explained to the organisation to see how the concept can be best applied and then adopted. I see benefits of the program but do not have a great understanding and would prefer to be taught properly of its capability and functionality. I do not think there was sufficient buy-in from the start as the benefits were not/still are not particularly apparent.	Organisation communications and follow up on benefits of CoP.

Table V.

Cycle 1 – Dependent variables (system measures)

System measures (Dependent variables)	Activity	AAR 1
Number of members	Participants	20
Ratio of number of members to number of contributors (conversion rate)	Participants (core)	4 (20%)
	Participants (active)	6 (30%)
	Participants (peripheral)	10 (50%)
Number of contributions	New page created	13
	Page updated	18
	Comment	20

Table VI.

Cycle 1 – Syllk model impact on capability of online CoP

Syllk model	Expectations	Evidence through reflection	Met Expectations
Syllk model impacts: Learning Culture Infrastructure	Positive influence	Community participation depends a lot on the team dynamics and the organisational climate. CoP is a powerful tool to improve the workplace knowledge and sharing of ideas but need to be supported by appropriate work culture and organisational environment. Time is a significant issue, just too busy to be focused on forums and contributing, as much as I would love to. I can see the benefits for relevant topics specific to the organisation. High workload, so it is hard to find time to make comments and thoughts. I am not entirely sure what to talk about on there as of yet. I thought that it would be better to read other people's contributions first, before I jump in. I do not have anything relevant to add to the discussions at this stage. I have contributed, but not too much. The main reason is my current high workload. I have nothing to contribute or discuss at this stage. Lack of time but hope to participate soon.	Yes

5.4. Step 4) Action and Observe (cycle 2)

The trial online CoP continued to seek a positive user experience where staff are comfortable and confident in sharing their knowledge. Twenty-five (25) participants actively participated, contributed and absorbed knowledge, creating value to the organisation by way of improving communication channels to increase staff efficiency. Ten (10) new forum posts and topics were established covering process, tools and techniques. An employee engagement initiative focused on lateral communication was released to the wider organisation highlighting the future establishment of CoPs across the organisation. The communication update described how CoPs can support knowledge and information sharing within the organisation and provide a forum for employees with common interests to share ideas and information with each other.

5.4.1. Web 2.0 technologies and CoP participation

As discussed in the literature review, there is an association between Web 2.0 technologies and CoP participation. The emerging technologies of Web 2.0 are a significant new front line for KM (O'Dell and Hubert, 2011). Over the past years, we have seen the growing adoption of Web 2.0 technologies increasing the interactivity among employees to support participation in the sharing of ideas and knowledge (Lee et al., 2015). Web 2.0 refers to an emerging set of social and collaborative technologies that can be used to create a more networked organisation. Examples of Web 2.0 technologies include discussion boards, forums, social media platforms, blogs, webinars, and file-sharing applications (Lee et al., 2015; O'Dell and Hubert, 2011). Web 2.0 technologies facilitate contact and interactions between employees, encourage participation in activities and improve communications. O'Dell and Hubert (2011) suggest that CoPs are considered to be the heart of KM with Web 2.0 social networking the engine room of relationships and knowledge.

Lee et al. (2015 p. 42) were seeking to find "a positive association between the use of Web 2.0 technologies and participation in a project management community of practice". They found that the most popular tools used for assisting in personal and professional objectives were LinkedIn and webinars (Table VII). As expected, Facebook is frequently used for achieving personal objectives, however, is not as popular for professional objectives. Other tools used by the respondents were discussion boards/forums, internal company social media and blogs. According to Lee et al. (2015 p. 46-47) the data revealed that Web 2.0 technologies "are currently not extensively used by project managers for professional objectives … and that

the technologies may represent untapped resources for improving project management effectiveness as well as facilitating a stronger community of practice". A limitation with Lee et al. (2015) findings is that they did not distinguish between virtual (on-line) CoPs and face-to-face CoPs. Lee et al. (2015 p. 49) suggested that "virtual communities of practice by their virtual nature and their reliance on technologies are perhaps early adopters of Web 2.0 technologies and may use Web 2.0 technologies more innovatively or extensively than traditional face-to-face communities thus providing another area of future research".

Table VII.

Web 2.0 Collaboration tools

	Lee et al. (2015 p. 48)				Organisation - Trial on-line CoP			
Collaboration Tool	**I have used this for PERSONAL goals and objectives.**	**Top 5**	**I have used this for PROFESSIONAL goals and objectives.**	**Top 5**	**I have used this for PERSONAL goals and objectives.**	**Top 5**	**I have used this for PROFESSIONAL goals and objectives.**	**Top 5**
Blogs	35%		36%	5	57%	3	43%	4
Discussion Boards/Forums	44%		40%	4	86%	1	57%	2
Dropbox	46%	4	24%		43%	5	14%	
Facebook	60%	2	14%		71%	2	7%	
Google+	45%	5	27%		29%		21%	
Google Drive	24%		10%		29%		21%	
Google Hangouts	18%		5%		14%		7%	
Helpouts by Google	3%		1%		0%		0%	
Instagram	17%		4%		29%		0%	
Internal Company Social Media	23%		41%	3	14%		36%	5
LinkedIn	69%	1	67%	1	50%	4	64%	1
Pinterest	19%		5%		21%		0%	
Podcasts	32%		19%		36%		29%	
Skype [1]	n/a		n/a		86%	1	0%	
Snapchat	19%		1%		21%		21%	
Tumblr	8%		1%		0%		0%	
Twitter	31%		14%		29%		14%	
Webinars	60%	2	60%	2	43%	5	50%	3
YouTube/Vlogs	58%	3	27%		71%	2	50%	3

(1) Skype was not included in Lee et al. (2015)

Adapted from Lee et al. (2015 p. 48)

Fourteen (14) participants of the organisation trial online CoP completed a Web 2.0 collaboration tools survey during action research cycle 2. The results of the survey are presented in Table VII. The most popular tools used for assisting in personal objectives were discussion boards/forums, Skype, Facebook (as expected), blogs and Youtube/Vlogs. The most popular tools used for assisting in professional objectives were LinkedIn, discussion boards/forums, webinars and Youtube/Vlogs. Other tools (in the top 5) used by the respondents were internal company social media, blogs and Dropbox. The organisation trial online CoP top 5 most popular tools used for assisting in professional objectives were consistent with the findings of Lee et al. (2015).

The analysis of the data revealed that the organisation trial online CoP participants have an appetite for LinkedIn and discussion board/forum Web 2.0 technologies. What it does not show is how active are the

participants with these Web 2.0 technologies. The trial online CoP collaboration tool implemented has the LinkedIn and discussion board/forum capabilities. Current participation rates suggest that most of the participants are peripheral members keeping to the sidelines watching the core and active members interact (Wenger et al., 2002).

5.5. Step 5) Reflect (cycle 2)

Tables VIII, IX and X highlights participant contribution during the action research reflection activity where participant's comments were captured to reflect on both the study dependent research variables and the Syllk model impact. For the core and active participants, the capturing and sharing of knowledge was effective using the CoP forums and content pages. Overall the significant benefits were enabling online dialogue and introducing collaborative processes. The participants felt that the online CoP struggled with providing a sense of common purpose and did not have an impact on increasing efficiency and effectiveness. The participants felt that having a face-to-face element may help in building a more efficient CoP. The peripheral participants reflected on the role they played. One participant stated that they "lurked. I openly admit to lurking. I did read most of what was put on there, but no, I did not put anything up there". The literature reports on the different levels of CoP participation (Wenger et al., 2002). For this trial online CoP the levels of participation were consistent with the literature findings (refer to Table IX).

The Syllk model had a positive influence (refer to Table X) on the organisation capability of an online CoP. The participants emphasised that the barriers identified in Table I be real barriers to making a CoP function. The Syllk model *people* elements of learning, culture and social were highlighted as the most critical elements to align and get right for this organisation. A key outcome supported by the literature was the need to have the human (face-to-face) interface as part of a CoP, just having an electronic medium will not enable effective knowledge sharing CoPs (Hildreth et al., 2000).

Table VIII.

Cycle 2 – Dependent variables (Outcome measures)

Dependent variables	Expectations	Evidence through reflection	Met Expectations
Captured organisational memory	Increase	What I did is create pages and then put in the documentation, which I intended for other people to come in and to add their content. So, just the content evolves rather than just starting a forum where you have to read through all these messages, and after the forum gets too long, you cannot be bothered reading all those messages. It should just be a page that you can go and get the authoritative source of whatever it is that it is about.	Yes
		I though that the concept is ... very good. If one has ... developed a process when you have a difficult task, then you can share it with people and people can give feedback.	Yes
		I would want that tool to be a quick reference that I can just go and read a page about something and then I know what was written, rather than having to read all these posts and follow a conversation. I do not want to read a conversation. I just want to read the summary.	Partial
Benefits	Increase	Connect staff and increase trust between staff	Partial
		Enable online dialogue	Yes
		Stimulate learning	Partial
		Provide a shared context - sense of common purpose among staff	No
		Promote a knowledge sharing culture	Partial
		Generate new knowledge and access to new knowledge	Partial
		Introduce collaborative processes	Yes
		Cut through geographical barriers	Partial
		Increase efficiency and effectiveness	No
		Add value to professional lives	Partial
		Increase capability	Partial
		Reduce organisational costs	Partial

Table IX.

Cycle 2 – Dependent variables (System measures)

System measures (Dependent variables)	Activity	AAR 2	Participation levels Wenger et al. (2002)
Number of members	Participants	25	
Ratio of number of members to number of contributors (conversion rate)	Participants (core)	3 (12%)	10-15%
	Participants (active)	6 (24%)	15-20%
	Participants (peripheral)	16 (75%)	65-75%
Number of contributions	New page created	23	
	Page updated	28	
	Comment	56	

Table X.

Cycle 2 – Syllk model impact on capability of online CoP

Syllk model	Expectations	Evidence through reflection	Met Expectations
Syllk model impacts:		Time constraint, completing priorities, different levels of knowledge … all these things are the real barriers to making a community of practice work.	
Learning		It is the human touch that is important, where you identify certain people that have the same interests. You go and have a coffee, you see the body language, and you see the enthusiasm, or you do not see enthusiasm. You know, all of those things send a message that it not easily translated in this electronic medium.	
Culture	Positive influence		Yes
Social		It is learning a new way of doing things ... it is taking what you would normally do, have a hallway conversation, and try to turn that into something else. So that changes like any other change, it needs to be managed and have champions and leaders and pushers and followers.	

5.6. Step 6) Exit

The trial online CoP duration was planned to operate for a six-month period (Figure 3). At the end of the six-months, the research component came to an end and exited the action research cycle. The organisation continued to evaluate the benefits on the online CoP.

6. Discussion

The findings are now considered with reference to the research question. Limitations of this research study are noted, and the implications for further research are also provided.

6.1. Conceptually wiring an organisation for the capability of online CoP

During the reflection stages of the action research cycles, it was identified that the facilitators and barriers of the Syllk model need to be well understood and managed for effectively wiring (distributing know-how) the organisation for the capability of an online CoP. Understanding organisational facilitators and barriers and the associated KM practices and tools offers an opportunity to reflect and learn from past experiences (Kotnour and Vergopia, 2005).

The findings from the action research provide a case that an organisation can be wired for an online CoP. Figure 4 is an example of how the Syllk model can enable management to conceptualise how an online CoP is distributed across the organisation. The highlighted knowledge variables of the Syllk model elements shown in Figure 4 were found to be the most influential for the organisation participating in the action research.

The online CoP know-how commences with learning where expertise and experience skills come together. The knowledge or skill of sharing expertise and experience is in the heads and gestures of employees, and those who have the skill should be acknowledged, identified and encourage to share their learnings on an online CoP. Knowledge needs to be collected somewhere, if not at an online CoP then in manuals and documents and then referenced in the online CoP. For one to be good at an online CoP, we need an effective organisation culture. An online CoP culture needs to be seen and felt across the organisation. This comes through in the conversations (and actions) from leaders as they demonstrate that they believe an online CoP is important, and they fund (within reason) activities that enable it. Having a strong CoP link to organisational objectives will improve communications by creating more opportunities for leaders to connect with their teams, strengthen communication networks and increase employee consultation. The cultural message is, we

think there is significant value in sharing knowledge and exchanging ideas about our experiences, and we are going to make time for that activity and build communities. Social is where the organisation invests in socialising structures and promoting conversation that enables an online CoP to take place. An online CoP forum is not going to just happen; it requires all the other elements to align and work together.

Technology is needed to help facilitate the online CoP know-how and in this organisation, a website portal met the needs. Technology provides an online CoP home, a communication medium, links to process/templates, links to where know-how can be found in the organisation. Training into how to use the online CoP is important to have in place. The process helps to embed knowledge management through governance initiatives and the provision of a framework, process and templates. Having the infrastructure in place enables and facilitates open and frank knowledge sharing. Without high-quality intranet accessibility and availability, the online CoP sharing medium will be affected.

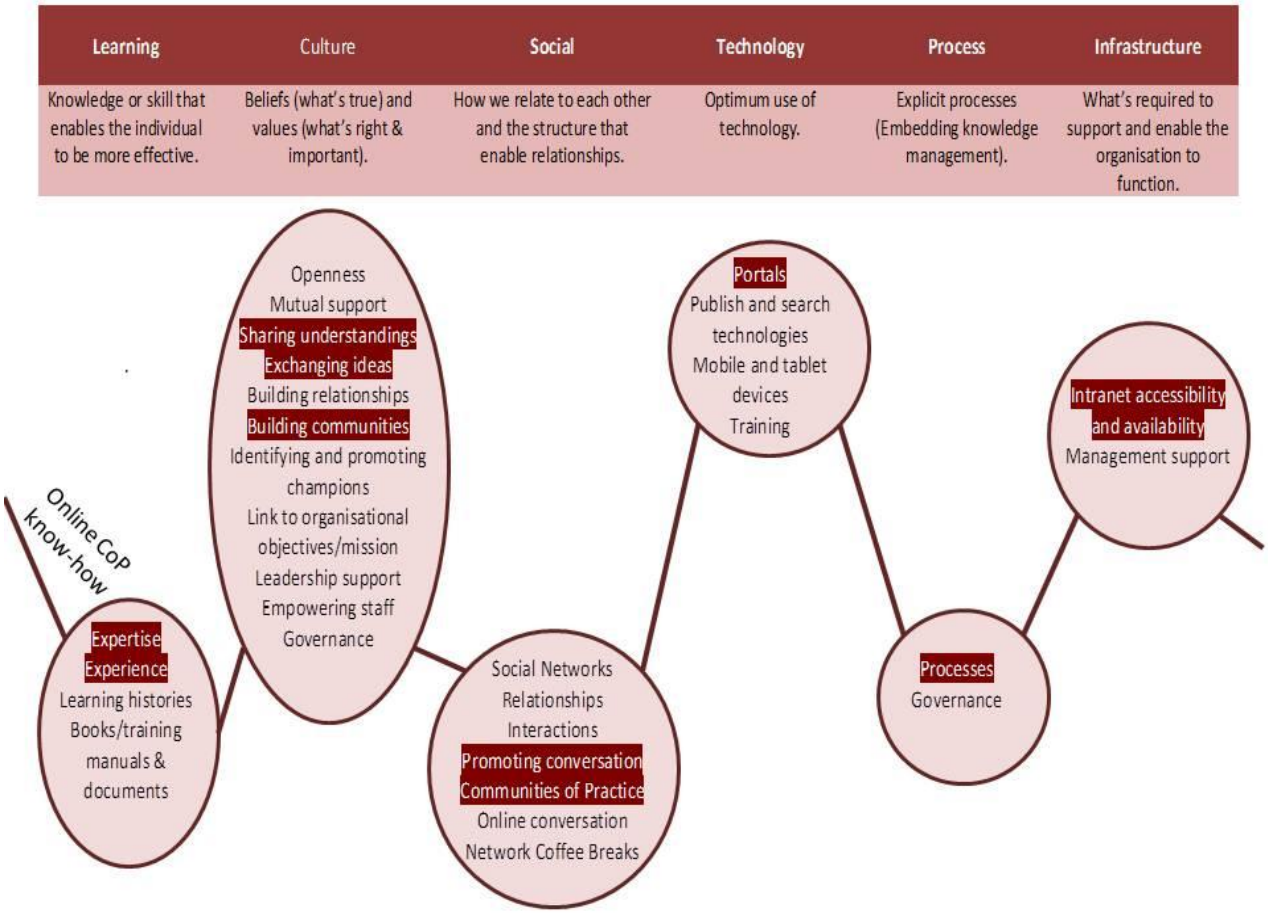


Figure 4. A Syllk model for the capability of an online CoP

The action research outcomes showed that an organisation is not a simple structure but rather a complex interconnected web (through the Syllk elements) of people and systems (Pässilä et al., 2013). For this organisation, the *people* elements of learning, culture and social had the most variables and needed a strong focus to align the elements to facilitate effective know-how. Additionally, Jassbi et al. (2015) recently highlighted that there are few studies dealing with the effect of organisational variables on CoPs. The outcomes of this action research contribute to the organisational CoP literature.

For a project organisation, the holding of regular or periodical CoP meetings, CoP network meetings promoting conversations and special interest groups will benefit how an organisation learns. There might also be other structures such as lunch and learn sessions (lunch box talks), or technical x-change forums (Duffield, 2015). From a project delivery capability perspective, the application of the Syllk model across the organisation enables the knowledge know-how that is wired across various people and system elements of an organisation for knowledge/lessons learned. This can lead to the development and application of new knowledge, improving project management and business activities (Association for Project Management, 2012; Duffield, 2015; Kotnour and Vergopia, 2005).

6.2. Limitations and challenges

Greenwood and Levin (2007, p. 63) highlight that "credibility-validity of action research knowledge is measured according to whether actions that arise from the research solve problems (workability) and increase participants' control over their situations". For this research project, action research was conducted in an organisational context and was met with external constraints that impacted the ability to resolve some of the problems being addressed. According to Greenwood and Levin (2007), they argue that in such a situation it would be harsh to conclude the action research project lacked credibility or validity if it is shown that learning had taken place in some form and that stakeholders were willing to accept and act on the collectively arrived at results.

Action research is often criticised as merely being consulting rather than research and that it lacks rigour (Baskerville and Wood-Harper, 1996; Coughlan and Coghlan, 2002). Coughlan and Coghlan (2002) highlights that consultants typically work under tighter time and budget constraints and is frequently linear (engage, analyse, act and disengage) where action research is cyclical (gathering data, feeding it back to those

concerned, analysing the data, planning, taking action and reflecting, leading to further cycles). The dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) where the action research cycles apply to both the project of interest (trial online CoP project) and the research (Syllk model application) was chosen for this research project to address potential consultant and rigour issues.

6.3. Implications for research and practice

The findings from this research form a sound structure for future research studies based on the application of the Syllk model for other capabilities. This research supports the premise that to successfully manage projects and day to day business activities the learning process is challenged by many barriers. Future research themes could focus on how to use the Syllk model to conceptualise the wiring of an organisation for any knowledge capability. The paper demonstrates that action research can benefit project management and KM researchers and practitioners.

7. Conclusion

The research highlights the importance in understanding organisational knowledge facilitators and barriers and the associated KM practices to understand how well they support or hinder learning lessons. For this organisation, the *people* elements of learning, culture and social had the most variables and needed a strong focus to align the elements to facilitate effective know-how. This study shows how the Syllk model enables management to conceptualise how organisational know-how for an online CoP is wired (distributed) across various people and system elements of an organisation. This study has established that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence organisational knowledge and lessons learned using an online CoP. Finally, the findings contribute to the organisational knowledge management literature for researchers and practitioners and provide an opportunity to improve organisational knowledge through the application of the Syllk model in wiring an organisation for (knowledge, lessons learned) online CoP capability.

Conflict of interest

There is no conflict of interest.

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