UNIVERSITY OF SOUTHERN QUEENSLAND

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An advanced systemic lesson learned knowledge model for
project organisations

A Thesis submitted by

Stephen Mark Duffield

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ABSTRACT

The research study described in this thesis was inspired by many years as a project manager, watching the failure of organisation projects, and the lessons learned. This led to the research idea of how can the lessons learned enable organisations to learn from past project experiences to drive continuous improvement.

The thesis is based on five published publications that collectively make a significant contribution to knowledge of the development of the Systemic Lessons Learned Knowledge (Syllk) model (Paper One) and application of the Syllk model (Papers Two, Three and Four) and the research methodology (Paper Five). I have applied an action research study which addressed the dual imperatives of both the research and problem solving by using a series of action research cycles on three separate projects.

The research method consisted of multiple spiral action research cycles. I have demonstrated how to apply the Syllk model to enable the organisations to disseminate and apply knowledge/lessons learned. The initial planning stage consisted of interviews, followed by focus groups, to identify the facilitators and barriers that impact upon 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. Initiatives were implemented, and actions were observed, monitored, and then evaluated after a period of reflection using an after-action review process. The results from this research showed how knowledge capability can be wired (distributed) across organisational systems (capability networked) and how the Syllk model can be used to conceptually facilitate this.

The research study described in this thesis provides insights into how an organisation learns and how it can be effectively wired to acquire and accumulate knowledge, including from lessons learned. The thesis highlights that the variables of the Syllk model (learning, culture, social, technology, process and infrastructure) were found to be the most dynamic and influential for the organisation participating in the action research. The action research outcomes showed that an organisation is not a simple structure, but rather, a complex interweaving and coupling (capability network) of the Syllk elements of people and systems. Processes in the organisation need to align with the elements of the Syllk model. Using action research is one possible way forward. One needs to understand how the organisation is wired for knowledge and lessons learned.

The findings from this research form a sound structure for future research studies based on the application of the Syllk model. This research supports the premise that to successfully manage projects and day-to-day business activities, the learning process is challenged by many barriers. The thesis demonstrates that action research can benefit project management and knowledge management researchers and practitioners.

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

CERTIFICATION OF THESIS

This thesis is entirely the work of Stephen Mark Duffield except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Student and supervisors signatures of endorsement are held at USQ.

"Those that fail to learn from history are doomed to repeat it."

Winston Churchill (1874 – 1965)

To my family and close friends

Robyn, Shawn, Kitty, Elise and others

for their unconditional love, care and support.

Parkinson's hope symbol

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Towards the end of the research journey, I was diagnosed with Parkinson's. The support I received from everyone helped to maintain a focus on completing the work. A special thank you to my wife Robyn who helped me transition into a life of living with Parkinson's while she was also dealing with the daily struggles of the chronic autoimmune disease of Lupus.

PUBLICATIONS CONTAINED IN THIS THESIS

Journal articles

Duffield, S., Whitty, S.J., (2015b). Developing a systemic lessons learned knowledge model for organisational learning through projects. International Journal of Project Management, vol. 33, no. 2, pp. 311-324.

Duffield, S., Whitty, S.J., (2016a). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. International Journal of Project Management, vol. 34, no. 3, pp. 429-443.

Duffield, S., (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE Journal of Information and Knowledge Management Systems, vol. 46, no. 2, pp. 267-294.

Duffield, S., Whitty, S.J., (2016b). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. International Journal of Project Management, vol. 34, no. 7, pp. 1280-1293

Duffield, S., (Forthcoming, 2017). Using Action Research in Practice: Useful Insights and Outcomes. ALAR: Action Learning and Action Research Journal, vol. 23, no. 1.

Book chapters

Duffield, S., (Forthcoming, 2017). Knowledge Management and Lessons Learned, in RA Group. & L Bowman (eds), *Project Controls Drumbeat*, First, Taylor and Francis Group, United Kingdom, ch 12.

Conference Papers

Duffield, S., Whitty, S.J., (2012). A systemic lessons learned and captured knowledge (SLLCK) model for project organizations., in: PMglobal (Ed.), 9th Project Management Australia Conference (PMOz 2012), Melbourne, Australia.

van der Hoorn, B, Duffield, S & Whitty, SJ (forthcoming, 2016). 'A 'lived experienced' tool for managing and building project delivery capability ', in ANZAM *proceedings of the ANZAM* Brisbane 6-9 December 2016.

PUBLICATIONS AND PRESENTATIONS ARISING FROM THIS THESIS

Since this research began, and as journal articles and conference Papers were published, the Syllk model has become recognised and acknowledged in various media formats and citations. To follow are lists of those to date:

Conference Papers

Duffield, S., (2015b). Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects, Australian Institute of Project Management National 2015 Conference. AIPM, 978-0-646-93699-4, Hobart

Conference/Congress/Symposium presentations

Duffield, S., (2015a). Application of a Systemic Lessons Learned Knowledge model for organisational learning through projects, Knowledge Management Australia 2015. Ark Group, Melbourne, 4-6 August 2015.

Duffield, S., (2015b). Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects, Australian Institute of Project Management National 2015 Conference. AIPM, 978-0-646-93699-4, Hobart.

Poster presentations

Duffield, S., (2013). An advanced systemic lesson learned and captured knowledge model for project organisations. Poster presented at the USQ Research Colloquia and Showcase conference, conducted 12-13 June 2013, Springfield, Qld, Australia.

Duffield, S., Whitty, S., (2015a). Organisations - Wiring for Capability (Poster presentation), AIPM 2015, Hobart.

Application and impact of the Syllk model

PM Lessons Learned Blog: A research blog on Project Management Lessons Learned and Knowledge Management: The home of the Systemic Lessons Learned Knowledge (Syllk) model.
www.pmlessonslearned.info
www.syllk.info

Whitty (2015): Executive Insights - Powering up your capability with the Syllk Model
https://www.youtube.com/watch?v=snIStgmXVPY

The Syllk Model: Wiring Organisations for Capability (know-how)
https://www.youtube.com/watch?v=sX65v_mz24g

Truly Reconceptualising Project Knowledge Management
https://www.youtube.com/watch?v=6cGq7rKCuSE

Managing knowledge in project environments; 5th December 2012 (UK APM Knowledge SIG)
https://storify.com/mik0ton/managing-knowledge-in-project-environments
https://www.apm.org.uk/news/managing-knowledge-project-environments

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LIST OF ABBREVIATIONS

AAR	After Action Reviews
ALARA	Action Learning Action Research Association
ALARj	Action Learning Action Research Journal
AM	Asset Management
APM	Association for Project Management [UK]
APQC	American Productivity and Quality Center
BP	British Petroleum
BPE	Building Performance Evaluation
CHAMPS	Champions of Change team
CMMI	Capability Maturity Model Integration
CF	Consent Form
CP	Capital Projects
CoP	Community of Practice
DARPA	Defense Advanced Research Projects Agency
DIKW	Data, Information, Knowledge and Wisdom model
ERA	Excellence in Research for Australia
EQ	Emotional Intelligence
FBC	[NASA] Faster, Better, Cheaper project
HR	Human Resources
ICT	Information and Communications Technology
ISO	International Organization for Standardization
IT	Information Technology
KLC	Knowledge Life Cycle
KM	Knowledge Management
LL	Lessons Learned
LLIS	[NASA] Lesson Learned Information System
LT	Leadership Team
NASA	National Aeronautics and Space Administration
NHS	National Health Service [England]
NVivo	NVivo is software that supports qualitative and mixed methods research
OGC	Office of the Government Commerce
OLM	Organisational Learning Mechanisms
P3M3	Portfolio, Program & Project Management Maturity
PADS	Performance Appraisal and Development
PDCA	Plan-Do-Check-Act
PC	People Culture [Syllk model]
PIS	Participant Information Sheet
PL	People Learning [Syllk model]
PMBOK®	A Guide to the Project Management Body of Knowledge
PMI	Project Management Institute

PMO   Project Management Office
PRINCE2   Projects In Controlled Environments, version 2
PS   People Social [Syllk model]
P.S.   Positivist approach to Science
QUAL   Qualitative
QUAN   Quantitative
RQ   Research Question
SECI   Socialization, Externalization, Combination, Internalization model of knowledge dimensions
SI   Systems Infrastructure [Syllk model]
SIG   Special Interest Group
SLLCK   Systemic lessons learned and captured knowledge model
SP   Systems Process [Syllk model]
Syllk   Systemic Lessons Learned Knowledge model
TNKM   The New Knowledge Management
TQM   Total Quality Management
USQ   University of Southern Queensland
VINE   Journal of Information and Knowledge Management Systems

1. INTRODUCTION

This thesis proposes that there is a need for a conceptual model for project organisations that clearly articulates how lessons from past project experiences can be embedded in organisational artefacts, processes, practices, and culture. 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; Li 2002, p. 585; Ministry of Defence 2010; Office of Inspector General 2012; Shergold 2015). In practice, organisational learning from projects rarely happens, and when it does it fails to deliver the intended results (Atkinson, Crawford & Ward 2006; Kerzner 2009; Klakegg et al. 2010; Milton 2010; Schindler & Eppler 2003; Shergold 2015; Williams 2008).

1.1. Background to the research

The inspiration for this thesis came about through many years as a project manager watching the failure to capture and apply lessons learned by organisations and from projects. There were some good and bad experiences, however, they were rarely captured and used by others. We often repeated the same task or behaviour without making use of the existing organisational knowledge to make improvements. For organisations to manage their knowledge and learn from lessons, we need to find a better way.

The early phase of the research commenced as part of a Master of Project Management with the University of Southern Queensland. The outcomes of the initial pre-doctoral research project identified and derived a systemic lessons learned and captured knowledge (SLLCK) model (Duffield & Whitty 2012) (Appendix A - 11.1.3).

1.2. Scope and research setting

This thesis demonstrates the development and application of a conceptual model, hereafter referred to as the Systemic Lessons Learned Knowledge model or Syllk (pronounced Silk) model, which is a variation of Reasons (1997, 2000) Swiss cheese model (Duffield & Whitty 2012; Duffield & Whitty 2015b). 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 projects and day to day business delivery performance (Duffield & Whitty 2015b).

The research in this thesis was limited to sampling of problem-solving projects that comprised of three public sector projects conducted by Australian state and federal government departments and agencies from late 2012 through to late 2015. I came close to working with three private sector organisations (mining information technology, health project management office, and an enterprise resource software company). The timing of the study became an issue for all three organisations. The organisations at the centre of this research program will be known

as Project A, Project B and Project C. Alias names for the organisations will be used in this thesis to protect the confidentiality of the participants (Walker & Haslett 2005).

Project A took place at a Branch of a large division of an Australian government organisation. The Branch is responsible for leading and coordinating state-wide infrastructure planning and delivery while ensuring that the life of built assets is optimised to deliver the infrastructure investment program. The Branch consists of the designing and building of infrastructure, asset and property services, and portfolio and investment units, and has approximately 160 staff. The Branch manages a sizable number of projects. The most significant and complex are approximately 200 capital projects with project budgets ranging from approximately A$1 million to A$1.7 billion. Currently, there is no consistent knowledge management (KM) framework utilised to manage the knowledge gathered during the planning, design, and delivery of these capital projects, including lessons learned. This lack of a consistent framework extends across all Branch projects. Following a P3M3 (Portfolio, Program and Project Management Maturity) assessment, the Branch leadership team acknowledged a need to develop a KM framework. The KM framework would provide support to their officers managing projects, utilise the knowledge gathered from experience and included lessons learned to improve their project processes and outcomes. The business improvement director of the Branch approached me to apply the Syllk model and assist the Branch (through research) in the implementation of a KM project to develop and implement a KM framework. The '(Branch) KM project' was endorsed by executive management in June 2013. The overall duration of the research and KM project was two years and four months (February 2013 to June 2015). The publications that came directly out of this research project are Duffield and Whitty (2016b), Duffield (2015b) and Duffield (Forthcoming, 2017).

Project B took place at a large division of an Australian government organisation. The division identified a commitment plan to develop productive partnerships, share learnings and project knowledge. A change management program (Champions of Change program) was implemented with a focus on storytelling, embracing improvement, while thinking laterally and trialling new methods. The division identified that the intervention and implementation of the Syllk model would benefit the organisation, and consequently, the action research study was endorsed by executive management in September 2013. The storytelling project duration was for 12 months. The publications that came directly out of this research project are Duffield and Whitty (2016a) and Duffield (Forthcoming, 2017).

Project C took place in an Australian government organisation. The organisation's KM steering committee approved the trial of an online Community of Practice (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. The publications that came directly out of this research project are Duffield (2016) and Duffield (Forthcoming, 2017).

1.3. Research problem

There is a general trend of project organisations failing to learn from their past experiences, while at the same time, being surrounded by lessons learned models and guides, and opinions on how to apply them (Brouwer 2011; Schindler & Eppler 2003; Shergold 2015). There has been significant spending on knowledge management (KM) initiatives (Ajmal, Helo & Kekäle 2010). However, many organisations lack the expertise and fail to learn from past projects and often are found to be reinventing the wheel (Ajmal, Helo & Kekäle 2010).

Cultural and social factors can be both a problem and solution to organisational learning (Duhon & Elias 2008). We have a need for a new paradigm for organisational learning that conceptualises and articulates how organisational capability (know-how) about successful project delivery is in practice distributed across and networked or interconnected to areas of the organisation (Duhon & Elias 2008; Wideman 2011). There is a need for a model (Syllk capability network diagrams) to show management the wiring (distributing capability (know-how)) of an organisation for the capability of KM and lessons learned.

1.3.1. General trend in failing to learn from projects

Milton (2010) highlights a significant dissatisfaction with project lessons learned processes. Lessons from projects might be identified, but not many are learned when it comes to picking up on early warning signs in problem projects (Klakegg et al. 2010). Out of 74 organisations that attempted lessons learned processes, 60 per cent were dissatisfied (Milton 2010). In another study, 62 percent of 522 project practitioners responded that they had a process for learning lessons, and of that only 11.7 per cent followed the process (Williams 2007). Furthermore, while the lessons learned process is popular, it fails to deliver the intended results as lessons are identified and are often not followed through and integrated into the organisation (O'Dell & Hubert 2011).

The problem of KM and the importance of capturing lessons learned and applying those learnings to drive continuous improvement, is growing with the increase in organisational complexity and the quantity of information and data that flows within and between these organisations (de Vasconcelos & Rocha 2016). Large institutions such as NASA have issues with the capturing and application of lessons learned from projects (Office of Inspector General 2012). Following reviews in 2000 of NASA's Mars Program, the Space Shuttle wiring problems, and the implementation of NASAs Faster, Better, Cheaper (FBC) project, NASA implemented action plans to improve sharing of experiences and lessons learned (Keegan & Griner 2000; Li 2002). In 2002 the Government Accountability Office found that NASA's lessons learned were not routinely identified, reviewed and accessed by project managers (Li 2002). A recent 2012 NASA Office of Inspector General audit report highlights that NASA project managers are still not routinely using the lessons learned information system (LLIS) to contribute new information or to search for lessons learned identified by others (Office of Inspector General 2012).

Other renowned institutions have similar issues with the capture and application of lessons learned. A review of the BP Deepwater Horizon accident investigation revealed how lessons learned from previous "well controlled event incidents" and "lines of communication" were not acknowledged or addressed and this was a contributing cause of the failure (BP 2010; Cleveland 2011). NASA today uses the BP Deepwater Horizon incident as a 'lessons learned' case study, paying particular attention to communication deficiencies around government oversight, disregarding of data, testing, changes to the process, safety culture and lessons learned from previous incidents (NASA 2011a).

There are also few signs that lessons are being learned from public sector projects. For example, the Australian State Victorian Government Ombudsman examined ten major ICT business transformation projects during 2011 and "identified that despite the extensive guidance, reports and literature available, agencies are still making the same mistakes around planning, governance, project management and procurement" (Brouwer 2011, p. 3). The Queensland Health Payroll System Commission of Inquiry highlighted that problems from the Queensland Health payroll project (the worst failure of public administration in Australia) "were known to be ones not uncommon in large government projects of this kind. The neglect of them, in this case, is cause to think it is likely the lessons will again be ignored" (Chesterman 2013, p. 219). Recently the Australian Government delivered a *learning from failure* report highlighting why large government policy initiatives have gone so badly wrong in the past and how the chances of success in the future can be improved (Shergold 2015).

1.3.2. Not for the want of opinions, guides, and models on lessons learned

Generally speaking, there are many opinions and guides, but little practical advice regarding workable processes that effectively enable the organisation to learn from past project experiences. The importance of capturing and applying lessons learned is highlighted in various project management guides, standards, methodologies and maturity models. Lindner and Wald (2011) note a gap in project management practice, identifying a need for more research in understanding the role knowledge management has in lessons learned.

Reich and Wee (2006) report an extensive review of how knowledge management practices are embedded within the 3rd edition PMBOK® Guide (Project Management Institute 2004). Table 1-1 highlights the changes over the last 30 years of how the term lessons learned has been referenced and used with all versions (up to 6th edition) of the PMBOK® Guide. The PMBOK® Guide 4th edition is focused on process improvement as a result of lessons learned (Project Management Institute 2008a). However, in the PMBOK® Guide 4th and 5th editions (2008b, 2013) the 'lessons learned' process is not discussed anywhere except for a glossary description and both versions refer to a different description of what is a lesson learned.

PMBOK® Guide 5th Edition (2013) has an additional twenty-two lesson learned references (mainly due to a new knowledge area – Stakeholder Management) and remains focussed on project closure lesson learned activities. The PMBOK® Guide 5th edition also aligns with the KM Data, Information, Knowledge and Wisdom (DIKW) model. However, the DIKW model which is based on the work of Ackoff (1989) has been challenged by the KM community as "unsound and methodologically undesirable" (Frické 2009, p. 1; Rowley 2007; Vala-Webb 2012).

Up until the PMBOK® Guide 6th edition, there has been a disregard to KM processes and lessons learned methods. The exposure draft version of PMBOK® Guide 6th edition is proposing a new process "Manage Project Knowledge" (Project Management Institute 2016, p. line reference 1213):

Manage Project Knowledge is the process of using existing knowledge and creating new knowledge to achieve the project's objectives and contribute to organizational learning. The key benefit of this process is that existing knowledge and new knowledge are used in the project and knowledge created by the project is available to support organizational operations and future projects or phases.

I have provided review comments to the PMI (some have been accepted with modification), and my initial observation of this new process is that this would appear to be a significant step in the right direction as KM is more than lessons learned.

Table 1-1 PMBOK® Guide lessons learned analysis

Title	Year	Edition	Results
The Project Management Body of Knowledge	1987	1987	Wideman sets out the criteria for a PMBOK (Wideman, 1995). Discussion on establishing legislated or *de facto* standards. The guide is essentially a glossary of terms.
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	1996	1996	(21 results of Lesson Learned) The term lessons learned is reference in the knowledge areas of Integration (Communications), Scope, Schedule and Cost. The use of lessons learned is focused on the cause of variances and other lessons learned and that they should be documented in a historical database for both the current project and other projects within the organisation. The guide also notes that the objective of a quality audit is to identify lessons learned.
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	2000	2000	(29 results of Lessons Learned) Added the term "lessons learnt" to its glossary and now includes lessons learned in Risk Management.
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	2004	3rd Edition	(62 results of Lessons Learned) A focus on Organizational corporate knowledge base. Significant change in the way the Guide dealt with the concept of Project-based Learning through the use of the Lessons Learned object. The Guide has placed importance on collecting and using Lessons Learned throughout the life cycle of the project (Reich and Wee, 2006). Glossary includes "lessons learned", since it appears as an output of the work of each knowledge area (Wideman, 2005).
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	2008	4th Edition	(54 results of Lessons Learned) Additional focus on process improvement as a result of lessons learned.
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	2013	5th Edition	(78 results of Lessons Learned) Additional 22 references (mainly due to a new knowledge area – Stakeholder Management) and remains focussed on project closure lesson learned activities. The 5th edition also aligns with the Data, Information, Knowledge and Wisdom (DIKW) model.
A Guide to the Project Management Body of Knowledge (PMBOK Guide)	TBA *2017*	6th Edition	New process *Manage Project Knowledge* is part of the Executing Process Group and Project Integration Management knowledge area. "Manage Project Knowledge is the process of using existing knowledge and creating new knowledge to achieve the project's objectives and contribute to organizational learning. The inputs and outputs of this process are depicted below." (Project Management Institute, 2016)

Reich and Wee (2006) suggest that the PMBOK® Guide is an explicit knowledge document with a focus on creating and using explicit knowledge. The PMBOK® Guide is process focused on "*what*" and "*how*" to do the process, and silent on the "*why*" to do a process. Reich and Wee (2006) also provide alignment of the PMBOK® Guide with the Nonaka SECI model and note that there is a strong emphasis on externalisation and combination elements. Reich and Wee (2006, p. 24) recommend that "the PMBOK® Guide becomes transformed into a true knowledge guide - both imparting and recognizing the knowledge needed to complete projects successfully".

Jugdev (2012) states that the PMBOK® Guide uses lessons learned terminologies, such as audits; best practices; organisational process assets; and lessons learned. Jugdev (2012, p. 19) recommends that "practitioners should not accept the PMBOK® Guide at face value. The guide has value as just that, a systematic guide".

Jugdev (2012, p. 19) argues that it be "incumbent on both researchers and practitioners to understand lessons learned as ways of mobilizing (constructing and sharing) valuable project knowledge in more than concrete ways (such as through meetings)". The PMBOK® Guide is very "mechanistic and rigid when, in essence, lessons learned, learning and knowledge are more organic and fluid. Knowledge changes and it circulates. Knowledge goes beyond being transmitted or transferred" and is also about workplace learning, situated learning as applied to KM and lessons learned (Jugdev 2012, p. 19).

Organisations are also not to be found wanting for lessons learned models and methods. The Project Management Institutes' OPM3 Organizational Project Management Maturity Model (Project Management Institute 2008b) references lessons learned. However, there is less guidance than that provided in the PMBOK® Guide. The Association for Project Management (APM) Body of Knowledge 6th Edition (Association for Project Management 2012) refers to knowledge management as the governance process rather than identification of the specific process around lessons learned. The APM Body of Knowledge 6th Edition highlights the importance of people skills (communities of practice, learning and development) and delivery of information management (Association for Project Management 2012). The Office of Government Commerce PRINCE2® project methodology encourages project teams to "...learn from previous experience: lessons are sought, recorded and acted upon throughout the life of the project" (OGC 2009, p. 12). PRINCE2® has a single process (a lessons learned log) for recording lessons learned and reporting on them (lessons learned report) (OGC 2009).

The Capability Maturity Model Integration (CMMI) model which provides for best practice organisational process improvement (Chrissis, Konrad & Shrum 2003) highlights that process improvement proposals and process lessons learned are key work products and sub-processes. Midha (2005) has discussed the benefits of CMMI and identifies the classic approach of collecting and translating key lessons into processes. In addition, Von Zedtwitz (2002) has developed a capability model for post-project reviews based on the standard five-stage capability model.

The last guide to consider would be the recent changes to the ISO 9001:2015(E) Quality management systems – requirements (ISO 2015) standard. KM and lessons learned have typically been highlighted in project management bodies of knowledge (PMBOK® Guide, APM Body of Knowledge and PRINCE2®).

With the release of ISO 9001:2015(E) there is now a global requirement, for quality management on *organisational knowledge* (ISO 2015 p. 7):

> 7.1.6 Organizational knowledge
> The organization shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services.
> This knowledge shall be maintained and be made available to the extent necessary.
> When addressing changing needs and trends, the organization shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates.
> NOTE 1 Organizational knowledge is knowledge specific to the organization; it is generally gained by experience. It is information that is used and shared to achieve the organization's objectives.
> NOTE 2 Organizational knowledge can be based on:
> a)   internal sources (e.g. intellectual property; knowledge gained from experience; lessons learned from failures and successful projects; capturing and sharing undocumented knowledge and experience; the results of improvements in processes, products and services);
> b)   external sources (e.g. standards; academia; conferences; gathering knowledge from customers or external providers).

The focus of the ISO Standard is to manage the knowledge maintained by an organisation. The Standard identifies that an organisation needs to safeguard for loss of knowledge (through staff turnover, failure to capture and share knowledge), and to ensure an organisation acquires knowledge (learning from experience, mentoring and benchmarking) (ISO 2015).

However, whilst there are many models and methods to choose from, much of the literature re-enforces the point that *people factors* influence the success of the lessons learned process. A learning organisation culture is critical to successful dissemination of lessons learned (Andriessen & Fahlbruch 2004; Fernie et al. 2003; Leistner 2010; Sense 2007).

1.3.3. People factors – both a problem and solution to lessons learned

There is no doubt major challenges exist to get employees to participate, access, and re-use the captured knowledge (Milton 2005; O'Dell, Grayson & Essaides 1998; O'Dell & Hubert 2011). Duhon and Elias (2008) reports that failure of learning valuable lessons from projects can be connected to the learning, cultural, and social people factors (Hartmann & Dorée 2015). Learning in organisations is very much a social, not a solitary, phenomenon (Hartmann & Dorée 2015; Simon 1991). What an individual learns in an organisation is very much dependent on what is already known to (or believed by) other members of the organisation and what kinds of information are present in the organisational environment. Knowledge is also affected by social and intellectual credibility (Blackman & Henderson 2001). However, what causes the problem is that project managers are "people-oriented, free-thinkers, passionate, autocratic, conservative and pragmatic" and in most cases, these behaviours can hinder organisational cross-project sharing of lessons learned and knowledge integration (Pemsel & Wiewiora 2013, p. 41).

Furthermore, from the collective point of view, project teams often know when they are in trouble. However, they take no or minimal effort to resolve errors as owning up to failure may cause shame (Von Zedtwitz 2002). A protective post-lessons learned attitude weakens the process and hides the real problems of the

project (Duhon & Elias 2008). When a problem is recognised, teams are biased in favour of learning the least-threatening lessons. Duhon and Elias (2008) argue that all in an industry sector should be learning from the mistakes of others and that we typically view others as substandard to us and do not believe we can learn from them. Therefore, it is often hard to obtain correct and relevant information on what went wrong.

Social and cultural factors also provide solutions to organisational learning. Of the number of methods used to disseminate lessons learned, two are of particular interest: namely; process-based methods and social-based methods. Process-based methods are those lessons learned where the knowledge is reflected in an organisations policies, processes, and procedures (Garon 2006; Keegan & Turner 2001; Midha 2005; O'Dell & Grayson 1997; Schindler & Eppler 2003; Williams 2007). Moreover, social based methodologies are those lessons learned that are not easy to break up and transfer knowledge from one person to another (Bresnen et al. 2003; Fernie et al. 2003). As Fernie et al. (2003) points out, knowledge sharing is best performed through the communication of individuals. Two clearly identifiable social-based processes that appear successful are networking and mentoring (Bresnen et al. 2003; Huang & Newell 2003).

1.3.4. Project organisations require a new paradigm for organisational learning through projects

The dissemination and application of lessons learned through projects are critical to organisational programs and projects achieving success (Disterer 2002). Lindner and Wald (2011) point out a gap in project management practice and suggest there is a need for more research in understanding the role KM plays in project management methodologies. Neef (2005) identifies an integrated knowledge and risk management approach where organisations need to capture knowledge as in lessons learned and then apply the knowledge learned using risk management and decisions support system techniques to avoid the mistakes of the past and improve the performance of projects and the organisation. Williams (2008, p. 262 emphasis added) also argues that there be a need for "wider research into how lessons [*from projects*] can be disseminated throughout an organization and incorporated into organizational practice". Moreover, as Wideman (2011, p. 1) puts it:

> Why is it that we do not usually make a good job of capturing lessons learned and past experiences, to say nothing of project management wisdom generally from our elders? I suggest that we have two major challenges: First is that in spite of all the technology that is available to us today, we have not yet found a presentation format that captures the essence of this wisdom in a way that is relevant to future usage, readily searchable and easy to store. That is to say, we need an archive that is user-friendly and commonly accepted.
>
> Secondly, we have a serious cultural problem. With the advertising market continually shouting "new and improved", who wants stuff that is "old hat", "yesteryear" and "when were you born?" Each new generation naturally thinks it knows best, is reluctant to take advice and besides, prefers to make its own mistakes. Isn't it more fun that way, to enjoy a "voyage of discovery"?

Let's face it, didn't we too behave the same way when we started? And this in spite of the fact that the elements of project management were evident at the time of building the great pyramids of Egypt and, for all we know, in building Stone Henge also.

And so, until these two things change, we are probably condemned to continue to throw away the valuable resources that you describe, just as today's society happily discards its recreational toys and gadgets long before they are worn out. Indeed, if it were not so, that could mean that there were a lot fewer projects and our economy in even worse shape than it is now.

1.3.5. Capability networks

The term capability can be best described as project work that is dependent on an individual's or organisation's ability to undertake the activity (van der Hoorn & Whitty 2015). The individual or organisation may lack the capability and will seek a distributed and systemic network to provide the integrated capability.

The term network is used to describe how the component parts of an emergent useful phenomenon are connected together. Two key examples of what are described as complex adaptive networks that are associated with knowledge distribution are human cultures and the human brain (Gabora 1997; Whitty & Maylor 2009). That is to say that knowledge is not to be found stored in some way in one spot, but rather it is distributed across a network of interconnected component parts.

Projects and organisations are often described as complex adaptive systems which evolve through adaptive exploration and the transformation of information (Cooke-Davies et al. 2007; Gabora 1997; Harkema 2003; Williams 1999). Gabora (1997) and Whitty (2005; 2009) both describe the connection of biological structures and cultural ideas and practices and how they evolve through selection and transmission, and the implications for human behaviour within complex adaptive systems such as an organisation.

Kaeshavarz et al. (2010) and Holland (1996) further describe such social complex adaptive systems as comprising individuals and organisations, and as having a distributed network of control rather than a central point of control. Furthermore, Holland (1992, p25) point out how complex adaptive systems rely on "parallelism, competition and recombination" to adapt to new information within a system. Moreover, Bullmore and Sporns (2009) describe the structural and functional makeup of complex networks such as the human brain to comprise nodes, clusters, hubs and module parameters. Human knowledge, therefore, which extends beyond the human brain, is not only stored as interconnected cells within the brain (Bullmore & Sporns 2009; Whitty 2009), but it is also stored across, for example, organisational cultural artefacts, rituals, and practices (Walsh & Ungson 1991), that are also interconnected, or for want of another term – *capability networked*.

1.4. Selection of Research Methodology

The research is positioned where it is aligned to the interpretivist research paradigm (Collis & Hussey 2009; Guba & Lincoln 1994). I reviewed several research methodologies and I found that action research challenges the claims of a positivistic view of knowledge and embraces the concept of knowledge as socially constructed with human interaction (Brydon-Miller, Greenwood & Maguire 2003). I then reviewed a dual cycle approach to solving a problem proposed by McKay and

Marshall (2001) to identify how cycles of problem-solving activity can be incorporated into the research interest. This dual cycle approach highlighted the significant contributions that action research has had on information systems, people, and organisations. 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 & Wood-Harper 1996; Raelin 1998; Susman & Evered 1978; Zuber-Skerritt & Perry 2002).

I have been careful when working with terms like; Participatory action research, Practitioner research, Industrial action research, Action science, Action learning, Soft systems approaches, Participatory research, Collaborative action research, Classroom action research, Problem resolving action research and, Critical participatory action research (Kemmis, McTaggart & Nixon 2014, p.8-12). I have chosen to use the term *action research* for this research program as a general used term, which then allows an interface with the traditional research approach (McNiff & Whitehead 2011).

1.5.   Ethical considerations

This research program was conducted with ethics approval obtained from the University of Southern Queensland Human Research Ethics Committee on 18 March 2013 with the approval number H13REA038. The ethics approval was granted for three years, resulting in an expiry date for this approval of 11 March 2016. A requirement of the ethics approval granted is that participants are provided with a Participant Information Sheet (PIS) describing the nature and objectives of the research, as well as the process of data collection, and a Consent Form (CF) which is to be signed by the participant in agreement to the terms stated in the PIS. Samples of a PIS and CF used for this research program are included in Appendix B and C, respectively.

1.6.   Limitations and delimitations

The research limitations and challenges are documented in each of the five published journal papers. This research program is considered to have two main delimitations. Firstly, the research was limited to sampling of problem-solving projects that comprised of three public sector projects conducted by Australian state and federal government departments and agencies from late 2012 through too late 2015. As previously mentioned, I came close to working with three private organisations. Unfortunately, the timing of the research became an issue for all three organisations. There is now an opportunity to further the research in repeating the research study with private sector projects.

The second delimitation is related to action research. 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). To address the second delimitation, the dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) was applied.

The main limitation of the research program relates to action research methodological issues of workability and credibility-validity. Where "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" (Greenwood and Levin, 2007, p. 63). For each of the research projects, action research was conducted in an organisational context and was occasionally met with external constraints that impacted on the ability to resolve some of the problems being addressed. Issues with the allocation of project resources and organisational changes were experienced in all three projects. 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.

1.7. Thesis outline

The combination of the published journal papers of this thesis (Table 1-2) addresses the primary research problems and associated research questions of the thesis. A statement of authorship and proof of publication (Appendix D) is provided for each paper. Figure 1.1 provides an outline of the thesis. The chapters are a combination of supporting discussion and papers that, at the time of writing, four papers (Papers One, Two, Three and Four) have been published in internationally recognised journals and Paper Five is under review and scheduled for publication in 2017 in an internationally recognised journal.

> **Given that the thesis consists of multiple papers focused on the application of the Syllk model, there is an unavoidable repetition of some of the presented material.**

The thesis consists of 11 chapters:

- The current chapter is the introduction (Chapter 1).

- Chapter 2 presents the literature review supported by a published paper (Paper One). The literature review continues in Papers Two, Three and Four. Chapter 2 also presents an extended literature review ensuring an in-depth understanding of the main existing theories related to the research problem. At the end of chapter 2 is a section on the Syllk model which is also the key outcome of Paper One.

- Chapter 3 presents the thesis research questions.

- Chapter 4 presents the research methodology and the results of managing the action research projects. Chapter 4 is supported by Paper Five, and this includes a summary discussion of the useful insights and implications for action researchers.

Chapters 5, 6, and 7 comprise the body of the thesis and support the results and discussions of published Papers Two, Three and Four (respectively). Each of the following chapters briefly describes the project background and highlights any extended literature review and supporting data contained in the associated appendix:

- Chapter 5 has a focus on the application of the Syllk model for organisational learning through projects (Paper Two, Appendix E).

- Chapter 6 has a focus on the application of the Syllk model for storytelling (Paper Three, Appendix F).

- Chapter 7 has a focus on the application of the Syllk model for an online community of practice (Paper Four, Appendix G).

Chapter 8 summarises the overall discussion of the research findings and discussion of the research questions followed by the implications for research and practice.

Chapter 9 provides the conclusions from the research and also presents the academic contribution, the significance of research and a discussion on further research.

Chapters 10 covers the references and Chapter 11 contains the associated chapter appendices. Three appendices (A, H, & K) consist of a Book Chapter and Conference Papers.

Table 1-2 Lists of journal papers

Paper #	Citation	Publication details
Paper One	Duffield, S., Whitty, S.J., (2015b). Developing a systemic lessons learned knowledge model for organisational learning through projects. International Journal of Project Management, vol. 33, no. 2, pp. 311-324.	Published in proceedings Peer reviewed DOI: 10.1016/j.ijproman.2014.07.004 2013 ERA Ranking: A 2014 SCImago Journal Rank (SJR):1.508 SNIP: 2.736 Impact Factor: 2.436 Supporting Literature Review
Paper Two	Duffield, S., Whitty, S.J., (2016b). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. International Journal of Project Management, vol. 34, no. 7, pp. 1280-1293.	Published in proceedings Peer reviewed http://dx.doi.org/10.1016/j.ijproman.2016.07.001 2013 ERA Ranking: A 2014 SCImago Journal Rank (SJR):1.508 SNIP: 2.736 Impact Factor: 2.436 Supporting Project A
Paper Three	Duffield, S., Whitty, S.J., (2016a). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. International Journal of Project Management, vol. 34, no. 3, pp. 429-443.	Published in proceedings Peer reviewed doi:10.1016/j.ijproman.2015.11.004 2013 ERA Ranking: A 2014 SCImago Journal Rank (SJR):1.508 SNIP: 2.736 Impact Factor: 2.436 Supporting Project B
Paper Four	Duffield, S., (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE Journal of Information and Knowledge Management Systems, vol. 46, no. 2, pp. 267-294	Published in proceedings Peer reviewed doi/abs/10.1108/VJIKMS-09-2015-0052 2013 ERA Ranking: B Supporting Project C
Paper Five	Duffield, S., (Forthcoming, 2017). Using Action Research in Practice: Useful Insights and Outcomes. ALAR: Action Learning and Action Research Journal, vol. 23, no. 1.	Peer review completed, revised paper with ALARj editor, scheduled for publication in Volume 23, Issue 1. http://journal.alara.net.au/index.php/alarj http://www.alara.net.au/ 2013 ERA Ranking: C Supporting Projects, A, B & C

The papers are included in this thesis for non-commercial purposes.

Chapter 1	Introduction
Chapter 2	Extended literature review
	Literature review: Duffield, S., Whitty, S.J., (2015a) [Paper One]
Chapter 3	Research questions
Chapter 4	Research methodology
	Duffield, S., Forthcoming (2017) [Paper Five]
Chapter 5	Project A
	Project A: Duffield, S., Whitty, S.J., (2016b) [Paper Two]
Chapter 6	Project B
	Project B: Duffield, S., Whitty, S.J., (2016a) [Paper Three]
Chapter 7	Project C
	Project C: Duffield, S., (2016) [Paper Four]
Chapter 8	Discussion
Chapter 9	Conclusion
Chapter 10	References
Chapter 11	Appendices A to L
	Appendix A Duffield, S. Whitty, S.J., (2012) Appendix H Duffield., Forthcoming (2017) Appendix K van der Hoorn, B, Duffield, S & Whitty, SJ., Forthcoming (2016)

Peer reviewed

Figure 1-1 Thesis outline

2. LITERATURE REVIEW

The beginning of this chapter explores the scope of the research literature review and further supplements the body of the chapter as detailed in the attached Paper One "Developing a systemic lessons learned knowledge model for organisational learning through projects" (Duffield & Whitty 2015b). The literature review continued throughout the research program, as relevant literature is defined by the data collected in each action research cycle (Dick 1993). The literature was often used to assist with the action research problem-solving challenges. As a result, the literature review is expanded in the following chapter papers:

- Paper Two (refer to Chapter 5 - Project A): The scope of the literature review is contained to what is known about organisational learning and the Syllk model.

- Paper Three (refer to Chapter 6 - Project B): The scope of the literature review is contained to what is known about storytelling and the Syllk model.

- Paper Four (refer to Chapter 7 - Project C): The scope of the literature review is contained to what is known about CoP mechanisms and the Syllk model.

2.1. Literature review (Paper One)

The body of literature concerned with the problem as stated in Chapter 1 is broad as it embraces organisational knowledge, the 'lessons learned mechanisms' by which organisations can gain knowledge from past experiences, and how some organisations successfully adapt to their changing environment by inculcating learning through a conceptual model. Moreover, this literature is discussed because the organisation is a complex adaptive system, and learning is achieved by distributing capability (know-how) across its various interconnected or networked functions. Paper One reviews the following areas with enough depth to show the limitations the literature currently has in practically addressing the research problem:

- Organisational knowledge and lessons learned

- How complex adaptive systems learn (embed capability (know-how))

- Projects are a means of adapting and therefore learning

- Some organisations already enhance their capacity to adapt and learn

- Reasons Swiss cheese Model as a concept and structure to enhance learning.

2.2. Extended literature review

The extended literature review supports all of the research papers associated with this chapter. The extended literature review will focus on knowledge, KM, knowledge conversion, learning, organisational learning, lessons learned, followed by culture, and will support the establishment of gaps in the current literature.

2.2.1. Knowledge

"What is knowledge?" represents a question that humankind has grappled with for centuries at least back to Plato and Aristotle (Hislop 2005; O'Dell, Grayson & Essaides 1998). The current day knowledge exploration is attributed to Drucker (1993) (knowledge as management resource and power), Wiig (1997) (knowledge as a form of belief), Polanyi (1958) and Polanyi (2009) (distinction between tacit and explicit knowledge) and Davenport and Prusak (1998, p. 5):

> Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates in and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

Tacit knowledge is subjective, environment-specific and personal. Tacit knowledge is difficult to communicate, whereas explicit or codified knowledge is objective, easily communicated and transferred without in-depth experience (Nonaka & Takeuchi 1995). Polanyi (2009, p. 4) stated "...we can know more than we can tell" and contends that human beings create knowledge by involving themselves with objects through a process Polanyi calls "indwelling". Nonaka and Takeuchi propose that tacit knowledge consists of cognitive and technical elements. The cognitive element is based on Johnson-Lairds (1983) "mental models" (schemata, paradigms, perspectives, beliefs and viewpoints) where humans create working models of the world in their minds. The technical element is the existing capability (know-how) and skills. The cognitive elements are important as they form the mobilisation process in creating new knowledge. An understanding of people elements in the lessons learned knowledge process requires further work as Duhon and Elias (2008) reports that failure of learning valuable lessons from projects can be connected to a number of cultural, social and cognitive factors (Bresnen et al. 2003; Fernie et al. 2003; Hartmann & Dorée 2015; Holste & Fields 2010).

2.2.2. Knowledge Management (KM)

During the 1980s, individuals and organisations began to value the role of knowledge in competitive business and industrial environments. A number of reports emerged during the late 1980s in the public domain. They focussed on how to manage knowledge explicitly (Wiig 1997). During the 1990s, various KM journals and conferences started to appear with exponential growth, and the knowledge focus started to drive the development of KM frameworks and literature (Hasan & Handzic 2003; Hislop 2005; Wiig 1997). Some of the major approaches to KM frameworks were identified by Nonaka and Takeuchi (1995) (knowledge processes), Nonaka and Kono (1998) (enablers framework), and Alavi and Leidner (2001) (six knowledge perspectives and ten knowledge areas). O'Dell et al. (1998, p. 6) from the American Productivity and Quality Center (APQC) describes KM as "...a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance".

Edwards et al. (2003) conducted a survey of KM academics and practitioners which highlighted the following most influential authors in the domain of knowledge management: Nonaka; Nonaka and Takeuchi; Davernport and Prusak; and Snowden.

Edwards et al. (2003, p. 60) further conclude that the single most important challenge to KM is "...to produce a coherent and cohesive body of theory, based on empirical evidence".

In Australia, KM became very active early in 2001 when Standards Australia formed a technical writing committee to develop the Australian Knowledge Management Standard. The first edition of the Standard was released in 2003 (Standards Australia 2005) and provided clear KM definitions. The Australian KM Standard (2005, p. 2) defines knowledge as "A body of understanding and skills that is constructed by people and increased through interaction with other people and with information". Burford and Ferguson (2011) researched Australian government organisations and found that most participants had not heard of the Australian KM Standard and identified a significant gap between KM practice and the Standard. An observation of the Australian KM Standard on lessons learned is that the Standard does not reference the lessons learned process. This opens up a potential problem as the Standard differs from current PM knowledge sources.

Many avoid defining KM as there is a general feeling that a KM definition is difficult to achieve (Firestone & McElroy 2003). Firestone and McElroy identified a KM definition 'specification gap' and they prefer the term knowledge life cycle (KLC) as the new approach to KM, and are critical of many KM definitions by influential authors. Firestone and McElroy also conclude that publishing standards for KM is premature as most of the KM literature fails to make the distinction between KM and knowledge processing.

Across the globe, many organisations in public and private sectors are now recognising KM as being of central importance to advanced economies and organisational performance (Burr 2009; Hislop 2005). Nousala et al. (2009) report that it is difficult to implement KM process in organisations that are project-based, as setting up activities across stovepipe organisations (preventing cross-organisational communication) and profit cost centres are challenging. However, it is clear that KM in project-based organisations is critical to maintain the competitive advantage (Ajmal, Kekäle & Takala 2009; Love, Edum-Fotwe & Irani 2003; Nousala et al. 2009).

Prusak (2011) suggests that the knowledge management principles developed in the mid-1990s and early-2000s were developed with information in mind and not knowledge, and that is one of the key reasons that knowledge management efforts have run into problems. Prusak (2011, p. xii) further states that we now know different things about working with knowledge:

> Knowledge is better understood as a flow. It is highly dynamic, non-linear, and difficult to measure or even manage. Working with it entails new techniques that we are still learning about. Although technology surely has its place, working with knowledge is primarily a human activity needing human organization and understanding. Knowledge in organizations is profoundly social and best managed in groups, networks, communities, and practices.

O'Dell and Hubert (2011, p. 2) describe the new edge in KM based on APQC research and benchmarking activities and define KM as "...a systematic effort to enable information and knowledge to grow, flow, and create value". The new forces affecting KM are: digital immersion (multitasking); social computing; evolving

demographics and dynamics; mobile devices and video (O'Dell & Hubert 2011). O'Dell and Hubert state that a KM program needs to include the teachable moment (when a person is most open to learning) and the management of knowledge above and in the flow of work (which is focused on making KM part of the work process).

Snowden (2002) submits that we are getting to the end of the second generation of KM (SECI model of Nonaka and Takeuchi). Snowden (2002, p. 2) further submitted that the third generation of KM "requires the clear separation of context, narrative and content management and challenges the orthodoxy of scientific management". Wiig et al. (1997) identified the lessons learned process as a key KM practice. The KM life cycle, when applied, describes the lessons learned cycle. By understanding the KM theories we further develop our understanding of the lessons learned process around the areas of knowledge flow, people, organisation structure, and technology.

2.2.3. Knowledge Conversion

A key element of KM is the knowledge conversion process. Nonaka and Takeuchi (1995) developed four modes of knowledge conversion based on cognitive psychology known as the SECI model (socialization – tacit to tacit / externalization – tacit to explicit / combination – explicit to explicit / internalization – explicit to tacit) (Figure 2-1). Nonaka and Takeuchi (1995) also state that the knowledge transformation is interactive and spiral-based. They further note that an organisation's knowledge is produced in an active and continuous interaction between explicit and tacit knowledge (Figure 2-2). When consideration is given to the enabling conditions of the modes of knowledge, Nonaka and Takeuchi (1995) derived an integrated five phase model of an organisational knowledge conversion process (Figure 2-3). The difficulty of transferring tacit to explicit knowledge on projects is frequently discussed and most authors refer to the importance of the externalisation mode of the SECI model (Bresnen et al. 2003; Fernie et al. 2003; Holste & Fields 2010; Keen & Tan 2007; Nonaka 2007; Nousala, Hall & John 2007; Reich & Wee 2006).
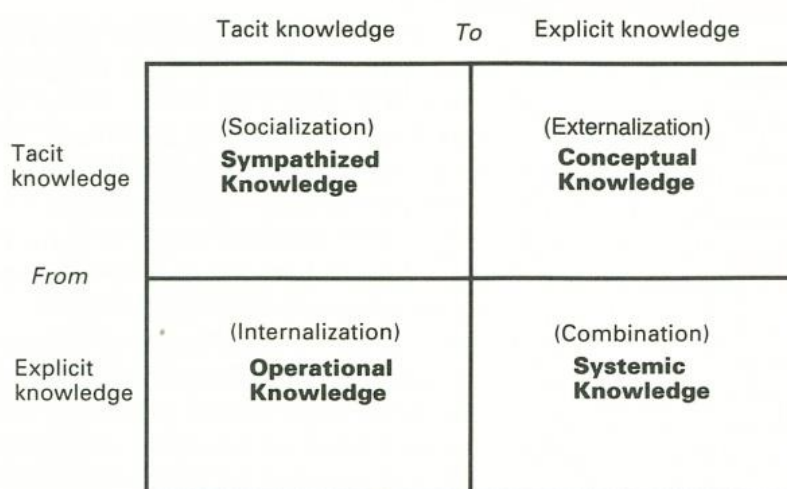
Figure 2-1 SECI model
Source: (Nonaka & Takeuchi 1995, p. 72)
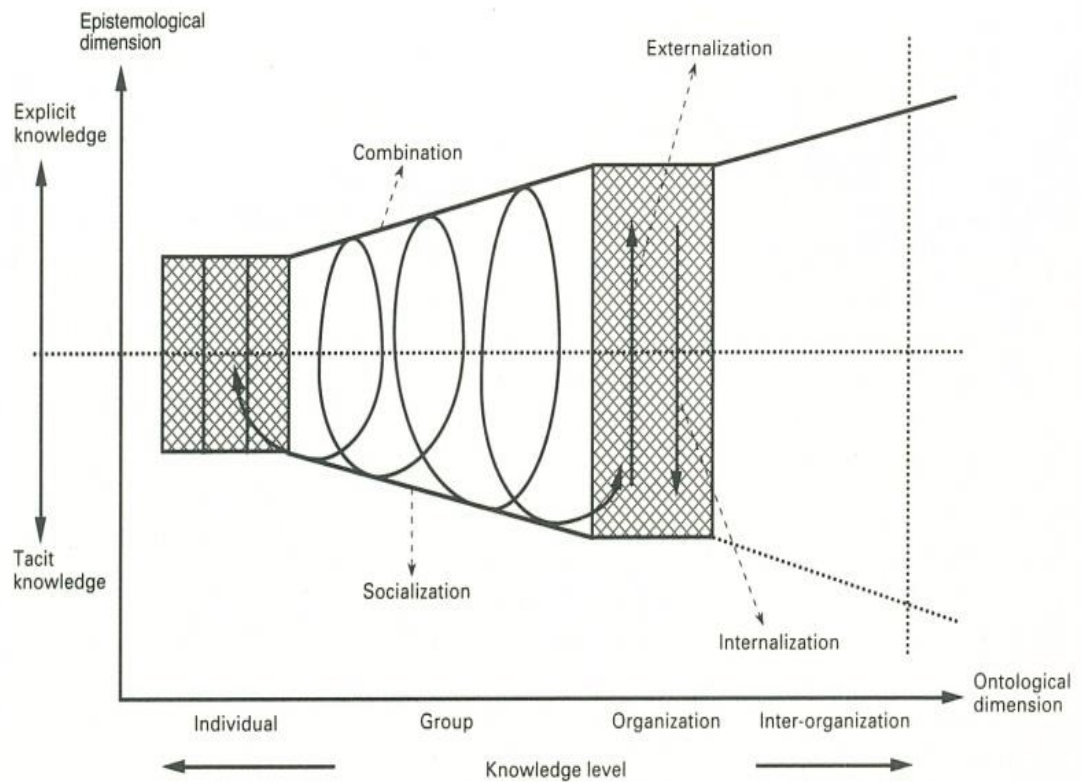
Figure 2-2 Spiral of organisational knowledge creation
Source: (Nonaka & Takeuchi 1995, p. 73)
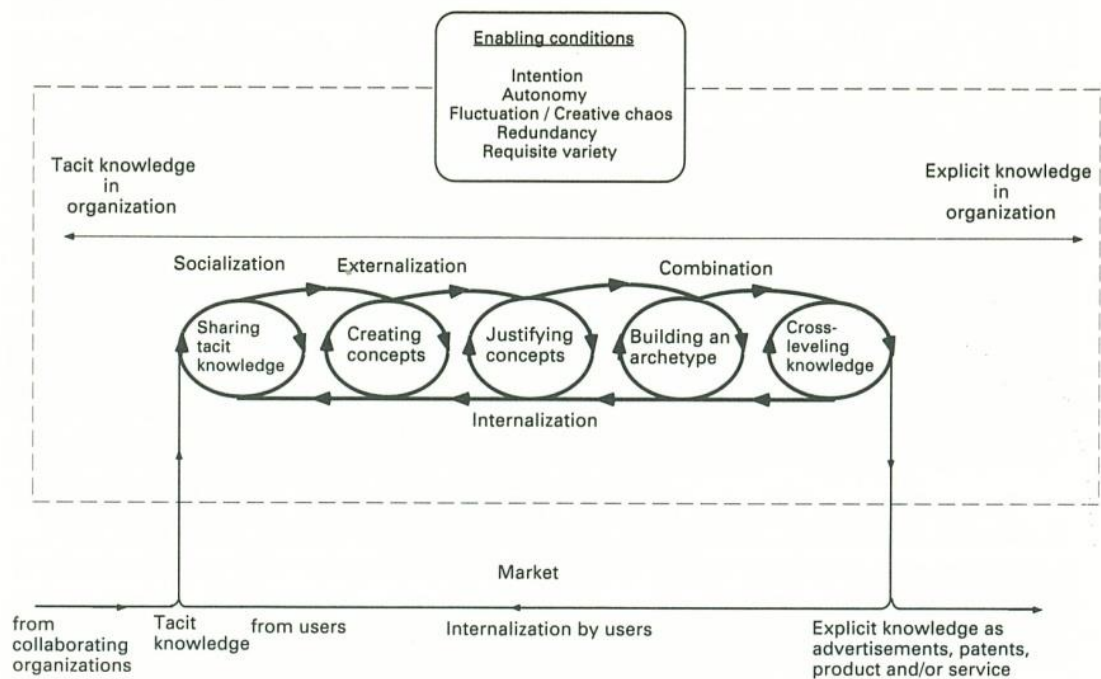
Figure 2-3 Five-phase model of the organisational knowledge – creation process
Source: (Nonaka & Takeuchi 1995, p. 84)

Bratianu (2010) concludes that the SECI model (Nonaka & Takeuchi 1995) represents the Japanese culture and organisational behavior and there are limitations in applying the model within different cultural environments. Then, considering the whole cycle, the fact that a "good part of the flowing knowledge passes several times through the spiral channels, raises the question of reusable knowledge", which expands "the two dimensional knowledge dynamic model into a three dimensional one" (Bratianu (2010, p. 198).

Firestone and McElroy (2003) indicate that the SECI model (Nonaka & Takeuchi 1995) may be incomplete. The oversight is that the SECI model neglects to consider 'implicit' knowledge. Firestone and McElroy (2003) maintain that tacit knowledge is inexpressible, and there can be no conversion from tacit to explicit whereas implicit knowledge can be converted to explicit. Keen and Tan (2007, p. 4) refer to implicit knowledge as "...what we take for granted, rarely think about and are surprised to find that others do not share". Srikantaiah et al. (2010, p. ix) refer to implicit knowledge as "...knowledge that is not captured in documentary form but in practice could be". Polanyi (1958) makes reference to implicit knowledge, so it is interesting to note that Nonaka and Takeuchi (1995) made no provision for implicit knowledge. Wilson (2002), Keen and Tan (2007) and Srikantaiah et al. (2010) propose to include implicit knowledge as the link between explicit and tacit knowledge. Additionally, Day (2005) states that implicit and tacit knowledge are often synonymous terms, and he attempts to clear up the implications for KM. The challenge with knowledge conversion and the lessons learned process is the ability to capture and transfer/disseminate the tacit/implicit knowledge subject as the KM project management process is primarily explicit in nature.

2.2.4. Learning and Organisational Learning

This part of the literature review will focus on the learning component of the lessons learned process. Maqsood (2006), Maqsood et al. (2004) and Duhon and Elias (2008) all highlight the need to understand cognitive psychology when examining the effectiveness of tacit knowledge in the learning process. Maqsood discusses how human information processing occurs and the need to understand: 'perception and recognition', cognitive styles (Van Gigch 1991); heuristics and biases in judgement (Baron 1998; Best 1989); functional fixedness and mental set (Baron 1998); and mental models (Best 1989; Johnson-Laird 1983). Maqsood (2006) further reports that every person has a distinctive learning technique and learning depends on an individual's capability to effectively acquire and use in a timely manner. Maqsood et al. (2004) suggest that when capturing tacit knowledge, it is important to ensure that it is not under any bias and is understood in the right context, so incomplete knowledge should be avoided.

Duhon and Elias (2008, p. 1) describe learning as "...any increase in knowledge or skills that enable the learner to be more effective" in achieving their objectives. When faced with a problem, an individual should: collect and evaluate data, assess the situation; develop objectives and identify alternatives; evaluate alternatives, select the most appropriate; and then take action to implement. Learning will be impaired if there is a failure at any of these steps. Duhon and Elias (2008) developed a decision process model to understand the learning limits (Figure 2-4) and describe how the fields of psychology, decision theory, and sociology are important in understanding why learning is difficult.
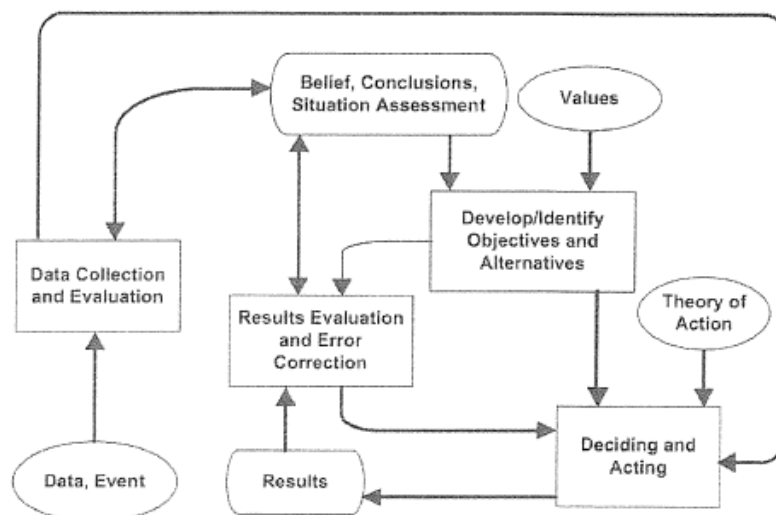
Figure 2-4 Influence diagram of a decision process
Source: (Duhon & Elias 2008, p. 2)

Duhon and Elias (2008) describe the influence of: heuristics and biases (psychology); sense making; team psychology and sociology; naturalistic decision making; and action science (theory of action) based on Argyris (1999) model I and II (Table 2-1). Duhon and Elias summarise that learning on projects is difficult considering that most projects are complex undertakings (Von Zedtwitz 2002). Duhon and Elias (2008) note that project team members develop different views as to the learnings, and when they commence the next project, their memories will fade.

Table 2-1 Theory of action (model I and II)

Theory of Action	
Typical Exposed Theory (Model II)	Threatening Situation (Model I)
Try to be fair and honest	Try to be in control
Seek and value accurate and valid data	Try to win
Involve other stakeholders	Seek data that supports your position
	Act unilaterally, try to avoid inquiry
	Try to 'save face'

Adapted from: (Argyris 1999; Duhon & Elias 2008)

Project teams often know trouble is near, however, they take no or limited action to correct mistakes, as admitting faults may cause embarrassment (model I) (Von Zedtwitz 2002). Typically project reviews often do not have an impact as the team becomes defensive and argues against problems rather than implement recommendations (Duhon & Elias 2008; Von Zedtwitz 2002). Duhon and Elias (2008) report that the same face-saving, defensive post-mortem attitude weakens the lessons learned process and hides the real problems of the project. When a problem is recognised, they are biased to learning the least-threatening lessons (model I, single loop learning). Duhon and Elias (2008, p. 5) state "…the more important a lesson is, the more difficult it is to learn". They re-iterate that most of what we learn are unactionable and that many project problems are caused by model I behaviour (Duhon & Elias 2008; Von Zedtwitz 2002). Model II behaviour is seen as difficult to achieve as project team members are typically not open and trusting in difficult

situations. The industry sector (as applicable to the project; may also be applicable to multiple industry sectors) as a whole should be learning from others mistakes. However, this is countered by in-group favouritism (Duhon & Elias 2008). If we view others as substandard to us, we then do not believe we can learn from them. Another issue is that it is often hard to get relevant information on what went wrong. Duhon and Elias (2008) conclude that the current project management culture highlights that there is a need to examine if the aviation safety practice of just culture would have a positive impact on project teams learning.

Reflective learning has also been recognised as playing a key part in project learning (Julian 2008; Nonaka & Takeuchi 1995; Raelin 2001; Smith 2001; Williams 2007, 2008) and can also be viewed as double loop learning (Argyris 1994). Senge (1990) presents the need for reflection reviews and states that unless those lessons change working practices, no organisational learning has taken place (Atkinson, Crawford & Ward 2006).

The review of learning literature reinforces that people factors influence the success of the lessons learned process, and that a learning organisation culture is critical to successful dissemination of lessons learned (Fernie et al. 2003; Sense 2007). The shift from the individual to the organisation is not straightforward. The work of Senge (1990) motivated companies to become learning organisations. The other particularly influential author was Nonaka (1991, 2007) and Nonaka and Takeuchi (1995). Nonaka (1991) described how Japanese companies working in innovation created knowledge-creating companies. Simon (1991, p. 125) states that:

> All learning takes places inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have. ...What an individual learns in an organization is very much dependent on what is already known to (or believed by) other members of the organization and what kinds of information are present in the organizational environment. ...Individual learning in organizations is very much a social, not a solitary, phenomenon.

Simon (1991) further reports that cognitive psychology concepts used for human learning can and should be applied to organisational learning research. Strang (2003) discusses the difficulties and provides a valuable insight into organisational learning theory. Strang (2003) recommends further research around organisational psychology factors that may explain why organisational learning methods are not applied even though the belief is that these practices would improve organisational project performance but rarely applied in practice.

Garvin (1993) discusses five main activities to becoming a learning organisation: 1) Systematic problem solving (based on the 'Deming' quality plan, do, check, act cycle); 2) Experimentation (use of demonstration projects.); 3) Learning from what went before (companies need to review both failures and success and document the lessons learned, unfortunately most fail to learn and allow knowledge to leave. Garvin (1993) sights the Boeing example of learning from the difficulties of different production lines.); 4) Learning from others (benchmarking and applying best practice); 5) Transferring knowledge (knowledge needs to spread rapidly and efficiently).

There are two themes that constantly surface from the literature as important; people culture and organisational structure. Duhon and Elias (2008) argues that an

organisation knows something if just one person knows it and that the organisation culture and structure enables that knowledge event to be used effectively on an organisational issue. Duhon and Elias (2008, p. 5) define organisational learning "...as an increase in the knowledge or skills of individual members of the organization or a change in the structure, processes, or culture of the organization that enables the organization to be more effective at planning and implementing actions that achieve the organization's objectives". They reference actions such as; individual learning; storage of knowledge that makes it available to others – checklists and work processes; organisational changes that re-focuses knowledge; culture changes to open and act on problems; and relationship building that enables skills and knowledge to deal with organisational problems. Hartmann and Dorée (2015) suggest that leaders of project-based organisations can support organisational learning by linking projects through strategic goals.

Duhon and Elias (2008) state that people learn by processing information using the human central nervous system. An organisation does not have a central nervous system, so there needs to be a structure that enables its personnel to learn (collect and analyse, transfer/disseminate and apply) as a group. Duhon and Elias (2008) found that individual learning is a cognitive (psychological) process, and for an organisation the learning process is social. Duhon and Elias (2008) suggest that organisations collect and disseminate knowledge using organisational learning mechanisms (OLM)s (Lipshitz, Popper & Friedman 2007). Examples of OLMs are: lessons learned studies; after action reviews, communities of practice; work processes; procedures; standards; mentoring; team-building exercises; classroom training.

Individual learning is held back by many people factors and these same factors can affect organisational learning, and in some cases, there are significant increased effects. Culture continues to have a significant impact on organisational learning and usefulness of learning mechanisms (Duhon & Elias 2008).

2.2.5. Lessons Learned

O'Dell and Hubert (2011, p. 69) stated that the 'lessons learned' approach typically focuses on a few key questions:

> What was supposed to happen?
> What actually happened?
> Why was there a difference or variation?
> Who else needs to know this information?

The major challenge is to then get employees to participate and reuse the captured knowledge "lessons learned" (Milton 2010; O'Dell, Grayson & Essaides 1998; O'Dell & Hubert 2011).

The literature on the 'lessons learned' process model provides many variations on essentially three process phases (Williams 2007). The three phases included in an effective 'lessons learned' process model are: creating, dissemination/transferring and application. Creating/identifying the knowledge consists of observing, collecting, and understanding the facts and information. A key element of this phase is to document the findings and provide sufficient information regarding the situation, action taken, results observed and recommendations. The

next phase provides for the dissemination of information through codification/verification, storage, sharing for easy access and transferring knowledge to organisational members, improvements to standard processes and procedures to reflect changes in identified best practices. The final element is where we adapt and use knowledge (Bresnen et al. 2003; Bresnen, Goussevskaia & Swan 2004; Cowles 2004; Liebowitz & Megbolugbe 2003; O'Dell & Grayson 1997; Schindler & Eppler 2003; Williams 2008).

The literature on knowledge identification and creation mention several ways temporary organisations or individuals reflect on their experiences. Common techniques are: lessons learned sessions; after-action reviews; project debriefings; close out meetings; post project appraisals/reviews; case study exercises; project reviews; project histories; project health checks; and project audits (Anbari, Carayannis & Voetsch 2008; Bakker et al. 2010; Busby 1999; Koners 2005; Maqsood, Walker & Finegan 2004; Reich, Gemino & Sauer 2008; Schindler & Eppler 2003; Von Zedtwitz 2002; Williams 2007). Each method has many different features and characteristics, however, they all essentially capture-disseminate-apply knowledge.

The literature on knowledge disseminating and transfer often refers to codification, verification, storing, searching, retrieving, knowledge sharing and training (Boh 2007; Cowles 2004; Firestone & McElroy 2003; O'Dell, Grayson & Essaides 1998; O'Dell & Hubert 2011; Schindler & Eppler 2003; Williams 2007). Schindler and Eppler (2003) reports that if projects do not frequently disseminate their experiences, the project knowledge could be forgotten by the end of the project. The literature provides many technological ways of storing and recording the knowledge; the key is to identify what works for an organisation and constantly monitor, update and keep it current and relevant (Williams 2007, 2008). Technology is a critical element to knowledge dissemination. Quite often technology is blamed for failure in knowledge dissemination (Williams 2007). Most organisations maintain their lessons learned in house for competitive advantage, although some organisations make their lessons learned available to the public (Basili et al. 2002; Li 2001, 2002; Madden 1996; NASA 2011b).

The 'disseminate knowledge' phase uses two methods of interest; 1) process methods and 2) social based methods. Process-based methodologies are those lessons learned where the knowledge is reflected in an organisations policies, processes and procedures. If projects follow the process then the chance of mistakes being repeated should be minimised (Keegan & Turner 2001; Midha 2005; O'Dell & Grayson 1997; O'Dell, Grayson & Essaides 1998; Schindler & Eppler 2003; Williams 2007). Social based methodologies are those lessons learned that are not easy to break up and transfer knowledge from one person to another (Bresnen et al. 2003; Fernie et al. 2003). Fernie et al. (2003) argue that knowledge sharing is best performed through the communication of individuals. Two social-based processes are networking and mentoring (Bresnen et al. 2003; Huang & Newell 2003). A critical component of success for social methods is to ensure that an organisations culture and environment provide support (Hoegl, Parboteeah & Munson 2003).

Knowledge dissemination is an important step in the process, and the work of Dixon (2000) helps to understand different strategies when dealing with the transfer of tacit or explicit knowledge. Dixon (2000) identifies five types of knowledge dissemination strategies: Serial Transfer, Near Transfer, Far Transfer, Strategic

Transfer and Expert Transfer (Dixon 2000; O'Dell et al. 2004). Literature reviews on knowledge application often state that a significant effort, commitment, understanding of people behaviour is required for both the organisation and individuals, as this is the area where the process typically breaks down and fails (Duhon & Elias 2008; Keegan & Turner 2001; Williams 2007, 2008).

2.2.6. Culture

Culture plays a significant part in knowledge management, organisational learning and in the effectiveness of learning mechanisms (Duhon & Elias 2008) and is central to the change management process (Firestone & McElroy 2003; Maqsood 2006). Dvir and Shenhar (2011, p. 20) state that "Great projects create a revolutionary project culture. The execution of great projects often requires a different project culture, which can spread to an entire organization". Williams (2007, 2008), Hislop (2005) and Maqsood (2006) all suggest that it is critical to understand the culture of an organisation before implementing or using a knowledge lessons learned method as surveys consistently reveal that the main obstacles to success are organisational people (social and culture) factors (Ajmal, Helo & Kekäle 2010; Ajmal, Kekäle & Takala 2009; Ajmal & Koskinen 2008). Hislop (2005) reported on what motivates employees to share their knowledge and expertise. Three reported areas were; 1) when workers feel valued for the skills; 2) trustworthiness; and 3) a committed organisation.

Firestone and McElroy (2003) state that it is important to understand the following types of culture barriers: topical, historical, behavioural (socialisation), normative, functional, mental, structural and symbolic. Ajmal and Koskinen (2008) define project culture as a harmony between organisational and professional culture. They also identify four core cultures of control, competence, collaboration, and cultivation. O'Dell et al. (2000) and Duhon and Elias (2008) discuss the impediments to sharing knowledge; do not have time; not invented here; divisional stove pipe; geographical scatter; people afraid that sharing will make them less valuable; unwillingness to share; poor leadership and legal constraints.

Reason (1997, p. 195) defines a just culture as "...an atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety-related information – but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour". The other important elements of a safety culture are to have a strong reporting, flexible and learning culture (Reason 1997). Reason (1997) further states that the learning culture is the easiest to engineer however is the most difficult to make work. Pettersson and Nyce (2011) state that just culture is where individuals in an organisation want to be open about failures and mistakes. Lucier (2003) argues that if you can encourage team members to document their mistakes with no fear of further action, you will be able to establish a useful knowledge system. The Global Aviation Information Network describes a just culture within the aviation industry as a system that has accessible memory and underpins a learning culture (Stastny & Garin 2004). Stastny and Garin (2004) discuss the benefits and obstacles in implementing a just culture and there appears to be many similarities with the benefits and obstacles of the project management lessons learned process (reporting, trust building and more effective management).

2.3. Gaps in Literature

The literature review highlights there is a considerable amount of research literature focused on knowledge management; lessons learned, organisational learning and culture (Srikantaiah et al. 2010). The literature review found limited research on "*how*" knowledge management, learning, and culture impact the domain of project management and temporary organisations (Duffield & Whitty 2012, 2015b). Lambe (2014, p. 3) reports that "there are still very few institutional mechanisms for leveraging evidence from KM practice in KM research, or for testing theoretical postulates in practice".

Duffield and Whitty (2012) adopted a qualitative approach using the literature (Table 2-2) and a range of tools (categorisation matrix, mind and concept maps) to carry out a deductive content analysis of the literature (Elo & Kyngäs 2008). The categorisation matrix, mind and concept maps exercise was based on the three sub-processes of data reduction, data display and conclusion drawing (Miles and Huberman 1994). The output of the analysis identified the most common lessons learned elements acknowledged by other researchers which defined the gaps that eventually formed the Syllk model. The following areas of interest were identified: technology, learning, social, people and networks (Duffield & Whitty 2012, 2015b).

These identified gap areas impact and hinder the dissemination and application of knowledge/lessons learned between the project team and the organisation. The literature review leans towards the people factor as the highest and most likely to influence the dissemination and application of knowledge/lessons learned in organisations.

As highlighted in this literature review and supported by Williams (2007, 2008) it is clear that more research is required to understand why the dissemination and application of knowledge/lessons learned in organisations are not effective (Abaunza & Kirytopoulos 2016; Almeida & Soares 2014; Andrew, Shang & Pheng 2015; Bennet & Bennet 2014; Chaves et al. 2016; Chronéer & Backlund 2015; Disterer 2002; Duhon & Elias 2008; Fernie et al. 2003; Hartmann & Dorée 2015; Lotti Oliva 2014; Love et al. 2016; NASA 2014; Shergold 2015; Savolainen & Ahonen 2015).

Furthermore, Duffield & Whitty (2015b) literature review (Paper One) explored organisational learning, lessons learned techniques, how naturally evolved complex adaptive systems learn and adapt, and how all this relates to the project organisation. The literature review focussed on successful learning organisations and showed how their learning mechanism are underpinned by James Reason's (1997, 2000) Swiss cheese model for safety and accident prevention. This formed the research question from the gap in the literature which is; how can the lessons learned concepts illustrated in Reason's Swiss cheese model be broadened beyond safety to meet the learning needs of project organisations?

2.4. A Systemic Lessons Learned Knowledge (Syllk) model

2.4.1. Syllk model – initial conceptual iterations

The Syllk model is grounded in Duffield and Whitty (2012; 2015b) and has undergone seven iterations. Appendix A (11.1.1) provides a pictorial view of the model iterations (refer to Figures A-1 to A-7). The early literature reviews that

supported the models were focussed on the areas of KM, knowledge, knowledge conversion, learning and organisational learning, lessons learned practices (creating, dissemination /transferring and application), culture and just culture.

Williams (2007, 2008) provides an extensive relevant literature review based on a Project Management Institute (PMI) grant to research current practices for lessons learned in the project management field. Williams (2007, 2008) literature review focuses on, motivation, concepts, current situation, creating knowledge, transferring knowledge and provides a solid foundation to build on further. These initial literature reviews were the drivers for the deductive content analysis that developed the SLLCK and Syllk model.

Paper One develops and proposes that the Syllk model (see Figure 2-5), grounded in the literature reviewed, represents the various organisational systems or functions (regarding elements) that collectively drive the overall behaviour of the organisation (Duffield & Whitty 2012; Duffield & Whitty 2015b). Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the various modes of social and cultural learning, along with the organisational processes, infrastructure and technology that support them (Duffield & Whitty 2012, 2015b).

The Syllk model replaces Reasons (1997) Swiss cheese model defence barrier layers (person, workplace, organisation factors (policies and procedures), and defences (technology, training, and regulations)) (refer to figure 2-6), 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. One can expect to see different facilitators and barriers within different organisations (Pinho, Rego & Cunha 2012). Negative impediments (barriers) need to be overcome for effective lessons learned (Collison 2006; Riege 2005), and the Syllk model can assist in identifying the barriers (Duffield 2016; Duffield & Whitty 2012; Duffield & Whitty 2015b; Leal-Rodríguez et al. 2014; Virolainen 2014).
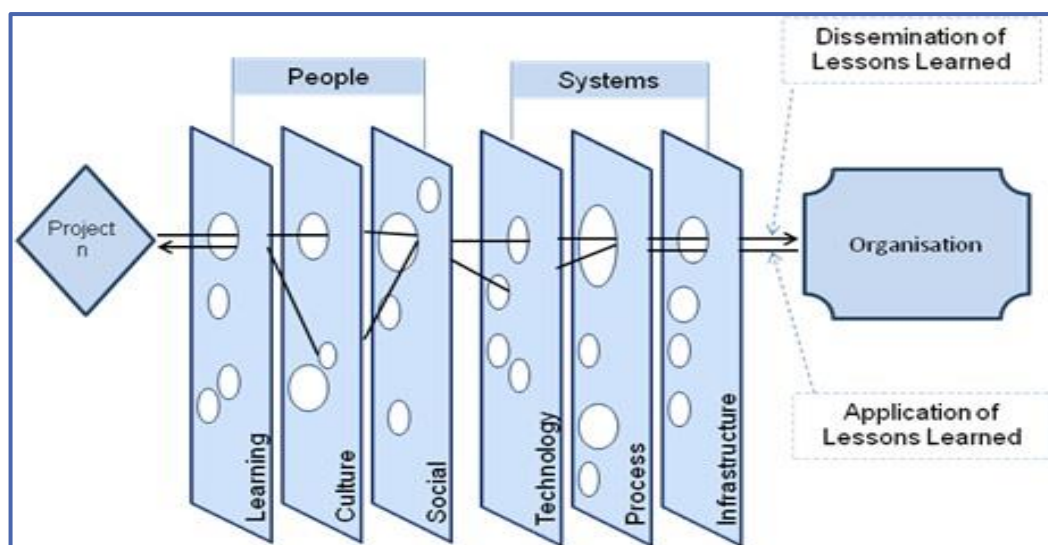
Figure 2-5 The Systemic Lessons Learned Knowledge Model
Source: (Duffield & Whitty 2015b)
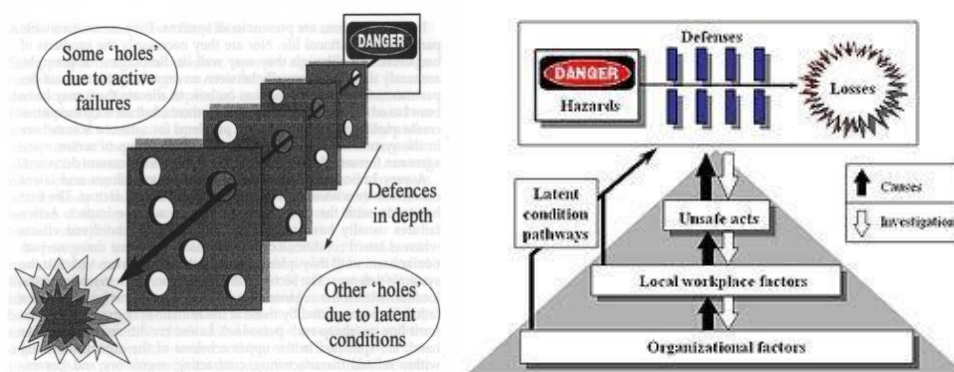
Figure 2-6 The Swiss cheese model of defences
Source: (Reason 1997, 2000)

Leal-Rodríguez et al. (2014) have indicated how an earlier version of the Syllk model (Duffield & Whitty 2012) 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.

Duffield and Whitty (2016a) have shown that the alignment of the people and system elements can positively influence an organisations capability for storytelling, and therefore learn and accumulate lessons from stories of past project experiences. Hedman et al. (2015) explained how the Syllk model shows that for organisations to learn, people and systems (processes and technology) needs to be aligned and that this combination is an effective way of organisational learning.

2.4.2. Syllk model barriers and facilitators

Accidents in a complex system occur through the accumulation of multiple factors and failures (EEC 2006). Reason's (1997, 2000) Swiss cheese model suggests multiple contributors (the holes in cheese slices) must be aligned for any adverse events to occur. Barriers in a system (the slices themselves) are intended to prevent errors that result in these adverse events (EEC 2006). As the Syllk model is conceptually based on the Swiss cheese model, the term *barrier* remained. A review of KM literature was undertaken to define the best fit opposite term.

The following terms were found to be used in KM literature; *enhancer* (Faraj & Sproull 2000); *enabler* (Anantatmula & Kanungo 2010; Lilleoere & Holme Hansen 2011) and *facilitators* (Blackman & Henderson 2001; Rodríguez-Elias et al. 2008). Rodríguez-Elias et al. (2008) went further in that they used a number of terms; *Knowledge flow enablers, Knowledge flow facilitators and KM Facilitators*. They were focussed on finding what current working tools might play as KM facilitators in starting up a KM initiative. The term *facilitator* was now part of the SLLCK and Syllk model literature.

2.4.3. Supporting literature for the SLLCK and Syllk models

Table 2-2 provides a listing of the literature that was used for the development of the SLLCK and Syllk models. Table 2-3 provides a listing of the 2013 to 2016 additional literature that was used for the application of the Syllk model in the published journal Papers Two, Three and Four.

Table 2-2 Supporting literature for the SLLCK and Syllk models

Reference	Reference Type	Title	People			System		
			Learning	Culture	Social	Technology	Process	Infrastructure
(Ajmal & Koskinen 2008)	Project Management Journal	Knowledge transfer in project based organizations: An organizational culture perspective	X	X	X	X	X	
(Ajmal, Helo & Kekäle 2010)	Journal of Knowledge Management	Critical factors for knowledge management in project business		X	X	X	X	X
(Andriessen & Fahlbruch 2004)	Book	How to manage experience sharing: from organisational surprises to organisational knowledge	X	X				
(APQC 2012)	Report	Putting Knowledge in the Flow of Work	X	X	X	X	X	
(Atkinson, Crawford & Ward 2006)	International Journal of Project Management	Fundamental uncertainties in projects and the scope of project management	X	X			X	X
(Bakker et al. 2010)	International journal of project management	Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer	X				X	
(Boh 2007)	Information and Organization (Journal)	Mechanisms for sharing knowledge in project-based organizations	X		X		X	
(Bransford et al. 2000)	Book	How people learn brain, mind, experience, and school	X			X	X	
(Bresnen et al. 2003)	International Journal of Project Management	Social practices and the management of knowledge in project environments	X		X	X	X	
(Brown et al. 2005)	Book	Storytelling in organizations: Why storytelling is transforming 21st century organizations and management	X		X	X		
(Dekker 2007)	Book	Just culture: balancing safety and accountability		X			X	
(Disterer 2002)	Journal of Knowledge Management	Management of project knowledge and experiences			X		X	
(Duhon & Elias 2008)	SPE Projects, Facilities & Construction (Journal)	Why It Is Difficult to Learn Lessons: Insights from Decision Theory and Cognitive Science	X	X	X		X	
(Duhon 2009)	SPE Conference Paper	Why We Do not Learn All We Should from HAZOPs	X	X	X		X	
(Fernie et al. 2003)	International Journal of Project Management	Knowledge sharing: context, confusion and controversy	X		X		X	
(Firestone & McElroy 2003)	Book	Issues in New Knowledge Management		X	X			
(Gasik 2011)	Project Management Journal	A Model of Project Knowledge Management	X		X		X	
(Hopkins 2005)	Book	Safety, culture and risk: the organisational causes of disasters		X			X	

Reference	Reference Type	Title	People			System		
			Learning	Culture	Social	Technology	Process	Infrastructure
(Julian 2008)	Project Management Journal	How project management office leaders facilitate cross-project learning and continuous improvement	X		X		X	
(Keegan & Turner 2001)	Management Learning (Journal)	Quantity versus Quality in Project-Based Learning Practices	X			X	X	
(Kerzner 2009)	Book	Project Management: A Systems Approach to Planning, Scheduling, and Controlling	X		X	X	X	
(Krammer 2010)	Book	Knowledge Management in Project Management	X		X	X	X	
(Leistner 2010)	Book	Mastering organizational knowledge flow how to make knowledge sharing work		X	X	X	X	
(Liebowitz & Megbolugbe 2003)	International Journal of Project Management	A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives	X	X		X	X	X
(Love, Fong & Irani 2005)	Book	Management of knowledge in project environments	X	X	X		X	
(Maqsood 2006)	Thesis	The Role of Knowledge Management in Supporting Innovation and Learning in Construction	X	X	X	X	X	X
(Milton 2005)	Book	Knowledge Management for Teams and Projects	X	X	X	X	X	X
(Nonaka & Takeuchi 1995)	Book	The knowledge-creating company: How Japanese companies create the dynamics of innovation	X	X	X		X	
(O'Dell & Grayson 1997)	Book	Identifying and Transferring Internal Best Practices		X		X	X	X
(O'Dell & Hubert 2011)	Book (APQC)	The new edge in knowledge: how knowledge management is changing the way we do business	X	X	X	X	X	
(Pasher & Ronen 2011)	Book	The complete guide to knowledge management a strategic plan to leverage your company's intellectual capital	X	X	X	X	X	
(Pugh 2011)	Book	Sharing hidden (know-how): how managers solve thorny problems with the knowledge jam		X	X			
(Reason 1997)	Book	Managing the Risks of Organizational Accidents	X	X			X	
(Schindler & Eppler 2003)	International Journal of Project Management	Harvesting project knowledge: a review of project learning methods and success factors	X				X	
(Stastny & Garin 2004)	Report (GAIN)	A Roadmap to a Just Culture: Enhancing the Safety Environment	X	X			X	
(Strang 2003)	PMI Global Congress 2003	Organizational Learning Across Projects	X	X	X	X	X	X

Reference	Reference Type	Title	People			System		
			Learning	Culture	Social	Technology	Process	Infrastructure
(Thomas 2012)	Book	The basics of project evaluation and lessons learned	X		X		X	X
(Wiig 1997)	Journal of Knowledge Management	Knowledge management: an introduction and perspective	X			X	X	X
(Williams 2007)	Book	Post-Project Reviews to Gain Effective Lessons Learned	X	X	X	X	X	X
(Williams 2008)	IEEE Transactions in Engineering Management	How do organisations learn lessons from projects–and do they?	X	X	X	X	X	
(Wysocki 2004)	Book	Project management process improvement					X	

Table 2-3 Additional supporting literature for the Syllk model (2013-2015)

Reference	Reference Type	Title	People			System		
			Learning	Culture	Social	Technology	Process	Infrastructure
Papers Two and Three								
(Hayes and Maslen, 2014)	Journal of Risk Research	Knowing stories that matter: learning for effective safety decision-making	X	X	X	X		
Papers Two, Three and Four.								
(Hedman et al.,2015)	University Master's degree	The Production of Comfort - How Financial Auditors Experience that they Become Comfortable with IT-auditors	X	X	X	X		
(Leal-Rodriguez et al., 2014)	International Journal of Project Management	From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context	X	X	X		X	
(Virolainen, 2014)	University Master's degree	Learning from projects: a qualitative meta-summary	X	X	X	X	X	
Paper Three; Project B accepted in 2015, published in 2016, literature section of paper.								
(Macrea, 2014)	Book	Close Calls: Managing Risk and Resilience in Airline Flight Safety	X	X	X	X	X	X
(Pässilä et al.,2013)	Journal of Workplace Learning	Creating dialogue by storytelling	X	X	X	X	X	X
(Peet, 2012)	Journal of Knowledge Management	Leadership transitions, tacit knowledge sharing and organizational generativity	X	X	X	X	X	
(Suppiah and Sandhu, 2011)	Journal of Knowledge Management	Organisational culture's influence on tacit knowledge-sharing behaviour	X	X	X			
Paper Four; Project C published in 2016, literature section of paper.								
(Chou et al., 2015)	International Journal of Information Management	Exploring the determinants of knowledge adoption in virtual communities: A social influence perspective	X	X	X	X		
(Jassbi et al., 2015)	VINE Journal of Information and Knowledge Management Systems	An empirical investigation for alignment of communities of practice with organization using fuzzy Delphi panel.	X	X	X	X		X
(Kim et al., 2011)	International Journal of Information Management	The cognitive selection framework for knowledge acquisition strategies in virtual communities	X	X	X			

Reference	Reference Type	Title	People			System		
			Learning	Culture	Social	Technology	Process	Infrastructure
(Lee et al., 2015)	Project Management Journal	Learning Through Interactions: Improving Project Management Through Communities of Practice	X	X	X	X	X	X
(Zhao et al., 2012)	International Journal of Information Management	Cultivating the sense of belonging and motivating user participation in virtual communities: A social capital perspective	X	X	X			

2.5. Where does the Syllk model fit within the theory and literature?

KM is the mixture of several disciplines; organisational theory, management theory, theory of action, sociology of knowledge, cognitive science, information systems theory and many others (Lange 2006). KM therefore lacks a generally agreed theoretical basis, which provides a challenge to the researcher. The Syllk model draws-on and contributes back to practice: Decision theory (Duhon & Elias 2008); Theory of action (Argyris 1999; Duhon & Elias 2008); Organisational learning theory (Duhon & Elias 2008; Garvin 1993; Simon 1991; Strang 2003); Theory of work-based learning (Raelin 2000); and Complex adaptive systems theory (Bennet & Bennet 2003; Bullmore & Sporns 2009; Holland 1992). The Syllk model is grounded in the literature, as reviewed in this thesis and associated published journal papers.

In line with complex adaptive systems theory the Syllk model represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the organisation. Where the Syllk model stands alone, is in the *systemic coupling* or relationships of systems and not the systems themselves. As a result, the Syllk model enables individuals (the people elements), systems and organisations to exhibit intelligent behaviour in a dynamic KM environment. Conceptually the Syllk model is a reverse relationship adaptation of James Reason's (1997, 2000) Swiss cheese model for safety and accident prevention. The model replaces Reason's (1997) defence layers 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 identified lessons. The Swiss cheese model (EEC 2006, p.9):

> As a conceptual framework is a heuristic explanatory device for communicating the interactions and concatenations that occur when a complex well-defended system suffers a catastrophic breakdown. In particular, it conveys the fact that no one failure, human or technical, is sufficient to cause an accident. Rather, it involves the unlikely and often unforeseeable conjunction of several contributing factors arising from different levels of the system. It also indicates what defines an

organizational accident, namely the concurrent failure of several
defences, facilitated, and in some way prepared, by suboptimal features
of the organisation design. In this regard it has proved very successful.
It is a simple metaphor easily remembered and passed on that
encompasses what is often a very complex story.

Booker, Bontis and Serenko (2008) found that there is a gap in the KM field
between theory and practice that needs to be filled. As the Swiss cheese model was
well regarded for communicating, there is scope to communicate a simple and clear
KM model (Syllk model) in the same way. During a focus group session (with
practitioners), the participants discussed how well the Syllk model represented the
complexity of the real world, and how all facilitators (systems) need to align to
enable a lesson to be learned and then captured (remembered) in various forms
across the organisation. One participant said "I can look at the diagram (Syllk model)
and not understand the detail of it all...but I can understand the concept behind
it...that you have to do lots of things to align to make it happen". One participant
raised a question about the various paths of arrows moving through the elements.
This led into a group discussion around culture and technology, and that different
culture (i.e. learning or reporting culture) and technology tools (i.e. wiki or intranet)
may be required to support the dissemination and application of various lessons. One
of the engineering participants declared that they could see how "each element has a
number of facilitating subsets, and that the model can represent knowledge stored
across the organisation". Another participant stated that they "found the model had
alignment with complexity and the organisational brain". Across the focus groups
there was agreement that it is the people element and the differences in people that
are most likely to negatively influence lesson learned processes and create barriers to
the dissemination and application of lessons learned in organisations. This was
supported by comments such as: "people make it happen"; "people learn in different
ways"; "everybody learns differently"; and "different mediums are needed for people
to learn".

Prusak (2015, p. 4) states that: "knowledge management is still in its infancy.
It has had some notable success as well as much failure, and still has a long way to
go in developing standardized and proven models and methods". Dalkir (2005, p. 72)
suggest "KM models are still fairly new to the practice or business of knowledge
management, and yet they represent the way ahead". Ale et al. (2014, p. 1) report
that KM models: "in the literature do not take into account all necessary aspects for
effective knowledge management". The two noteworthy failures related to KM are;
KM is just another management fad with an IT focus, and that there is a lack of
understanding of KM models and knowledge itself (Ale et al. 2014; Wilson 2002).
In a study of 28 KM related projects, Grant and Qureshi (2006) found that near 50%
of the projects failed or delivered unconvincing results. Successful projects "put less
effort into directly codifying tacit knowledge and put more effort into linking people
with knowledge to one another, to forming and supporting communities and, in
general, providing an environment in which knowledge might be shared, enhanced
and, sometimes, created" (Grant & Qureshi 2006, p. 4).

Early models and knowledge classifications (Ackoff (1989) DIKW model and
Nonaka and Takeuhi (1995) SECI model) have been useful in helping to understand
the nature of knowledge in organisations however they do not show how to make
effective use of knowledge (Ale et al. 2014). As previously discussed in this thesis
many authors have critique both the DIKW and SECI models and in most cases these

authors then offer new models that make up for the deficiencies of their predecessors: '*Cynefin* model' (Snowden 2002), *The New Knowledge Management* (TNKM) - 'The *KLC framework*' (Firestone & McElroy 2003) and, 'model of *knowledge creation within multidisciplinary project teams*' (Fong 2003).

Ale et al. (2014) identified a set of requirements that should be met by a KM model:

KM Implementation Requirements (Ale et al. 2014):
- Requirement I: KM initiatives alignment with organizational strategy
- Requirement II: Organizational knowledge identification (consciousness)
- Requirement III: KM activities structuring
- Requirement IV: Consideration of main activities related to KM
- Requirement IV.1: In relation to knowledge creation
- Requirement IV.2: In relation to knowledge distribution
- Requirement IV.3: In relation to knowledge representation and retrieval
- Requirement V: Distributed KM
- Requirement V.1: Balance between social and technological KM aspects
- Requirement V.2: Change in the organizational culture

The requirements are essentially a reference framework for KM implementation and if all can be achieved and aligned than we will have a *conceptual model that* should be able to *support the research questions* in Chapter 3. From the requirements, Ale et al. (2014) proposed a '*KM Conceptual model'* with a knowledge-management system architecture. Ale et al. (2014) also completed a comparative analysis of KM models against the identified requirements as shown in Table 2-4.

Table 2-4 Adequacy of KM models to KM Implementation Requirements

KM Model	KM Implementation Requirements								
	I	II	III	IV.1	IV.2	IV.3	V	V.1	V.2
Wigg (Wiig 1993)		X		X	X	X			
Nonaka (Nonaka 1994)				X					
Leonard-Barton (Leonard-Barton 1995)	X			X	X	X			
Arthur Andersen (Andersen 1996)		X		X	X	X			X
Choo (Choo 1996)	X			X					

KM Model	KM Implementation Requirements								
	I	II	III	IV.1	IV.2	IV.3	V	V.1	V.2
Van der Spek and Spijkervet (Van der Spek & Spijkervet 1997)				X	X	X			X
Meyer and Zack (Meyer & Zack 1996)				X	X	X			
Alavi (Alavi 2000)				X	X	X			
Bukowitz and Williams (Bukowitz & Williams 2000)	X	X		X	X	X			
Weick (Weick 2012)		X		X	X	X			
McElroy (McElroy 2003)		X		X	X	X			
Bennet and Bennet (Bennet & Bennet 2004)	X			X	X	X			

Adapted from: (Ale et al. 2014, p. 89)

2.5.1. Comparative analysis of the Syllk model

A comparative analysis of the Syllk model was completed (Table 2-5) showing how the Syllk model meets the requirements with associated thesis artefacts. In summary, the Syllk model stands up well against the KM Implementation requirements.

Table 2-5 Syllk model compliance to the KM Implementation requirements

Requirement I: KM initiatives alignment with organizational strategy	Syllk model compliance statement	Thesis artifacts
Success in both internal management and KM initiatives.	The implementation of Project A showed how the Syllk model assisted the Branch to deliver a KM initiative.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red.
Knowledge workers must understand the nature of this relationship, so that their daily efforts are directed towards the organizational strategic goal.	The Syllk elements of Culture and Infrastructure were applied here.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red.
Identifying which KM process (knowledge creation, distribution, storage, or	Lessons learned and day to day business activity experiences are distributed across	[Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model – competitive advantage

Requirement I: KM initiatives alignment with organizational strategy	Syllk model compliance statement	Thesis artifacts
retrieval) contributes more to preserve the competitive advantage of an organization.	organisational systems and people.	
This requirement is related to the extent to which knowledge management efforts provide support to organizational strategies.	The Syllk elements of Culture and Infrastructure were applied here.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red.

Requirement II: Organizational knowledge identification (consciousness)	Syllk model compliance statement	Thesis artifacts
Conscious of critical knowledge assets.	Knowledge audit activity part of the Syllk process element.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model.
Develop strategies and techniques to raise members' awareness of both the knowledge they need for their work and its possible availability in the organization.	All of the Syllk elements work together to support knowledge awareness.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model.

Requirement III: KM activities structuring	Syllk model compliance statement	Thesis artifacts
KM must be understood by management	The Syllk elements of Culture and Infrastructure are applied here.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red.
Resources for supporting knowledge development within the organization is obtained, unfolded, or used.	The Syllk elements of Culture and Infrastructure are applied here.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red.
KM must be conceived within the organizational strategic plan and driven by a model to guide the	The Syllk elements of Culture and Infrastructure are applied here.	[Project A] 11.5.1 IKnow(Branch) framework

Requirement III: KM activities structuring	Syllk model compliance statement	Thesis artifacts
implementation of all necessary activities.		[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. Highlighted in red. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model.

Requirement IV: Consideration of main activities related to KM	

Requirement IV.1: In relation to knowledge creation	Syllk model compliance statement	Thesis artifacts
Sustainable creation through linkage with social processes: knowledge creation is a process of social nature that entails transformations between tacit and explicit forms of knowledge.	The results from this research showed how knowledge capability can be wired (distributed) across organisational systems (capability networked) and how the Syllk model can be used to conceptually facilitate this.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model
These transformations (combination, externalization, internalization, and socialization) must be sustained within the organization for an effective knowledge creation.	The Syllk model was developed on the foundation knowledge creation.	11.1.1 Conceptual model iterations [Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model.
It is more important to improve new knowledge acquisition, particularly in terms of business innovation	The results from this research showed how knowledge capability can be wired (distributed) across organisational systems (capability networked) and how the Syllk model can be used to conceptually facilitate this.	[Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model – Facilitating innovation

Requirement IV.2: In relation to knowledge distribution	Syllk model compliance statement	Thesis artifacts
Identification of communities of practice and communities of knowledge:	Duffield (2016) in project C, focussed on 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 through the capability of an online Community of Practice (CoP).	Project C, Paper Four 11.1.1 Conceptual model iterations [Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model.
Knowledge networks implementation:	The Syllk model itself shows a knowledge network distributed across organisational systems and people. Syllk model shows clear dissemination and application of knowledge / Lessons learned.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model.

Requirement IV.3: In relation to knowledge representation and retrieval	Syllk model compliance statement	Thesis artifacts
Transparency of mechanisms for knowledge representation and retrieval:	The Syllk model replaces Reasons (1997) Swiss cheese model 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	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model Paper One Project A, Paper Two Project B, Paper Three Project C, Paper Four

Requirement IV.3: In relation to knowledge representation and retrieval	Syllk model compliance statement	Thesis artifacts
	be aligned to enable the **effective dissemination and application** of the lessons. One can expect to see different facilitators and barriers within different organisations. Negative impediments (barriers) need to be overcome for effective lessons learned and the Syllk model can assist in identifying those barriers. Syllk model shows clear dissemination and application of knowledge / Lessons learned.	Figure 2-5

Requirement V: Distributed KM	Syllk model compliance statement	Thesis artifacts
The need for knowledge management in a distributed way.	The results from this research showed how knowledge capability can be wired (distributed) across organisational systems (capability networked) and how the Syllk model can be used to conceptually facilitate this. …knowledge is not to be found stored in some way in one spot, but rather it is distributed across a Syllk network of interconnected component parts. This study shows how the Syllk model enables management to conceptualise (and illustrate) how organisational capability (know-how) is wired (distributed) across various people and system elements of an organisation.	[Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model. Project A, Paper Two Project B, Paper Three Project C, Paper Four
Distributed management, such as the possibility of handling local manifold perspectives within the organization, which	The results from this research showed how knowledge capability can be wired (distributed) across organisational systems	[Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model – Facilitating innovation

Requirement V: Distributed KM	Syllk model compliance statement	Thesis artifacts
leverages understanding, learning, and innovation.	(capability networked) and how the Syllk model can be used to conceptually facilitate this. Duffield and Whitty (2016a) in project B, focussed on a conceptual model for organisations that clearly and simply articulates how lessons learned and day to day business activity experiences through the capability of storytelling can be distributed across organisational systems and people. Duffield (2016) in project C, focussed on 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 through the capability of an online Community of Practice (CoP).	Project B, Paper Three Project C, Paper Four

Requirement V.1: Balance between social and technological KM aspects	Syllk model compliance statement	Thesis artifacts
Information technology is a critical, but not necessarily a key, element in KM	Technology is one of the 6 elements of the Syllk model.	Paper One. 11.1.1 Conceptual model iterations [Project A] 11.5.1 IKnow(Branch) framework [Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model. [Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model. Project B Project C
Information technology aims at the tacit to explicit conversion of knowledge, helping to capture, encode, and distribute organizational knowledge.	The syllk model aims for optimum use of technology.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model.

Requirement V.1: Balance between social and technological KM aspects	Syllk model compliance statement	Thesis artifacts
The social component of knowledge-related activities (tacit knowledge transfer, teaching and learning processes, etc.) must be taken into account.	Social is one of the 6 elements of the Syllk model. The social element in most cases has the highest Syllk model interventions.	[Project A] Figure E-2 KM Practice (independent variable / Interventions) alignment to the Syllk model.

Requirement V.2: Change in the organizational culture	Syllk model compliance statement	Thesis artifacts
Organizations must nourish a culture that facilitates knowledge creation, distribution, and use before underscoring information technologies as a means for accomplishing KM.	The action research outcomes showed that an organisation is not a simple structure but rather a complex interweaving and coupling (capability network) of the Syllk elements of people and systems. Processes in the organisation need to align with the elements of the Syllk model. Using action research is one possible way forward. One needs to understand how the organisation is wired for knowledge and lessons learned.	[Project A] Appendix E: Figure E-3 Integrated KM mind map incorporating the Syllk model
A new thought recognizes greater complexity in knowledge challenges faced by organizations, and includes considering KM in the context of complex adaptive systems.	The Syllk model provides a more ***systemic*** complex adaptive systems approach to knowledge and lessons learned. A major outcome of the three research projects was the formulation of the Syllk capability network diagrams (Paper Two-Figure 3, Paper Three-Figure 4, Paper Four-Figure 4). Figure 8-1 shows the overlay of the capability network relationships between the three research projects. In a way, this is where an organisation can be shown as a complex adaptive network that is associated with distributing capability (know-how) like the human body and brain.	(Paper Two-Figure 3, Paper Three-Figure 4, Paper Four-Figure 4). Figure 8-1

Adapted from: (Ale et al. 2014, pp. 76-77)

2.6. Bibliography

I have maintained in EndNote a bibliography of 844 articles (at 27 March 2017) associated with KM and lessons learned literature that includes the literature and articles I have used in the published journal papers and this thesis.

2.6.1. 2015 and 2016 literature aligned with both the research question and the Syllk model

I commenced my research activities in 2011, with the literature review at that time supporting the SLLCK model (refer Appendix A). The literature was revised in 2012 to support the development of the Syllk model in 2014, which was closely followed by the published IJPM journal Paper One in 2015. In 2016 the literature was again reviewed in support of this thesis. Table 2-6 highlights recent literature from 2015 to 2016 that is aligned with and reinforces the identified research problem and the associated Syllk model.

Table 2-6 2015-16 literature aligned with the research problem and the Syllk model

Reference	Reference Type	Title	Aligned with the Syllk model			Aligned with the research problem?		
			People	Systems	KM Process	Failing to learn	Lessons Learned	Organisational learning
(Abaunza & Kirytopoulos 2016) *Cites Paper One	Proceedings of the 20th International Symposium on Advancement of Construction Management and Real Estate	Lessons Learnt from Delivering Oil and Gas Projects in Australia: An Empirical Research		X	X	X		
(Ahern, Byrne & Leavy 2015)	International Journal of Managing Projects in Business	Developing complex-project capability through dynamic organizational learning	X	X	X	X		X
(Andrew, Shang & Pheng 2015)	International Surveying Research Journal	An Institutional Approach to Understanding Post-Project Reviews in the Construction Industry	X	X		X	X	X
(Calvo-Mora, Navarro-García & Periañez-Cristobal 2015)	International Journal of Project Management	Project to improve knowledge management and key business results through the EFQM excellence model	X	X				X
(Chaves et al. 2016) *Cites Paper One	Developing and enforcing internal information systems standards	A new approach to managing Lessons Learned in PMBoK process groups: the Ballistic 2.0 Model	X	X	X	X	X	X
(Chronéer & Backlund 2015)	Project Management Journal	A Holistic View on Learning in Project-Based Organizations	X	X			X	X
(Gasik 2015)	PM World Journal	An Analysis of Knowledge Management in PMBOK® Guide	X	X		X	X	X

Reference	Reference Type	Title	Aligned with the Syllk model			Aligned with the research problem?		
			People	Systems	KM Process	Failing to learn	Lessons Learned	Organisational learning
(Hartmann & Dorée 2015)	International Journal of Project Management	Learning between projects: More than sending messages in bottles	X		X	X		X
(Love et al. 2016) *Cites Paper One	International Journal of Project Management	Building absorptive capacity in an alliance: Process improvement through lessons learned	X	X		X	X	X
(Project Management Institute 2015)	Book	Capturing the value of project Management through knowledge transfer	X	X	X	X		X
(Quintana-Amate, Bermell-Garcia & Tiwari 2015)	Knowledge-Based Systems	Transforming expertise into Knowledge-Based Engineering tools: A survey of knowledge sourcing in the context of engineering design		X	X			
(Saunders 2015)	Project Management Journal	Toward High Reliability Project Organizing in Safety-Critical Projects		X		X		X
(Savolainen & Ahonen 2015)	International Journal of Project Management	Knowledge lost: Challenges in changing project manager between sales and implementation in software projects		X			X	X
(Shergold 2015)	Australian Public Service Commission	Learning from Failure: Why large government policy initiatives have gone so badly wrong in the past and how the chances of success in the future can be improved	X	X	X	X		X
(Zhao, Zuo, & Deng 2015)	International Journal of Project Management	Examining the factors influencing cross-project knowledge transfer: An empirical study of IT services firms in China	X	X		X	X	X

2.7.   Paper One: Statement of authorship

Duffield, S., Whitty, S.J., (2015b). Developing a systemic lessons learned knowledge model for organisational learning through projects. International Journal of Project Management, vol. 33, no. 2, pp. 311-324.

Conception and design of the project:
      PhD Candidate 80%
      Co-Author 20%

Data collection, analysis, and interpretation of research data:
      PhD Candidate 100%

Drafting significant parts of the work, or critically revising it so as to contribute to the interpretation:
      PhD Candidate 80%
      Co-Author 20%

Editing and preparation of final submission:
      PhD Candidate 90%
      Co-Author 10%

PhD Candidate Signature
Stephen M Duffield
Date: 22 March 2017

Co-Author Signature
Associate Professor S. Jonathan Whitty (Principal Supervisor)
Date: 22 March 2017

Developing a systemic lessons learned knowledge model for organisational learning through projects

Stephen Duffield *, S. Jonathan Whitty [1]

University of Southern Queensland, Springfield Campus, Queensland 4300, Australia

Abstract

A significant challenge for government and business project organisations is to ensure that lessons are learned and that mistakes of the past are not repeated. Both knowledge and project management literature suggests that in practice lessons learned processes rarely happen, and when it does it is concerned with lessons identification rather than organisational learning. There are limited practical models for general management to use to conceptualise what organisational learning is and therefore how to enable it. However, aspects of health care, nuclear power, rail, and aviation organisations have successfully implemented organisational learning by way of the Swiss cheese model for safety and systemic failures. This paper proposes an adaptation of the Swiss cheese model to enable project organisations to conceptualise how they learn from past project experiences and distribute successful project know-how across an organisational network of elements such as individual learning, culture, social, technology, process and infrastructure.
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Keywords: Project management; Knowledge management; Lessons learned; Organisational learning; Swiss cheese model

1. Introduction

There is a government and business need to successfully manage programmes and projects, to learn from success and failure, and to capture, disseminate and apply lessons learned (Li, 2002; NASA, 2012; National Audit Office, 2009; New Zealand Government, 2010). The Project Management Institute's (PMI) Project Management Body of Knowledge (PMBOK® Guide) identifies the importance of collecting and documenting lessons learned and implementing process improvements (Project Management Institute, 2008a). However, in practice organisational learning from projects rarely happens, and when it does it fails to deliver the intended results (Atkinson et al., 2006; Keegan and Turner, 2001; Kerzner, 2009; Klakegg et al., 2010; Milton, 2010; Schindler and Eppler, 2003; Williams, 2008; Wysocki, 2004,

2009). 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 distributed across a network of interconnected organisational faculties and systems.

In this paper we develop a conceptual model, hereafter referred to as the systemic lessons learned knowledge model or Syllk (pronounced Silk) model, which is a variation or adaptation 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. We present the case that both Swiss cheese and Syllk models capture the essence of how naturally evolving complex adaptive systems incrementally modify their behaviour over time to optimally fit their environment. Put simply; in aviation the Swiss cheese model enables lessons learned data to be collected from each plane flight today, so that the aviation industry can improve how planes fly tomorrow. For project organisations, we envisage that the Syllk

* Corresponding author. at: Tel.: +61 421 052 135.
  E-mail addresses: stephen@invictaprojects.com.au (S. Duffield),
whitty@usq.edu.au (S.J. Whitty).
  [1] Tel.:+61 7 3470 4548.

model will enable lessons learned data to be collected from each project so that the organisation is able to improve its future project delivery performance.

The paper begins with a problem statement about the organisational lessons learned paradox, namely; why, when there are so many opinions, guides, and models on organisational lessons learned processes, do organisations generally still fail to learn from their past project experiences? In this section we highlight that the problem is not with identifying lesson, nor is it to a lesser extent with the ability to store or share knowledge by technological means. But rather the problem appears to be that organisations are unable to apply or implement the lesson learned (knowledge) they have. They lack, metaphorically speaking, an organisational central nervous system and a way of conceptualising it so that it is actionable. More practically, this means organisations require an active and manageable systemic approach to lessons learned where learning through past experiences pervades all organisational processes, systems, and practices. With this point in mind the literature review explores organisational learning and lessons learned techniques, how naturally evolved complex adaptive systems learn and adapt, and how both these topics relate to the project organisation. We then review the literature on successful learning organisations and show how their learning mechanism is underpinned by James Reason's (1997, 2000) Swiss cheese model for safety and accident prevention. Our line of enquiry is formed from a gap in the literature which results in our research question; how can the lessons learned concepts illustrated in Reason's Swiss cheese model be broadened beyond safety to meet the learning needs of project organisations? To address this question based on the groundwork of the literature review, we describe the development of the Syllk model for organisational learning through projects and present the findings of a small conceptual test of the model with practitioner focus groups. Finally we discuss the findings within the framework of the literature and speculate on practical applications and future research opportunities.

2. The problem statement

In this section we discuss the general trend of project organisations failing to learn from their past experiences whilst at the same time being surrounded by lessons learned models and guides and opinions on how to apply them. We highlight how cultural and social factors can be both a problem and solution to organisational learning, and discuss the need for a new paradigm for organisational learning that conceptualises and articulates how organisational know-how about successful project delivery is in practice distributed across networked or interconnected areas of the organisation.

2.1. There is a general trend in failing to learn from projects

There is significant dissatisfaction with project lessons learned processes as they are. Lessons from projects might be identified but not many are learned when it comes to picking up on early warning signs in problem projects (Klakegg et al., 2010). Out of 74 organisations that attempted lessons learned processes, 60%

were dissatisfied (Milton, 2010). In another study, 62% of 522 project practitioner responded that they had a process for learning lessons and of those only 11.7% followed the process (Williams, 2007). Furthermore, whilst the lessons learned process is popular, it fails to deliver the intended results as lessons are identified and are often not followed through and integrated into the organisation (O'Dell and Hubert, 2011).

Even institutions such as NASA have issues with lessons learned from projects. Following reviews in 2000 of NASA's Mars Program, the Space Shuttle wiring problems, and the implementation of NASA's Faster, Better, Cheaper (FBC) project, NASA implemented action plans to improve sharing of experiences and lessons learned (Keegan and Griner, 2000; NASA, 2012). In 2002 the Government Accountability Office found that NASA's lessons learned were not routinely identified, reviewed and accessed by project managers (Li, 2002). A recent 2012 NASA Office of Inspector General audit report highlights that NASA project managers are still not routinely using the lessons learned information system (LLIS) to contribute new information or to search for lessons learned identified by others (NASA, 2012).

Other renowned institutions have similar lesson learned issues. A review of the BP Deepwater Horizon accident investigation revealed how lessons learned of previous "well control event incidents" and "lines of communication" were not acknowledge or addressed and was a contributing cause to the failure (BP, 2010; Cleveland, 2011). NASA today uses the BP Deepwater Horizon incident as a lessons learned case study paying particular attention to communication deficiencies around government oversight, disregard of data, testing, changes to process, safety culture and lessons learned from previous incidents (NASA, 2011).

There are also few signs that lessons are being learnt through public sector projects. For example the Australian State Victorian Government Ombudsman examined 10 major ICT business transformation projects during 2011 and identified that despite the extensive guidance, reports and literature available, agencies are still making the same mistakes around planning, governance, project management and procurement (Brouwer, 2011). The Queensland Health Payroll System Commission of Inquiry highlighted that problems from the Queensland Health payroll project (the worst failure of public administration in Australia) "were known to be ones not uncommon in large government projects of this kind. The neglect of them in this case is cause to think it is likely the lessons will again be ignored" (Chesterman, 2013, p. 219).

2.2. Not for the want of opinions, guides, and models on lessons learned

Generally speaking, there are many opinions and guides, but little practical advice regarding workable processes that effectively enable the organisation to learn from past project experiences. Over the last 14 years the PMBOK® Guide has increased its references to the term lessons learned. In the PMBOK® Guide 4th edition there is a focus on process improvement as a result of lessons learned (Project Management Institute, 2008a). However, in the PMBOK® Guide 4th and 5th editions (2008b, 2013) the 'lessons learned' process is not

discussed anywhere except for a glossary description and both versions refer to a different description on what is a lesson learned. PMBOK® Guide 5th edition (2013) has an additional twenty two references (mainly due to a new knowledge area — Stakeholder Management) and still remains focussed on project closure lesson learned activities. The PMBOK® Guide 5th edition also aligns with the Knowledge Management (KM) Data, Information, Knowledge and Wisdom (DIKW) model. However, the DIKW model which is based on the work of Ackoff (1989) has been challenged by the KM community as "unsound and methodologically undesirable" (Frické, 2009; Rowley, 2007; Vala-Webb, 2012).

Organisations are also not to be found wanting for lessons learned models and methods. The Project Management Institute's OPM3 Organizational Project Management Maturity Model (Project Management Institute, 2008b) references lessons learned. However, there is less guidance than that provided in the PMBOK® Guide. The APM Body of Knowledge 6th Edition (Association for Project Management, 2012) refers to knowledge management as the governance process rather than identification of the specific process around lessons learned and highlights the importance of people skills (communities of practice, learning and development) and delivery of information management. The Office of Government Commerce PRINCE2 (OGC, 2009, p. 12) project methodology encourages project teams to "...learn from previous experience: lessons are sought, recorded and acted upon throughout the life of the project". PRINCE2 has a single process (a lessons learned log) for recording lessons learned and reporting on them (lessons learned report). The last to consider would be the Capability Maturity Model Integration (CMMI) model which provides for best practice organisational process improvement (Chrissis et al., 2003), where process improvement proposals and process lessons learned are said to be key work products and sub-processes. Midha (2005) has discussed the benefits of CMMI and identifies the classic approach of collecting and translating key lessons into processes, whereas Von Zedtwitz (2002) has developed a capability model for post-project reviews based on the standard five-stage capability model. But whilst there are many models and methods to choose from, much of the literature re-enforces the point that *people factors* influence the success of the lessons learned process and that a learning organisation culture is critical to successful dissemination of lessons learned (Andriessen and Fahlbruch, 2004; Fernie et al., 2003; Leistner, 2010; Sense, 2007).

2.3. People factors — both a problem and solution to lessons learned

There are no doubt major challenges to get employees to participate, access, and reuse the captured knowledge (Milton, 2005; O'Dell and Hubert, 2011; O'Dell et al., 1998). Duhon and Elias (2008) report that failure of learning valuable lessons from projects can be connected to the learning, cultural and social people factors. Learning in organisations is very much a social, not a solitary, phenomenon (Simon, 1991, p. 125). What an individual learns in an organisation is very much dependent on what is already known to (or believed by) other members

of the organisation and what kinds of information are present in the organisational environment. It is also affected by social and intellectual credibility (Blackman and Henderson, 2001). However, what causes a problem is that project managers are "...people-oriented, free-thinkers, passionate, autocratic, conservative and pragmatic" and in most cases these behaviours can hinder organisational cross-project sharing of lessons learned as (Pemsel and Wiewiora, 2013, p. 38).

Furthermore, from the collective point of view, project teams often know they are in trouble. However, they take no or minimal effort to resolve errors as owning up to failure may cause shame (Von Zedtwitz, 2002). A protective post lessons learned attitude weakens the process and hides the real problems of the project (Duhon and Elias, 2008). When a problem is recognised they are biased to learning the least-threatening lessons. Duhon and Elias (2008) argue that all in an industry sector should be learning from the mistakes of others, and that we typically view others as substandard to us and don't believe we can learn from them. Therefore it is often hard to get correct and relevant information on what went wrong.

However, social and cultural factors also provide solutions to organisational learning. Of the number of methods used to disseminate lessons learned, two are of particular interest, namely; process methods and social based methods. Process based methodologies are those lessons learned where the knowledge is reflected in an organisation's policies, processes and procedures (Garon, 2006; Keegan and Turner, 2001; Midha, 2005; O'Dell and Grayson, 1997; Schindler and Eppler, 2003; Williams, 2007). And social based methodologies are those lessons learned that are not easy to break up and transfer knowledge from one person to another (Bresnen et al., 2003; Fernie et al., 2003). As Fernie et al. (2003) point out, knowledge sharing is best performed through the communication of individuals, and two clearly identifiable social-based processes that appear successful are networking and mentoring (Bresnen et al., 2003; Huang and Newell, 2003). The new Syllk model presented in this paper is an attempt to integrate the features of both the process and social based methodologies.

2.4. Project organisations require a new paradigm for organisational learning through projects

The dissemination and application of lessons learned through projects are critical to organisational programmes and projects achieving success (Disterer, 2002). Lindner and Wald (2011) point out a gap in project management practice and suggest that there is a need for more research in understanding the role Knowledge Management (KM) plays in project management methodologies. Neef (2005) identifies an integrated knowledge and risk management approach where organisations need to capture knowledge as in lessons learned and then apply the knowledge learned using risk management and decision support system techniques to avoid the mistakes of the past and improve the performance of projects and the organisation. Williams (2008, p. 262) also argues that there is a need for "...wider research into how lessons [from projects] can be disseminated throughout an organisation and incorporated into organisational practice". And as Wideman (2011, p. 1 emphasis added) puts it, "...in spite

of all the technology that is available to us today, we have not yet found a *presentation format* that captures the essence of this wisdom in a way that is relevant to future usage, readily searchable and easy to store. …we have a serious cultural problem. …we are probably condemned to continue to throw away the valuable resources."

3. Literature review

The body of literature concerned with the problem as stated above is broad as it embraces organisational knowledge, the lessons learned mechanisms by which organisations can gain knowledge from past experiences, and how some organisations successfully adapt to their changing environment by inculcating learning through a conceptual model. Moreover, this literature is discussed in light of the fact that the organisation is a complex adaptive system and learning is achieved by distributing know-how across its various interconnected or networked functions. We briefly review each of these areas with enough depth to show the limitations the literature currently has in practically addressing the problem.

3.1. Organisational knowledge and lessons learned

Today, in the context of the organisation, knowledge exploration is attributed; to Drucker (1993) where knowledge is a management resource and power; to Wiig (1997) where knowledge is a form of belief; to Polanyi (1958; 2009) who explores the distinction between tacit and explicit knowledge; and to Davenport and Prusak (2000, p. 5) where knowledge in organisations "becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms".

Polanyi's (1958) work formed the foundation for KM theory authors Nonaka and Takeuchi (2007; 1995) who state that whereas explicit or codified knowledge is objective, easily communicated and transferred without in depth experience; tacit knowledge is subjective, environment-specific, personal, and is difficult to communicate. Polanyi and Sen (2009, p. 4) contend that "…we can know more than we can tell" and that humans create knowledge by involving themselves with objects through a process. Tacit knowledge therefore consists of cognitive and technical elements (Nonaka and Takeuchi, 1995). The cognitive elements are "mental models" (schemata, paradigms, perspectives, cultural beliefs and viewpoints) where humans create working models of the world in their minds and act upon them. The technical elements are the existing know how and skills (Johnson-Laird, 1983). Organisational knowledge therefore extends beyond the individual human component. It is not found in one place. It is emergent behaviour that is distributed across interconnected organisational cultural artefacts, rituals, and practices (Walsh and Ungson, 1991).

Organisational knowledge plays a key role in the development of both enterprise and project risk management controls and treatments by first searching and learning what others have done (what has worked and what has failed) so the wheel is not reinvented (Li, 2002; Liebowitz and Megbolugbe, 2003).

According to Neef (2005) a company cannot manage its risks without managing its knowledge. Projects fail due to a lack of lessons learned among the project team or lack of knowledge sharing. KM tools and techniques can be used to communicate risks among members of a project team. It is important that the organisation manages knowledge risk management which would require the identification, dissemination and application of knowledge related to potential enterprise and project risks to contribute to risk management prediction and response analysis (Alhawari et al., 2012; Neef, 2005).

Duhon and Elias (2008) argue that an organisation knows something if just one person knows it and that the organisation culture and structure enables that knowledge event to be used effectively. They reference actions such as; individual learning; knowledge storage (checklists and work processes); organisational changes that re-focus knowledge; culture changes to open and act on problems; and relationship building that enables skills and knowledge to deal with organisational problems. They also state that people learn by processing information using the human central nervous system. However, an organisation does not have a central nervous system, so it needs to create analogous structures to enable its personnel to learn as one holistic group.

Culture per se plays a significant part in KM, organisational learning, and in the effectiveness of learning mechanisms (Andriessen and Fahlbruch, 2004; Duhon and Elias, 2008; Eskerod and Skriver, 2007; Leistner, 2010). As Dvir and Shenhar (2011, p. 20) point out, "great projects create a revolutionary project culture. The execution of great projects often requires a different project culture, which can spread to an entire organisation." Williams (2007, 2008), Hislop (2005) and Maqsood (2006) all suggest that it is critical to understand the culture of an organisation before implementing or using lessons learned processes. Furthermore, surveys consistently reveal that the main obstacles to project success are organisational people (social and culture) factors (Milton, 2010; O'Dell and Hubert, 2011; Williams, 2007). In summary, organisational knowledge or know-how of how to respond to the business environment are behaviours and actions that are embedded in and distributed across organisational artefacts, system and processes, and cultural practices and rituals. They are networked elements that together generate a particular organisational response.

The established literature on lessons learned processes provides many variations on essentially three process steps; identification (capture), dissemination (transferring) and application (implementation). However, it is the application that appears to be the most difficult to operationalise (Duhon and Elias, 2008; Keegan and Turner, 2001; Williams, 2007).

On identification: Common lessons identification and capture techniques are: reflection, lessons learned sessions; after action reviews; project debriefings; close out meetings; post project appraisals/reviews; case study exercises; community of practices; project milestone reviews; post mortems, project histories; project health checks; and project audits (Anbari et al., 2008; Bakker et al., 2011; Maqsood et al., 2004; Schindler and Eppler, 2003; Williams, 2007). O'Dell and Hubert (2011, p. 69) point out that there are some typical questions that are focused on: "what was supposed to happen?, what actually happened?, why

was there a difference or variation? and who else needs to know this information?". It is the identification practices and tools that are often mistaken as complete lessons learned processes.

On dissemination: Disseminating and transfer often refer to codification, verification, storing, searching, retrieving, knowledge sharing and training (Boh, 2007; Firestone and McElroy, 2003; O'Dell and Hubert, 2011; O'Dell et al., 1998; Schindler and Eppler, 2003; Williams, 2007).

On application: Broadly speaking, knowledge application often requires a significant effort, commitment, and understanding of people behaviour for both the organisation and individuals as this is the area where the lesson learned application process typically breaks down and fails (Duhon and Elias, 2008; Keegan and Turner, 2001; Williams, 2007). Maqsood (2006), and Duhon and Elias (2008) highlight the need to understand cognitive psychology when examining the effectiveness of tacit knowledge in the learning process. Another challenge to organisational learning is that every person has a distinctive learning technique and that learning depends on an individual's capability to effectively acquire and use in a timely manner (Maqsood, 2006). Application is seen as the final piece of the lesson learned puzzle. The "…implementation of any [lessons learned] system should be driven by a strategic business need (i.e. learning) that adopts a holistic perspective which considers the implications to the project processes, tools, and people" (Carrillo et al., 2013). Application has also been conceptualised in the form of a project learning roadmap, consisting of three main components, namely: key elements (various processes that bring about change in lesson learned practices); actions (required actions both corporate and project team participate in); and an implementation guide (a form of checklist to assure aforementioned processes and actions are completed) (Carrillo et al., 2013).

The literature provides numerous technology solutions of storing, recording and accessing lessons learned. The key is to identify what works for an organisation and constantly monitor, update, and keep it current and relevant (Williams, 2007, 2008). Information Technology (IT) is a critical element to knowledge dissemination. Quite often technology is blamed for failure in knowledge dissemination (Williams, 2007). Maqsood (2006) and Newell et al. (2008) suggest that IT systems can be a key enabler to learning and supporting information sharing. Newell (2004) discusses the ineffectiveness of relying on IT to capture and share learnings and highlights how people prefer to use social networks (Bresnen et al., 2003). Williams (2007) reports that there is an over-reliance on IT systems and that IT is only part of the KM process. Often organisations implement an IT system solution without considering the organisation learning needs and implementations that focus on technology typically fail (Barnes, 2011).

In the relationships between process, people and technology, technology is only 10% of the knowledge management solution with the remaining 90% related to human capital (Maqsood and Finegan, 2009). There is a move away from KM being IT or process or people focussed to a more aligned and balance people, process and technology approach (O'Dell and Hubert, 2011). It is also recognised that the use of IT social media is having a positive influence on current knowledge management practices (O'Dell

and Hubert, 2011), and that the introduction of social software and online social networking has re-opened the debate over the relationship between technology and knowledge management (Orlikowski, 2007). Moreover, the incursion of digital immersion (internet and digital technology) coupled with the impact of mobile devices and video is having a positive impact on knowledge management (O'Dell and Hubert, 2011). Barnes (2011) has identified the following technologies that can support and enable knowledge management activities: business intelligence, client relationship management system, contact centre software, incident management software, learning management system, expertise location system, records management technology, component content management systems, enterprise content management system, document capture system, search technology, portal technologies, workflow technologies, e-discovery technology, blog software, micro-blogging software, social networking software, instant messaging technology and collaboration technologies. In addition to technology another support system for organisational learning is infrastructure, where having the right facilities, equipment and materials in place supports effective lessons learned practices (Thomas, 2012).

3.2. How complex adaptive systems learn (embed know-how)

It is at this point that we must acknowledge that an organisation is a complex adaptive system (Stacey, 2007). A complex adaptive system is a system that learns. It is a special case of a complex system where its behaviour is shaped by past experiences. It is a system that embeds and distributes knowledge about its past environments across its various faculties. Whereas complex systems such as the weather do not adapt in any way to their environment, complex *adaptive* systems like human civilisation, stock markets, social insect and ant colonies, the human body and human brain (Bak, 1997; Bar-Yam, 2003), and the organisation (Holland, 1996; Keshavarz et al., 2010; Stacey, 1996) do adapt to their changing environment. When it is said that a complex adaptive system is 'adaptive', what is meant specifically is that the system (i.e. the bounded or interconnected network of linked components that form it) is over time able to modify or alter its structure and behaviour in a beneficial way (Edelman et al., 2009) to 'fit' its environment (Smit et al., 1999). To put it another way, 'adaptive' means to embed beneficial capabilities or responses from past experiences (Bruderer, 1996). In short, complex adaptive systems learn how to respond to their *particular* environment.

As with a naturally evolved complex adaptive system, the organisation and its interconnected network of human components or agents are subjected to various combinations of internal and external selection pressures (Dosi and Marengo, 2007). The organisation's decision making behaviour is distributed across the network of organisational employees who are acting on their own behavioural rules and the rules that are embedded in the organisation's processes and practice (Dosi and Marengo, 2007).

3.3. Projects are a means of adapting and therefore learning

Fulmer (2000) argues that the project and project management has emerged as an adaptation to the organisational structure, and

it has resulted in response to competitive pressures from dynamic business operating environments. Organisations and their projects are often described as complex adaptive systems which evolve through adaptive exploration and the transformation of information through projects (Cooke-Davies et al., 2007; Gabora, 1997; Harkema, 2003; Williams, 1999). Today it is 'the project' that is now the unit of organisational work (Maylor et al., 2006). What were once business strategies are now programmes, and programmes comprise projects (Maylor et al., 2006). Not only are projects a pragmatic means of controlling work and the workforce in a dynamic environment (Cicmil and Hodgson, 2006), but they are also an activity that organisations use to gain and capture knowledge (Sherif, 2006) about their environment (Sense, 2009), to innovate and explore new markets (Gann and Salter, 1998), and to compete against others (McKenna and Whitty, 2012). To put this in more evolutionary and complex adaptive systems terms, projects are a mechanism by which organisations can adapt to better fit their environments. However, using projects in this way needs to be a conscious consideration by an organisation, and generally speaking as the literature shows this is not the case. But there are some exceptions.

3.4. Some organisations already enhance their capacity to adapt and learn

Health care, nuclear power, rail and aviation have a lot in common; they are all high hazard, high risk and high reliability organisations. They also attain high levels of safety, and experience organisational learning by addressing safety problems. They also have a flexible and informed reporting systems with a strong commitment to a *just culture* environment (CMO, 2000; Dekker, 2007; Hayes, 2009; Hopkins, 2005, 2009; Jeffcott et al., 2006; Queensland Health, 2012c; Shabel and Dennis, 2012; Weick and Sutcliffe, 2001). These organisations typically have systems in place to learn from mistakes, and are open to change and have a commitment to operating resiliently (Hopkins, 2009; Reason, 2000; Weick and Sutcliffe, 2001). They often have a collaborative learning environment that utilises complex adaptive system principles (Matthews and Thomas, 2007; Weick and Sutcliffe, 2001). The term safety culture came into the public domain after the Chernobyl nuclear disaster in 1986 and quickly spread to the aviation, chemical and health care system (Kohn et al., 2000; Weick and Sutcliffe, 2001). Within these industries they use the Reason (1997, 2000, 2008) Swiss cheese model for conceptualising, communicating, and developing accident prevention defences and systems to control risks.

The nuclear power industry created the Institute of Nuclear Power Operations (INPO) following the Three Mile Island nuclear power event (Carroll, 2004). The INPO identifies precursors and disseminates lessons learned and best practices to ensure that every plant operates with the best available knowledge (Carroll, 2004; INPO, 2013). A recent INPO publication shares the lessons learned of the nuclear accident at the Fukushima Daiichi nuclear power station (INPO, 2012).

One of the triggers for change in health care organisations was the American Institute of Medicine's report *To Err is Human* (Kohn et al., 2000). Since 2000, health care organisations have

been adopting high-reliability organisation (HRO) practices (specifically aviation practices) around communication, peer checking, peer coaching, team behaviour, reporting and root cause analysis (CMO, 2000; Gaba, 2003; Gordon et al., 2013; Hilliard et al., 2012; Pronovost et al., 2006; Rivard et al., 2006; Tamuz and Harrison, 2006; Van der Schaaf, 2002). With health care, a systemic approach to patient safety focuses on latent conditions and situational factors (Reason, 1990) supported by cognitive, social and cultural organisation factors (Henriksen and Dayton, 2006). Research highlights that HROs learn their lessons through the safety process of collecting, analysing and disseminating information from errors as well as proactive checks on the organisation vital signs (Hopkins, 2009; Vogus and Sutcliffe, 2007a; Weick and Sutcliffe, 2001). Recent research in health care identifies a supporting and positive relationship with organisational safety and patient safety (Hilliard et al., 2012; Singer et al., 2008; Vogus and Sutcliffe, 2007b).

Since 2007 Queensland Health (Australia) has had in place a 'learning to action' programme which has made significant improvements to patient safety. Each year patient safety learning to action reports have been provided to the general public describing the lessons learned and changes to the management of clinical incidents (Queensland Health, 2012b). Queensland Health clinicians now seem prepared to acknowledge problems compared to the pre-2007 culture. There appears to be a good safety, reporting, and just culture environment taking hold in the Department (Queensland Health, 2012a,c). Clinical staff have been trained in all aspects of patient safety and many of their training programmes are being used by other health systems (Queensland Health, 2012c). A steady growth in incident reporting has been shown in the 2012 patient safety from learning to action report (Queensland Health, 2012c) and a high participation in reviewing incidents has led to many improvements from small changes in a clinic or ward to major state-wide changes.

Carroll (2004) describes the association of accident precursors and knowledge management using the relationships of the Reason's (1997) Swiss cheese model. From a knowledge management lessons learned perspective Carroll (2004, p. 128) states that "…precursors are signals of possible problems, chinks in an operation's armour, or pathways to accidents" and that we should focus on improving our defences and learning our lessons. Organisations need to focus on the local environment of problems and the knowledge identified to deal with them, on top of the universal nature of what is learned and what may be needed in other parts of the organisation (Carroll, 2004). Organisations "…must consider knowledge not only as a stock of information, but also as providing the capability of inquiring, imagining, bridging boundaries, building networks of trusting relationships, and taking action. Precursor events are opportunities to enact and improve organisational practices" (Carroll, 2004, p. 134).

3.5. Reason's Swiss cheese Model as a concept and structure to enhance learning

James Reason's (1997) work on safety, learning and just culture highlights a lot of similarities with project management

lessons learned (Duhon and Elias, 2008). Reason's (1997, 2000) Swiss cheese model (Fig. 1a) conceptualises organisational accidents as a complex chain of active failures and latent conditions. The Swiss cheese model conceptualises the implementation of 'defences in depth', where one identifies that systems and processes have errors (holes) in them, which are necessarily brought about by human factors, and there are defence layers to prevent accidents from occurring (Reason, 1997). The defence layers or cheese slices consist of the person (unsafe acts), the workplace (working conditions), various organisation factors (policies and procedures), and defences (technology, training and regulations) (Reason, 1997). Improvements in organisational and workplace factors lessen the amount of unsafe acts that can occur. High-reliability organisations (HROs) use the Swiss cheese model to provide a basis for trend analysis and learning from incidents (Hayes, 2009). The Swiss cheese model has also been adapted with operational feedback to make improvements to management practices the same way it does for technical issues (Hayes, 2009).

The aviation industry worldwide started to focus on system safety and just culture around the early 1990s and has its lesson learned systems in place mainly due to a very stringent standardisation of its procedures, technology and personnel (GAIN, 2004; Van der Schaaf, 2002). A key element of the aviation just safety culture is the reporting culture where people are prepared to report their errors and near misses. Today there are typically three types of reporting systems; mandatory accident and incident systems, voluntary incident systems, and confidential accident and incident systems (GAIN, 2004). High risk and reliability industries have demonstrated that the implementation of incident (near misses, close calls, warning events) reporting systems is essential and their benefits far outweigh their costs to the organisation, and they accelerate the transformation of lessons learned (Barach and Small, 2000).

Reason (1997) points out that a learning culture is easy to engineer, yet most difficult to make work. He argues that what is required is a *just* culture and defines this as "…an atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety-related information — but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour" (Reason, 1997, p. 195).

Dekker (2007) states that a just culture is where individuals in an organisation want to be open about failures and mistakes. Lucier (2003) argues that if you can encourage team members to document their mistakes with no fear of further action, you will be able to establish a useful knowledge system.

4. Research question

What is missing from the literature is a conceptual model for project organisations that clearly articulates how lessons from past project experiences can be embedded in organisational artefacts, processes, practices, and culture. With this in mind, and considering that some organisations such as aviation do effectively learn in terms of safety and accident prevention experiences, our research question is:

How can the lessons learned concepts of Reason's Swiss cheese model be broadened beyond safety and accident prevention to enable organisations to learn [repeatedly embed beneficial practices] from past project experiences?

5. Developing a systemic lessons learned knowledge (Syllk) model for organisational learning through project

5.1. The Syllk model

The proposed Syllk model is grounded in the literature reviewed above. In line with complex adaptive systems theory it represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the organisation. Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the various modes of social and cultural learning, along with the organisational processes, infrastructure and technology that support them. The holes in the element (the facilitators of learning) all need to align to effectively apply (implement) a lessons learned. The model has undergone a number of conceptual iterations. An initial review of the literature pertaining to lessons learned focused on the dissemination of lessons learned and a preliminary model was developed (Fig. 1b). This version highlights the people, process, learning
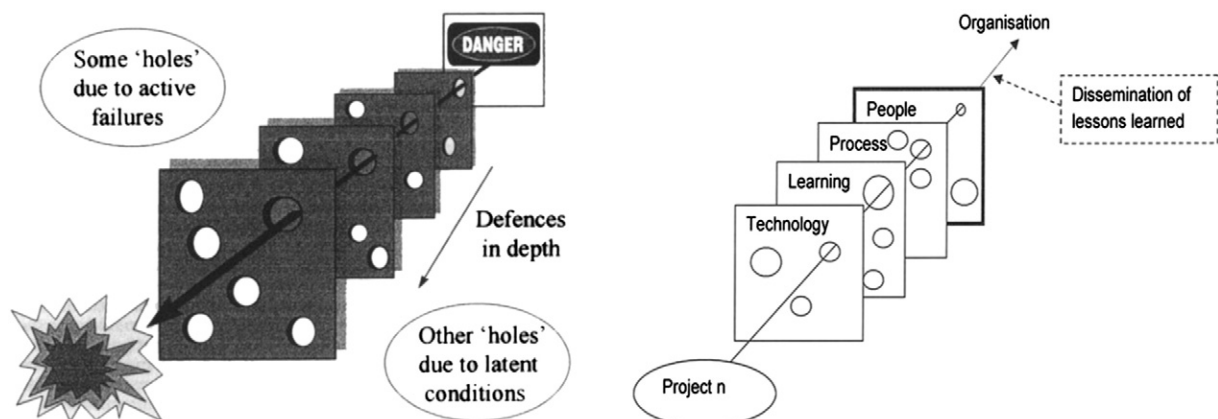

Fig. 1. a. The Swiss cheese model of defences — b. Initial Syllk model of facilitators.

and technology structures that influence the dissemination of lessons learned between those involved in delivering the project and the parent organisation.

The literature already shows that the identification of lessons learned appears to be done quite well in most organisations, whereas the dissemination and application of lessons learned fail to deliver the intended results (Atkinson et al., 2006; Keegan and Turner, 2001; Kerzner, 2009; Milton, 2010; Schindler and Eppler, 2003; Williams, 2008; Wysocki, 2004, 2009).

The review of project, knowledge and organisational management literature highlights the people element (learning, culture and social aspects), the system element (technology, process, and infrastructure) and the integration of the elements that form a knowledge network that captures and therefore influences the dissemination and application of lessons learned between project participants and the organisation. These elements were derived from the literature review by means of a grouping-categorisation matrix, and a deductive content analysis process (see Elo and Kyngäs (2008)). This process assisted in the development of the first Syllk model (Fig. 2) that contained the most common lessons learned elements acknowledge by the literature.

The model, as with its predecessor, replaces Reason's (1997) defence layers 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 identified lessons. As an example of this, Table 1 shows a sample of facilitators for each element of the model as identified by focus group participants. Lessons learned practices were identified that align with the facilitators and also address the barriers (not shown in table) that when aligned (all working together) will lead to effective dissemination and application of the identified project group lessons.

5.2. Testing the Syllk model concept with focus groups

To test the Syllk model to see if it enabled organisational lessons learned concepts to be articulated in the context of projects, a qualitative exploratory focus group research methodology approach was used. The focus group provides the practical experience and performs as a diagnostic tool to test the model (Zikmund, 2010). It also enables multiple perspectives to be clarified to achieve a solid understanding and interpretation of the model (Zikmund, 2010). The Syllk model was presented to five focus groups, and audio recordings were made of each session. The first focus group consisted of five participants, the second had eleven participants. The participants were project, engineering and knowledge management professionals from local South East Queensland Australia organisations. The third (nine participants), the forth (eleven participants), and the fifth (five participants) focus groups were part of a research project for a large government department and the participants consisted of various professional backgrounds.

During the focus group session the Syllk model was explained and participants were encouraged to make comments and provide feedback on their first impressions of the model. Worksheets (large sheets of paper) were labelled in terms of the Syllk model elements (learning, culture, and so on) and placed on desks or walls. Participants were asked to individually identify, in terms of the elements, the positive openings (facilitators) and negative impediments (barriers) that impact on lessons learned through project activities. The results of the worksheets were then reviewed and discussed with the wider group.

5.3. Results of the test

First impressions from the focus group participants were encouraging (participant comments are in quotes). During the focus group sessions the participants were able to express their assent to the model and affirm that it supported their experiences
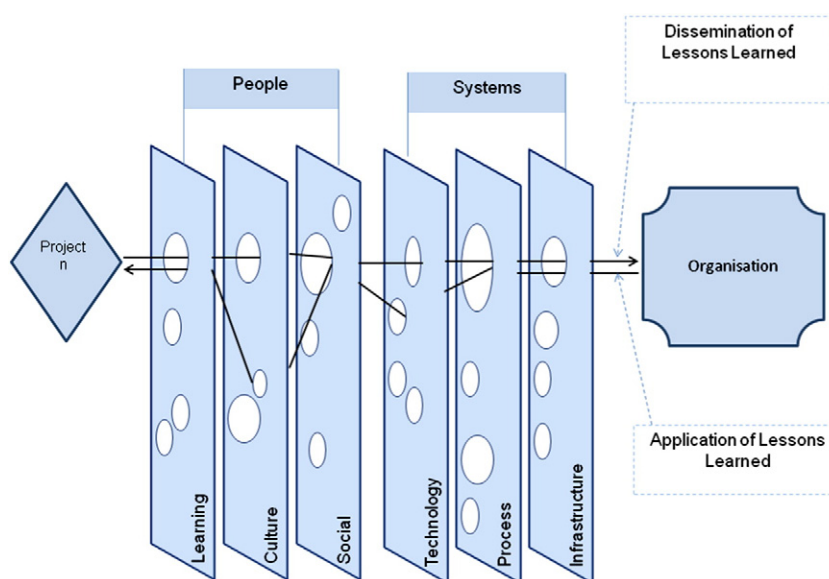

Fig. 2. The first systemic lessons learned knowledge model.

Table 1
Lessons learned facilitators and associated practices.

Facilitators (identified by focus group)	Lessons learned practices
People learning	
• Mentoring (and one-on-one coaching)	Stories and lessons through storytelling
• Small workshops (in-house) same skill level	Communities of practice
• Willingness to share and learn from each other; others willing to listen and accept new ideas; for us we have a large and growing multidisciplinary that compliment and respect each other.	Mentoring/coaching
People culture	
• Value and encourage people to contribute	Positive and supportive tone from leadership teams
• Providing support to those who want to increase their knowledge	Link to organisational objectives
• Regular updates on organisation focus	
People social	
• Acknowledge individual/group/team activities	Communities of practice
• Reward and recognition of work achieved	Promoting conversation
Systems technology	
• Dashboard — knowledge capture	Intranet site
	Knowledge libraries, portals, intranets
Systems process	
• Guidelines for process to achieve an 'across the board' consistent approach	Knowledge management framework
• Drives and delivers best practice	
System-infrastructure	
• Co-location of teams and staff	Communal knowledge work areas

whilst reconceptualising the topic of lessons learned. Drawing on their experiences, participants were able to identify the facilitators to lessons learned (i.e. the holes in the model) and the barriers (i.e. the absence of a hole). One participant said "the model does make sense, it does sort of gel with the old adage of a catastrophe that has six or seven things in a row lined up and when you take any one of those out it doesn't necessarily occur, so I can certainly see the model transpire." This supports the idea that a number of things need to come together and be supportive of each other in order to enable a beneficial practice. Another participant emphasised that "technology is the enabler, not necessarily the be all and end all. You can have the best technology systems in the world but unless you have the culture and attitude to use them they won't bear the fruit. ...and that a culture and social attitude is a priority for capturing knowledge from learning experiences".

Whilst the participants raised much of what has already been identified in the literature such as time pressures (Disterer, 2002; Leistner, 2010; Williams, 2008); blame culture (Andriessen and Fahlbruch, 2004; Schindler and Eppler, 2003; Williams, 2008); poor IT (Duhon and Elias, 2008; Leistner, 2010; Williams, 2008); social barriers (Disterer, 2002; Duhon and Elias, 2008; Maqsood, 2006); and knowledge is power (Leistner, 2010), they also identified facilitators that have limited coverage in the lessons learned literature, such as;

- a high level of knowledge and credibility of individuals, and where people are committed to credible processes
- a culture of respect, where knowledge, experience, and systems are respected, and these systems form part of the everyday job
- a culture of helping people.

Frequently the participants discussed how well the model represented the complexity of the real world, and how all facilitators (systems) need to align to enable a lesson to be learned and then captured (remembered) in various forms across the organisation. One participant said "I can look at the diagram (model) and not understand the detail of it all...but I can understand the concept behind it...that you have to do lots of things to align to make it happen." One participant raised a question about the various paths of arrows moving through the elements. This led into a group discussion around culture and technology, and that different culture (i.e. learning or reporting culture) and technology tools (i.e. wiki or intranet) may be required to support the dissemination and application of various lessons.

One of the engineering participants declared that they could see how "each element has a number of facilitating subsets, and that the model can represent knowledge stored across the organisation". Another participant stated that they "found the model had alignment with complexity and the organisational brain". Across the focus groups there was agreement that it is the people element and the differences in people that are most likely to negatively influence lesson learned processes and create barriers to the dissemination and application of lessons learned in organisations. This was supported by comments such as: "people make it happen"; "people learn in different ways"; "everybody learns differently"; and "different mediums are needed for people to learn".

Some groups spent more time discussing culture and process, whilst others focused more on social aspect. One engineering participant confirmed that "organisational systems and processes provide a supporting role to the people." Using the Syllk model as a construct for the discussion, one group lesson learned scenario

raised demonstrated how the elements of learning, culture, process and infrastructure were opened (had facilitators) to capturing knowledge, whereas the elements of social and technology were closed and prevent the dissemination and application of the identified lessons. One participant from this discussion said "often the things that go wrong or right are not because of the processes and technical knowledge, it is often because of people and the interaction between people. …if we just have a focus on processes and information flows and that sort of thing we would always miss the point. …and that is why this model is so good, as it is not about just technical expertise, just process, it is this and this and this…and getting it all lined up."

The focus groups provided feedback as to how the model can help them. Participants said that "…the model helps with the change management process". Another said "it reflects complexity, as it is hard to get a lesson learned through, so it is not just about having a database, it is not just about one thing it is about a *series* of things. I like the way it kind of stacks it up and shows it working". One participant said "we were getting lots of push from our KM team to get lessons learned going and get it implemented to meet deliverables. Had we had the model we would have been able to present to the Directors to show them what needs to be invested in to do it properly, as it is not just about doing a process."

A problem for many organisations is the lack of recognition of problem complexity. A participant said "the Syllk model conceptualises the problem well in a way that enables the problems to be discussed, and that it provides a good alignment of what has to be in place to allow the lessons learned process to deliver the intended results." Finally, the participants were able to build on and refine the Syllk model (see Fig. 3) illustrating how the connected elements of the Syllk model represent the organisation as a whole, how lessons learned from previous projects can be disseminated (spread) across the elements, and how these lessons can be applied in future projects.

6. Discussion

The Syllk model (Fig. 3) builds on Reason's (1997) comprehensive 'Swiss cheese model of defences' (Fig. 1a). The Syllk model specifies its elements in terms of people, process, learning and technology and highlighting the facilitators (holes in the cheese) and barriers as described by Reason (1997). Management systems, technology and processes are never still, and project based organisations need to embrace the concept of continuous improvement (learning) in order to remain viable in today's competitive world (Ajmal et al., 2009; Disterer, 2002; Lampel et al., 2008). The Syllk model is able to assist in this process as it appears to engage project participants with the organisational learning process in a holistic manner. The alignment of a learning culture with a safety, flexible, reporting and just culture as described by Reason and Hobbs (2003) provides a sound confirmation that the Syllk model is able to be understood by HROs (organisations that are familiar with the Swiss cheese model). The importance of this alignment factor is to show how the elements of people, process, learning and technology need to align for an organisation to learn. These organisations use and align data, information and knowledge effectively, and couple it with constant improvements to their systems (Hopkins, 2009; Vogus and Sutcliffe, 2007a; Weick and Sutcliffe, 2001). Reason (1997 p. 9) describes the Swiss cheese model holes "as shifting around, coming and going, shrinking and expanding in response to operator actions and local demands". For the Syllk model the holes will also shift around, come and go, shrink and expand in response to knowledge management actions and organisational and project demands.

The data generated from the focus group sessions appears to ground the Syllk model in the lesson learned, organisational learning, people factors and the complex adaptive systems literature. The amount of discussion time spent during the focus group sessions on culture, social and process emphasises the importance these elements are to practitioners which supports the findings in the respective literature of Anbari et al. (2008),
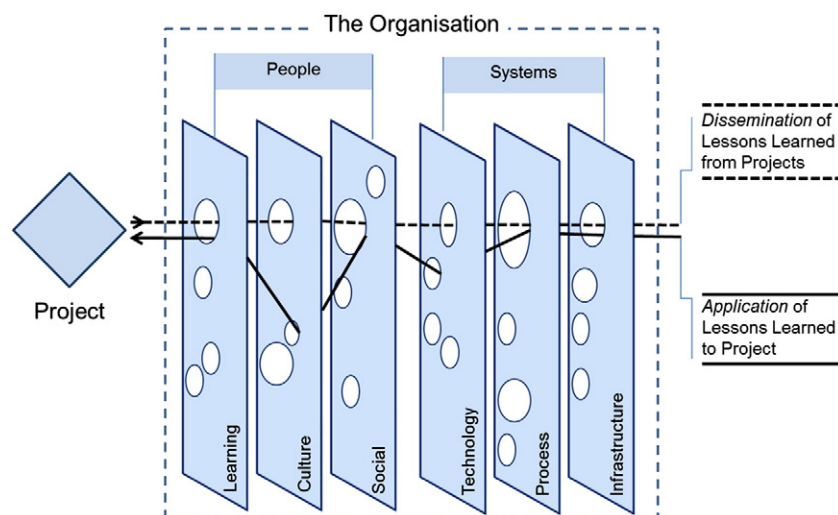

Fig. 3. A refined 'systemic lessons learned knowledge (Syllk) model'.

Bakker et al. (2011), Duhon and Elias (2008), Hislop (2005), Maqsood (2006), Schindler and Eppler (2003) and Williams (2007, 2008). One clear finding during the focus group sessions was the confirmation that lessons identification processes do exist and appear to function, but that the problem is with the dissemination and application of lessons learned. This situation leads to a false sense that lessons learned process is working and that organisations are learning from their experiences when in fact only the first part of the process (lessons identified–observed) is functioning. This separation of the lessons (identification) learned process is seldom discussed in the literature, and this paper has added to this discussion.

The study has brought forth supporting evidence that a conceptual model such as the Syllk model could in principle positively influence the dissemination and application of project management lessons learned between project participants and the organisation. The focus group discussions on complexity are notable as they emphasise how the Syllk model can resemble and conceptualise the networked 'brain' of an organisation. This supports the literature of complex adaptive systems and knowledge distribution across complex networks (Argote, 2003; Gabora, 1997; Whitty, 2012).

Understanding the impact of culture and just culture was identified as a key factor by the focus groups, and this was supported by the strong parallels found with health care, nuclear power, rail and aviation organisations. By applying the Syllk model to an organisation and identifying the lessons learned and knowledge management facilitators and barriers for each of the model elements (learning, culture, social, technology, process and infrastructure) an organisation can better understand the knowledge management practices required to support an environment that captures, disseminates and applies knowledge lessons learned. The implementation of the Syllk model is expected to identify organisational and project performance improvements such as reduction of the time and cost to solve problems, identification and treatment of risks and improvements to policies, systems and processes.

7. Limitations and challenges

One of the challenges with content analysis is that the process is flexible in nature and there is no simple right way of doing it (Elo and Kyngäs, 2008; Leedy and Ormrod, 2009). The focus group approach does have some limitations and disadvantages. A unique sampling problem could arise as two of the focus groups had similar backgrounds and experiences. The results could be dependent on the moderator and finally the groups are not intended to represent the larger population (Zikmund, 2010). To address some of these limitations this study will be repeated with project organisations from disparate sectors.

8. Future research

The preliminary findings from this research form a sound structure for a future study based on a four stage participatory action research method (plan, action, observe and reflect) adapted from McKay and Marshall (2001) and McNiff and Whitehead (2002). Planned implementation changes based on the Syllk model will be observed, monitored and evaluated for their impact on key variables identified in business or project organisational company metrics (financial gains, performance, sharing, innovation, stakeholder relationships).

This research supports the premise that the project management lessons learned processes today can largely be considered incomplete and somewhat ill-conceived. Future research themes could focus on how project management lessons learned is best represented to the practitioner community and their organisations in a way that could be captured in project management methodologies and bodies of knowledge.

9. Conclusion

This research study is focussed on exploring whether lessons learned concepts of Reason's Swiss cheese model be broadened beyond safety and accident prevention to enable organisations to learn from past project experiences. The study suggests that by reconceptualising lessons learned in terms of an adaptation of the Swiss cheese model for safety and accident prevention, the Syllk model can influence the identification, dissemination and application of project management lessons learned. This study has established that the alignment of the people and system elements has the potential to positively influence the success of an organisation's lessons learned processes. The study found that the people element and culture factor may well be the most likely to negatively influence lessons learned in organisations. Furthermore, the study also established that several elements of the model need to align to ensure organisational lessons are learned by means of projects. Finally, the findings contribute to the project and knowledge management literature and provide an opportunity to improve project knowledge sharing, and ensure projects achieve success for organisations to maintain a competitive advantage.

Conflict of interest

The authors declare that there are no conflict of interest.

Acknowledgements

References

Ackoff, R., 1989. From data to wisdom. J. Appl. Syst. Anal. 16, 3–9.

Ajmal, Kekäle, Takala, 2009. Cultural impacts on knowledge management and learning in project-based firms. J. Inf. Knowl. Manag. Syst. 39, 339–352.

Alhawari, S., Karadsheh, L., Nehari Talet, A., Mansour, E., 2012. Knowledge-based risk management framework for information technology project. Int. J. Inf. Manag. 32, 50–65.

Anbari, F.T., Carayannis, E.G., Voetsch, R.J., 2008. Post-project reviews as a key project management competence. Technovation 28, 633–643.

Andriessen, J.H.E., Fahlbruch, B., 2004. How to Manage Experience Sharing: From Organisational Surprises to Organisational Knowledge, 1st ed. Elsevier, Amersterdam; Boston.

Argote, L.B.R., 2003. Managing knowledge in organizations: an integrative framework and review of emerging themes. Manag. Sci. 49, 571–582.

Association for Project Management, 2012. APM Body of Knowledge, 6th ed. Imprint Digital, Buckinghamshire.

Atkinson, R., Crawford, L., Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. Int. J. Proj. Manag. 24, 687–698.

Bak, P., 1997. How Nature Works: The Science of Self-Organized Criticality. Oxford University Press, Oxford.

Bakker, R.M., Cambré, B., Korlaar, L., Raab, J., 2011. Managing the project learning paradox: a set-theoretic approach toward project knowledge transfer. Int. J. Proj. Manag. 29, 494–503.

Barach, Small, 2000. Reporting and preventing medical mishaps: lessons from nonmedical near miss reporting systems. Br. Med. J. 320, 759–763.

Barnes, S., 2011. Aligning people, process and technology in knowledge management. In: Serventie (Ed.), Ark Group in Association with Inside Knowledge.

Bar-Yam, Y., 2003. Dynamics of Complex Systems: Studies in Nonlinearity. Westview Press.

Blackman, Henderson, 2001. Does a learning organisation facilitate knowledge acquisition and transfer? Electron. J. Radic. Organ. Theory 7 (1) (Waikato Management School (WMS) at the University of Waikato, New Zealand.).

Boh, W.F., 2007. Mechanisms for sharing knowledge in project-based organizations. Inf. Organ. 17, 27–58.

BP, 2010. Deepwater Horizon Accident Investigation Report.

Bresnen, Edelman, Newell, Scarbrough, Swan, 2003. Social practices and the management of knowledge in project environments. Int. J. Proj. Manag. 21, 157–166.

Brouwer, G., 2011. In: V. Ombudsman (Ed.), Own Motion Investigation into ICT-Enabled Projects. Victorian Ombudsman, Victorian Government Printer, Melbourne.

Bruderer, E.J.V., 1996. Organizational evolution, learning, and selection: a genetic-algorithm-based model. Acad. Manag. J. 39, 1322–1349.

Carrillo, Ruikar, Fuller, 2013. When will we learn? Improving lessons learned practice in construction. Int. J. Proj. Manag. 31, 567–578.

Carroll, J.S., 2004. Knowledge management in high-hazard industries. Accid. Precursor Anal. Manag. 127–136.

Chesterman, 2013. Queensland Health Payroll System Commission of Inquiry. The State of Queensland.

Chrissis, M.B., Konrad, M., Shrum, S., 2003. CMMI®: guidelines for process integration and product improvement. Addison-Wesley, Boston.

Cicmil, S., Hodgson, D., 2006. Are projects real? The PMBOK and the legitimation of project management knowledge. In: Hodgson, D., Cicmil, S. (Eds.), Making Projects Real. Palgrave MacMillan.

Cleveland, C., 2011. Macondo: the gulf oil disaster. Encyclopedia of Earth.

CMO, 2000. In: Chairman, C. (Ed.), An Organisation with a Memory. UK Department of Health Expert Group.

Cooke-Davies, T., Cicmil, S., Crawford, L., Richardson, K., 2007. Mapping the strange landscape of complexity theory, and its relationship to project management. Proj. Manag. J. 38, 50–61.

Davenport, T., Prusak, L., 2000. Working Knowledge: How Organizations Manage What They Know. Harvard Business Press.

Dekker, S., 2007. Just Culture: Balancing Safety and Accountability. Ashgate, Aldershot, England; Burlington, VT.

Disterer, G., 2002. Management of project knowledge and experiences. J. Knowl. Manag. 6, 512–520.

Dosi, G., Marengo, L., 2007. Perspective—on the evolutionary and behavioral theories of organizations: a tentative roadmap. Organ. Sci. 18, 491–502.

Drucker, P.F., 1993. Post-Capitalist Society. Butterworth Heinemann, Oxford.

Duhon, H., Elias, J., 2008. Why it is difficult to learn lessons: insights from decision theory and cognitive science. SPE Proj. Facil. Const. 3, 1–7.

Dvir, D., Shenhar, A., 2011. What Great Projects Have in Common, MIT Sloan Management Review. pp. 18–21.

Edelman, L.B., Chandrasekaran, S., Price, N.D., 2009. Systems biology of embryogenesis. Reprod. Fertil. Dev. 22, 98–105.

Elo, S., Kyngäs, H., 2008. The qualitative content analysis process. J. Adv. Nurs. 62, 107–115.

Eskerod, P., Skriver, H.J., 2007. Organizational culture restraining in-house knowledge transfer between project managers—a case study. Proj. Manag. J. 38, 110–122.

Fernie, S., Green, S.D., Weller, S.J., Newcombe, R., 2003. Knowledge sharing: context, confusion and controversy. Int. J. Proj. Manag. 21, 177–187.

Firestone, J., McElroy, M., 2003. Key Issues in New Knowledge Management. Elsevier Science, Burlington, MA.

Frické, M., 2009. The knowledge pyramid: a critique of the DIKW hierarchy. J. Inf. Sci. 35, 131–142.

Fulmer, W.E., 2000. Shaping The Adaptive Organisation: Landscapes, Learning, and Leadership in Volatile Times. AMACOM Books, New York.

Gaba, D.M., 2003. Special Issue. Safety First: Ensuring Quality Care in the Intensely Productive Environment—The HRO Model. Anesthesia Patient Safety Foundation Newsletter.

Gabora, L., 1997. The origin and evolution of culture and creativity. J. Memet. Evol. Model. Inf. Transm. 1, 1–28.

GAIN, 2004. A roadmap to a just culture: enhancing the safety environment, In: Stastny, P., Garin, A., Gordon, R., Edwards, C., Johnson, M., Moylan, P., Schanne, J. (Eds.), GAIN Working Group E, First ed.

Gann, D.M., Salter, A., 1998. Learning and innovation management in project-based, service-enhanced firms. Int. J. Innov. Manag. 02, 431–454.

Garon, S., 2006. Space project management lessons learned: a powerful tool for success. J. Knowl. Manag. 10, 103–112.

Gordon, Mendenhall, O'Connor, 2013. Beyond the Checklist: What Else Health Care Can Learn from Aviation Teamwork and Safety. Cornell University Press, New York.

Harkema, S., 2003. A complex adaptive perspective on learning within innovation projects. Learn. Organ. 10, 340–346.

Hayes, J., 2009. Incident reporting: a nuclear industry case study. In: Hopkins, A. (Ed.), Learning from High Reliability Organisations. CCH Australia Limited, Sydney.

Henriksen, K., Dayton, E., 2006. Organizational silence and hidden threats to patient safety. Health Serv. Res. 41, 1539–1554.

Hilliard, Sczudlo, Scafidi, Cady, Villard, Shah, 2012. Our journey to zero: reducing serious safety events by over 70% through high-reliability techniques and workforce engagement. J. Healthc. Risk. Manag. 32, 4–18.

Hislop, D., 2005. Knowledge Management in Organizations: A Critical Introduction. Oxford University Press, Oxford; New York.

Holland, J., 1996. Hidden Order: How Adaptation Builds Complexity. Addison-Wesley, Reading, Mass.

Hopkins, A., 2005. Safety, Culture and Risk: The Organisational Causes of Disasters, 1st ed. CCH Australia, Sydney, N.S.W.

Hopkins, A., 2009. Learning from High Reliability Organisations. CCH Australia Limited, Sydney.

Huang, J.C., Newell, S., 2003. Knowledge integration processes and dynamics within the context of cross-functional projects. Int. J. Proj. Manag. 21, 167–176.

INPO, 2012. Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, INPO 11–005 Addendum. Institute of Nuclear Power Operations, Atlanta, GA.

INPO, 2013. Institute of Nuclear Power Operations.

Jeffcott, S., Pidgeon, N., Weyman, A., Walls, J., 2006. Risk, trust, and safety culture in UK train operating companies. Risk Anal. 26, 1105–1121.

Johnson-Laird, P.N., 1983. Mental models: Towards a Cognitive Science of Language, Inference, and Consciousness. Harvard University Press, Cambridge, Mass.

Keegan, B., Griner, C., 2000. In: NASA (Ed.), Enhancing Mission Success — A Framework for the Future (A Report by the NASA Chief Engineer and the NASA Integrated Action Team).

Keegan, A., Turner, J.R., 2001. Quantity versus quality in project-based learning practices. Manag. Learn. 32, 77–98.

Kerzner, H., 2009. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 10th ed. John Wiley & Sons, Hoboken, N.J.

Keshavarz, N., Nutbeam, D., Rowling, L., 2010. Social complex adaptive systems. A response to Haggis. Soc. Sci. Med. 70, 1478–1479.

Klakegg, O., Williams, T., Walker, D., Andersen, B., Magnussen, O., 2010. Early Warning Signs in Complex Projects. Project Management Institute Inc., Newtown Square, Pennsylvania.

Kohn, L.T., Corrigan, J., Donaldson, M.S., 2000. To Err is Human: Building a Safer Health System. National Academy Press, Washington, D.C.

Lampel, J., Scarbrough, H., Macmillan, S., 2008. Managing through projects in knowledge-based environments: special issue introduction by the guest editors. Long Range Plan. 41, 7–16.

Leedy, P.D., Ormrod, J.E., 2009. Practical Research: Planning and Design, 9th ed. Pearson Education, Upper Saddle River, N.J.; Harlow.

Leistner, F., 2010. Mastering Organizational Knowledge Flow: How to Make Knowledge Sharing Work. John Wiley & Sons, Hoboken, N.J.

Li, 2002. GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned. In: Office, U.S.G.A. (Ed.), (Washington, DC.).

Liebowitz, J., Megbolugbe, I., 2003. A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives. Int. J. Proj. Manag. 21, 189–198.

Lindner, F., Wald, A., 2011. Success factors of knowledge management in temporary organizations. Int. J. Proj. Manag. 29, 877–888.

Lucier, C., 2003. When knowledge adds up to nothing — why knowledge management fails and what you can do about it. Dev. Learn. Organ. 17, 32–35.

Maqsood, T., 2006. The Role of Knowledge Management in Supporting Innovation and Learning in Construction, School of Business Information Technology. RMIT University.

Maqsood, T., Finegan, A., 2009. A knowledge management approach to innovation and learning in the construction industry. Int. J. Manag. Proj. Bus. 2, 297–307.

Maqsood, T., Walker, D., Finegan, A., 2004. Project histories and project learning—a knowledge management challenge. 20th Annual ARCOM Conference. Association of Researchers in Construction Management, Heriot Watt University, pp. 561–570.

Matthews, J.I., Thomas, P.T., 2007. Managing clinical failure: a complex adaptive system perspective. Int. J. Healthc. Qual. Assur. 20, 184–194.

Maylor, H., Brady, T., Cooke-Davies, T., Hodgson, D., 2006. From projectification to programmification. Int. J. Proj. Manag. 24, 663–674.

McKay, J., Marshall, P., 2001. The dual imperatives of action research. Inf. Technol. People 14, 46–59.

McKenna, T., Whitty, S.J., 2012. Reconceptualising project management methodologies for a post-postmodern era. In: Crawford, L. (Ed.), 9th Annual Project Management Australia Conference Incorporating the PMI Australia National Conference (PMOz), Melbourne, Australia, pp. 34–54.

McNiff, Whitehead, 2002. Action Research: Principles and Practice, 2nd ed. RoutledgeFalmer, New York.

Midha, A., 2005. How to incorporate "lessons learned" for sustained process improvements. NDIA CMMI Technology Conference.

Milton, N., 2005. Knowledge Management For Teams and Projects. Chandos Publishing, Oxford.

Milton, N., 2010. The Lessons Learned Handbook: Practical Approaches to Learning from Experience. Chandos Publishing, Oxford, UK.

NASA, 2011. The Deepwater Horizon Accident: Lessons for NASA. Academy of Program/Project & Engineering Leadership.

NASA, 2012. In: General, N.O.o.I (Ed.), Review of NASA's Lessons Learned Information System (Washington, DC.).

National Audit Office, 2009. Helping Government Learn. The Stationary Office, London.

Neef, D., 2005. Managing corporate risk through better knowledge management. Learn. Organ. 12, 112–124.

New Zealand Government, 2010. Major Projects Report: Overview & Assessment. In: Ministry of Defence, N.Z.D.F., Office of the Auditor-General (Eds.), Ministry of Defence, Wellington.

Newell, S., 2004. Enhancing cross-project learning. Eng. Manag. J. 16, 12–20.

Newell, S., Goussevskaia, A., Swan, J., Bresnen, M., Obembe, A., 2008. Interdependencies in complex project ecologies: the case of biomedical innovation. Long Range Plan. 41, 33–54.

Nonaka, I., 2007. The knowledge-creating company. Harv. Bus. Rev. 85, 162.

Nonaka, I., Takeuchi, H., 1995. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation (New York).

O'Dell, Grayson, 1997. In: APQC (Ed.), Identifying and Transferring Internal Best Practices. APQC, Houston.

O'Dell, Hubert, 2011. The New Edge in Knowledge: How Knowledge Management is Changing the Way We Do Business. John Wiley & Sons, New Jersey.

O'Dell, Grayson, Essaides, 1998. If Only We Knew What We Know: The Transfer of Internal Knowledge and Best Practice. Free Press, New York.

OGC, 2009. Managing Successful Projects with PRINCE2. TSO, London.

Orlikowski, W.J., 2007. Sociomaterial practices: Exploring technology at work. Organ. Stud. 28, 1435–1448.

Pemsel, S., Wiewiora, A., 2013. Project management office a knowledge broker in project-based organisations. Int. J. Proj. Manag. 31, 31–42.

Polanyi, M., 1958. Personal Knowledge; Towards a Post-Critical Philosophy. University of Chicago Press, Chicago.

Polanyi, M., Sen, A., 2009. The Tacit Dimension. University of Chicago Press, Chicago; London.

Project Management Institute, 2008a. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 4th ed. PMI Inc., Newtown Square, Pa.

Project Management Institute, 2008b. Organizational Project Management Maturity Model (OPM3®), 2nd ed. Project Management Institute Inc., Newtown Square, Pa.

Project Management Institute, 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th ed. PMI Inc., Newtown Square, Pa.

Pronovost, P.J., Berenholtz, S.M., Goeschel, C.A., Needham, D.M., Sexton, J.B., Thompson, D.A., Lubomski, L.H., Marsteller, J.A., Makary, M.A., Hunt, E., 2006. Creating high reliability in health care organizations. Health Serv. Res. 41, 1599–1617.

Queensland Health, 2012a. Patient Safety Reports (Brisbane).

Queensland Health, 2012b. Clinical safety and quality model governance framework in hospital and health services. In: C.f.H.I., Queensland Health (Eds.), Patient Safety and Quality Improvement Service. Queensland Government, Brisbane.

Queensland Health, 2012c. Patient safety: from learning to action 2012. In: Queensland Health, C.f.H.i (Ed.), Patient Safety and Quality Improvement Service. Queensland Health, Brisbane, Herston.

Reason, 1990. Human Error. Cambridge University Press, Cambridge England; New York.

Reason, 1997. Managing the Risks of Organizational Accidents. Ashgate, Aldershot, Hants, England; Brookfield, Vt., USA.

Reason, 2000. Human error: models and management. Br. Med. J. 320, 768.

Reason, 2008. The Human Contribution: Unsafe Acts, Accidents and Heroic Recoveries. Ashgate, Farnham, England; Burlington, VT.

Reason, J.T., Hobbs, A., 2003. Managing Maintenance Error: A Practical Guide. Ashgate Publishing.

Rivard, P.E., Rosen, A.K., Carroll, J.S., 2006. Enhancing patient safety through organizational learning: are patient safety indicators a step in the right direction? Health Serv. Res. 41, 1633–1653.

Rowley, J., 2007. The wisdom hierarchy: representations of the DIKW hierarchy. J. Inf. Sci. 33, 163–180.

Schindler, Eppler, 2003. Harvesting project knowledge: a review of project learning methods and success factors. Int. J. Proj. Manag. 21, 219–228.

Sense, A.J., 2007. Learning within project practice: cognitive styles exposed. Int. J. Proj. Manag. 25, 33–40.

Sense, A.J., 2009. The social learning character of projects and project teams. Int. J. Knowl. Manag. Stud. 3, 195–208.

Shabel, Dennis, 2012. Missouri's just culture collaborative. J. Healthc. Risk. Manag. 32, 38–43.

Sherif, K., 2006. An adaptive strategy for managing knowledge in organizations. J. Knowl. Manag. 10, 72–80.

Simon, H.A., 1991. Bounded rationality and organizational learning. Organ. Sci. 2, 125–134.

Singer, S., Lin, S., Falwell, A., Gaba, D., Baker, L., 2008. Relationship of safety climate and safety performance in hospitals. Health Serv. Res. 44, 399–421.

Smit, B., Burton, I., Klein, R.J.T., Street, R., 1999. The science of adaptation: a framework for assessment. Mitig. Adapt. Strateg. Glob. Chang. 4, 199–213.

Stacey, R.D., 1996. Complexity and Creativity in Organizations. Berrett-Koehler Publishers, San Francisco.

Stacey, R.D., 2007. Strategic Management and Organisational Dynamics: The Challenge of Complexity to Ways of Thinking about Organisations. Financial Times Prentice Hall.

Tamuz, M., Harrison, M.I., 2006. Improving patient safety in hospitals: contributions of high-reliability theory and normal accident theory. Health Serv. Res. 41, 1654–1676.

Thomas, W.H., 2012. The Basics of Project Evaluation and Lessons Learned. CRC Press, Boca Raton, FL.

Vala-Webb, G., 2012. The DIKW Pyramid Must Die, KM World. (http://www.kmworld.com/, Washington, DC.).

Van der Schaaf, T.W., 2002. Medical Applications of Industrial Safety Science, Quality and Safety in Health Care. BMJ Publishing Group Ltd, pp. 205–206.

Vogus, T.J., Sutcliffe, K.M., 2007a. The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. Med. Care 45, 997–1002.

Vogus, T.J., Sutcliffe, K.M., 2007b. The safety organizing scale: development and validation of a behavioral measure of safety culture in hospital nursing units. Med. Care 45, 46–54.

Von Zedtwitz, M., 2002. Organizational learning through post-project reviews in R&D. R&D Manag. 32, 255–268.

Walsh, J.P., Ungson, G.R., 1991. Organizational memory. Acad. Manag. Rev. 16, 57–91.

Weick, Sutcliffe, 2001. Managing the Unexpected: Assuring High Performance in an Age of Complexity. Jossey-Bass, San Francisco.

Whitty, S.J., 2012. Complexity Science Insights for Managers.

Wideman, R.M., 2011. On the August PMWT Editorial on Lessons Learned by Knowledge Lost, PM World Today. PMForum, Inc.

Wiig, K., 1997. Knowledge management: an introduction and perspective. J. Knowl. Manag. 1, 6–14.

Williams, T., 1999. The need for new paradigms for complex projects. Int. J. Proj. Manag. 17, 269–273.

Williams, T., 2007. Post-Project Reviews to Gain Effective Lessons Learned. Project Management Institute, Newtown Square, USA.

Williams, T., 2008. How do organisations learn lessons from projects—and do they? IEEE Trans. Eng. Manag. 55, 248–266.

Wysocki, R.K., 2004. Project Management Process Improvement. Artech House, Boston.

Wysocki, R.K., 2009. Effective Project Management Traditional, Agile, Extreme, 5th ed. Wiley Pub, Indianapolis, IN.

Zikmund, W.G., 2010. Business Research Methods, 8th ed. South-Western Cengage Learning, Mason, OH.

3. RESEARCH QUESTIONS

Despite the importance of KM to organisations, why is there no simple existing KM model that organisations can adopt? What is missing from the literature is a conceptual model for project organisations that *clearly articulates how lessons from past projects experiences can be embedded in organisational artefacts, processes, practices, and culture*. With this in mind, and considering that some organisations such as aviation do effectively learn in terms of safety and accident prevention experiences, the high-level research question is:

[RQ 1]. How can the lessons learned concepts of Reasons Swiss cheese model be broadened beyond safety and accident prevention to enable organisations to learn [repeatedly embed beneficial practices] from past project experiences?

The high-level research question can be decomposed into three sub-research questions as highlighted in the associated thesis publications for each of the research projects (Figure 3-1).
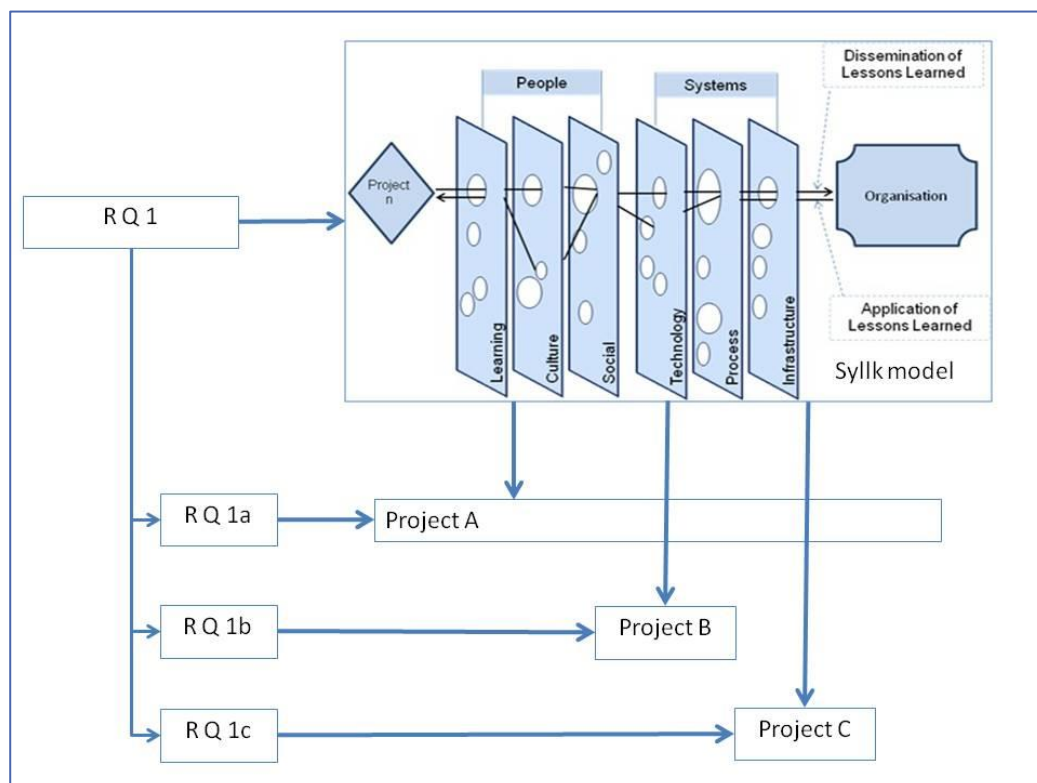
Figure 3-1 Relationship of research questions and research projects

Duffield and Whitty (2016b) in project A, focussed on how a tool such as the Syllk model could be practically used by a project organisation to capture knowledge and lessons from its project work and successfully distribute this knowledge capability (know-how) across its organisational systems and people. With this in mind, the research question is:

> *[RQ 1a] {How} Can the Systemic Lessons Learned Knowledge (Syllk) model enable a project organisation to learn from past project experiences?*

Duffield and Whitty (2016a) in project B, focussed on a conceptual model for organisations that clearly and simply articulates how lessons learned and day to day business activity experiences through the capability of storytelling can be distributed across organisational systems and people. With this in mind, the research question is:

> *[RQ 1b] {How} Can the Systemic Lessons Learned Knowledge (Syllk) model be used by a project organisation to conceptualise (and enhance) its capability of storytelling?*

Duffield (2016) in project C, focussed on 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 through the capability of an online Community of Practice (CoP). With this in mind, the research question is:

> *[RQ 1c] 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

This chapter explores the research methodology and is further supported by the detailed attached Paper Five; Duffield, S., (Forthcoming, 2017). Using Action Research in Practice: Useful Insights and Outcomes. ALAR: Action Learning and Action Research Journal, vol. 23, no. 1. The aim of Paper Five is to describe a direct and personal account of the issues and challenges that occurred in the three action research projects. Paper Five reports on the action research cycles applied to each of the research projects for both the organisational problem-solving activity and the research activity. Action research insights, implications, and limitations of this research study are also noted in Paper Five.

4.1.   Research paradigm

Taking a top-down view of research options, a research paradigm provides the overarching framework that defines the researchers approach to the development of knowledge (Collis & Hussey 2009; Guba & Lincoln 1994)). The research paradigm interpretivism was selected as the primary approach to addressing the research problems for each associated research project. Action research was selected as the methodology that reflects the philosophical assumptions of interpretivism (Table 4-1).

The selection of an interpretivist approach for the research is based on appropriate social science that also offers to address the research questions in this research program (Guba & Lincoln 1994). Collis and Hussey (2009, p. 81) state that the "philosophical assumptions that underpin action research are that the social world is constantly changing, and the researcher and the research are part of this change". However, there "is considerable debate about the methodological and epistemological basis of action research" (McNiff & Whitehead 2011, p. 39).

Action research challenges the claims of a positivistic view of knowledge and embraces the concept of knowledge as socially constructed with human interaction (Brydon-Miller, Greenwood & Maguire 2003). Susman and Evered (1978, p. 585) in their assessment of scientific merits of action research concluded "...we find all positivist approaches to science (P.S.) to be deficient in their capacity to generate knowledge for use by members of organizations for solving the problems they face". They note that action research is more agreeable to the perspective of organisations generating knowledge for application to organisational problems (Baskerville 1999) and operations management (Coughlan & Coghlan 2002).

Table 4-1 Assumption of the main research paradigms

Assumption of the main research paradigms		
Philosophical assumption	Positivism	Interpretivism
Ontological assumption (the nature of reality)	Reality is objective and singular, separate from the researcher	Reality is subjective and multiple, as seen by the participants
Epistemological assumption (what constitutes valid knowledge)	Researcher is independent of that being researched	Researcher interacts with that being researched
Axiological assumption (the role of values)	Research is value-free and unbiased	Researcher acknowledges that research is value-laden and biases are present
Rhetorical assumption	The researcher writes in a formal style, uses the passive voice and accepted quantitative words.	The researcher writes in an informal style, uses the personal voice and accepted qualitative words.
Methodological assumption (the process of research)	Process is deductive Use large sample size Study of cause and effect with a static design (categories are isolated beforehand) Research is context free Generalizations lead to prediction, explanation, and understanding Results are accurate and reliable through validity and reliability (typically high reliability but with low validity)	Process is inductive Use small sample size Study of mutual simultaneous shaping of factors with an emerging design (categories are identified during the process) Research is context bound Patterns and/or theories are developed for understanding Findings are accurate and reliable through verification (typically low reliability but with high validity)

Adapted from: (Collis & Hussey 2009; Creswell 2009, 2012; Mayoh & Onwuegbuzie 2013, p. 4)

4.2. Action research defined

A significant criticism of action research is the challenge of defining the term and the lack of consistent approaches. The lack of consistent methods enables such a wide range of interpretations to be made that it becomes hard to assess and review the rigour of an action research project. Researchers can have difficulties applying action research methodology that can be used in different ways, which poses potential problems for the researcher as well and may lead to a lack of confidence in the results by those who are interested in the outcomes. There are many definitions of action research, and they differ between authors. Most agree that action research is a reflective process (Herr & Anderson 2005). The definition approach taken in this research program is structured on the working definition authored jointly by the participants at the Brisbane International Symposium on Action Research in 1989 (Table 4-2).

Table 4-2 Working definition of action research

If yours is a situation in which
• people reflect on and improve (or develop) their own work and their own situations
• by tightly inter-linking their reflection and action; and
• also making their experience public not only to other participants but also to other persons interested in and concerned about the work and the situation, i.e. their (public) theories and practices of the work and the situation;
and if yours is a situation in which there is increasingly
• data-gathering by participants themselves (or with the help of others) in relation to their own questions;
• participation (in problem-posing and in answering questions) in decision-making;
• power-sharing and the relative suspension of hierarchical ways of working towards industrial democracy;
• collaboration among members of the group as a "critical community";
• self-reflection, self-evaluation and self-management by autonomous and responsible persons and groups;
• learning progressively (and publicly) by doing and by making mistakes in a "self-reflective spiral" of planning, acting, observing, reflecting, replanning, etc.;
• reflection which supports the idea of the "(self-) reflective practitioner";
then yours is a situation in which action research is occurring.

Source: (Altrichter et al. 2002, p.130; McNiff & Whitehead 2011, pp. 24-25)

4.3. The action research methodology

The term action research was pioneered by Kurt Lewin toward social research which combined the generation of theory with changing the social system through the researcher acting on or in the social system (Lewin 1946). Action research is a way of both changing the system and generating critical knowledge about through a continuous cycle of planning, acting, observing and reflecting (Lewin 1946). Action research is a methodology that provides an effective 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 & Hussey 2009; Kemmis, McTaggart & Nixon 2014; Lewin 1946, McNiff & Whitehead 2011).

4.4. Action research suitability to this research

Action research was selected as the most suitable methodology to answer the research questions as the research is focused on 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 & Wood-Harper 1996; Raelin 1998; Susman & Evered 1978; Zuber-Skerritt & Perry 2002). Action research has also been used in project management research to implement organisational change (Sankaran, Tay & Orr 2009), how project managers acquire

and exchange knowledge (Algeo 2014), knowledge management systems (Mau 2005; Orr 2006; Sankaran 2009; Sankaran, Tay & Orr 2009; Walker 2007; Walker & Sankaran 2014), and storytelling (Boyce 1996; Pässilä, Oikarinen & Kallio 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, which has the potential to address and overcome knowledge sharing barriers. Kotnour and Vergopia (2005) applied action research on a NASA Kennedy Space Center lessons learned study where the approach actively engaged participants in the development and application of new knowledge.

4.5. The action research approach

The action research method applied to this study consisted of multiple spiral 'action research' cycles of the four stage process (plan, action, observe, and reflect) adapted from Zubert-Skerritt (cited in Altrichter et al. 2002), McKay and Marshall (2001), McNiff and Whitehead (2011) and shown in Figure 4-1.

The dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) and Marshall et al. (2006) as shown in Figure 4-2 was applied to both the organisational problem-solving activity (problem-solving activity interest - (a) in Figure 4-2) and the research activity of the Syllk model (research interest – (b) in Figure 4-2). The custodian of the research interest is the researcher, and the custodian of the problem-solving interest is the organisation in the study (Marshall et al. 2010).
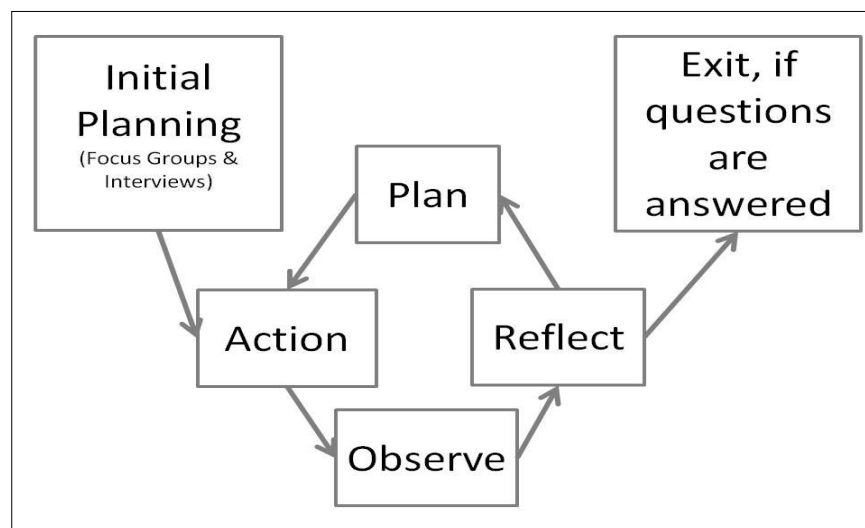
Figure 4-1 Adapted action research cycle
Adapted from: (Zubert-Skerritt, cited in Altrichter et al. 2002), McKay & Marshall (2001), McNiff & Whitehead (2011)
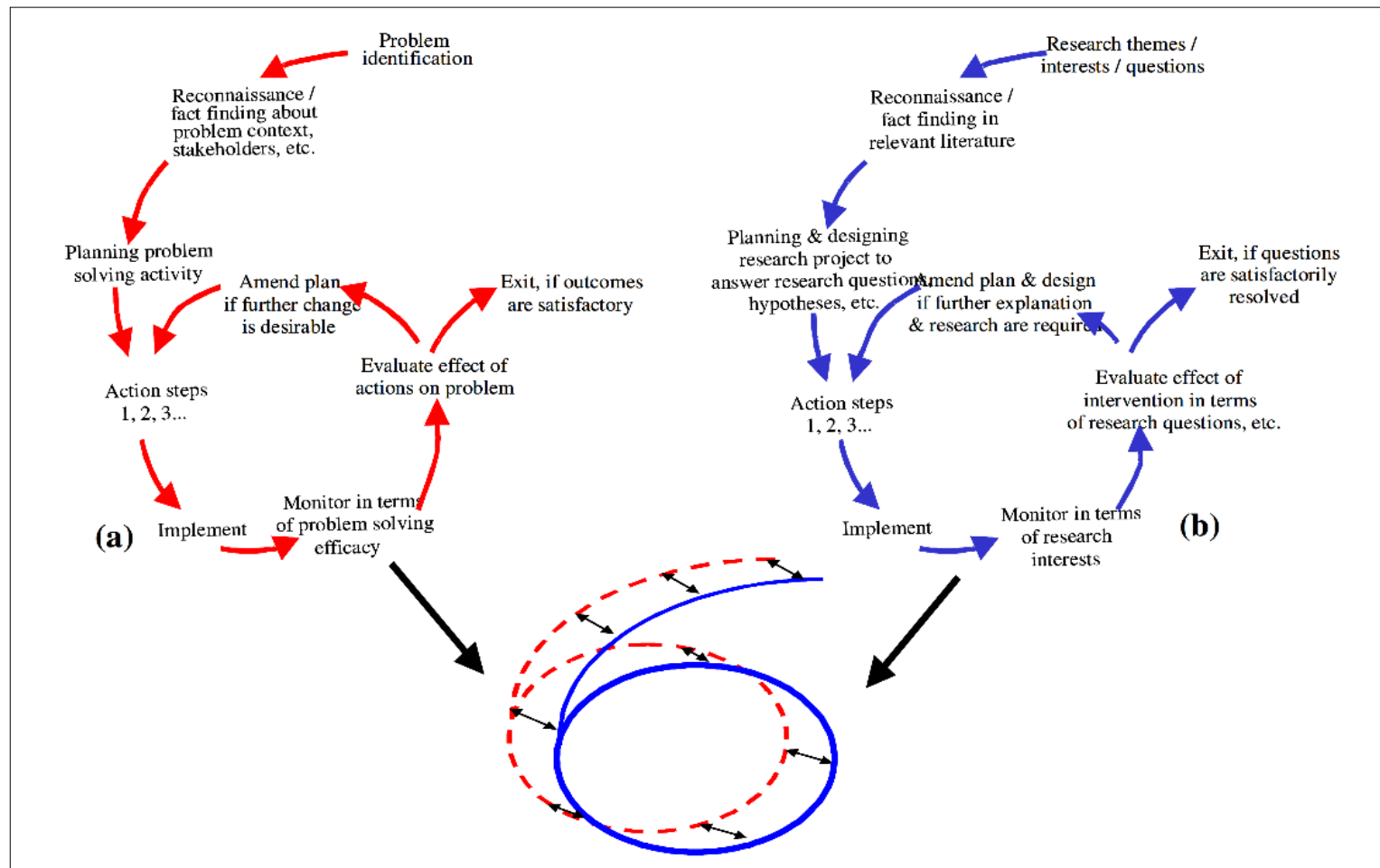
Figure 4-2 The dual imperatives of action research
Source: (Marshall, Salas & McKay 2006, p. 2)

4.6. Action research using mixed method procedures

In theory, action research is usually situated within the qualitative tradition. However, research literature reveals the use of both qualitative and quantitative approaches, either separately or combined in one study, by which it may seem to be similar to mixed methods research (Creswell 2005; Mayoh & Onwuegbuzie 2013). Creswell (2009) describes this as a concurrent transformative approach (Figure 4-3) where the research is using a qualitative theoretical perspective as well as using the concurrent collection of both qualitative and quantitative data. The approach involved triangulation of qualitative and quantitative data to cover information that provided evidence of the research findings. Johnson, Onwuegbuzie & Turner (2007) refer this approach as qualitative dominant mixed research, where the priority is given to the QUAL element.

During the research program action research cycles both qualitative (Project A, B, and C) and quantitative (Project C) data were collected, analysed and interpreted. Project C put into practice action research using mixed method procedures where focus groups, interviews, observations, document reviews, and surveys are concurrently used (Creswell 2009; Hesse-Biber & Johnson 2013).

Social science theory
Qualitative theory

QUAL (A, B & C)   +   QUAN (C)
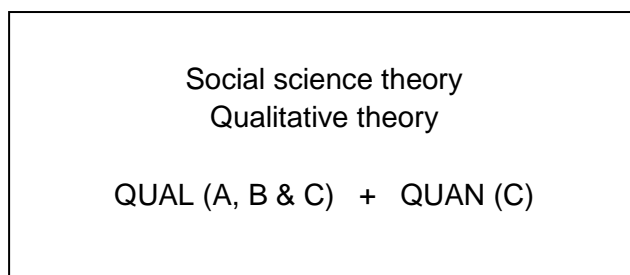
Figure 4-3 Concurrent transformative approach
Adapted from: (Creswell 2009)

4.7. Data collection

Data collection methods are determined by the selected methodology, with qualitative researchers choosing from a number of available methods such as interviews, focus groups, documents, meeting records, logs, and diaries which all rely on the researcher as the main data gathering instrument (Bazeley 2013; Collis & Hussey 2009; Creswell 2005; Patton 1990). The researcher needs to pay attention to how the data is consistently collected from reliable project sources (Bazeley 2013; Creswell 2005). The credibility of the data can also be ensured by the researcher subjecting their data to repeated member checking by the research participants (Bazeley 2013; Lincoln & Guba 1985) and participant debriefing (Mertler 2013).

Melrose (2001) states that triangulation of data increases qualitative rigor where data is collected from multiple sources using mixed methods to establish trends and patterns as is the case with this research program. 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, observations and survey (project C)) and has been coded for themes and patterns using qualitative data analysis software (NVivo

10/11). 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 & Martin 2005). Deliberate and conscious reflection of any interpretations is essential in action research (Dick 1993).

Research program project data was collected from multiple sources as shown in Table 4-3. The researcher's interaction with each project involves interviews, meetings with stakeholders, focus group workshops with participants, CoP meetings with participants, and after-action reviews with participants. A collection of data from multiple sources and at multiple times in multiple locations is typical of qualitative research (Bazeley 2013; Collis & Hussey 2009; Creswell 2012; Richards 2009). The mix of interview data and various meetings is typical in qualitative business research (Bazeley 2013; Collis & Hussey 2009; Richards 2009).

Table 4-3 Data collection

Available data	Project A	Project B	Project C
Project documentation (business and project artifacts)	All relevant project documentation available to the researcher	All relevant project documentation available to the researcher	All relevant project documentation available to the researcher
Meeting minutes (Community of practice meetings, team meetings, focus groups and interviews)	Hard copy extracts Audio recordings if researcher present	Hard copy extracts Audio recordings if researcher present	Hard copy extracts Audio recordings if researcher present
Observations via diary entries	Researcher diary/journal entries	Researcher diary/journal entries	Researcher diary/journal entries
Surveys	No survey data available	No survey data available	Survey data available
After action reviews regularly conducted to capture reflection activities	Hard copy extracts and audio recordings if researcher present	Hard copy extracts and audio recordings if researcher present	Hard copy extracts and audio recordings if researcher present

4.8.   Data analysis

Overall the content analysis process was applied to the research program. The development of the Syllk model was derived from the literature review using a grouping-categorisation matrix and a deductive content analysis process (Duffield & Whitty 2015b; Elo & Kyngäs 2008). The deductive content analysis is often used when researchers want to retest existing data in a new concept and model (i.e. Syllk model) (Elo & Kyngäs 2008). The inductive content analysis process is best used

when there is not enough data, and knowledge known as this approach enables the categorisation of data (Elo & Kyngäs 2008).

For each of the research projects the qualitative data collected was evaluated using a general inductive approach to help in identifying what is working well and what needs improving (Elo & Kyngäs 2008; Lincoln & Guba 1985; Patton 1990; Thomas 2006) and identifying lessons learnt that are then contenet analysed to find common themes (Mau 2005). The general inductive content analysis method (Elo & Kyngäs 2008; Thomas 2006) has been used and adapted in action research related projects (Day et al. 2006; Orr 2006). The steps of inductive content analysis are open coding, creating categories and abstraction (Elo & Kyngäs 2008; Thomas 2006). Categories were based on the dependent, and independent variables, and action research interventions. The abstraction activity formulates and groups categories. The abstraction process continues as far as is reasonable and possible (Elo & Kyngäs 2008). The process is consistent with qualitative data analysis as described by Miles and Huberman (1994) and the Qualitative Data Analysis work of Bazeley (2013).

Audio recordings were professionally transcribed. Qualitative data analysis software (NVivo 10/11) was used to make content analysis more manageable and ordered (Bazeley 2013; Elo & Kyngäs 2008). The use of the software helped to facilitate and analyse the large quantity of data that was collected (Cepeda & Martin 2005) in all three research program projects. The NVivo software program enabled searches of collected data (after-action reviews (AAR), focus groups, interviews, meetings, project materials) for words, phrases, expressions or statements related to the theoretical concepts from the literature and the identified research areas of interest (Bazeley 2013; Bazeley & Jackson 2013).

The research issues (results of AAR reflection activities) guided the data analysis as did the existing (KM practices) literature to enable the generation of results (evidence through reflection) (Bazeley 2013; Miles & 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 & Martin 2005). However, the use of a structured action research design, tested data collection tools, and data analysis processes provided meaningful action research outcomes (Dick 2001).

4.9. Role of the researcher

The role of the researcher is discussed in Paper Five (Duffield Forthcoming 2017). Action researchers can adopt a variety of roles to guide the scope and environment of their relationships with project participants. Table 4-4 highlights the role of researcher categories defined by Adams (2010) and Herr and Anderson (2005). Action researchers are often involved in the project, where participation and learning occurs collectively between the participants and the researcher (Adams 2010). Action researchers act as facilitators and are fundamental to the action research process. The participant status of the researcher needs to be acknowledged and should be treated as a resource for the process. This relationship of the researcher with the participants is one of the factors that differentiates action research from other social science methodologies.

Greenwood and Levin (2007) suggest that action researchers achieve a balance of review and support through a variety of actions, including facilitation, direct feedback, written reflections, and citing cases from the literature where similar

problems, opportunities or processes have occurred. The action researcher needs to know how to be the *friendly outsider*, open up lines of discussion, and be able to make clear the knowledge that guides the project. Participants can sometimes be referred to as internal researchers, as they are encouraged to make sense of, and apply, a wide variety of professional learning that can be translated into project action. Herr and Anderson (2005) take the view that action researchers may operate as insider(s) and outsider(s) (refer to Table 4-4).

Table 4-4 Role of the Researcher Categories

Position	Adams (2010)	Herr and Anderson (2005))
Complete participant	The identity of the researcher is neither concealed nor disguised. The researchers' and participants' goals are synonymous; the importance of participants' voice heightens the necessity that issues of anonymity and confidentiality are the subject of ongoing negotiation.	Insider (studies on self-practice) / Insider in collaboration with other insiders / Insider in collaboration with outsider(s). Contributes to knowledge base, Improved/critiqued practice, Self / professional; / organisational; transformation
Participant observer	The action researcher negotiates levels of accessibility and membership in the participant group, a process that can limit interpretation of events and perceptions. However, results derived from this type of involvement may be granted a greater degree of authenticity if participants are provided the opportunity to review and revise perceptions through a member check of observations and anecdotal data.	Reciprocal collaboration (insider – outsider teams) Contributes to knowledge base, Improved/critiqued practice, Professional / organisational transformation
Observer participant	The researcher does not attempt to experience the activities and events under observation but negotiates permission to make thorough and detailed notes in a fairly detached manner.	Outsider in collaboration with insider(s) Contributes to knowledge base, Improved/critiqued practice, Organisational development transformation
Complete observer	The researcher adopts passive involvement in activities or events, and a deliberate - often physical - barrier is placed between the researcher and the participant to minimize contamination.	Outsider(s) studies insider(s) Contributes to knowledge base

Adapted from: (Adams 2010; Herr & Anderson 2005)

Coughlan and Coghlan (2002, p. 227) indicate that "action researchers are outside agents who act as facilitators of the action and reflection within an organisation". Table 4-5 shows the role of the researcher in each of the research projects. A finding of the research in projects (A and B), was that the researcher (facilitator) role evolved throughout the action research cycle. To have done otherwise would have been unproductive and disadvantaged the participants and internal researchers. The researcher facilitated and co-facilitated workshop sessions, worked individually with participants, and assisted in the development of data and information.

Table 4-5 Role of the researcher in the research projects

Role of the researcher	Project A	Project B	Project C
Participant observer Reciprocal collaboration (insider – outsider teams)			The researcher participated in meetings and was a member of the Project team (Community Owner). The Project team managed the project problem-solving diagnosis, reflection and planning activities.
Observer participant Outsider in collaboration with insider(s)	The researcher participated in meetings. The Project team managed the project problem-solving diagnosis, reflection and planning activities and occasionally sought help from the researcher.		

Adapted from: (Adams 2010; Herr & Anderson 2005)

As each project progressed, participants came to understand the action research process. The researcher was needed less like an action research expert and spent more time sourcing literature that supported the projects. The researcher was able to focus more on the research findings. The participants were managing their projects. However, they relied on the researcher to look at the overall picture.

4.9.1. Conducting research within one's own organisation

When managing dual roles there is a possibility for role confusion (Coghlan & Shani 2008; Holian & Coghlan 2013). The organisational role may demand involvement and active commitment while the research role may require a more detached, more theoretic, objective and neutral observer position. Another issue is pre-understanding (Coghlan & Shani 2008; Holian & Coghlan 2013): "Pre-understanding refers to such things as people's knowledge, insights, and experience before they engage in a research program" (Coghlan & Shani 2008, p. 646-647). An advantage of being an insider researcher is that the researcher has important knowledge about cultures and informal structures of the organisation; this includes knowledge about sub-cultures, traditions, norms and authority bases. The disadvantage is that it may be difficult for the researcher to stand back from the organisation to assess and critique the organisation (Coghlan & Shani 2008).

Some researchers highlight that doing action research in one's own organisation is political (Coghlan & Shani 2008; Holian & Coghlan 2013). Features of action research, such as close examination of an issue, encouraging questioning, and encourage action, may be threatening to an existing organisational culture. Therefore, the insider researcher needs to be politically astute in deciding to engage in action research. Political stakeholder relationships also need to be managed to achieve successful action research outcomes. These relationships include the relationship between the researcher and sponsor; the sponsors relationship to other stakeholders; and the relationship between the researcher and stakeholders (Coghlan

& Shani 2008). Leading the research involves attention to all relationships and involving stakeholders.

4.10. Assessing the quality of the research

Goodness, validity, trustworthiness, credibility, and workability are all terms used to describe criteria for good quality action research (Herr & Anderson 2005). There are many different views on how quality requirements are applied to action research. Table 4-6 provides alignment of the research activities and associated actions with the quality-related criteria associated with action research. I note that it is difficult, if not impossible, to replicate an action research study and hence to replicate its findings (McKay & Marshall 1999). The selected list of quality criteria was derived following an analysis of action research literature (Baskerville & Wood-Harper 1996; Coughlan & Coghlan 2002; Greenwood & Levin 2007; Herr & Anderson 2005; McNiff & Whitehead 2011; McTaggart 2005; Melrose 2001).

Table 4-6 Quality assessment

Action taken	Validity	Trustworthiness	Reality	Reliability	Rigour	Triangulation	Workability	Transferability	Relevance
Research program projects addressed the problem in practice/achievement of action-oriented outcomes	X				X		X	X	X
Generation of new knowledge	X				X		X	X	
Research project teams had an open and honest communication and change culture in group meetings/workshops	X	X	X	X	X		X		
Education of both researcher and participants own learning	X	X	X	X	X		X		
Active value adds participation of research participants empowering them with new understandings	X	X	X	X	X		X	X	
Collaboration took place and the research outcome, solution, evaluation, and reflection were relevant	X	X		X	X		X	X	X
Academic supervision and review	X	X	X	X	X		X		X
Member checks by research participants and participant debriefing	X	X	X	X	X				
Peer reviewed journal papers representing each project	X	X	X	X	X	X	X	X	X
Public testing at conference presentations with diverse audience and feedback	X	X	X	X	X		X	X	X
Validation of research findings at other organisations	X	X	X	X	X		X	X	
A sound and appropriate research strategy and research methodology and individual action research projects	X			X	X				X
Literature review aligned with action research cycles	X			X	X				
Multiple data sources (QUAL+QUAN); multiple projects; multiple collection methods	X			X	X	X	X		
Content analysis/Coding consistency checks	X	X		X	X				
Researchers own critical reflection	X			X	X				
Dual cycle (parallel) process	X	X		X	X				
Limited scope of each research cycle	X				X				

Action taken	Validity	Trustworthiness	Reality	Reliability	Rigour	Triangulation	Workability	Transferability	Relevance
Sufficient number of action research cycles	X	X			X				
Deliberate and conscious reflection of any interpretations	X				X				
Triangulation of data collection techniques	X			X	X	X			

Validity: Validation is to do with people agreeing that what you say is believable. Validity is showing that the action research has a truth value and is trustworthy (McNiff & Whitehead 2011). Kemmis and McTaggart (2000) see validity as being aligned with the generation of information that is appropriate for bringing about change. Argyris et al. in Coughlan and Coghlan (2002) inferred that to maintain validity, action researchers need to perform consciously the action research cycles, testing assumptions and subjecting them to public testing. Herr and Anderson (2005) in Table 4-7 have linked validity criteria to action research goals:

Table 4-7 Action research validity criteria linked to action research goals

Goals of Action Research	Quality/Validity Criteria
The generation of new knowledge	Dialogic and process validity
The achievement of action-oriented outcomes	Outcome validity
The education of both research the and participants	Catalytic validity
Results that are relevant to the local setting	Democratic validity
A sound and appropriate research methodology	Process validity

Source: (Herr & Anderson 2005, p. 55)

Dialogic validity focuses on communication with peers to establish the relevance and significance of the action research data collection, design, and implementation of the action, evaluation and reflection. The research is examined through a form of peer review (Herr & Anderson 2005).

Outcome validity is demonstrated by the amount to which the intervention resolved the real world and research problem. This judgement is based on the quality of the data and the evaluation of the action following implementation (Herr & Anderson 2005). Greenwood and Levin (2007) call this workability.

Catalytic validity is the degree to which the research activity focuses, reorients and energises participants and the researcher, towards knowing reality to change it. This is where action research can influence transformational change (Herr & Anderson 2005).

Democratic validity refers to the extent to which the researcher and research participant's stakeholders were involved in and collaborated in working the real-world problem. During the action research cycle steps there is the need to show collaboration.

Process validity asks to what extent problems are framed and resolved to ensure there is ongoing learning of the people and the system. If the process is unsound than this may have an impact on the *outcome validity*. There is a

need to demonstrate that evidence gathered can verify the design and implementation of the action. Triangulation of data collected is applied to ensure that evidence can be obtained from multiple sources.

McTaggart (2005, pp. 408-10) has established some points of reference that should make action research 'validity' more defensible, more educative and more useful for all participants:

- Establish credibility among participants and informants

- Triangulation of observations and interpretations

- Participant 'confirmation' and 'release' of research 'reporting' of all kinds

- Establishing an 'audit trail' and 'shared archive' of data and interpretations

- Testing the coherence of arguments, the authenticity of evidence and prudence of action.

Trustworthiness: Herr and Anderson (2005) use Lincoln and Guba (1985) where a study's trustworthiness involves the demonstration that the researchers interpretations of the data are credible, and hold truth value to those who supplied the data. Lincoln and Guba (1985) base their research in a naturalistic inquiry setting, whereas action researchers typically operate in intervention mode where they plan, act, observe and reflect, leading to trustworthiness in action research being different to associated qualitative methodology. The intention is not to produce a perfect answer to a universal question, but to improve practice within a given environment, more reflective practice into a systematic framework and contribute to the findings with a wider audience (Pickard 2013). Herr and Anderson (2005) provide the five criteria (Table 4-7) that can be applied to the measures of trustworthiness in action research (Pickard 2013).

Reality: Intentions, meanings, goals, and values are expected in organisation patterns, behaviour, and action: these forms of practices represent a reality. Forms of practice in action research are dependent upon working with specific people in specific contexts (Gustavsen, Hansson & Qvale 2008).

Reliability: Dick (2002) states that the current concepts of reliability and validity are useful for action research in that the researcher should collect as far as possible information that is not idiosyncratic and that it is to some extent reliable. The method of data collection is triangulated to improve reliability (Melrose 2001). Action researchers can meet determinants of reliability if primary contextual variables remain constant, and if researchers are as disciplined as possible in gathering, analysing and interpreting the evidence of their research using triangulation strategies (Adams 2010).

Rigour: In general, rigour refers to the quality, validity, accuracy, and credibility of action research, and its findings (Mertler 2013). Melrose (2001) states that interpretations of validity are worth considering as a way of providing rigour. Action research develops rigour as it proceeds through some action research cycles (Dick 2002). Rigour in action research can be shown by the participant's reputation and consistency in participation. Rigorous action research uses appropriate methods of collecting data (Melrose 2001). McNiff and Whitehead (2011) and Melrose (2001)

state that an effective technique to ensure rigour is triangulation. Baskerville and Wood-Harper (1996) imply that a characteristic of action research is the circulation of the results to the scientific community.

Triangulation: The Open University in McNiff and Whitehead (2011) defined triangulation as cross-checking the existence of certain phenomena and the veracity of individual accounts by gathering data from some informants and some sources to produce as full and balanced study as possible. Triangulating is one of the important steps in building trustworthiness. As the research makes progress and information is tabled, steps should be taken to validate against another source. No single article of information ought to be considered unless it can be triangulated (Lincoln & Guba 1985).

Workability: Workability is a factor in establishing the worth of the research. We must figure out whether the actions taken in the action research cycles result in a solution to the real-world problem. Appropriate changes in appropriate directions are the confirmation of outcomes generated by action research (Melrose 2001). For action research, it is important to demonstrate a change and improvement in the real world. Action research contributes to organisation change and communication through encouraging the new exchange of ideas with each other (Melrose 2001). Workability means whether or not a result can be identified as a result of the original problem or whether adjustment of the interpretation or redesign of the actions is necessary (Greenwood & Levin 2007).

Transferability: An action research study must consider how knowledge generated can be utilised by those in the research situation and those beyond the research situation. New research knowledge needs to be transferable so that it can be used in similar problems in other environments (Herr & Anderson 2005).

Relevance: Alternate research methods to action research struggle to maintain relevance to the real world (Baskerville & Wood-Harper 1996; Susman & Evered 1978). The empirics of action research ensure that it takes place within a multivariate real-world situation, which ensures that relevance is less of a problem. Action research is a process that can encapsulate both relevance and rigour (Carberry 2001). The aim of action research is to put together a system and to then modify the relationships of the system to its relevant environment (Susman & Evered 1978).

4.11. Researcher bias

Table 4.1 acknowledges that research biases are present in interpretivism and associated action research methodology. In both researcher roles (refer to table 4-5), the researcher was the data collection instrument and the researcher was aware of potential researcher bias. Therefore, the researcher was conscious of being included in the research context (the PhD candidate research context being researcher in multiple roles, the friendly outsider, project practitioner, community member, community owner, academic peer reviewer, action research using self-reflection, a member of professional organisations (ethical awareness) and conference presenter). From this perspective, the researcher used self-awareness and was capable of making an analysis and argument about the phenomena being observed (Richards 2009).

Two research quality areas that are affected by researcher bias are validity and reliability (Norris 1997). Table 4-8 identifies that action taken to address the potential researcher bias on this research program. In addition, the Dual cycle

(parallel) process of McKay and Marshall (2001) addresses the rigour, credibility and the risk of research bias as it requires researchers to focus on their research interests and their responsibilities.

Table 4-8 Action taken to address researcher bias

Action taken to address researcher bias	Validity	Reliability
Academic supervision and review (Coughlan & Coghlan 2002)	X	X
Member checks by research participants and participant debriefing (Lincoln & Guba 1985; Richards 2009)	X	X
Peer reviewed journal papers representing each project (Coughlan & Coghlan 2002)	X	X
Public testing at conference presentations with diverse audience and feedback (Coughlan & Coghlan 2002)	X	X
Validation of research findings at other organisations (Herr & Anderson 2005; Richards 2009)	X	X
Researchers own critical reflection (Dick 2002; Herr & Anderson 2005; Richards 2009)	X	X
Triangulation of data collection techniques (Lincoln & Guba 1985)	X	X
Dual cycle (parallel) process (McKay & Marshall 2001)	X	X

4.12. Action research reports

Action research reporting is dependent on the problem solving activity requirements. However, they typically are not required, as the process is the product (Patton 1990). For each of the action research projects a PowerPoint presentation report was presented at the evaluation and reflection activity of the action research cycle. The presentation covered the purpose of the research, the research context, the action research methodology, the outcomes, reflection outcomes and learnings and highlighted usable knowledge. The presentation covered the essential items identified in Coughlan and Coghlan (2002). Project A also utilised the Iknow (Branch) framework document (Appendix E) to help with setting the action research scene and knowledge management activities/interventions.

4.13. Using action research in practice

The aim of Paper Five is also to describe a direct and personal account of the issues and challenges that occurred in the three action research projects. Paper Five describes the role of the researcher, data collection methods, challenges in action research, evaluation of the quality aspects of the research followed by possible methodological limitations and issues.

Paper Five also reports on the action research cycles applied to each of the research projects for both the organisational problem-solving activity (problem-

solving activity interest - (a) in Figure 4-2) and the research activity of the Syllk model (research interest – (b) in Figure 4-2). Action research insights, implications, limitations and challenges of this research study are noted in Paper Five.

4.14. Paper Five: Statement of authorship

Duffield, S., (Forthcoming, 2017). Using Action Research in Practice: Useful Insights and Outcomes. ALAR: Action Learning and Action Research Journal, vol. 23, no. 1.

Conception and design of the project:
      PhD Candidate 100%

Data collection, analysis, and interpretation of research data:
      PhD Candidate 100%

Drafting significant parts of the work, or critically revising it so as to contribute to the interpretation:
      PhD Candidate 100%

Editing and preparation of final submission:
      PhD Candidate 100%

PhD Candidate Signature
Stephen M Duffield
Date: 22 March 2017

Conduct of Review Signature
Associate Professor S. Jonathan Whitty (Principal Supervisor)
Date: 22 March 2017

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Using Action Research in Practice:
Useful Insights and Outcomes

Stephen Duffield

Abstract:

The aim of this paper is to describe a direct and personal account of the issues and challenges that occurred in three action research projects that were part of a doctoral research program. The action research cases were carried out in various government organisations and were researching the application of a Systemic Lessons Learned Knowledge (Syllk) conceptual model. The focus of the paper is on the general methodological issues and problems of action research. The author hopes that readers will benefit from the direct and transparent account of the practical problems encountered in the studies.

Introduction

The aim of this paper is to describe a direct and personal account of the issues and challenges that were encountered during three action research projects that were studied as part of a doctoral research program. The action research cases were carried out in federal and state government organisations and were researching the application of a conceptual model, hereafter referred to as the Systemic Lessons Learned Knowledge model (Syllk) model (Duffield 2016; Duffield & Whitty 2015, 2016a, 2016b). The doctoral research program proposed that reconceptualising organisational knowledge and lessons learned through the Syllk model can influence organisation learning. The focus of the paper is not on the Syllk model, but on the general methodological issues and problems of action research. The paper begins with a background on the Syllk model, a discussion on the context of the research projects followed by a discussion on the action research methodology. The methodology challenges and issues will be examined, and the action research methodology application for each project will be discussed in detail, followed by discussion and conclusion that provides useful insights for action researchers and reflective practitioners.

Syllk model background

The doctoral research program proposed that the Syllk model (see Figure 1) enables management to conceptualise how organisational know-how is wired (distributed) across various people and system elements of an organisation (Duffield & Whitty 2015). The research program outcomes have established that the alignment of the Syllk model elements (learning, culture, social, technology, process and infrastructure) can positively influence an organisation

learning (Duffield 2016; Duffield & Whitty 2012; Duffield & Whitty 2015, 2016a, 2016b).

Figure 1: The Systemic Lessons Learned Knowledge (Syllk) model
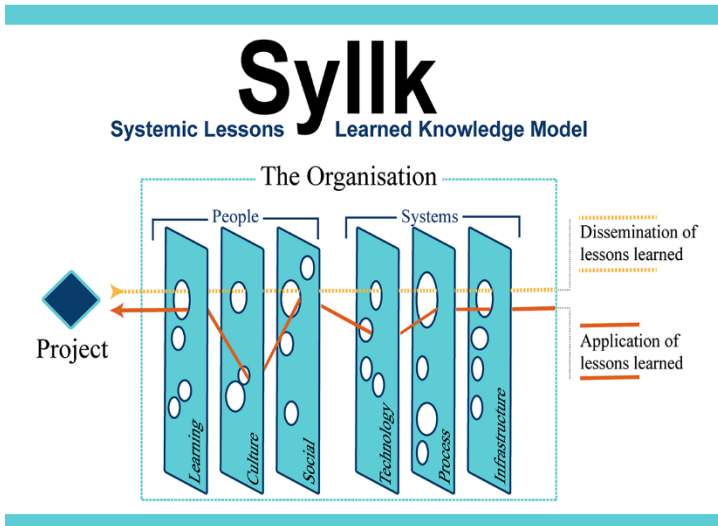
Source: (Duffield & Whitty 2015)

In line with complex adaptive systems theory, the Syllk model represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the organisation (Duffield & Whitty 2012; Duffield & Whitty 2015). Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the various modes of social and cultural learning, along with the organisational processes, infrastructure and technology that support them (Duffield & Whitty 2012; Duffield & 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 2016; Duffield & Whitty 2012; Duffield & Whitty 2015; Leal-Rodríguez et al. 2014; Virolainen 2014).

Leal-Rodríguez et al. (2014) have indicated how an earlier version of the Syllk model (Duffield & Whitty 2012) 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 and culture play an important role in learning from projects. Duffield and Whitty (2016b) have shown that the alignment of the people and system elements can positively influence an organisation's capability for storytelling, and therefore learn lessons and accumulate from stories of past project experiences. Hedman et al. (2015) explain how the Syllk model shows that for organisations to learn, people and systems (processes and technology) need to be aligned, and that this combination is the best way of organisational learning.

Research Project Context

The doctoral research program consisted of applying action research to three research projects known as Project A, Project B and Project C. Alias names for the organisations will be

used in this paper to protect the confidentiality of the participants (Walker & Haslett 2005).

Project A took place at a Branch of a large division of an Australian government organisation. The Branch consists of the design and build infrastructure, asset and property services, and portfolio and investment units and has approximately 160 staff. The Branch manages a sizable number of projects. The most significant and complex are approximately 200 capital projects with project budgets ranging from approximately $1 million to $1.7 billion. Currently, there is no consistent knowledge management (KM) framework utilised to manage the knowledge gathered during the planning, design and delivery of these capital projects, including lessons learned. This lack of a consistent framework extends across all Branch projects. The business improvement director of the Branch approached the researcher (the researcher was not a member of the Branch) to apply the Syllk model and assist the Branch (through research) in the implementation of a KM project to develop and implement a KM framework. The '(Branch) KM project' was endorsed by executive management in June 2013. The overall duration of the research and KM project was two years and four months (February 2013 to June 2015) (Duffield 2015; Duffield & Whitty 2016a).

Project B took place at a large division of an Australian government organisation. The division identified a commitment plan to develop productive partnerships, share learnings and project knowledge. A change management program (Champions of Change program) was implemented with a focus on storytelling (Storytelling Project – Project B) embracing improvement while thinking laterally and trialling new methods. The division identified that the intervention and implementation of the Syllk model would benefit the organisation, and consequently, the action research study was

endorsed by executive management in September 2013. The storytelling project duration was for 12 months (Duffield & Whitty 2016b).

Project C took place in an Australian government organisation. The organisation's KM steering committee approved the trial of an online Community of Practice (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 that 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.

The Action 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 the system through a continuous cycle of planning, acting, observing and reflecting (Lewin 1946). Action research is a methodology that provides an effective way of delivering a conscious change in a partly controlled surrounding. Put simply, the action researcher enters a situation and attempts to deliver change and monitors the results (Collis & Hussey 2009; Lewin 1946).

Action research model

The action research model and method proposed for the doctoral research program research projects consisted of multiple spiral *action research* cycles of the 4 stage process (plan, action, observe (collect data) and reflect (analyse and interpret data)) adapted from Zubert-Skerritt in Altrichter et al. (2002), McKay and Marshall (2001), McNiff and Whitehead (2011) and shown in Figure 2.

Figure 2: The Action Research Cycle
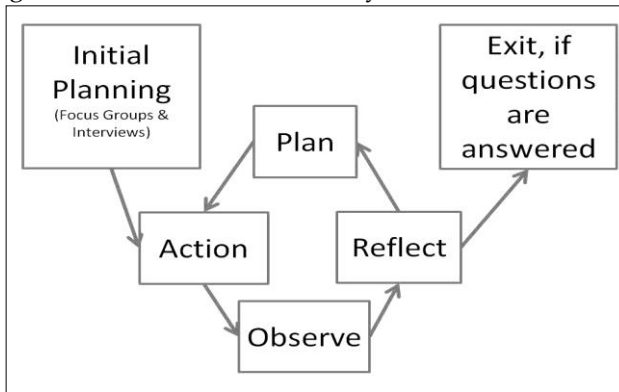
Adapted from: (Zubert-Skerritt, cited in Altrichter et al. 2002), (McKay & Marshall 2001),(McNiff & Whitehead 2011)

The dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) and Marshall et al. (2006) as shown in Figure 3, was also adapted. The action research cycles were applied to both the organisational problem solving activity (*problem-solving activity interest* - (a) in Figure 3a) and the research activity of the Syllk model (*research interest* – (b) in Figure 3b). The custodian of the research interest is the researcher, and the custodian of the problem-solving interest is the organisation in the study (Marshall et al. 2010).

Figure 3: The Dual Imperatives of Action Research

Source: (Marshall, de Salas & McKay 2006, p. 2)
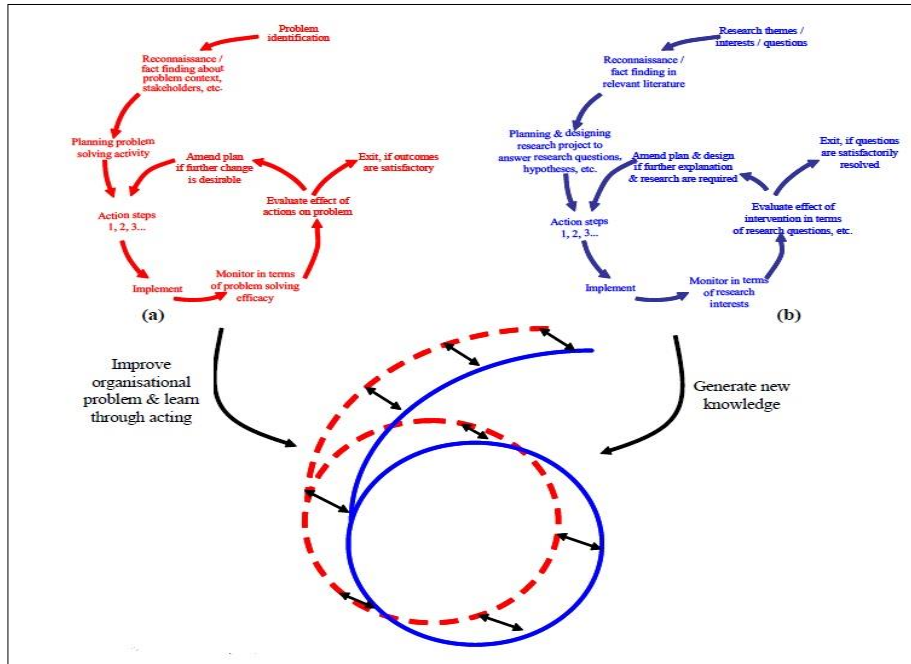
Figure 3(a): The Dual Imperatives of Action Research –
P*roblem-solving activity interest*

(a)

Improve
organisational
problem & learn
through acting

Source: (Marshall, de Salas & McKay 2006, p. 2)

Figure 3(b): The Dual Imperatives of Action Research –
Research interest
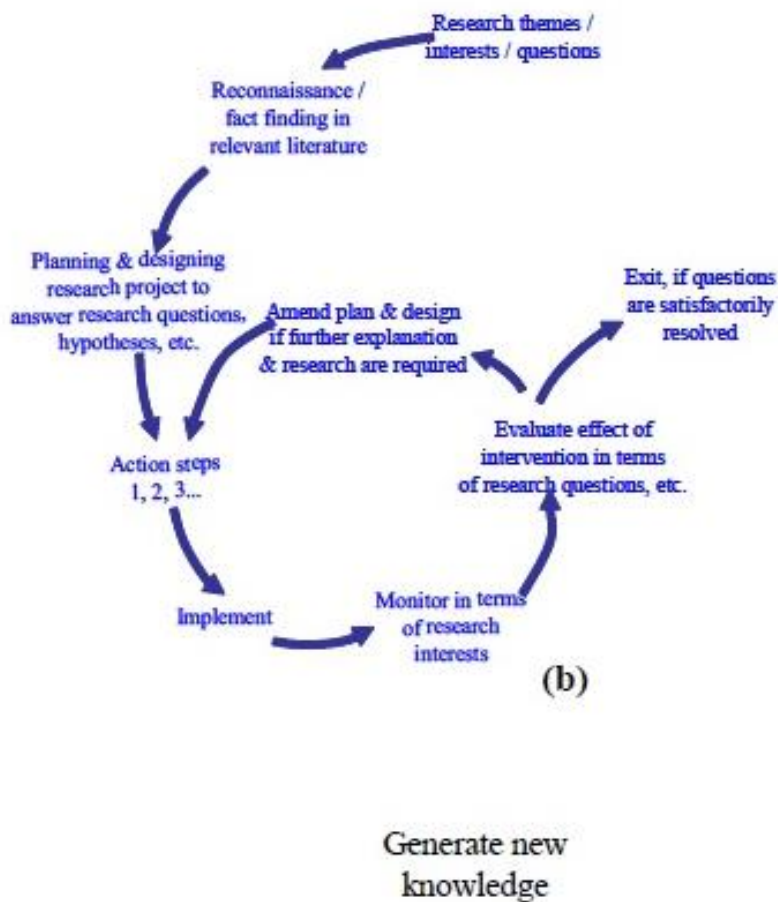
Source: (Marshall, de Salas & McKay 2006, p. 2)

Ethics approval

Ethics approval and clearance for this doctoral research program was obtained from the University of Southern Queensland to conduct the studies. Action research issues are often faced by researchers in securing ethics approval (Sankaran, Hill & Swepson 2006; Walker & Haslett 2005). For this doctoral research program, the ethics application was revised to explain in detail the action research methods, and this included a visual representation of the action research cycle methodology as shown in Figure 2.

Action research suitability to this research

Action research was the most suitable methodology to answer the doctoral research program problems as the research was 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) suggested that action research type activities would be a useful approach when discussing articles about the 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 & Wood-Harper 1996; Baskerville 1999; Raelin 1998; Susman & Evered 1978; Zuber-Skerritt & Perry 2002).

Action research has also been used in project management research to implement organisational change (Sankaran, Tay & Orr 2009), and knowledge management systems (Mau 2005; Orr 2006; Sankaran 2009; Sankaran, Tay & Orr 2009; Walker

2007; Walker & Sankaran 2014). 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. Kotnour and Vergopia (2005) applied action research on a NASA Kennedy Space Center lessons learned study where the approach actively engaged participants in the development and application of new knowledge.

Role of the researcher

Action researchers can adopt a variety of roles to guide the scope and environment of their relationships with project participants. Action researchers are often involved in a high percentage of project participation and learning occurs collectively between the participants and the researcher (Adams 2010). Herr and Anderson (2005) take the view that action researchers may operate as insider(s) and outsider(s). Coughlan and Coghlan (2002, p. 227) indicate that 'action researchers are outside agents who act as facilitators of the action and reflection within an organisation'.

Table 1 shows the role of the researcher in each of the doctoral research program projects. A finding of the research in projects (A and B), was that the researcher (facilitator) role inevitably evolved throughout the action research cycle. To have done otherwise would have been unproductive and disadvantage the participants and internal researchers. The researcher role was clearly one of action research and knowledge management expertise. The researcher facilitated and co-facilitated workshop sessions, worked individually with participants and assisted in the development of data and information.

Table 1. Role of the Researcher – Projects

Role of the researcher		Project A	Project B	Project C
Participant observer Reciprocal collaboration (insider – outsider teams)	The action researcher negotiates levels of accessibility and membership in the participant group, a process that can limit interpretation of events and perceptions.			The researcher participated in all of the meetings and was the Community owner of the project team. The Project team managed the project problem-solving diagnosis, reflection and planning activities.
Observer participan Outsider in collaboration with insider(s)	The researcher does not attempt to experience the activities and events under observation but negotiates permission to make thorough and detailed notes in a fairly detached manner.	The researcher participated in some of the meetings. The project team managed the project problem-solving diagnosis, reflection and planning activities and occasionally sought advice from the researcher.		

Adapted from: (Adams 2010; Herr & Anderson 2005)

As each project progressed, participants came to understand the action research process. The researcher was needed less as an action research expert and spent more time sourcing literature that supported the projects. The researcher was able to focus more on the research findings. The participants were managing their own projects, however they relied on the researcher to pay attention to the overall picture.

Conducting research within one's organisation

Conducting research within one's organisation (Project C) requires that the researcher balances the project role they hold with the additional role of researcher. Herr and Anderson (2005) describe this in terms of insider/outsider research, where insider refers to a person from within the project, and outsider refers to a person external to the project and who may be external to the organisation, such as a consultant.

The researcher takes on an additional role to their organisational one, which can be seen to both cause difficulties and sharpen the focus of the project activities. The difficulty is due to the challenge of ensuring that when one person has dual roles (researcher and project member (community owner)), that they have clear and visible responsibilities. With Project C, the responsibilities of the researcher and community owner were documented in all of the relevant project documentation and were made clear to the project stakeholders, sponsor and community project members. A mutually beneficial clear research arrangement was put in place with members of the organisation informed and aware of the dual work and academic nature of the project (Holian & Coghlan 2013). The community members were invited to participate and were free to decline to be involved (Holian & Coghlan 2013). It was clear to organisational stakeholders that the project could benefit from

the researcher's overall program of work and impact on what and how the organisation learns (Coghlan 2005).

Challenges in action research

Action research is often criticised as merely being consulting rather than research and that it lacks rigour (Baskerville & Wood-Harper 1996; Coughlan & Coghlan 2002). The following four factors help to differentiate between action research and consulting (Gummeson, cited in Coughlan & Coghlan 2002, p. 237) and the need for the researcher to be strong and loyal to the research rigour:

(1) Consultants who work in an AR mode are required to be more rigorous in their inquiry and documentation.
(2) Researchers require theoretical justifications, while consultants require empirical justifications.
(3) Consultants work under tighter time and budget constraints.
(4) Consultation is frequently linear - engage, analyse, act and disengage. In contrast, AR is cyclical - gathering data, feeding it back to those concerned, analysing the data, planning action, taking action and evaluating, leading to further data gathering and so on.

Rigour in action research refers to how data is generated, gathered, explored and evaluated, and how events are questioned and interpreted through multiple action research cycles so that early interpretations can be challenged and refined (Dick & Swepson 1994; Melrose 2001). The dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) where the action research cycles apply to both the problem-solving activity interest (organisational problem-solving activity) and the research interest (Syllk model application) was chosen for this research project to address potential consultant and rigour issues when undertaking action research process as a researcher and practitioner.

McKay and Marshall (1999, p. 602) also state that the two-action research 'cycles are not conducted independently of one another, but are highly interlinked and somewhat contingent upon one another.'

Melrose (2001) states that triangulation of data increases qualitative rigor where data is collected from multiple sources and mixed methods to establish trends and patterns as is the case with this doctoral research program projects. In projects A, B and C, 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 & Martin 2005). Deliberate and conscious reflection of any interpretations is essential in action research (Dick 1993).

There are many risks with action research. Baskerville (2000, p. 196) state that 'action researchers face risks that other scientists will challenge their underlying data and analytical techniques'. The action researcher is often criticised for analytical techniques and traditional notions of validity and reliability. Baskerville (2000) reports that action research teams often learn from first-degree outcome failures and that we should also be learning from our success. There are two main stakeholder groups in action research projects: clients and researchers (Baskerville 2000). Clients are focused on the practical problem and researchers are focussed on the contribution to scientific theory. There is a domination risk

that the researcher wants to create knowledge, and the client wants to fix their practical problem. Collaboration between the project team and researcher is critical to treat the domination risk. Baskerville (2000) concludes that an inherent risk in conducting action research is the academic research culture of publishing or perish. This doctoral research program has treated this risk in publishing peer-reviewed journal papers for each project.

Assessing the Quality of the Doctoral Research Studies

Goodness, validity, trustworthiness, credibility, and workability are all terms used to describe criteria for good quality action research (Herr & Anderson 2005). There are many different views on how quality requirements are applied to action research. Table 2 provides a summary of the quality-related criteria associated with action research. I note that it is difficult, if not impossible, to replicate an action research study and hence to replicate its findings (McKay, J & Marshall, P. 1999). The selected list of quality criteria was derived following an analysis of action research literature (Baskerville & Wood-Harper 1996; Coughlan & Coghlan 2002; Greenwood & Levin 2007; Herr & Anderson 2005; McNiff & Whitehead 2011; Melrose 2001).

Table 2: Quality summary assessment

Action taken	Validity	Reliability	Rigour	Triangulation	Workability
Research program projects addressed the problem in practice / achievement of action oriented outcomes	X		X		X
Generation of new knowledge	X		X		X
Research project teams had an open and honest communication and change culture in group meetings / workshops	X	X	X		X
Education of both researcher and participants own learning	X	X	X		X
Active value add participation of research participants empowering them with new understandings	X	X	X		X
Collaboration took place and the research outcome, solution, evaluation and reflection were relevant	X	X	X		X
Academic supervision	X		X		X
Member checks by research participants and participant debriefing	X	X	X		
Peer reviewed journal papers representing each project	X	X	X	X	X
Public testing at conference presentations with diverse audience and feedback	X	X	X		X
Validation of research findings at other organisations	X	X	X		X
A sound and appropriate research strategy and research methodology and individual action research projects	X	X	X		
Literature review aligned with action research cycles	X	X	X		
Multiple data sources (QUAL+QUAN); multiple projects; multiple collection methods	X	X	X	X	X
Researchers own critical reflection	X	X	X		
Dual cycle (parallel) process	X		X		
Limited scope of each research cycle	X		X		
Sufficient number of action research cycles	X		X		
Deliberate and conscious reflection of any interpretations	X		X		
Triangulation of data collection techniques	X	X	X	X	

Possible methodological limitations and Issues

One potential methodological issue relates to workability. Where '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' (Greenwood & Levin 2007). For these doctoral research program research projects, action research was conducted in an organisational context and was occasionally met with external constraints that impacted upon the ability to resolve some of the problems being addressed. Issues with the allocation of project resources and organisational changes were often experienced in all three projects. According to Greenwood and Levin (2007), 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.

The second potential methodological issue relates to conducting research in one's organisation. The experiences of Coghlan and Shani (2008) and Holian and Coghlan (2013) described earlier in this section highlight the potential problems that could occur. The risk of encountering similar problems are treated in this research in that:

- the mutually beneficial research arrangement in place highlights the project could benefit from the researchers' overall program of work and impact on what and how the organisation learns
- the executive steering committee and project stakeholders are supportive of the trial project and associated research
- the organisation has agreed to this research arrangement given the research component will not have any negative impact on the project activities

- the researcher works in a senior management role in the organisation and can manage his own time and has access to stakeholders, technical administrators and staff in the organisation
- the researcher is new to the organisation and has limited cultural pre-understanding
- the researcher does not have established links with most of the staff who are participants (community members) in the action research and project activities.

Managing an Action Research Project

The following sections explore the action research cycles for each of the projects. Both the *Theoretical Research Interest* and the *Real-World Problem-Solving Interest* will be discussed. The steps of each action research cycle are based on McKay and Marshall (2001).

> **Given that the paper consists of multiple projects focused on the application of the Syllk mode, there is an unavoidable repetition of the presented material.**

Action research cycles – Project A

Action research methodology was applied to Project A in 9 steps consisting of 3 cycles as shown in Figure 4.

Figure 4. Action research steps applied to Project A
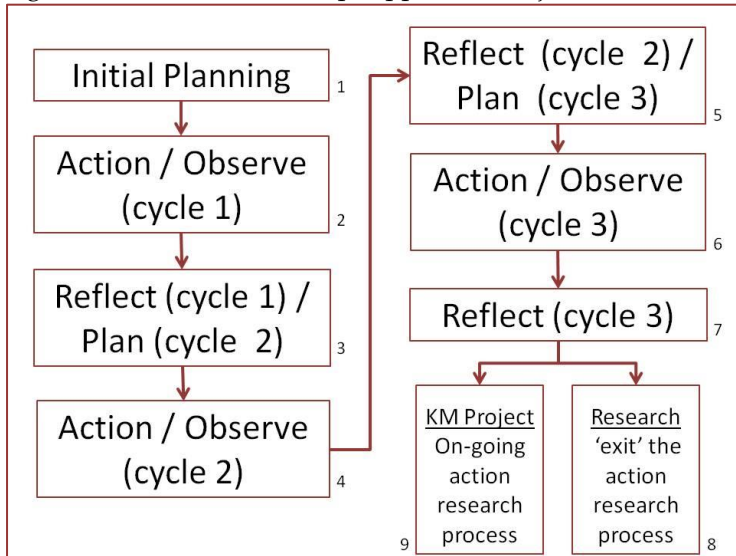
Adapted from: Zubert-Skerritt in (Altrichter et al. 2002) and (McKay & Marshall 2001; McNiff & Whitehead 2011)

Project A: The Theoretical Interest Cycle for Research

A-Initial Planning [step 1]

- Research themes/interests/questions
- Reconnaissance/fact-finding in relevant literature
- Planning and designing research project to answer research questions, hypotheses, etc.

A-Research [step 1]

The focus on this research (theoretical interest) was to investigate how the Syllk model enables a project organisation to learn from past project experiences. What is missing from the literature is a study that clearly and simply articulates how a 'lessons learned' tool such as the Syllk model could be practically used by a project organisation to capture knowledge and lessons from its project work and successfully distribute this knowledge (know-how capability) across its organisational systems and people.

The initial planning stage for the research design component of the study consisted of interviews with two Branch directors followed by two focus groups of Branch project practitioners (20 participants). The interview and focus groups verified the understanding of how the Syllk model would work in the organisation (Reed & Payton 1997). The focus groups identified the barriers and facilitators that impact the Syllk model within the Branch which formed the foundation for a KM framework.

A-Action / Observe (cycle 1) [step 2]:

- Action steps and Implement
- Monitor in terms of research interests.

A-Research [step 2]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers and KM practices mapped to the Syllk elements. The researcher sought feedback from the project participants informally (verbally and via email). Researcher reflections were recorded in a research log. This monitoring presented

insight into the progress of the project A in terms of answering the research question.

A-Reflect (cycle 1) / Plan (cycle 2) [step 3]

- Evaluate effect of intervention in terms of research questions, etc.
- Amend plan and design if further explanation and research are required.

A-Research [step3]

A CoP reflection meeting was held, and the participants comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). When reflecting on the research interest of the Syllk model, a CoP participant stated that "...when we did our workshop to capture the blockers [barriers]…we then further looked at the Syllk model…for our project what is becoming clear is having a system to capture [stories] and retrieve [stories], because, without that, the project was going nowhere. So for us having a platform was using the Syllk model. The technology became the critical element to get right, then working with the other elements could happen at their timeframe, but without technology, nothing gelled together." No research planning changes were noted.

A-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of research interests.

A-Research [step 4]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers, the change in the KM practices mapped to the Syllk elements and how

the Syllk model supported the knowledge audit process and development of key knowledge indicators. The researcher sought feedback from the Project participants informally (verbally and via email). Researcher reflections were recorded in a research log. This monitoring presented insight into the progress of the Project A in terms of answering the research question.

A-Reflect (cycle 2) / Plan (cycle 3) [step 5]

- Evaluate effect of intervention in terms of research questions, etc.
- Amend plan and design if further explanation and research are required.

A-Research [step 5]

A CoP reflection meeting was held, and the participants comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). No research planning changes were noted.

A-Action / Observe (cycle 3) [step 6]

- Action steps and Implement
- Monitor in terms of research interests.

A-Research [step 6]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers, the change in the KM practices mapped to the Syllk elements and how the Syllk model supports key knowledge indicators. The researcher sought feedback from the Project participants informally (verbally and via email). Researcher reflections were recorded in a research log. This monitoring presented insight into the progress of the project A in terms of answering the research question.

A-Reflect (cycle 3) [step 7]

- Evaluate effect of intervention in terms of research questions, etc.

A-Research [step 7]

A CoP reflection meeting was held, and the participants' comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). No research planning changes were noted.

A-Exit [step 8]

- Exit, if questions are satisfactorily resolved.

A-Research [step 8]

The research component exited the action research process as the researcher determined that there was sufficient intervention evidence to provide answers to the research question.

Project A: The Real-World Problem-Solving Interest Cycle for Practice

A more detailed description of the project and the outcomes can be found at (Duffield 2015; Duffield & Whitty 2016a).

A-Initial Planning [step 1]

- Problem identification
- Reconnaissance/fact-finding about problem context, stakeholders etc.
- Planning problem-solving activity.

A-KM Project [step 1]

As previously discussed, the Project A Real-World Problem-Solving interest focussed on a Government Branch establishing a KM project to develop and implement a KM framework. The Branch approached the researcher to apply the Syllk model and assist the Branch (through research).

The research focus groups provided input into the planning element of the problem–solving KM project. A KM project team meeting was held to identify KM practices from the KM literature. These were then aligned with each of the Syllk elements to facilitate best learning and address the identified barriers.

The KM practices were further refined into KM interventions and initiatives to support the development of what was to be called the "IKnow(Branch) KM framework" and the implementation plan. The interventions and initiatives were developed by the (Branch) KM project team in discussion with the researcher.

A-Action / Observe (cycle 1) [step 2]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

A-KM Project [step 2]

The KM project interventions and initiatives formed the schedule of tasks (action steps) assigned to CoP members. They consisted of KM practices such as the development of best practice directories, lessons learned logs, storytelling and the establishment of a CoP. Various KM project CoP meetings and activities took place over a

period of six months. KM interventions and initiatives were observed, monitored and evaluated against the KM project and the Syllk model.

A-Reflect (cycle 1) / Plan (cycle 2) [step 3]

- Evaluate effect of actions on problem
- Amend plan if further change is desirable.

A-KM Project [step 3]

A CoP reflection meeting was held, and the participants comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). The reflection planning activity identified some changes. From a planning perspective, some of the interventions and initiatives were not implemented (such as e-learning, mentoring/buddying and alignment to performance appraisals). Others were aligned with capabilities and resources available within the Branch (best practice directories, lessons learned project reviews and written stories).

A-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

A-KM Project [step 4]

The KM interventions and initiatives formed the revised schedule of tasks (actions) assigned to the KM project CoP members. Various meetings and activities took place over a period of nine months. The interventions and initiatives of best practice directories took the form of establishing baseline project requirements. 'Lessons learned' activities consisted of project reviews and building performance evaluations (industry best practice). Storytelling started to

take shape within the Branch, and the CoP became an active 'participant' group. An attempt was made to develop an intranet portal and use available social media tools to connect, ask questions and to share knowledge and information.

A-Reflect (cycle 2) / Plan (cycle 3)[step 5]

- Evaluate effect of actions on problem
- Amend plan if further change is desirable.

A-KM Project [step 5]

A CoP reflection meeting was held, and the participants' comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest. The following findings came out in the reflection activity. The sub-Branch commenced using best practice directories containing defined project requirements. Building performance evaluations, lessons learned and project reviews were more evident in project meetings and stories were being shared in relevant forums.

One of the research interest outcomes of the knowledge audit was identifying knowledge, information and data enablers (facilitators) and blockers (barriers) aligned and mapped to the Syllk model. Following the reflection activity, planning for cycle 3 commenced where one initiative (Knowledge Audit) was not implemented. The remaining interventions and initiatives were further aligned with capabilities and resources available within the Branch.

A-Action / Observe (cycle 3) [step 6]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

A-KM Project [step 6]

The revised KM interventions and initiatives formed the new schedule of tasks (actions) assigned to the KM project CoP members. Various meetings and activities took place over a period of eight months with steady progress of the project activities achieved during this phase of the KM.

A-Reflect (cycle 3) [step 7]

- Evaluate effect of actions on problem.

A-KM Project [step 7]

A CoP reflection meeting was held, and the participants comments were captured to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). The Syllk facilitators, barriers and KM practices were reviewed and framed against the interventions and initiatives. The CoP reviewed their expectations and identified plan areas of improvement and changes for on-going cycles.

A-On-going [step 9]

- Planning problem-solving activity.

A-KM Project [step 9]

The KM project (problem-solving interest) found the action research process a valuable exercise and decided to carry on with the action research cycles as they continued with the implementation of the KM framework and associated activities.

Action research cycles – Project B

Action research methodology was applied to Project B in 6 steps consisting of 2 cycles as shown in Figure 5.

Figure 5. Action research steps applied to Project B
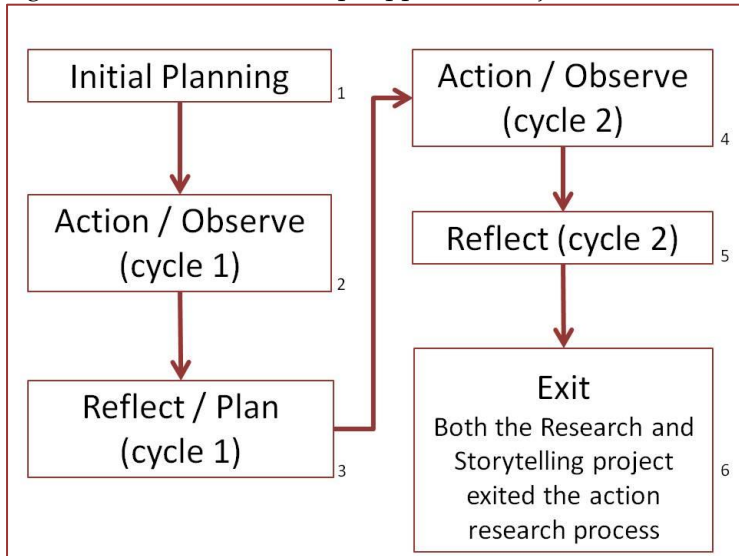
Adapted from: Zubert-Skerritt in (Altrichter et al. 2002) and (McKay & Marshall 2001; McNiff & Whitehead 2011)

Project B: The Theoretical Interest Cycle for Research

- Research themes/interests/questions
- Reconnaissance/fact-finding in relevant literature
- Planning and designing research project to answer research questions, hypotheses, etc.

B-Research [step 1]

The focus on this research (theoretical interest) was to investigate how the Syllk model can be used by a project organisation to conceptualise (and enhance) its capability of storytelling? 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 of storytelling can be distributed across organisational systems and people.

The initial planning stage for the research design component of the study consisted of an interview with two directors followed by a focus group of project practitioners (seven participants). The interview and focus groups verified the understanding of how the Syllk model would work in the organisation (Reed & Payton 1997). The focus groups identified the barriers and facilitators that impact upon the Syllk model within the division.

KM practices identified in KM literature were then aligned with each of the Syllk elements to facilitate learning and address the identified barriers. The KM practices were further refined by the project team into storytelling interventions and initiatives to support the storytelling project plan.

B-Action / Observe (cycle 1) [step 2]

- Action steps and Implement
- Monitor in terms of research interests.

B-Research [step 2]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers and KM practices mapped to the Syllk elements. The researcher

sought feedback from the project participants informally (verbally and via email). Researcher reflections were recorded in research reports. This monitoring presented insight into the progress of the project B in terms of answering the research question.

B-Reflect (cycle 1) / Plan (cycle 1) [step 3]

- Evaluate effect of intervention in terms of research questions, etc
- Amend plan and design if further explanation and research are required.

B-Research [step 3]

A CoP after-action review (reflection meeting) was held, and the participants' comments were captured, reflecting on the storytelling project (problem-solving interest) and the Syllk model (research interest). No research planning changes were noted. At this stage of the action research cycle, the Syllk model had a positive influence and also confirmed the impact the identified barriers (highlighted in step 1) were having on the project outcomes.

B-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of research interests.

B-Research [step 4]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers, the change in the KM practices mapped to the Syllk elements and how the Syllk model supported the storytelling project (Duffield & Whitty 2016b). The researcher sought feedback from the Project participants informally (verbally and via email). Researcher reflections were recorded in research

reports. This monitoring presented insight into the progress of the project B in terms of answering the research question.

B-Reflect (cycle 2) [step 5]

- Evaluate effect of intervention in terms of research questions, etc.

B-Research [step 5]

A CoP after-action review (reflection meeting) was held, and the participants' comments were captured to reflect on the storytelling project (problem-solving interest) and the Syllk model (research interest). No research planning changes were noted.

Some significant findings came out in the after-action review activity. The Syllk model had a positive influence on the organisation's capability for storytelling. The participants realised that by using the Syllk model, this helped to identify how the capability of storytelling operates and is embedded in the various systems of the organisation. One participant stated that:

> When you think about a slice of cheese... and how storytelling works. ...all those barriers and infrastructure just were there still. They were not going away. ...so now you perhaps reshape your whole storytelling focus around the ones that are working. ...I can see all this stuff working. I mean, you have got top-level coverage; you have got all the support. ...you have got all the processes in place, you have got the tools in place.

B-Exit [step 6]

- Exit, if questions are satisfactorily resolved.

B-Research [step 6]

The research component exited the action research process as the researcher determined that there was sufficient intervention evidence to provide answers to the research question.

Project B: The Real-World Problem-Solving Interest Cycle for Practice

A more detailed description of the project and the outcomes can be found at Duffield and Whitty (2016b).

B-Initial Planning [step 1]

- Problem identification
- Reconnaissance/fact-finding about problem context, stakeholders etc.
- Planning problem-solving activity.

B-Storytelling Project [step 1]

As previously discussed the Project B Real-World Problem-Solving interest focussed on a Division implementing a change management program with a focus on storytelling. The division approached the researcher to apply the Syllk model and assist the division (through research).

The research focus group activity identified the barriers and facilitators that impact the Syllk model within the Division. Participants reinforced the benefit of a focus group in that the activity had "...been really insightful. It has helped us form as [a team] well..." KM practices identified in the literature were then aligned with each of the Syllk elements to facilitate the best learning and address the identified barriers. The KM practices were

further refined into storytelling interventions and initiatives to support the development of a storytelling project plan. The interventions and initiatives were developed by the project team in discussion with the researcher.

B-Action / Observe (cycle 1)[step 2]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

B-Storytelling Project [step 2]

Storytelling interventions and initiatives formed the storytelling project plan (action steps) assigned to CoP members. Various meetings and activities took place with a focus on holding CoP team meetings, developing a process, engaging communications, presenting storytelling and holding a story month. Storytelling interventions and initiatives were observed, monitored and evaluated against the Storytelling project and the Syllk model.

B-Reflect (cycle 1) / Plan (cycle 1) [step 3]

- Evaluate effect of actions on problem
- Amend plan if further change is desirable.

B-Storytelling Project [step 3]

An after-action review (reflection meeting) was held and significant evidence of participant contribution was documented to reflect on project actions. There was evidence that some interventions and initiatives expectations were partially met, and others were identified as work in progress. The systems changes consisted of the development of process tools in preparation of a website. There was some success in storytelling. However, the participants highlighted some barriers (as idfentifierd in

step 1) were still causing issues and that they needed to engage with executive management to help address the barriers. New and revised actions were then planned with a significant focus on a need to engage executive officer support, the establishment of a website, and continue removal of identified barriers identified in step 1.

B-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

B-Storytelling Project [step 4]

The storytelling project team commenced engagement with executive officers and leaders within the division. A story template and process was established, followed by a go-live website. Storytelling skills, processes, examples of stories and storytelling were uploaded on the website. The team then focussed on the removal of the remaining Syllk culture, technology and Infrastructure barriers highlighted in step 1.

B-Reflect (cycle 2) [step 5]

- Evaluate effect of actions on problem.

B-Storytelling Project [step 5]

An after-action review (reflection meeting) was held where participants' comments were captured to reflect on both the storytelling project and the research study. The participants identified that leaders are telling stories, people hearing stories, storytelling in team meetings and understanding the importance of storytelling learning and development skills were important findings. An example of a very effective leader who uses stories was discussed and identified which led to an additional interview.

Finally, the learning skills of storytelling need to be part of management development, and the website becomes more about the training courses and learnings of storytelling rather than a collection of stories. The timing of the reflection activity coincided with the end of the research activity that enabled an exit in the action research cycle.

B-Exit [step 6]

- Exit, if outcomes are satisfactory.

B-Storytelling Project [step 6]

Exit, as outcomes are satisfactory. Following the above evaluation process, it was determined that the storytelling project has been successful.

Action research cycles – Project C

Action research methodology was applied to Project C in 9 steps consisting of 3 cycles as shown in Figure 6.

Figure 6: Action research steps applied to Project C
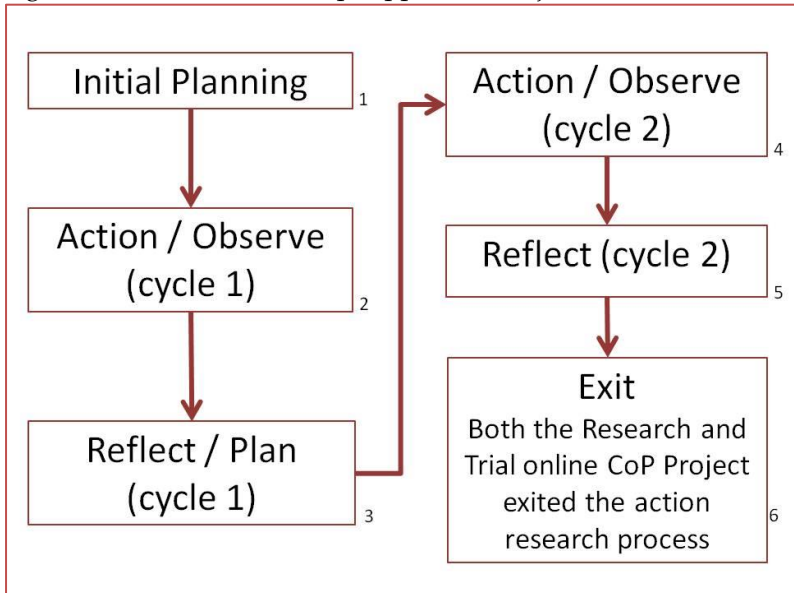
Adapted from: Zubert-Skerritt in (Altrichter et al. 2002) and (McKay & Marshall 2001; McNiff & Whitehead 2011))

Project C: The Theoretical Interest Cycle for Research

C-Initial Planning [step 1]

- Research themes/interests/questions
- Reconnaissance/fact-finding in relevant literature

- Planning and designing research project to answer research questions, hypotheses, etc.

C-Research [step 1]

The focus on this research (theoretical interest) was to investigate how the Syllk model can be used by a project organisation to conceptualise (and enhance) the capability of an online CoP. 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.

The initial planning stage for the research design component of the study consisted of four interviews followed by two focus groups of project practitioners (12 participants). The interview and focus groups verified the understanding of how the Syllk model would work in the organisation (Reed & Payton 1997). The focus groups identified the barriers and facilitators that impact the Syllk model within the organisation.

KM practices identified in KM literature were then aligned with each of the Syllk elements to facilitate learning and address the identified barriers. The KM practices were further refined by the project team into a trial online CoP project plan.

C-Action / Observe (cycle 1) [step 2]

- Action steps and Implement
- Monitor in terms of research interests.

C-Research [step 2]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers and KM practices mapped to the Syllk elements. The researcher sought feedback from the project participants informally (verbally and via email). Researcher reflections were recorded in research reports. This monitoring presented insight into the progress of the project C in terms of answering the research question.

C-Reflect (cycle 1) / Plan (cycle 1) [step 3]

- Evaluate effect of intervention in terms of research questions, etc.
- Amend plan and design if further explanation and research are required.

C-Research [step 3]

A reflection meeting was held with eight participants. Comments were captured from a survey and emailed documentation to reflect on both the study research variables and the Syllk model. No research planning changes were noted.

C-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of research interests.

C-Research [step 4]

The research interest focussed on observing and monitoring the Syllk facilitators and barriers and KM practices mapped to the Syllk elements. The researcher sought feedback from the project participants informally (verbally and via email). Researcher reflections were

recorded in research reports. This monitoring presented insight into the progress of the project C in terms of answering the research question.

C-Reflect (cycle 2) [step 5]

- Evaluate effect of intervention in terms of research questions, etc.

C-Research [step 5]

A reflection meeting was held with 10 participants. Comments were captured from a survey and emailed documentation to reflect on both the study research variables and the Syllk model. No research planning changes were noted. The Syllk model had a positive influence on the organisation capability of an online CoP. The participants emphasised that the barriers identified in step 1 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.

C-Exit [step 6]

- Exit, if questions are satisfactorily resolved.

C-Research [step 6]

Exit, as research question is satisfactorily resolved: Following the above evaluation process, it was determined that there be sufficient evidence to provide answers to the research question.

Project C: The Real-World Problem-Solving Interest Cycle for Practice

A more detailed description of the project and the outcomes can be found at Duffield (2016).

C-Initial Planning [step 1]

- Problem identification
- Reconnaissance/fact-finding about problem context, stakeholders etc.
- Planning problem-solving activity.

C-Trial online CoP Project [step 1]

As previously discussed the Project C Real-World Problem-Solving interest focussed on an organisation implementing a trial online CoP. The organisation division approached the researcher to apply the Syllk model and assist the organisation (through research).

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. 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.

C-Action/Observe (cycle 1) [step 2]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

C-Trial online CoP Project [step 2]

Twenty 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 twelve comments and some associated likes. Some forum topic posts highlighted the barriers identified in step 1.

C-Reflect (cycle 1) / Plan (cycle 1) [step 3]

- Evaluate effect of actions on problem
- Amend plan if further change is desirable.

C-Trial online CoP Project [step 3]

A reflection meeting was held with eight 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 step 1.

C-Action / Observe (cycle 2) [step 4]

- Action steps and Implement
- Monitor in terms of problem-solving efficacy.

C-Trial online CoP Project [step 4]

Twenty-five participants actively participated, contributed and absorbed knowledge, creating value to the organisation by way of improving communication channels to increase staff efficiency. Ten 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.

A survey was conducted to understand the association between Web 2.0 technologies and CoP participation. The survey highlighted that the organisation participation rates were similar with literature benchmarks. Online CoP interventions and initiatives and project actions were observed, monitored and evaluated against the project plan and the Syllk model.

C-Reflect (cycle 2) [step 5]

- Evaluate effect of actions on problem.

C-Trial online CoP Project [step 5]

A reflection meeting was held with ten participants. Participants' comments were captured to reflect on the project. 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 literature reports on the different

levels of CoP participation (Wenger, McDermott & Snyder 2002). For this trial online CoP the levels of participation were consistent with the literature findings.

C-Exit [step 6]

- Exit, if outcomes are satisfactory.

C-Trial online CoP Project [step 6]

Exit, as outcomes are satisfactory. Following the above evaluation process, it was determined that the trial online CoP project had been successful. The organisation continued to evaluate the benefits on the online CoP for expansion across the organisation.

Discussion

The experience of using the adapted Zubert-Skerritt in Altrichter et al. (2002) , McKay and Marshall (2001) and McNiff and Whitehead (2011) approach has been a positive experience for the researcher in this program. The adapted literature have addressed many of the practical issues that the researcher will come across to assist in the implementation of the AR methodology and associated methods. Table 3 provides a summary of the following useful insights and outcomes for action researchers.

The *role of researcher* as discussed in this paper was a significant challenge in all three research projects. The participant status of the researcher needs to be acknowledged by all stakeholders to the research activities. The action researcher needs to know how to be the friendly outsider, open up lines of discussion and be able to make clear the knowledge that guides the project. As each project progressed, participants learned more about the action research process. The researcher was needed less to assist with the AR process and spent more time sourcing literature that supported the projects. In project C, the dual roles became blurred and there was a need to often reflect on both roles. The researcher had to make it clear to the participants that this project was not a management exercise.

The *dual cycle* aspect of the McKay and Marshall (2001) approach has proven to be invaluable for this research program. The dual focus aspect helped to resolve issues where the researcher and project practitioners had quite different interests in the research project and the approach still met both needs. There is an absence of a set of guidelines, and literature case examples of the dual focus approach and this gave the researcher the opportunity to interpret the meaning of the AR steps. My experience on all three AR

projects was that we were not always synchronised with the AR steps, with the exception of the reflection step. The *reflection* activity was always a joint step, where the benefits of the after-action review significantly assisted both the researcher and project practitioners. Another area that helped the researcher was the AR cycle steps assisted the researcher to gather data, feeding it back to those concerned, analysing the data, planning action, taking action and evaluating, leading to further data gathering and so on. This process addresses the validity, credibility, workability and consultancy concerns that are often raised on AR projects.

Action research was conducted in an organisational context and was occasionally met with *external constraints* that impacted on the ability to resolve some of the problems being addressed. Issues with the allocation of project resources and organisational changes were often experienced in all three projects which in some cases made it difficult to deliver project milestones and outcomes.

The *ethics application* was revised to explain in detail the action research methodology and associated methods, and this included a visual representation of the action research cycle methodology. The feedback received made it clear that not all academics are across the AR methodology. Finally, the researcher needs to be mindful of *project size* and the impacts that may occur. Project A Problem-Solving project was significantly larger scope than Project B and C. Many more issues (parallel tasks) had to be resolved which impacted on both the Problem-Solving and Research Interest projects.

AR is acknowledged to have many challenges and tensions, and can be a difficult research methodology to embrace (Marshall, de Salas & McKay 2006). McKay and Marshall's assertion that their framework would 'be invaluable to the researcher, particularly a new researcher, in helping to shape

his / her research design and the subsequent conduct of the action research study', proved to be substantiated in this research program (McKay, J & Marshall, P. 1999).

Table 3: Summary of the useful insights and outcomes for action researchers

Problem	Associated literature
Role of researcher	
The participant status of the researcher needs to be acknowledged by all stakeholders to the research activities. The action researcher needs to know how to be the friendly outsider, open up lines of discussion.	Greenwood and Levin (2007) suggest that good action researchers achieve a balance of review and support through a variety of actions, including facilitation, direct feedback, written reflections and citing cases from the literature where similar problems, opportunities or processes have occurred.
	The experiences of Coghlan and Shani (2008) and Holian and Coghlan (2013) highlight the potential problems that could occur.
Dual cycle (parallel) process of action research	
There is limited literature as to how to apply the AR cycle steps.	McKay and Marshall (2001) and associated literature proved to be valuable (Marshall, de Salas & McKay 2006; Marshall et al. 2010).
Reflection	
The reflection activities of the action research cycle were the most intense, where both the researcher and participants reviewed, discussed, compared and recorded the real learning.	Researcher is the facilitator of the reflection activities (Coughlan & Coghlan 2002). The value of reflection in learning and action research has been reinforced by Walker et al. (2008) and Dick (1993).
External constraints	
AR was conducted in an organisational context and	According to Greenwood and Levin (2007), they argue that in

Problem	Associated literature
was occasionally met with external constraints.	such a situation it would be harsh to conclude the AR 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.
Ethics	
The ethics application was revised to explain in detail the action research methodology.	Action research issues are often faced by researchers in securing ethics approval (Sankaran, Hill & Swepson 2006; Walker & Haslett 2005).
Project Size	
Project A was significantly larger scope than Project B and C. Had many more issues that had to be resolved which impacted on both AR cycles.	McNiff and Whitehead (2011) highlights the need to stay focussed on one issue, which means making sure that you understand the issues and place the others on hold.

Conclusion

This paper provides a direct and personal account of the issues and challenges that occurred in three action research projects that were part of a doctoral research program. Here I will discuss the contributions to methodology and practice, and further conclude with limitations and future research.

Contribution to Methodoldgy and practice

Since KM became a fashionable phrase in the mid-1990s, the KM practice has modest experience of experimental research methods. Most of the KM literature is descriptive or derived from best practices (Firestone & McElroy 2003; O'Dell & Hubert 2011). The research in this paper has been experimentation with action research methods coupled with existing methodologies practices. The action research component of reflection and intervention is fundamental to action research (Dick 1993). The focus of the paper is on the general methodological issues and problems of action research. The insight and outcomes for action researchers were focused on the following areas: Role of the researcher; Dual cycle (parallel) process; Reflection; External constraints; Ethics and Project size.

Feedback from scholars and peers:
> *"The researcher has taken risks, and mitigated the risks to make the results manageable, credible, valid, authentic, and highly useful. The researcher has justified his original contribution through the insights he has proposed"*

> *"by using Action Research the candidate executed research based practices, where questions, problems, and challenges were identified and formed by the subsequent needs of the practice and practitioners"*

> *The PhD candidate "demonstrated that the study was definitely worth undertaking, and the questions were valuable to ask. The outcomes demonstrated why anyone should care and why the study mattered.*

Although in a qualitative study limitations exist associated with generalizability, the candidate, through the Action Research method exhibits the probability that lessons learned are repeatable"

"…the candidate demonstrates the capacity to undertake independent research that has direct impact on practice"

Limitations and future research

There are always limitations with research, and in addition to the previously mentioned action research limitations, there is a limitation that should be noted. The research in this thesis was limited to sampling of problem-solving projects that comprised of three public sector projects conducted by Australian state and federal government departments and agencies from late 2012 through to late 2015. Opportunities for providing further related research include repeating the research study with private sector projects. I came close to working with three organisations (mining information technology, health project management office, and an enterprise resource software company). The timing of the study became an issue for all three organisations.

My goal in this paper has been to discuss some of the AR challenges and tensions, as AR can be a difficult research methodology to embrace. The research has enhanced the practices within the participating organisations and linked academia with industry in enhancing the 'dual cycle' knowledge areas of 'problem-solving and research interests.'

Acknowledgements

Biography

Stephen is a University of Southern Queensland Confirmed PhD Candidate and has a research interest in organisational knowledge and lessons learned. Stephen has 35 years' experience with both public and private sector organisations with a major focus on program management, governance, risk management and aviation safety management.

References

Adams, P 2010, 'Action Research', in Salkind (ed.), *Encyclopedia of Research Design*, SAGE Publications, Inc., Thousand Oaks.

Altrichter, H, Kemmis, S, McTaggart, R & Zuber-Skerritt, O 2002, 'The concept of action research', *The Learning Organization*, vol. 9, no. 3, pp. 125-31.

Avison, D, Lau, F, Myers, M & Nielsen, P 1999, 'Action research', *Communications of the ACM*, vol. 42, no. 1, pp. 94-7.

Baskerville, R 2000, 'Conducting action research: High risk and high reward in theory and practice', *Qualitative Research in Information Systems*, pp. 192-218.

Baskerville, R & Wood-Harper, AT 1996, 'A critical perspective on action research as a method for information systems research', *Journal of Information Technology*, vol. 11, no. 3, pp. 235-46.

Baskerville, RL 1999, 'Investigating information systems with action research', *Communications of the AIS*, vol. 2, no. 3es, p. 4.

Cepeda, G & Martin, D 2005, 'A review of case studies publishing in management decision 2003-2004', *Management Decision*, vol. 43, no. 6, pp. 851-76.

Coghlan, D 2005, 'Insider Action Research Projects: Implications for Practising Managers', in B Cooke & JW Cox (eds), *Fundamentals of Action Research Volume II*, SAGE, London, vol. II, ch 54, pp. 229-44.

Coghlan, D & Shani, A 2008, 'Insider Action Research: The Dynamics of Developing New Capabilities', in P Reason & H Bradbury (eds), *Handbook of action research: Participative inquiry and practice*, Sage, ch 45, pp. 643-55.

Collis, J & Hussey, R 2009, Business research : a practical guide for undergraduate & postgraduate students, 3rd edn, Palgrave Macmillan, Hampshire, UK ; New York, NY.

Collison, C 2006, 'Avoiding the typical barriers to effective KM', *KM review, Volume 9 Issue 4, 16-19*, vol. 9, 4.

Coughlan, P & Coghlan, D 2002, 'Action research for operations management', *International Journal of Operations & Production Management*, vol. 22, no. 2, pp. 220-40.

Dick, B 1993, *You Want to do an Action Research Thesis?*, viewed 14 November 2016, <http://www.aral.com.au/resources/arthesis.html>.

Dick, B & Swepson, P 1994, 'Appropriate Validity and its Attainment Within Action Research: An Illustration Using Soft Systems Methodology ', *AEROL*, < http://www.aral.com.au/resources/sofsys2.html>.

Duffield, S 2015, 'Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects', in *Australian Institute of Project Management National 2015 Conference*, AIPM, 978-0-646-93699-4, Hobart, pp. 56-69.

Duffield, S 2016, 'Application of the Syllk model wiring an organisation for the capability of an online Community of Practice', *VINE Journal of Information and Knowledge Management Systems*, vol. 46, no. 2, pp. 267-94.

Duffield, S & Whitty, SJ 2012, 'A systemic lessons learned and captured knowledge (SLLCK) model for project organizations.', in *9th Project Management Australia Conference (PMOz 2012)*, Eventcorp Pty Ltd, Melbourne, Australia.

Duffield, S & Whitty, SJ 2015, 'Developing a systemic lessons learned knowledge model for organisational learning through projects', *International Journal of Project Management*, vol. 33, no. 2, pp. 311-24.

Duffield, S & Whitty, SJ 2016a, 'Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects', *International Journal of Project Management*, vol. 34, no. 7, pp. 1280-93.

Duffield, S & Whitty, SJ 2016b, 'How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling', *International Journal of Project Management*, vol. 34, no. 3, pp. 429-43.

Firestone, J & McElroy, M 2003, Key Issues in New Knowledge Management, Elsevier Science, Burlington, MA.

Greenwood, D & Levin, M 2007, An Epistemological Foundation for Action Research: Introduction to Action Research. , SAGE Publications, Inc., Thousand Oaks, CA.

Hedman, S, Påhlman, L & Törnby, A 2015, 'The Production of Comfort - How Financial Auditors Experience that they Become Comfortable with IT-auditors', Uppsala University.

Herr, K & Anderson, GL 2005, The action research dissertation: A guide for students and faculty, Sage Publications.

Holian, R & Coghlan, D 2013, 'Ethical issues and role duality in insider action research: Challenges for action research degree programmes', *Systemic Practice and Action Research*, vol. 26, no. 5, pp. 399-415.

Kotnour, T & Vergopia, C 2005, 'Learning-Based Project Reviews: Observations and Lessons Learned from the Kennedy Space Center', *Engineering Management Journal*, vol. 17, no. 4, pp. 30-8.

Leal-Rodríguez, AL, Roldán, JL, Ariza-Montes, JA & Leal-Millán, A 2014, 'From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context', *International Journal of Project Management*, vol. 32, no. 6, pp. 894-907.

Lewin, K 1946, 'Action research and minority problems', *Journal of social issues*, vol. 2, no. 4, pp. 34-46.

Marshall, P, de Salas, K & McKay, J 2006, 'Action research in practice: balancing the dual imperatives', *ACIS 2006 Proceedings*, p. 10.

Marshall, P, Wilson, P, de Salas, K & McKay, J 2010, 'Action research in practice: issues and challenges in a financial services case study', *The Qualitative Report*, vol. 15, no. 1, pp. 76-93.

Mau, M 2005, 'Action research: Connecting knowledge in the Australian public sector organization', *actKM Online Journal of Knowledge Management*, vol. 2, no. 1, pp. 58-69.

McKay, J & Marshall, P 1999, '2x6= 12, or does it equal Action Research?', in *Australasian Conference on Information Systems, Wellington*, Citeseer.

McKay, J & Marshall, P 1999, 'A Framework for Rigour in Action Research', in *Americas Conference on Information Systems (AMCIS)*, .

McKay, J & Marshall, P 2001, 'The dual imperatives of action research', *Information Technology & People*, vol. 14, no. 1, pp. 46-59.

McNiff, J & Whitehead, J 2011, All you need to know about Action Research, 2nd edn, SAGE, London.

Melrose, MJ 2001, 'Maximizing the rigor of action research: why would you want to? How could you?', *Field Methods*, vol. 13, no. 2, pp. 160-80.

O'Dell, C & Hubert, C 2011, The new edge in knowledge : how knowledge management is changing the way we do business, John Wiley & Sons, New Jersey.

Orr, M 2006, 'The Implementation of Electronic Health Knowledge Management Systems', Southern Cross University, Southern Cross University Press, Lismore.

Orr, M & Sankaran, S 2007, 'Mutual empathy, ambiguity, and the implementation of electronic knowledge management within the complex health system', *Emergence: Complexity & Organization*, vol. 9, no. 1-2, pp. 44-55.

Raelin, JA 1998, 'Work-based learning in practice', *Journal of Workplace Learning*, vol. 10, no. 6/7, pp. 280-3.

Ragsdell, G 2009, 'Participatory action research: a winning strategy for KM', *Journal of Knowledge Management*, vol. 13, no. 6, pp. 564-76.

Reason, J 1997, Managing the Risks of Organizational Accidents, Ashgate, Aldershot, Hants, England; Brookfield, Vt., USA.

Reed, J & Payton, VR 1997, 'Focus groups: issues of analysis and interpretation', *Journal of Advanced Nursing*, vol. 26, no. 4, pp. 765-71.

Riege, A 2005, 'Three-dozen knowledge-sharing barriers managers must consider', *Journal of Knowledge Management*, vol. 9, no. 3, pp. 18-35.

Sankaran, S 2009, 'Applying action research to conduct practitioner research in knowledge management', in J Xu (ed.), *Enhancing organisational capability through knowledge management*, Southern Cross University Press, Lismore, pp. 23-40.

Sankaran, S, Hill, G & Swepson, P 2006, 'Should Australian AR theses be examined using a developmental approach adopted by US universities?', *ALAR: Action Learning and Action Research Journal*, vol. 11, no. 2, p. 28.

Sankaran, S, Tay, BT & Orr, M 2009, 'Managing organizational change by using soft systems thinking in action research projects', *International Journal of Managing Projects in Business*, vol. 2, no. 2, pp. 179-97.

Susman, GI & Evered, RD 1978, 'An assessment of the scientific merits of action research', *Administrative science quarterly*, pp. 582-603.

Virolainen, T 2014, 'Learning from projects: a qualitative metasummary', Lappeenranta University of Technology.

Walker, B & Haslett, T 2005, 'Action Research in Management: Ethical Dilemmas', in B Cooke & JW Cox (eds), *Fundamentals of Action Research Volume II*, SAGE, London, vol. II, ch 57, pp. 287-98.

Walker, DH, Anbari, FT, Bredillet, C, Söderlund, J, Cicmil, S & Thomas, J 2008, 'Collaborative academic/practitioner research in project management: Examples and applications', *International Journal of Managing Projects in Business*, vol. 1, no. 2, pp. 168-92.

Walker, S 2007, What are the Major Barriers to the Successful Implementation of Knowledge Management Projects in the Telecommunications Industry?: A Participatory Action Research Study, Southern Cross University, <http://books.google.com.au/books?id=2GnctgAACAAJ>.

Walker, S & Sankaran, S 2014, 'A participatory action research study of knowledge management implementation in a large European telecommunication company in their UK office', *Gibaran Journal of Applied Management*, vol. 6, no. 2, pp. 36-63.

Wenger, E, McDermott, RA & Snyder, W 2002, Cultivating communities of practice: A guide to managing knowledge, Harvard Business Press, Boston, Massachusetts.

Zuber-Skerritt, O & Perry, C 2002, 'Action research within organisations and university thesis writing', *Learning Organization, The*, vol. 9, no. 4, pp. 171-9.

5. PROJECT A

Paper Two "*Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects*" reports on the application of the Syllk model to enable management to conceptualise how organisational capability (know-how) for projects is wired (distributed) across various elements of an organisation (Duffield & Whitty 2016b).

This study is an application of the Syllk model that enables management to conceptualise how organisational capability (know-how) for projects is wired (distributed) across various elements of an organisation. The research method consisted of action research cycles within a large divisional branch of a government organisation. Knowledge management interventions and initiatives were implemented with three action research cycles completed. Actions and changes were observed, monitored, evaluated, and reflected on using an after-action review process. This study has established that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence an organisations capability for organisation learning. This study shows how the Syllk model enables management to conceptualise (and illustrate) how organisational capability (know-how) is wired (distributed) across various people and system elements of an organisation.

5.1. Project background

Project A took place at a Branch of a large division of an Australian government organisation. The Branch is responsible for leading and coordinating state-wide infrastructure planning and delivery while ensuring that the life of built assets is optimised to deliver the infrastructure investment program. The Branch consists of the design and builds infrastructure, asset and property services, and portfolio and investment units and has approximately 160 staff. The Branch manages a sizable number of projects. The most significant and complex projects are approximately 200 capital projects with project budgets ranging from approximately A$1 million to A$1.7 billion.

Currently, there is no consistent knowledge management (KM) framework utilised to manage the knowledge gathered during the planning, design, and delivery of these capital projects, including lessons learned. This lack of a consistent framework extends across all Branch projects. Following a P3M3 (Portfolio, Program and Project Management Maturity) assessment, the Branch leadership team acknowledged a need to develop a KM framework to support their officers directing and managing projects, and to utilise the knowledge gathered from experience and included lessons learned to improve their project processes and outcomes.

The business improvement director of the Branch approached me to apply the Syllk model and assist the Branch (through research) in the implementation of a KM project to develop and implement a KM framework. The '(Branch) KM project' was endorsed by executive management in June 2013. The overall duration of the research and KM project was two years and four months (February 2013 to June 2015). The Branch identified that the implementation of the Syllk model would

benefit the organisation to understand the knowledge management barriers and facilitators associated with lessons learned from project work.

5.2. Knowledge flow opportunity with ISO 9001:2015(E)

ISO 9001:2015(E) Quality management systems – requirements has recently been revised and now contains an organisational knowledge element. Research project A is situated around an Australian government organisation which has no requirement to be compliant with the new ISO 9001:2015(E) clause 7.1.6 (Organisational knowledge). During the research activities, there was awareness in understanding a potential positive impact of an early draft version of the ISO 9001 standard. As suppliers to the government are required to hold ISO 9001 quality management certification, a potential *knowledge flow* opportunity was highlighted. When the government contracts to industry, there could now be a potential flow of knowledge between both industry and government through the organisations adapting and aligning with the Syllk model. Walker (2015) reports that with alliance contracts collaboration enables knowledge transfer and alliance members share knowledge more readily which helps to understand the needs of the project.

Table 5-1 identifies where the Syllk model elements are aligned with the ISO 90001:2015(E) requirements. The potential interest was in holding an interactive workshop (We really need to talk (sub-Branch)CK and lessons learned – Appendix E, Figure E-1) showing participants how the Syllk model can be applied to their organisational setting and to the wider supply chain. Unfortunately, due to competing resources (personnel) within the Branch the workshop was postponed (refer to Paper Two, table 8).

Table 5-1 Syllk model aligned with the ISO 9001:2015(E) requirements

Syllk model	ISO 9001:2015(E)
Syllk model	0.3.2 (Plan-Do-Check-Act cycle) 7.1.6 (Organizational knowledge) 9.3 (Management review) 10.3 (Continual improvement) A.7 (Organizational knowledge)
People	
Learning	7.1.6 (Organizational knowledge) A.7 (Organizational knowledge)
Culture	0.2 (Quality management principles) 4.1(Understanding the organization and its context) 5.0 (Leadership) 6.0 (Planning)
Social	4.1 (Understanding the organization and its context) 7.4 (Communication)
Systems	
Technology	4.1 (Understanding the organization and its context) 7.5 (Documented information)
Process	0.1 (General – Plan-Do-Check-Act) 0.3 (Process approach) 0.3.2 (Plan-Do-Check-Act cycle) 4.4 (Quality Management system and its processes) 7.1.4 (Environment for the operation of processes) 7.1.6 (Organizational knowledge)

Syllk model	ISO 9001:2015(E)
Infrastructure	7.1.3 (Infrastructure)

A review of the literature shows linkages between Total Quality Management (TQM) and learning, and between action research and learning (Duffield Forthcoming 2017; Kumar 2012). Kumar (2012) concludes that there is a relationship between learning, TQM (Plan-Do-Check-Act (PDCA)) and action research. From a Syllk model perspective, there is a three-way linkage between the Syllk model (OLM, learning), TQM (PDCA) and action research (action research cycles and reflective learning) that provides a product for the "ISO 9001:2015(E) Organizational knowledge" requirement (Figure 5-1).

5.3. Project A data extracts

Appendix E contains the following extracts of data as supplementary information in support of Paper Two:

- Iknow(Branch) framework extract

    The following Iknow(Branch) framework was an important supporting document in the KM Project (Project A: Real-World Problem-Solving interest) associated with Paper Two. As the project progressed, the participants came to understand the action research process. I was needed less like an action research expert and spent more time sourcing literature that supported the project (the Iknow(Branch) framework document provides one of the opportunities to support the project). I was then able to focus more on the research findings while the participants were managing the project. However, they relied on me to pay attention to the overall picture.

- Figure E-1: We really need to talk about (sub-Branch)CK and Lessons Learned (refer to 5.2)

- KM Practice (independent variable/interventions)

    Table E-1 and Figure E-2 provides insight to the action research cycle #3. These charts assisted in providing inputs to the network capability diagram for project A.

- Figure E-3: KM benefits integrated KM mind map incorporating the Syllk model. This mind map was introduced to the project team to help them understand how the Syllk model integrated with the organisation and what benefits could be achieved.
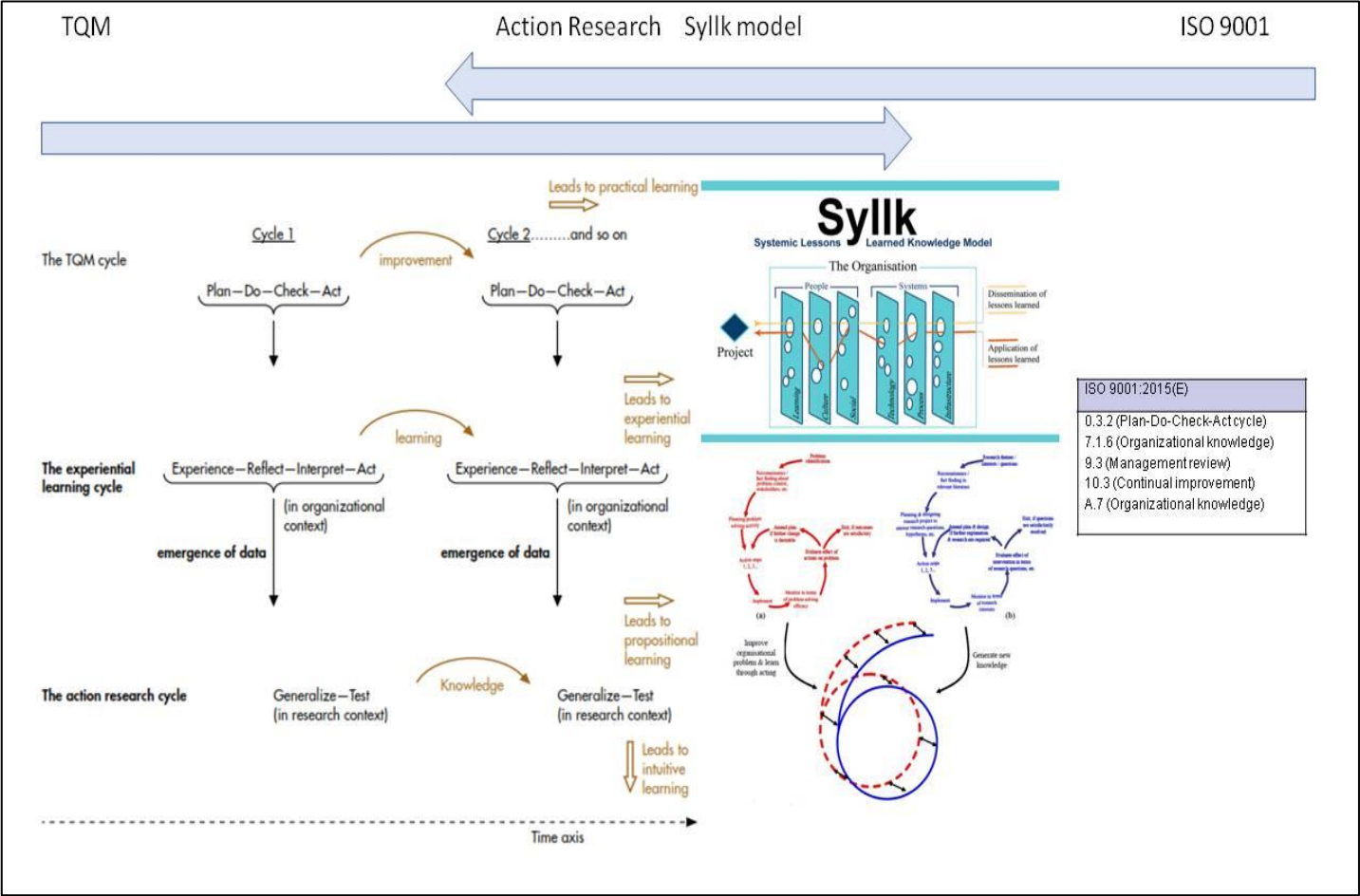
Figure 5-1 Three way interface TQM(AR) - Syllk(AR) - ISO9001
Adapted from: (Kumar 2012, p. 58)

5.4. Paper Two: Statement of authorship

Duffield, S., Whitty, S.J., (2016b). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. International Journal of Project Management, vol. 34, no. 7, pp. 1280-1293.

Conception and design of the project:
PhD Candidate 100%

Data collection, analysis, and interpretation of research data:
PhD Candidate 100%

Drafting significant parts of the work, or critically revising it so as to contribute to the interpretation:
PhD Candidate 90%
Co-Author 10%

Editing and preparation of final submission:
PhD Candidate 90%
Co-Author 10%

PhD Candidate Signature
Stephen M Duffield
Date: 22 March 2017

Co-Author Signature
Associate Professor S. Jonathan Whitty (Principal Supervisor)
Date: 22 March 2017

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Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects

Stephen M. Duffield *, S. Jonathan Whitty

Business, Education, Law & Arts, University of Southern Queensland, Springfield Campus, Australia

Abstract

This study is an application of the Systemic Lessons Learned Knowledge (Syllk) model that enables management to conceptualise how organisational know-how for projects is wired (distributed) across various elements of an organisation. The research method consisted of action research cycles within a large divisional branch of a government organisation. Knowledge management interventions and initiatives were implemented with three action research cycles completed. Actions and changes were observed, monitored, evaluated, and reflected on using an after action review process. This study has established that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence an organisation's capability for organisation learning. This study shows how the Syllk model enables management to conceptualise (and illustrate) how organisational know-how is wired (distributed) across various people and system elements of an organisation.

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Keywords: Project learning; Knowledge management; Lessons learned; Organisational learning; Action research

1. Introduction

There is an organisational 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; Ministry of Defence, 2010; Office of Inspector General, 2012; Shergold, 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).

In this paper we apply a conceptual model, hereafter referred to as the Systemic Lessons Learned Knowledge model or Syllk (pronounced Silk) model, which is a variation of Reason's (1997, 2000) Swiss cheese model (Duffield and Whitty, 2012; Duffield and Whitty, 2015). 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.

The organisation at the centre of this research is a large government departmental branch that identified a need to share project knowledge. The branch identified that the implementation of the Syllk model would benefit the organisation to understand the knowledge management (KM) barriers and facilitators associated with lessons learned around project work. The dissemination and application of lessons learned through projects are critical to organisational programs and projects achieving success (Disterer, 2002). Lindner and Wald (2011) point out a gap in project management practice and suggest there is a need for more research in understanding the role KM plays in project management methodologies. Williams (2008, p. 262) also argues that there be a need for "... wider research into how lessons [from projects] can be disseminated throughout an organization and incorporated into organizational practice". And as Wideman (2011, p. 1 emphasis added) puts it, "in spite of all the technology that is available to us today, we have not yet found a *presentation format* that captures the essence of this wisdom in a way that is

* Corresponding author.
  E-mail address: stephen@invictaprojects.com.au (S.M. Duffield).

relevant to future usage, readily searchable and easy to store. ... we have a serious cultural problem. ... we are probably condemned to continue to throw away the valuable resources".

The paper begins with a literature review exploring organisational learning, the Syllk model, and leads to the research question. We then describe the project under study and the applied 'action research' methodology. Finally, we discuss the findings within the framework of the literature, the limitations, and challenges, and speculate on practical applications and future research opportunities.

2. Literature review

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

2.1. Organisational learning

The review of learning literature re-enforces that people factors influence the success of the lessons learned process and that a learning organisation culture (a culture that values learning process) is critical to successful dissemination of lessons learned (Fernie et al., 2003; Sense, 2007; Von Zedtwitz, 2002). The shift from the individual to the organisation is not straightforward. The work of Senge (1990) motivated companies to identify themselves as learning organisations. Another influential author is Nonaka (1991, 2007) and Nonaka and Takeuchi (1995). Nonaka (1991) described how Japanese companies working in innovation created knowledge-creating companies. As Simon (1991, p. 125) states:

> All learning takes places inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have. ... What an individual learns in an organization is very much dependent on what is already known to (or believed by) other members of the organization and what kinds of information are present in the organizational environment. ... Individual learning in organizations is very much a social, not a solitary, phenomenon.

2.2. Organisational knowledge

Today, in the context of the organisation, knowledge exploration is attributed to; Drucker (1993) where knowledge is a management resource and power; Wiig (1997) where knowledge is a form of belief; Polanyi (1958, 2009) who explores the distinction between tacit and explicit knowledge; and Davenport and Prusak (2000, p. 5) where knowledge in organisations "becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms".

Polanyi's (1958) work formed the foundation for Nonaka (2007); Nonaka and Takeuchi (1995) who state that whereas explicit or codified knowledge is objective and easily communicated and transferred without in-depth experience; tacit knowledge is subjective, environment-specific, personal, and is difficult to communicate. Polanyi (2009, p. 4) contend that "we can know more than we can tell" and that humans create knowledge by involving themselves with objects through a process. Tacit knowledge consists of cognitive and technical elements (Nonaka and Takeuchi, 1995). The cognitive elements are "mental models" (schemata, paradigms, perspectives, cultural beliefs and viewpoints) where humans create working models of the world in their minds and act upon them. The technical elements are the existing know-how and skills (Johnson-Laird, 1983). Organisational knowledge, therefore, extends beyond the individual human component. It is not found in one place. It is emergent behaviour that is distributed across interconnected organisational cultural artefacts, rituals, and practices (Walsh and Ungson, 1991).

Organisational knowledge plays a key role in the development of both enterprise and project risk management controls and treatments by first searching and learning what others have done (what has worked and what has failed), so the wheel is not reinvented (Li, 2002; Liebowitz and Megbolugbe, 2003). According to Neef (2005) a company cannot manage its risks without managing its knowledge. Projects fail due to a lack of lessons learned from the project team or lack of knowledge sharing. KM tools and techniques can be used to communicate risks among members of a project team. It is important that the organisation manage knowledge risk management which would require the identification, dissemination, and application of knowledge related to potential enterprise and project risks to contribute to risk management prediction and response analysis (Alhawari et al., 2012; Neef, 2005).

Duhon and Elias (2008) argue that an organisation knows something if just one person knows it and that the organisation culture and structure enables that knowledge event to be used effectively. They reference actions such as; individual learning; knowledge storage (checklists and work processes); organisational changes that re-focuses knowledge; culture changes to open and act on problems; and relationship building that enables skills and knowledge to deal with organisational problems. They also state that people learn by processing information using the human central nervous system. However, an organisation does not have a central nervous system, so it needs to create analogues structures to enable its personnel to learn as one holistic group.

Culture per se plays a significant part in KM, organisational learning, and in the effectiveness of learning mechanisms (Andriessen and Fahlbruch, 2004; Duhon and Elias, 2008; Eskerod and Skriver, 2007; Leistner, 2010). As Dvir and Shenhar (2011, p. 20) point out, "Great projects create a revolutionary project culture. The execution of great projects often requires a different project culture, which can spread to an entire organization". Williams (2007, 2008); Hislop (2005) and Maqsood (2006) all suggest that it is critical to understand the culture of an organisation before implementing or using lessons learned processes. Furthermore, surveys consistently reveal that the main obstacles to project success are organisational people factors (Milton, 2010; O'Dell and Hubert, 2011; Williams, 2007). In summary, organisational

knowledge or the know-how of how to respond to the business environment are behaviours and actions that are embedded in, and distributed across, organisational artefacts, system and processes, and cultural practices and rituals. They are networked elements that together generate a particular organisational response.

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).

In line with complex adaptive systems theory, the Syllk model (see Fig. 1), represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour and responses of the organisation (Duffield, 2016; Duffield and Whitty, 2012; Duffield and Whitty, 2015, 2016). Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the various 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 learned. 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).

Leal-Rodríguez et al. (2014) have indicated how an earlier version of the Syllk model (Duffield and Whitty, 2012) 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. Duffield and Whitty (2016) have shown that the alignment of the people and system elements can positively influence an organisation's capability for storytelling, and therefore learn and accumulate lessons from stories of past project experiences. Hedman et al. (2015) explain how the Syllk model shows that for organisations to learn, people and systems (processes and technology) needs to be aligned and that this combination is the best way of organisational learning.

3. Research question

What is missing from the literature is a study that clearly and simply articulates how a tool such as the Syllk model could be
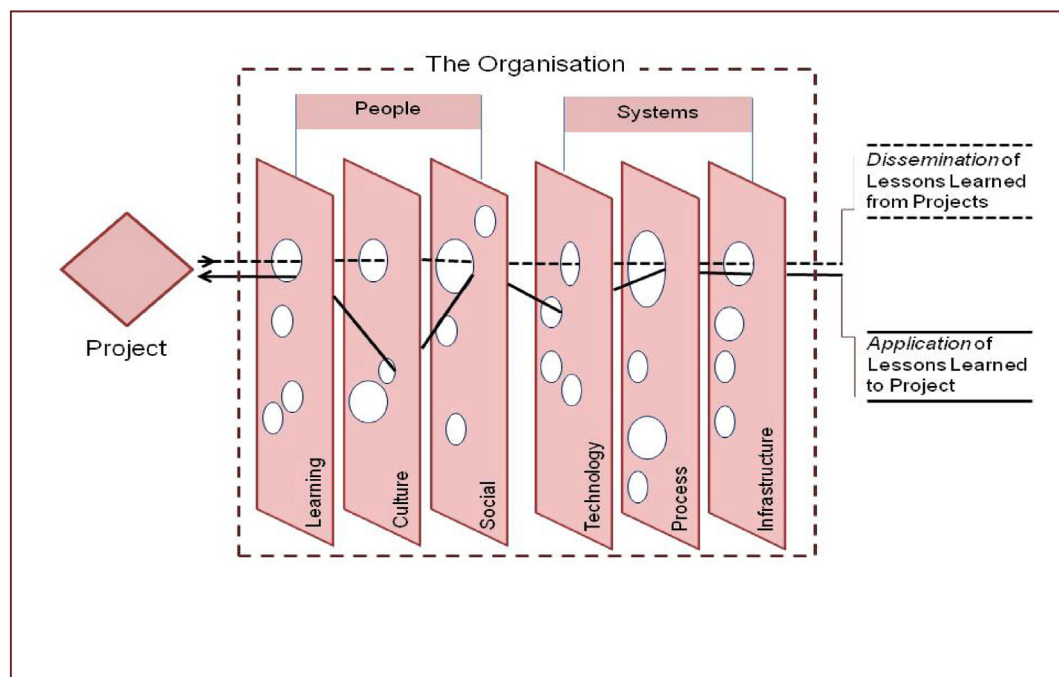
Source: (Duffield and Whitty, 2015)

Fig. 1. The Systemic Lessons Learned Knowledge model.

practically used by a project organisation to capture knowledge and lessons from its project work and successfully distribute this knowledge (know-how capability) across its organisational systems and people. With this in mind the overarching research question is:

[RQ] Can the Systemic Lessons Learned Knowledge (Syllk) model enable a project organisation to learn from past project experiences?

4. Research methodology

4.1. Problem-solving interest (KM Project)

The study took place at a Branch of a large division of a government organisation. [Branch will be the alias name for the organisation in which the study was conducted. The real identity of the Branch has been disguised to protect the confidentiality of the participants. Ethics clearance was obtained from the University of Southern Queensland to conduct the study.] The Branch is responsible for leading and coordinating state-wide infrastructure planning and delivery while ensuring that the life of built assets is optimised to deliver the infrastructure investment program. The Branch consists of the design and build infrastructure, asset and property services, portfolio and investment units and has approximately 160 staff. The Branch manages a sizable number of projects. The most significant and complex are approximately 200 capital projects with project budgets ranging from approximately $1 million to $1.7 billion. Currently, there is no consistent KM framework utilised to manage the knowledge gathered during the planning, design, and delivery of these capital projects, including lessons learned. This lack of a consistent framework extends across all Branch projects. Following a P3M3 (Portfolio, Program & Project Management Maturity) assessment, the Branch leadership team acknowledged a need to develop a KM framework to support their officers directing and managing projects, and to utilise the knowledge gathered from past experience and include lessons learned to improve their project processes and outcomes. The business improvement director of the Branch approached the researcher (the researcher was not a member of the Branch) to apply the Syllk model and assist the Branch (through research) in the implementation of a KM project to develop and implement a KM framework. The '(Branch) KM project' was endorsed by executive management in June 2013. The overall duration of the research and KM project was two years and four months (February 2013 to June 2015).

### 4.2. Action research suitability to this research

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 effective way of delivering a conscious change in a partly controlled surrounding. The action researcher enters a situation and attempts to deliver change and monitors the results (Collis and Hussey, 2009; Lewin, 1946).

Action research was selected as the most suitable method to employ to answer the research question as the research is focused on business change management, organisational learning and project management body of knowledge (Baskerville, 1999; Baskerville and Wood-Harper, 1996; Raelin, 1998; Susman and Evered, 1978; Zuber-Skerritt and Perry, 2002). 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) and knowledge management systems (Mau, 2005; Orr, 2006; Sankaran, 2009; Sankaran et al., 2009; Walker, 2007; Walker and Sankaran, 2014). 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. Kotnour and Vergopia (2005) applied action research on a NASA Kennedy Space Center lessons learned study where the approach actively engaged participants in the development and application of new knowledge.

4.3. The action research approach

The action research method applied to this study consisted of multiple spiral 'action research' cycles of the 4 stage process (plan, action, observe and reflect) adapted from Zubert-Skerritt in Altrichter et al. (2002); McKay and Marshall (2001); McNiff and Whitehead (2002). The dual cycle (parallel) process of action research proposed by McKay and Marshall (2001) was implemented where the action research cycles were applied to both the *KM project* (problem-solving interest) and the *research* application of the Syllk model (research interest). The custodian of the research interest is the researcher, and the custodian of the problem-solving interest is the Branch Project 'Community of Practice (CoP)' team which consisted of 7 participants. The researcher participated in some of the CoP meetings. The CoP team managed the KM project problem-solving diagnosis, reflection and planning activities and occasionally sought advice from the researcher. Action research methodology was applied to this study in 9 steps consisting of 3 cycles as shown in Fig. 2. For simplicity of presenting the findings, steps 2 to 6 consist of two separate stages of the action research process.
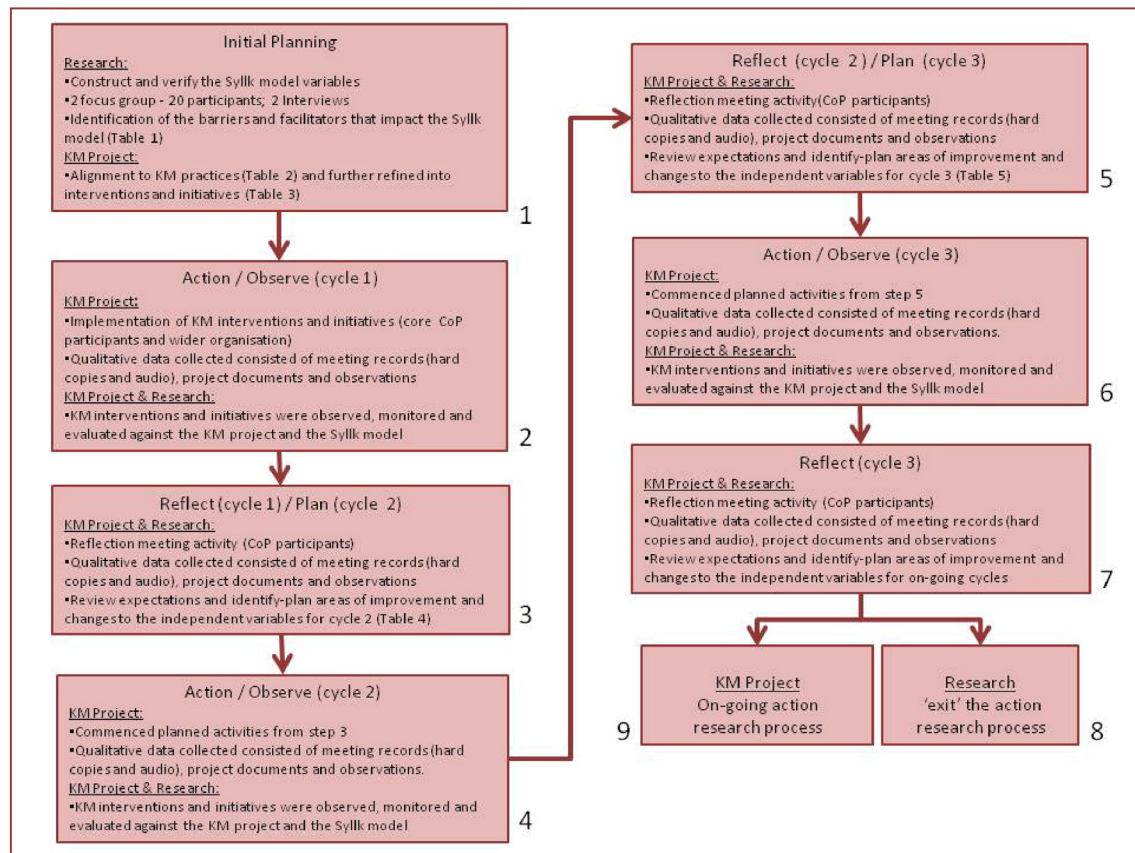
Source: Adapted from Zubert-Skerritt in Altrichter et al. (2002), McKay and

Marshall (2001), McNiff and Whitehead (2002)

Fig. 2. Action research steps applied to this study.

4.4. Action research methods of analysis

The qualitative data collected (meeting records (hard copies and audio), project documents and observations during each action research cycle) was evaluated using a general inductive approach to help in identifying what is working well and what needs improving (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 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). 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). 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 (Fig. 2, step 1) for the research design component of the study consisted of interviews with 2 Branch directors followed by 2 focus groups of Branch project practitioners (20 participants). The interview and focus groups verified the understanding of how the Syllk model would work in the organisation. The identification of barriers and facilitators is an important step in KM (Pinho et al., 2012). The focus groups identified the barriers and facilitators that impact the Syllk model within the Branch (Table 1).

Table 1
Facilitators and barriers [in terms of Syllk elements].

Facilitators	Barriers
People Learning	**People Learning**
Relevant information available when needed	Loss of people/knowledge
Mentoring	People position changing – lost knowledge
Small workshops (in-house) same skill level	Time and program pressure to sharing
Sharing/crossing different people experience	Learning models for different people
Drawing on your own and other's experience from other positions, industries, etc.	Information overload
Willingness to share and learn from each other	No planned career or succession planning
Evidence-based not opinion	No training plans in place
Lifelong learning	Lack of access to training
Resources-diversity to aid learning	Lack of funding for training workshop
Set the right scene for learning to deliver (positive environment)	Past lessons learnt workshops - shelf ware
	Lack of opportunity for social networking across areas especially professional networking
People Culture	**People Culture**
Engagement, positive environment, diversity across ages	Poor communication, change management
Emotional intelligence	Penalty for disclosure, divulging errors
Empowerment, let managers manage, open disclosure	Poor leadership, Lack of trust, leading to overly complicated and highly inefficient approval/governance processes
Value and encourage people to contribute	No shared view about corporate knowledge
Colleagues sharing knowledge and experience	Disparate group, Fear of being replaced, blame culture
Respect at all levels across team promoting learning	Knowledge is power
Open minds supporting change, open shared accountabilities	Politically motivated decisions
Regular updates on organisation focus	
Working in familiar groups	
People Social	**People Social**
Acknowledge individual/group/team activities	Lack of recognition
Reward and recognition of work achieved	Poor treatment of employees as people
Speed bumps on long the way are managed and addressed across the team, become positive not a negative.	Willingness to share lessons learned across projects and to improve
Systems Technology	**Systems Technology**
Dashboard - knowledge capture and review	Incompatibility with private sector
Implementation training	Complex dashboard, ineffective financial and reporting
	Lack of tools/functionality; Lack of modern tools, not linked
	Reliability, modern up to date software
Systems Process	**Systems Process**
System process is simple and easily understood	Poor implementation of new process and change
Forms and checklists	Post-occupancy too late in process
Guidelines for process to achieve an across the board consistent approach	Continual change of processes
Innovative approach	Language not appropriate to audience
Demonstrated active commitment to process at all levels	Overly complicated; Bureaucratic rigid and complex
Flexible and supports innovation	Too detailed, too perspective, Do what I say
Matches the need of the business	Limited compliance monitoring (lack of resources)
Drives and delivers best practice	Reliance on areas outside of our business
Systems Infrastructure	**Systems Infrastructure**
Co-location	Poor accommodation
Making lessons applicable to current activities	Unreliable IT systems; No external access to IT
	Poor filing; retrieval
	Different: stakeholders; consultants; locations and data bases
	Changing management structure/priorities, lack of resourcing
	Too much churn in people and processes

The research focus groups provided input into the planning element of the problem–solving KM project. A KM project team meeting was held to identify KM practices from the KM literature (APQC, 2012; Duffield and Whitty, 2012; Duffield and Whitty, 2015; Tan et al., 2009) that were then aligned with each of the Syllk elements to best facilitate learning and address the identified barriers (Table 2).

The KM practices were further refined into KM interventions and initiatives to support the development of what was to be called the "IKnow(Branch) KM framework" and the implementation plan interventions and the initiatives (Table 3 – cycle 1).

The interventions and initiatives were developed by the (Branch) KM project team in discussion with the researcher.

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

The KM project interventions and initiatives formed the schedule of tasks assigned to CoP members. The interventions and initiatives consisted of KM practices such as the development of best practice directories, lessons learned logs, storytelling and the establishment of a CoP. The CoP enabled the establishment of special interest sub–groups and that provided an opportunity to

Table 2
KM practices addressing facilitators and barriers mapped to the Syllk elements.

Syllk elements	KM practices
People **Learning**	Specific focus group sessions on KM topics
	Learning before, Learning during, Learning after
	Stories and lessons, Storytelling
	Individual learning interviews
	Learning histories
	Communities of practice
	Lunch and learn session, breakfast sessions
	Forums, Technical X-Change
	Mentoring/Buddying; Apprenticeships
People **Culture**	Tone from Leadership teams
	Team KM sharing events
	Alumni club
	Identifying and promoting champions
	Reward and Recognition
	Link to organisation objectives
	Align culture and business
	Expertise List
	Performance appraisals - leadership
People **Social**	Yellow Pages (expertise locator list), Knowledge matrix
	Promoting conversation: open plan office, communal knowledge areas, online conversation, town hall and roundtable meetings, lunch and learn sessions
	Knowledge cafe's
	Communities of practice
	Stories and lessons, Storytelling
Systems **Technology**	IKnow(Branch) Intranet site
	Lessons learned repositories
	Knowledge libraries, portals web, wikis, intranets
	Publish and search technologies
	Blogs, social media, what is new (post)
	Enterprise Content Management
Systems **Process**	IKnow(Branch) Framework- (how does the KM work in (Branch))
	Post project reviews/peer assists/reviews/after action reviews
	Knowledge handover, following a retrospect lessons learned workshop.
	Risk Management
	Employee Development
	Conduct a knowledge network analysis
	Conduct a knowledge audit
	Types of learning reusable project knowledge
Systems **Infrastructure**	Layout of teams
	Promoting conversation, Open plan office, communal knowledge areas
	Intranet availability
	Performance appraisals, Employee development

Table 3
Cycle 1: KM framework and implementation plan.

Interventions and initiatives	Status
Best Practice Directory	Part implemented
Lessons Learned	Part implemented
Story telling	Tried to implement
Questions and Answers	No implementation
Communities of Practice	Implemented
Special Interest Groups	Tried to implement
Portal	Tried to implement
Yellow Pages	No implementation
Knowledge Audit	Tried to implement
E-learning	No implementation
Mentoring / buddying	No implementation
Performance appraisals	Tried to implement

5.3. Step 3) Reflect (cycle 1) and Plan (cycle 2)

A CoP reflection meeting was held, and the participants comments were captured (Table 4) to reflect on the KM project (problem-solving interest) and the Syllk model (research interest).

The reflection planning activity identified a need to change the focus from a Branch (IKnow(Branch)) initiative to a sub-Branch ((sub-Branch) Community of Knowledge (CK)) initiative. The leader of the CoP stated that "we started with IKnow(Branch) because that was the driving force and intent ... but really we have shifted the focus from Branch to [more specific sub-Branch] Infrastructure, for useful connectivity with the organisation and the regional units".

Some of the interventions and initiatives (Table 5) were not implemented (such as e-learning, mentoring/buddying and alignment to performance appraisals). Others were aligned with capabilities and resources available within the Branch (best practice directories, lessons learned project reviews and written stories).

When reflecting on the research interest of the Syllk model, a CoP participant stated that "... when we did our workshop to capture the blockers [barriers] ... we then further looked at the

Table 4
Cycle 1 reflection outcomes.

Cycle 1: KM project reflection outcomes
KM governance and sponsor activities successful
KM project implementation plan developed
KM project launch
CoP established with terms of reference
13 CoP meetings held
LinkedIn site established
Story template developed and 3 stories shared
Knowledge audit scoped
Reviewed Intranet options
Expertise list - yellow pages scoped
Difficulty in establishing e-learning and mentoring
Push back with alignment to performance appraisals
Review Key Knowledge Indicators
Name change to highlight 'community of knowledge'

Cycle 1: Syllk model reflection outcomes
Syllk model facilitators and barriers foundation for KM project implementation plan
Syllk model used in identifying Key Knowledge Indicators
Syllk model elements useful for knowledge audit and survey

allow participants to ask questions about relevant knowledge topics of interest. Various KM project CoP meetings and activities took place over a period of six months. Table 3 highlights that status of the interventions and initiatives.

The research interest focussed on observing and monitoring the Syllk facilitators and barriers (Table 1) and KM practices mapped to the Syllk elements (Table 2). During a CoP meeting, a participant stated that there is a "need to start with the knowledge audit and then perform a baseline survey with targeted questions around the areas where we are looking to impact and improve (e.g. [Syllk] learning, culture, social, technology, process and infrastructure, etc)".

Table 5
Cycle 1and 2: KM framework and implementation plan.

Cycle 1: IKnow(Branch)		Cycle 2: (sub-Branch)CK	
Interventions and initiatives	Status	Interventions and initiatives	Status
Best Practice Directory	Part implemented	Best Practice Directory [Capital Infrastructure Requirements]	Implemented
Lessons Learned	Part implemented	Lessons Learned [Project Reviews, Building Performance Evaluations]	Implemented
Story telling	Tried to implement	Stories [Storytelling part of (sub-Branch)CK-CoP]	Part implemented
Questions and Answers	No implementation	Questions and Answers [Social Media]	Tried to implement
Communities of Practice	Implemented	Communities of Practice	Implemented
Special Interest Groups	Tried to implement	(sub- Branch)CK [Special Interest Groups/Social Media sub-groups]	Tried to implement
Portal	Tried to implement	Portal [Social Media - (sub-Branch)CK]	Tried to implement
Yellow Pages	No implementation	(sub-Branch)CK Connect [Social Media]	Tried to implement
Knowledge Audit	Tried to implement	(sub-Branch)CK Knowledge Audit	Part implemented
E-learning	No implementation	E-learning	Not implemented
Mentoring / buddying	No implementation	Mentoring / buddying	Not implemented
Performance appraisals	Tried to implement	Performance appraisals	Not implemented

Syllk model … for our project what is becoming clear is having a system to capture [stories] and retrieve [stories], because, without that, the project was going nowhere. So for us having a platform was using the Syllk model. The technology became the critical element to getting right, then working with the other elements could happen at their timeframe, but without technology, nothing gelled together".

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

The KM interventions and initiatives (Table 5 ((sub-Branch)CK - cycle 2)) formed the revised schedule of tasks assigned to the KM project CoP members. Various meetings and activities took place over a period of nine months. The interventions and initiatives of best practice directories took the form of establishing baseline project requirements. Lessons learned activities consisted of project reviews and building performance evaluations (industry best practice) (Preiser, 2005). Storytelling started to take shape within the Branch, and the CoP became an active 'participant' group. An attempt was made to develop an intranet portal and use available social media tools to connect, ask questions and share knowledge and information. The research interest focussed on observing and monitoring the Syllk facilitators and barriers (Table 1), the change in the KM practices mapped to the Syllk elements (Table 2) and how the Syllk model supported the knowledge audit process and development of key knowledge indicators.

5.5. Step 5) Reflect (cycle 2) and Plan (cycle 3)

A CoP reflection meeting was held, and the participants comments were captured (Table 6) to reflect on the KM project (problem-solving interest) and the Syllk model (research interest).

The following findings came out in the reflection activity. The sub-Branch commenced using best practice directories containing defined project requirements. Building performance evaluations, lessons learned and project reviews were more evident in project meetings and stories were being shared in relevant forums as a CoP participant stated that in team meetings

a "knowledge sharing exercise we do is those building performance evaluations".

The knowledge audit mapped and identified sub-Branch knowledge into 4 categories: (1) Market knowledge – what we do; (2) Human-centred knowledge – who you work with, how you work; (3) Organisational knowledge – how you do it; and (4) Intellectual property knowledge – what special knowledge do you need to operate (Brooking, 1999). One of the research interest outcomes of the knowledge audit was identifying knowledge, information and data enablers (facilitators) and blockers (barriers) aligned and mapped to the Syllk model. The CoP participant leading the knowledge audit stated that "what I am finding though is that it [knowledge audit] really is trying to understand what is this information actually providing us? … So let's look at market knowledge: name some projects that you're working on and with whom, and how is this work documented and where can it be found? So it's about information, but it's about where the information is stored and how you can get to that, and who you most often collaborate with".

Following the reflection activity, planning for cycle 3 commenced where the Knowledge Audit initiative was not

Table 6
Cycle 2 reflection outcomes.

Cycle 2: KM project reflection outcomes
KM governance and sponsor activities on-going and supportive
KM project implementation plan revised and updated
CoP terms of reference revised – new name
13 CoP meetings held
LinkedIn site updated with new name - take up minimal - (Q&A on LinkedIn)
Stories shared in CoP meetings/team meetings
Knowledge audit commenced
Intranet establishment issues
Yellow pages ((sub-Branch)CK Connect [Social Media]) issues
Reviewed draft Key Knowledge Indicators
Best Practice Directory [Capital Infrastructure Requirements] implemented
Lessons Learned [Project Reviews, Building Performance Evaluations] implemented
We really need to talk about lessons learned - workshop
Organisational challenges

Cycle 2: Syllk model reflection outcomes
Syllk model facilitators and barriers reviewed as part of reflection activity
Syllk model elements formed the foundation for Key Knowledge Indicators
Syllk model elements used in identifying knowledge audit domains

implemented due to resource management concerns. The remaining interventions and initiatives were further aligned with capabilities and resources available within the Branch (Table 7 (sub-Branch)CK - cycle 3).

5.6. Step 6) Action and Observe (cycle 3)

The KM interventions and initiatives (Table 7 – cycle 3) formed the revised schedule of tasks assigned to the KM project CoP members. Various meetings and activities took place over a period of eight months with steady progress of the project activities achieved during this phase of the KM project. A CoP participant highlighted how story telling is now happening beyond the CoP and team meetings, as "we do this toolbox talk, which is really knowledge sharing about different aspects within Branch, and that is on a lunchtime. We've only just started this, and we are up to about the third one". The research interest focussed on observing and monitoring the Syllk facilitators and barriers (Table 1), the change in the KM practices mapped to the Syllk elements (Table 2) and how the Syllk model supports key knowledge indicators.

5.7. Step 7) Reflect (cycle 3)

A CoP reflection meeting was held, and the participants comments were captured (Table 8) to reflect on the KM project (problem-solving interest) and the Syllk model (research interest). The Syllk facilitators, barriers and KM practices (Tables 1 and 2) were reviewed and framed against the Table 5 interventions and initiatives. The following findings came out in the reflection activity. The sub-Branch expanded the telling of stories into lunch box talks, and the use of Yammer as a social, portal and questions and answer forum started to take hold within the Branch. One of the CoP participants said "We are now trying to use Yammer more. That is something that [the Branch] have tried to use, because it is like a quick, immediate success story for [the Branch] ... one of our strategies is a quick-win arrangement ... with getting some new stories out there".

5.8. Step 8 - 9) Research Exit (cycle 3); KM Project on-going Plan, Action, Observe and Reflect

The researcher determined that there was sufficient intervention evidence to answer the research question and exit the action research process. The researcher used the critical reflection activities in each cycle to observe the application of learning to bring about change (Dick, 1993). Cycle 1 observed mainly exploration activities. During cycle 2 the activities were more about improving and changing intervention and initiatives. Cycle 3 was more about evaluation. The outputs of the reflection activities combined with the cycle observations provided the opportunity to end the research interest cycle (Melrose, 2001).

The KM project (problem-solving interest) found the action research process a valuable exercise and decided to carry on with the action research cycles as they continued with the implementation of the KM framework and associated activities highlighted in Table 7 ((sub-Branch)CK - cycle 3).

Table 7
Cycle 1, 2 and 3: KM framework and implementation plan.

Cycle 1: IKnow(Branch)		Cycle 2: (sub-Branch)CK		Cycle 3: (sub-Branch)CK	
Interventions and initiatives	Status	Interventions and initiatives	Status	Interventions and initiatives	Status
Best Practice Directory	Part implemented	Best Practice Directory [Capital Infrastructure Requirements]	Implemented	Best Practice Directory [Capital Infrastructure Requirements]	Implemented
Lessons Learned	Part implemented	Lessons Learned [Project Reviews, Building Performance Evaluations]	Implemented	Lessons Learned [Project Reviews, Building Performance Evaluations]	Implemented
Story telling	Tried to implement	Stories [Storytelling part of (sub-Branch)CK-CoP]	Part implemented	Stories [Storytelling part of (sub-Branch)CK-CoP, lunch box talks]	Implemented
Questions and Answers	No implementation	Questions and Answers [Social Media]	Tried to implement	Questions and Answers [Social Media]	Part implemented
Communities of Practice	Implemented	Communities of Practice	Implemented	Communities of Practice [(sub-Branch)CK CoP, Interface meetings]	Implemented
Special Interest Groups	Tried to implement	(sub- Branch)CK [Special Interest Groups/Social Media sub-groups]	Tried to implement	(sub-Branch)CK [Special Interest Groups/Social Media sub-groups]	Part implemented
Portal	Tried to implement	Portal [Social Media - (sub-Branch)CK]	Tried to implement	Portal [Social Media [Yammer] - (sub-Branch)CK]	Part implemented
Yellow Pages	No implementation	(sub-Branch)CK Connect [Social Media]	Tried to implement	(sub-Branch)CK Connect [Social Media [Yammer]]	Part implemented
Knowledge Audit	Tried to implement	(sub-Branch)CK Knowledge Audit	Part implemented	(sub-Branch)CK Knowledge Audit	Not implemented
E-learning	No implementation	E-learning	Not implemented		
Mentoring / buddying	No implementation	Mentoring / buddying	Not implemented		
Performance appraisals	Tried to implement	Performance appraisals	Not implemented		

Table 8
Cycle 3 reflection outcomes.

Cycle 3: KM project reflection outcomes
KM governance and sponsor activities - some lack of support (changes in management)
Publication of Design Infrastructure book
5 CoP meetings held
LinkedIn site – closed and replace with Yammer - (Q&A on Yammer)
Stories shared in CoP meetings/team meetings/lunch box talks
Special Interest groups formed. Some are using social media - Yammer
Knowledge audit not completed – resource intensive (Service Delivery Catalogue delivered)
Intranet establishment issues
Yellow pages ((sub-Branch)CK Connect [Social Media]) via Yammer
Key Knowledge Indicators – implementation challenges
Best Practice Directory [Capital Infrastructure Requirements] implemented
Lessons Learned [Project Reviews, Building Performance Evaluations, Team meetings] implemented
We really need to talk about lessons learned – workshop postponed
Organisational challenges
Cycle 3: Syllk model reflection outcomes
Syllk model facilitators and barriers reviewed as part of reflection activity
Syllk model elements formed the foundation for Key Knowledge Indicators

6. Discussion

6.1. Wiring an organisation with knowledge/lessons learned

It has been shown by the action research cycles, and highlighted during the reflection stages, that the identified Syllk model

facilitators and barriers need to be well understood and managed to effectively connect or couple up (or conceptually wire) organisational systems together. Understanding organisational facilitators/barriers and the associated KM practices and tools offers an opportunity to reflect and learn from past experiences (Kotnour and Vergopia, 2005; Pinho et al., 2012).

The findings from this action research provide evidence that an organisation can be effectively wired to acquire and accumulate knowledge/lessons learned. Fig. 3 is an example of how the Syllk model can enable executive and senior management to conceptualise and illustrate how organisational know-how (project delivery capability) is wired across various systems of an organisation for knowledge/lessons learned. The highlighted knowledge variables of the Syllk model elements shown in Fig. 3 were found to be the most dynamic and influential for the organisation participating in the action research. The action research outcomes revealed that an organisation is not a simple structure but rather a complex interweaving and coupling (through the Syllk elements) of people and systems.

To explain Fig. 3, the knowledge/lessons learned know-how commences with learning where storytelling and storytelling skills come together. The knowledge or skill of telling a good story is in the heads and gestures of employees, and those who have the skill should be acknowledged and identified, and those that need the skill should be provided with a learning and development toolkit and training courses. To be good at storytelling a storytelling culture needs to be seen and felt across the organisation. The storytelling culture comes through
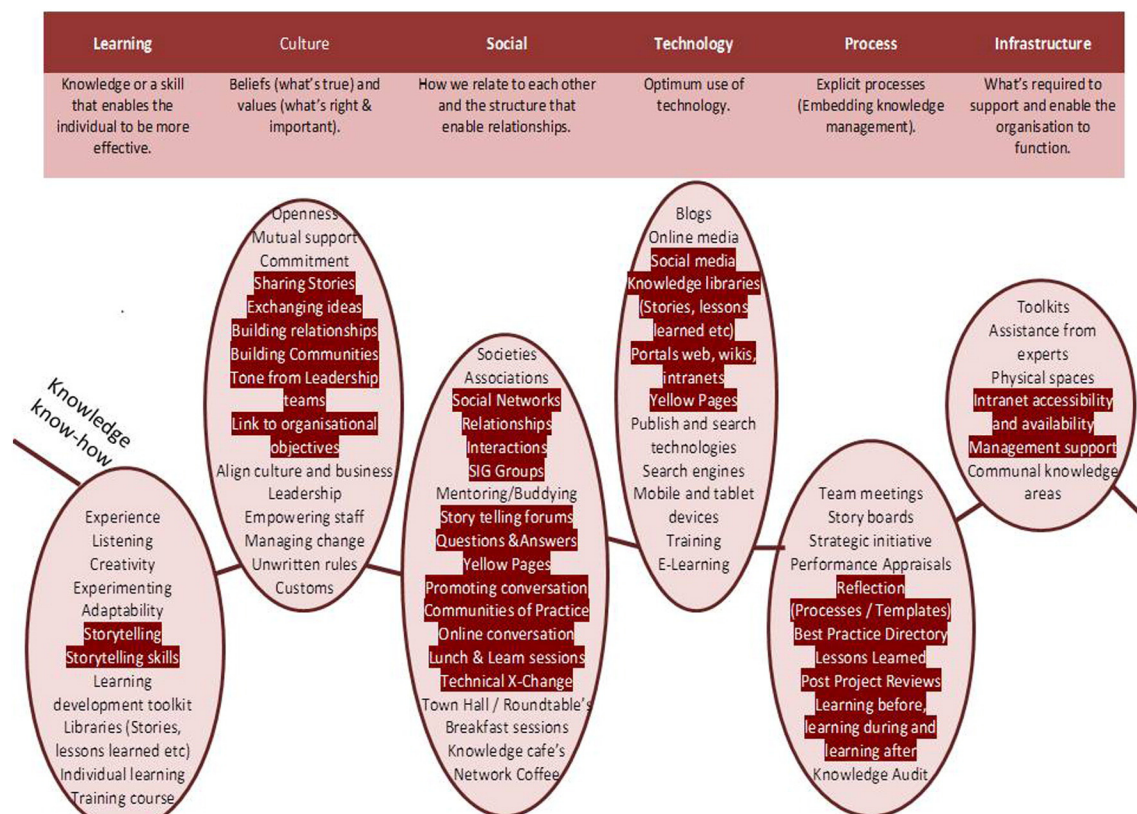

Fig. 3. Organisational wiring for knowledge.

in the conversations (and actions) from senior management as they demonstrate that they believe sharing stories, exchanging ideas, building relationships and communities is important, and they fund (within reason) activities that enable it. Having a close connection to organisational objectives as part of a cultural renewal strategy to improve communications by creating more opportunities for leaders to connect with their teams, strengthen communication networks and increase employee consultation. The cultural message from senior management is 'we think there is significant value in sharing stories and anecdotes of our experiences, and we are going to make time for that activity'. Social is where the organisation invests in social structures that enable knowledge and lessons learned to take place. These might be regular or periodical communities of practice meetings, storytelling forums, special interest groups and social media (Yammer) sub-groups. There might be other structures such as lunch and learn sessions (lunch box talks) or team meetings. A technical x-change forum requires all the other elements to align and work together.

Technology is needed to help facilitate the knowledge/ lessons learned know-how and in this organisation, an intranet web portal, and Yammer platform met the needs. Technology provides a knowledge library home, a communication medium, links to process/templates, links to where knowledge can be found in the organisation and learning development tools. The process helps to embed knowledge/lessons learned through strategic initiatives and the provision of a framework, process, and templates. The use of best practice directories, lessons learned reviews and building performance evaluation forums works well in this organisation. Identifying that learning happens before, during and after and that reflection activities have a significant

impact on learning. Having the infrastructure in place enables and facilitates open and frank knowledge sharing. Without the physical space for valued and open communication (remember our cultural values and beliefs) to take place, all the other activities will go to waste. Without high-quality intranet accessibility and availability, the knowledge/lessons learned sharing medium will be affected. There is a need for management support, experts, and leaders to enable the learning, culture, and social elements.

6.2. Implementing the Syllk model in project organisations

The implementation of the Syllk model in project organisations involves the organisation teams to identify the barriers and facilitators that exist in the organisation against the Syllk model elements. KM practices are aligned (synthesised) with these elements. Fig. 3 is an example of the Syllk aligned KM practices for an organisation. However, this alignment will be different for each organisation and projects within the organisation. In summary, Fig. 4 provides a flow diagram of the Syllk model implementation process and Table 9 supports the process with an explanation of each process step.

6.3. Limitations and challenges

Greenwood and Levin (2007, p. 10) 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
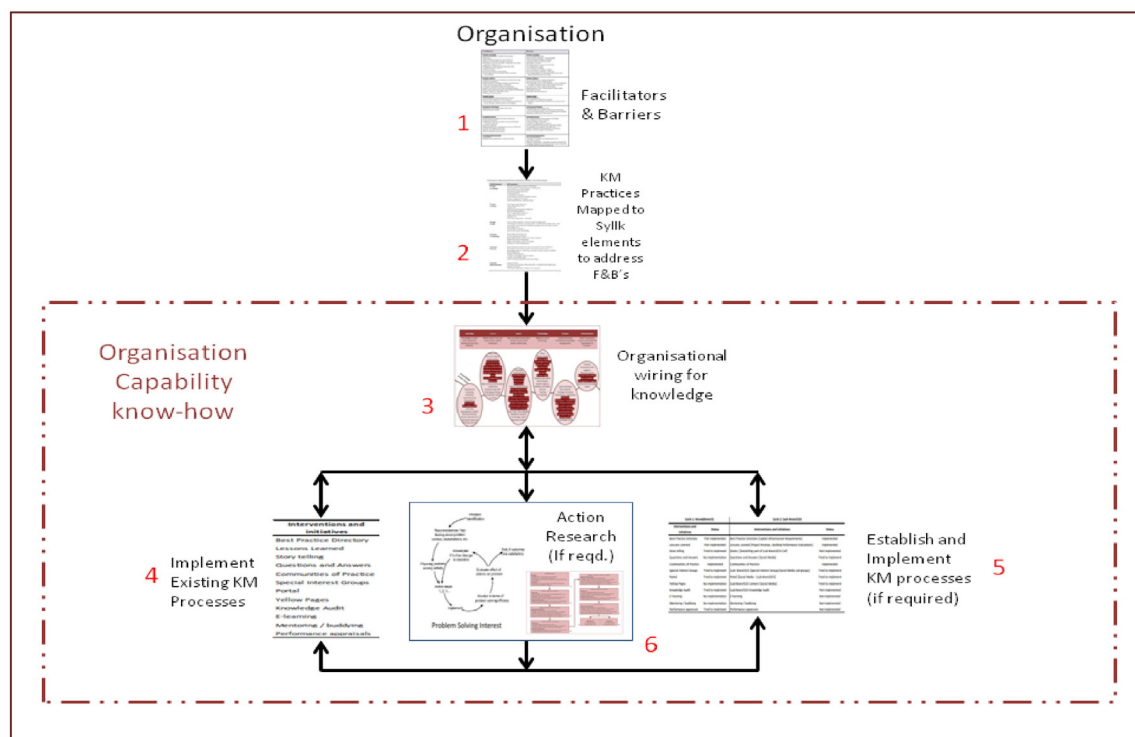

Fig. 4. Syllk model implementation process.

Table 9
Syllk model implementation process detail

ID #	Explanation of process step
1	Using a workshop, brainstorm or focus group techniques, participants identify and record the facilitators and barriers against each of the Syllk model elements (learning, culture, social, technology, process and infrastructure) to knowledge/lessons learned with their organisation.
2	KM practices are aligned (synthesised) with each Syllk element. This is where KM expertise aligns KM practices to address the facilitators and/or barriers that are highlighted in each of the Syllk elements. This step requires participants to have a reasonable mature level and understanding/ skill in KM. Participants may need to consider external assistance. When identifying KM practices it is important to address both the facilitators and barriers of the organisation.
3	The outcomes of ID2 can be presented in the Syllk model format showing those KM processes that work well (dark shade) and those KM processes that sometimes work in certain situations (shown as light shade). This is known as the Swiss cheese effect where KM practices need to align across the Syllk elements for successful knowledge\lessons learned organisational capability know-how.
4	Often participants will find that existing KM practices are in place. Some might be effective, others may not be effective. This is where the application of Action Research cycles (plan, action, observe and reflect) may be required to assist in improving the implementation of existing KM processes.
5	If there are new KM practices that are required to be established, it is recommended that the organisation use the Action Research cycles (plan, action, observe and reflect) to help establish and implement the KM practices within the organisation.
6	Application of the Action Research process if required (refer to Fig. 2).

Source: Adapted from Zubert-Skerritt in Altrichter et al. (2002); McKay and Marshall (2001); McNiff and Whitehead (2002).

that impacted on the ability to resolve some of the problems being addressed. Greenwood and Levin (2007) 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 results that were arrived at collectively.

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 (KM project) and the research (Syllk model application) was chosen for this research project to address potential consultant and rigour issues.

6.4. 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 organisational capabilities and project teams within an organisation. This research supports the premise that to successfully manage project work 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 capability (Duffield and Whitty, 2016). The paper demonstrates that action research can benefit project management and knowledge management researchers and practitioners through learning from your experience, and applying that learning to bring about change.

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. The study suggests that by reconceptualising knowledge and lessons learned the Syllk model can influence organisation learning. This study shows how the Syllk model enables management to conceptualise (and illustrate) how organisational know-how 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 organisation learning. Finally, the findings contribute to the project and knowledge management literature for researchers and practitioners and provide an opportunity to improve project organisational knowledge through the application of the Syllk model in wiring an organisation for knowledge and lessons learned capability.

8. Authors note

Conflict of interest

There is no conflict of interest.

References

Alhawari, S., Karadsheh, L., Nehari Talet, A., Mansour, E., 2012. Knowledge-Based Risk Management framework for Information Technology project. Int. J. Inf. Manag. 32, 50–65.

Altrichter, H., Kemmis, S., McTaggart, R., Zuber-Skerritt, O., 2002. The concept of action research. Learn. Organ. 9, 125–131.

Andriessen, J.H.E., Fahlbruch, B., 2004. How to manage experience sharing : from organisational surprises to organisational knowledge. first ed. Elsevier, Amsterdam; Boston.

APQC, 2012. Putting Knowledge in the Flow of Work. APQC, Texas.

Atkinson, R., Crawford, L., Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. Int. J. Proj. Manag. 24, 687–698.

Avison, D.E., Lau, F., Myers, M.D., Nielsen, P.A., 1999. Action research. Commun. ACM 42, 94–97.

Baskerville, R.L., 1999. Investigating information systems with action research. Communications of the AIS 2, p. 4.

Baskerville, R.L., Wood-Harper, A.T., 1996. A critical perspective on action research as a method for information systems research. J. Inf. Technol. 11, 235–246.

Brooking, A., 1999. Corporate memory: Strategies for knowledge management. Cengage Learning EMEA.

Burr, T., 2009. In: Comptroller and Auditor General, N.A.O. (Ed.), Helping Government Learn. The Stationary Office, London.

Cepeda, G., Martin, D., 2005. A review of case studies publishing in management decision 2003-2004. Manag. Decis. 43, 851–876.

Collis, J., Hussey, R., 2009. Business Research: A Practical Guide for Undergraduate & Postgraduate Students. third ed. Palgrave Macmillan, Hampshire, UK; New York, NY.

Collison, C., 2006. Avoiding the typical barriers to effective KM. KM Rev. 9 (4), 16–19.

Coughlan, P., Coghlan, D., 2002. Action research for operations management. Int. J. Oper. Prod. Manag. 22, 220–240.

Davenport, T., Prusak, L., 2000. Working knowledge: How organizations manage what they know. Harvard Business Press.

Day, K., Orr, M., Sankaran, S., Norris, T., 2006. The reflexive employee: action research immortalised? ALAR 11, 5.

Dick, B., 1993. You Want to do an Action Research Thesis? http://www.aral.com.au/resources/arthesis.html

Dick, B., Swepson, P., 1994. Appropriate Validity and its Attainment Within Action Research: An Illustration Using Soft Systems Methodology AEROL. http://www.aral.com.au/resources/sofsys2.html.

Disterer, G., 2002. Management of project knowledge and experiences. J. Knowl. Manag. 6, 512–520.

Drucker, P.F., 1993. Post-capitalist society. Butterworth Heinemann, Oxford.

Duffield, S., 2016. Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE J. Inf. Knowl. Manag. Syst. 46, 267–294.

Duffield, S., Whitty, S.J., 2012. A systemic lessons learned and captured knowledge (SLLCK) model for project organizations. In: PMglobal (Ed.), 9th Project Management Australia Conference (PMOz 2012). Eventcorp Pty Ltd., Melbourne, Australia.

Duffield, S., Whitty, S.J., 2015. Developing a systemic lessons learned knowledge model for organisational learning through projects. Int. J. Proj. Manag. 33, 311–324.

Duffield, S., Whitty, S.J., 2016. How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. Int. J. Proj. Manag. 34, 429–443.

Duhon, H., Elias, J., 2008. Why It Is Difficult To Learn Lessons: Insights from Decision Theory and Cognitive Science. SPE Proj. Facil. Constr. 3, 1–7.

Dvir, D., Shenhar, A., 2011. What great projects have in common. MIT Sloan Manag. Rev. 18–21.

Eskerod, P., Skriver, H.J., 2007. Organizational culture restraining in-house knowledge transfer between project managers—A case study. Proj. Manag. J. 38, 110–122.

Fernie, S., Green, S.D., Weller, S.J., Newcombe, R., 2003. Knowledge sharing: context, confusion and controversy. Int. J. Proj. Manag. 21, 177–187.

Greenwood, D., Levin, M., 2007. An Epistemological Foundation for Action Research: Introduction to Action Research. Introduction to Action Research. SAGE Publications, Inc., Thousand Oaks, CA.

Hayes, J., 2009. Incident reporting: A nuclear industry case study. In: Hopkins, A. (Ed.), Learning from high reliability organisations. CCH Australia Limited, Sydney.

Hayes, J., Maslen, S., 2014. Knowing stories that matter: learning for effective safety decision-making. J. Risk Res. 18, 714–726.

Hedman, S., Påhlman, L., Törnby, A., 2015. The Production of Comfort - How Financial Auditors Experience that they Become Comfortable with IT-auditors. Department of Business Studies. Uppsala University.

Hislop, D., 2005. Knowledge management in organizations: a critical introduction. Oxford University Press, Oxford ; New York.

Johnson-Laird, P.N., 1983. Mental models: towards a cognitive science of language, inference, and consciousness. Harvard University Press, Cambridge, Mass.

Kerzner, H., 2009. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. 10th ed. John Wiley & Sons, Hoboken, N.J.

Klakegg, O., Williams, T., Walker, D., Andersen, B., Magnussen, O., 2010. Early Warning Signs in Complex Projects. Project Management Institute Inc, Newtown Square, Pennsylvania.

Kotnour, T., Vergopia, C., 2005. Learning-Based Project Reviews: Observations and Lessons Learned from the Kennedy Space Center. Eng. Manag. J. 17, 30–38.

Leal-Rodríguez, A.L., Roldán, J.L., Ariza-Montes, J.A., Leal-Millán, A., 2014. From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context. Int. J. Proj. Manag. 32, 894–907.

Leistner, F., 2010. Mastering organizational knowledge flow how to make knowledge sharing work. John Wiley & Sons, Hoboken, N.J.

Lewin, K., 1946. Action research and minority problems. J. Soc. Issues 2, 34–46.

Li, A., 2002. GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned. In: Office, U.S.G.A. (Ed.) U.S. General Accounting Office, Washington, DC.

Liebowitz, J., Megbolugbe, I., 2003. A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives. Int. J. Proj. Manag. 21, 189–198.

Lindner, F., Wald, A., 2011. Success factors of knowledge management in temporary organizations. Int. J. Proj. Manag. 29, 877–888.

Maqsood, T., 2006. The Role of Knowledge Management in Supporting Innovation and Learning in Construction. School of Business Information Technology. RMIT University.

Mau, M., 2005. Action research: Connecting knowledge in the Australian public sector organization. actKM Online J. Knowl. Manag. 2, 58–69.

McKay, J., Marshall, P., 2001. The dual imperatives of action research. Inf. Technol. People 14, 46–59.

McNiff, J., Whitehead, J., 2002. Action Research: Principles and Practice. second ed. RoutledgeFalmer, New York.

Melrose, M.J., 2001. Maximizing the rigor of action research: why would you want to? How could you? Field Methods 13, 160–180.

Milton, N., 2010. The Lessons Learned Handbook: Practical Approaches To Learning From Experience. Chandos Publishing, Oxford, UK.

Ministry of Defence, 2010. In: Ministry of Defence, N.Z.D.F., and the Office of the Auditor-General (Ed.), Major Projects Report: Overview & Assessment. Ministry of Defence, Wellington.

Neef, D., 2005. Managing corporate risk through better knowledge management. Learn. Organ. 12, 112–124.

Nonaka, I., 1991. The Knowledge-Creating Company, Harvard Business Review on Knowledge Management. 1998 ed. Harvard Business School Publishing, Boston.

Nonaka, I., 2007. The knowledge-creating company. Harv. Bus. Rev. 85, 162.

Nonaka, I., Takeuchi, H., 1995. The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford University Press, Inc., New York.

O'Dell, C., Hubert, C., 2011. The new edge in knowledge : how knowledge management is changing the way we do business. John Wiley & Sons, New Jersey.

Office of Inspector General, 2012. Review of NASA's Lessons Learned Information System in: General. In: N.O.o.I. (Ed.) Office of Inspector General, Washington, DC.

Orr, M., 2006. The Implementation of Electronic Health Knowledge Management Systems. Southern Cross University, Southern Cross University Press, Lismore.

Orr, M., Sankaran, S., 2007. Mutual empathy, ambiguity, and the implementation of electronic knowledge management within the complex health system. Emergence: Complexity & Organization 9, 44–55.

Pinho, I., Rego, A., Cunha, M.P., 2012. Improving knowledge management processes: A hybrid positive approach. J. Knowl. Manag. 16, 3.

Polanyi, M., 1958. Personal knowledge; towards a post-critical philosophy. University of Chicago Press, Chicago.

Polanyi, M., 2009. The tacit dimension (Michael Polanyi ; with a new foreword by Amartya Sen.). University of Chicago Press, Chicago ; London.

Preiser, W.F.E., 2005. Building Performance Assessment—From POE to BPE, A Personal Perspective. Archit. Sci. Rev. 48, 201–204.

Raelin, J.A., 1998. Work-based learning in practice. J. Work. Learn. 10, 280–283.

Ragsdell, G., 2009. Participatory action research: a winning strategy for KM. J. Knowl. Manag. 13, 564–576.

Reason, J., 1997. Managing the Risks of Organizational Accidents. Ashgate, Aldershot, Hants, England; Brookfield, Vt., USA.

Reason, J., 2000. Human error: models and management. Br. Med. J. 320, 768.

Riege, A., 2005. Three-dozen knowledge-sharing barriers managers must consider. J. Knowl. Manag. 9, 18–35.

Sankaran, S., 2009. Applying action research to conduct practitioner research in knowledge management. In: Xu, J. (Ed.), Enhancing organisational capability through knowledge management. Southern Cross University Press, Lismore, pp. 23–40.

Sankaran, S., Tay, B.T., Orr, M., 2009. Managing organizational change by using soft systems thinking in action research projects. Int. J. Manag. Proj. Bus. 2, 179–197.

Schindler, M., Eppler, M., 2003. Harvesting project knowledge: a review of project learning methods and success factors. Int. J. Proj. Manag. 21, 219–228.

Senge, P., 1990. The Fifth Discipline, The Art & Practice of the Learning Organization, Revised Edition. 2006 ed. Doubleday, New York.

Sense, A.J., 2007. Learning within project practice: Cognitive styles exposed. Int. J. Proj. Manag. 25, 33–40.

Shergold, P., 2015. In: Commission, A.P.S. (Ed.), Learning from Failure: Why large government policy initiatives have gone so badly wrong in the past and how the chances of success in the future can be improved. Australian Public Service Commission.

Simon, H.A., 1991. Bounded Rationality and Organizational Learning. Organ. Sci. 2, 125–134.

Susman, G.I., Evered, R.D., 1978. An assessment of the scientific merits of action research. Adm. Sci. Q. 582–603.

Tan, H.C., Anumba, C.J., Carrillo, P.M., Bouchlaghem, D., Kamara, J., Udeaja, C., 2009. Capture and reuse of project knowledge in construction. Wiley-Blackwell.

Thomas, D.R., 2006. A general inductive approach for analyzing qualitative evaluation data. Am. J. Eval. 27, 237–246.

Virolainen, T., 2014. Learning from projects: a qualitative metasummary, School of Industrial Engineering and Management. Lappeenranta University of Technology.

Von Zedtwitz, M., 2002. Organizational learning through post–project reviews in R&D. R&D Manag. 32, 255–268.

Walker, S., 2007. What are the Major Barriers to the Successful Implementation of Knowledge Management Projects in the Telecommunications Industry?: A Participatory Action Research Study. Southern Cross University.

Walker, S., Sankaran, S., 2014. A participatory action research study of knowledge management implementation in a large European telecommunication company in their UK office. Gibaran J. Appl. Manag. Stud. 6, 36–63.

Walsh, J.P., Ungson, G.R., 1991. Organizational Memory. Acad. Manag. Rev. 16, 57–91.

Wideman, R.M., 2011. On the August PMWT Editorial on Lessons Learned by Knowledge Lost, PM World Today. PMForum, Inc.

Wiig, K., 1997. Knowledge management: an introduction and perspective. J. Knowl. Manag. 1, 6–14.

Williams, T., 2007. Post-Project Reviews to Gain Effective Lessons Learned. Project Management Institute, Newtown Square, USA.

Williams, T., 2008. How do organisations learn lessons from projects–and do they? IEEE Trans. Eng. Manag. 55, 248–266.

Zuber-Skerritt, O., Perry, C., 2002. Action research within organisations and university thesis writing. Learn. Organ. 9, 171–179.

6.   PROJECT B

Paper Three "*How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling*" reports on the application of the Syllk model to enable management to conceptualise how organisational capability (know-how) for storytelling is wired (distributed) and networked across various elements of an organisation (Duffield & Whitty 2016a). The research method consisted of action research cycles within a large division of a government organisation. Storytelling interventions and initiatives were implemented with two action research cycles completed. Actions and changes were observed, monitored, evaluated, and reflected on using an after-action review process. This study has established that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence an organisations capability for storytelling, and therefore learn lessons from stories of past project experiences.

6.1.   Project background

Project B took place at a large division of an Australian government organisation. The division identified a commitment plan to develop productive partnerships, share learnings and project knowledge. A change management program (Champions of Change program) was implemented with a focus on storytelling embracing improvement while thinking laterally and trialling new methods. The division identified that the intervention and implementation of the Syllk model would benefit the organisation, and consequently, the action research study was endorsed by executive management in September 2013. The storytelling project duration was for 12 months.

The organisation considered that the application and implementation of the Syllk model would benefit by providing them with an understanding of the barriers and facilitators associated with their storytelling approach, and subsequently with a way of improving their storytelling capability.

6.2.   Project B data extracts

Project B collected and analysed a large quantity of data that was coded in NVivo. Appendix F contains extracts of the coded data as supplementary information in support of Paper Three:

- Table F-1: Project B original data set in support of Paper Three table 4
- Table F-2: Project B original data set in support of Paper Three table 5
- Table F-3: Project B original data set in support of Paper Three table 6
- Table F-4: Project B original data set in support of Paper Three table 7

The following sample working sheets provide an insight into project B data analysis:

- Table F-5: Project B impact of Syllk model application – Research interest. The focus on this table was to show how the elements of the Syllk model impacted the storytelling project (Project B). A matrix was derived from the project transcripts.

- Figure F-1: Project B storytelling Syllk independent (KM practices) and dependent (measures) variables (working template)
- Table F-6: Project B variable coding outputs.
- Figure F-2: Project B Syllk capability network (wiring) diagram (working template)

Figure F-1 and Table F-6 provides a sample of the work sheets used during the analysis and design of the project variables and KM practices (interventions), which led to the development of the Syllk capability network diagram (Figure F-2).

6.3.   Paper Three: Statement of authorship

Duffield, S., Whitty, S.J., (2016a). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. International Journal of Project Management, vol. 34, no. 3, pp. 429-443.

Conception and design of the project:
    PhD Candidate 80%
    Co-Author 20%

Data collection, analysis, and interpretation of research data:
    PhD Candidate 100%

Drafting significant parts of the work, or critically revising it so as to contribute to the interpretation:
    PhD Candidate 80%
    Co-Author 20%

Editing and preparation of final submission:
    PhD Candidate 90%
    Co-Author 10%

PhD Candidate Signature
Stephen M Duffield
Date: 22 March 2017

Co-Author Signature
Associate Professor S. Jonathan Whitty (Principal Supervisor)
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How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling

Stephen Duffield [*], Stephen J. Whitty

University of Southern Queensland, Springfield Campus, QLD 4300 Australia

Abstract

This study is an application of the Systemic Lessons Learned Knowledge (Syllk) model that enables management to conceptualise how organisational know-how for storytelling is wired (distributed) across various elements of an organisation. The research method consisted of action research cycles within a large division of a government organisation. Storytelling interventions and initiatives were implemented with two action research cycles completed. Actions and changes were observed, monitored, evaluated, and reflected on using an after action review process. This study has established that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence an organisation's capability for storytelling, and therefore learn lessons from stories of past project experiences.
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Keywords: Project management; Knowledge management; Storytelling; Lessons learned; Organisational learning; Action research

1. Introduction

There is a government and business 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). 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).

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).

The organisation at the centre of this research is a large government department that created a commitment plan to develop productive partnerships and share organisational learning's and project knowledge. A 'champion of change programme' was implemented with a specific focus on storytelling as a knowledge management mechanism, as the literature indicates that the processes of storytelling are effective ways to identify, disseminate and apply lessons learned (Desouza et al., 2005; Goffin and Koners, 2011; Hayes and Maslen, 2014; Hoegl and Schulze, 2005; Linde, 2001; Milton, 2010; Williams, 2008). The organisation considered that the application and implementation of the Syllk model would benefit by providing them with an understanding of the barriers and facilitators associated with their

* Corresponding author at: University of Southern Queensland, Springfield Campus, Queensland, 4300 Australia. Tel.: +61 421 052 135.

E-mail addresses: stephen@invictaprojects.com.au (S. Duffield), whitty@usq.edu.au (S.J. Whitty).

storytelling approach, and subsequently with a way of improving their storytelling capability.

We begin with a literature review that explores storytelling and the Syllk model which leads to the research question. We then describe the study and the applied *action research* methodology. Finally, we discuss the findings within the framework of the literature, the limitations and challenges and speculate 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 *storytelling* 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 storytelling

Storytelling is one of the oldest and traditional means of passing on wisdom and culture and is a mechanism for sharing knowledge within organisations (Sole and Wilson, 2002). Swap et al. (2001, p. 103) defined an organisational story as, "a detailed narrative of past management actions, employee interactions or other intra- or extra-organizational events that are communicated informally within the organization". Stories usually include characters, plots, twists, and narrative perspectives and reflect skills, organisational norms, values and culture (Hyde, 2008; Swap et al., 2001). Well told stories can convey knowledge, information and emotion, both explicit and the tacit and are an influential way to represent and communicate complex, multi-layered thoughts (Snowden, 2000). Stories can increase organisational lessons learned, communicate common values and support a system to capture and share tacit dimensions of knowledge (Dalkir, 2013; Hayes and Maslen, 2014; Swap et al., 2001). Although some storytelling conditions such as authentic, believable and compelling needs to be in place to ensure value for the organisation (Dalkir, 2013). Furthermore Swap et al. (2001) conclude that if a story is understandable it will almost positively stimulate a cognitive connection to the listener's personal experiences providing an experience that increases the likelihood of being remembered (Parry and Hansen, 2007; Sims et al., 2009).

The telling of stories is an appropriate social method for identifying and capturing lessons learned, especially those related to tacit knowledge (Hayes and Maslen, 2014; Milton, 2010; Williams, 2008). Williams (2008) states that the social process of storytelling and recording is an effective way to explore project issues, capturing their complexity and behaviours outside organisational norms. Goffin and Koners (2011) noted that stories are often used in project lessons learned reviews to explain problem-solving, product specifications and budget. And Milton (2010) states that a story can support a lesson learned by providing valuable background and context, and therefore stories are easiest to learn from when they carry a lesson learned that is explicit and actionable.

Desouza et al. (2005) compared two ways of conducting project post reviews, via traditional reports and stories. Desouza et al. (2005) found that stories are high in knowledge richness and are easy to recall. Storytelling provides an excellent means to communicate norms, core beliefs, values and culture of the organisation, however they are less suitable for lessons learned on rules or policies (Desouza et al., 2005; Parry and Hansen, 2007). Milton (2010) suggests that storytelling alone with no analysis of the learning points, identification of the lesson, and movement into action is not an efficient way of conveying a lesson learned. Milton recommends that every story should have a clear conclusion so others can gain knowledge from the story. Linde (2001) highlights the evidence that suggests lesson learned databases are not effective in collecting and archiving stories as they have not considered that learning from stories is essentially a social process (Prusak, 2005). Where there are successful lessons learned systems, a significant effort has gone into the translation of oral stories or story reports into functional written texts (Linde, 2001).

Both Peet (2012) and Linde (2001) suggest that new leaders become accustomed to their roles by learning the stories of their organisation. However, with an increasing prominence on storytelling, relatively little is known about the kinds of stories and narratives that need to be told, how those stories should be encouraged and captured, or the ways in which people need to be guided to enable knowledge sharing to occur (Peet, 2012). Boje's (1991) study of the organisation as a storytelling system demonstrated that skilled storytellers and story interpreters are effective organisational communicators, are key to understanding the organisational culture and history, and possess skills that managers dealing with rapid change should develop. Boyce (1996) concludes that storytelling clearly expresses organisational culture and that storytelling is an effective tool for organisational renewal and workforce participation. Stories can play a central role in the change process (Taylor et al., 2002).

Harris and Barnes (2006) demonstrate the relevance of management storytelling skills to the practice of leadership. Harris and Barnes (2006) found that leaders who tell stories communicating key messages in an unforgettable way, show a pathway to leadership and develop more effective relationships with those they lead, and can generate an inspirational culture in their organisations. Leaders should research their own history and experience for *lessons learned* that can be communicated in the form of a story or narrative and learn to tell them with charismatic and visionary refinement at appropriate times (Parry and Hansen, 2007). When telling stories, the leader needs to be clear on why they are using them and to use more than one medium (Sole and Wilson, 2002). Taylor et al. (2002, p. 322) highlights that "managers can be both monitors and disseminators by using stories to help employees be aware of and make sense of changes, to allow an opportunity to reflect on and reassemble information to make it actionable, and to reveal unspoken or unconscious norms of the organization". Parry and Hansen (2007) report on conceptual similarities between leadership and organisational stories.

Sanne (2008) reports on how railway workers use informal storytelling within the operational communities and the need to

make an incident reporting scheme integrated with an existing storytelling practice to address the systemic causes of accidents. The storytelling of incidents and accidents is critical for sharing knowledge about recent events and what one might appropriately learn from them (Hayes and Maslen, 2014; Sanne, 2008). Incident reporting schemes and narrative storytelling are both critical in the organisational communication of safety culture (Coan, 2002; Hayes and Maslen, 2014). Aviation accident investigators actively share safety stories and their collective knowledge of risks and to summarise lessons learned. The investigators disseminate stories at air safety seminars, industry forums, visits to partner airlines, accident and incident reports, safety publications and their personal networks in the industry. Investigators use stories as a way to converse knowledge and also to refresh and contextualise their current concerns with lessons learned from the past. Stories and narratives take up a central place in communicating investigators knowledge of safety (Macrae, 2014).

Finally, the means by which a story is communicated is also an important factor. If stories are powerful in verbal form, their effect can be enhanced through the use of multimedia such as pictures, art-based and recorded clips (Pässilä et al., 2013; Swap et al., 2001). Linde (2001) identifies that although stories flow informally within organisations, it requires a skilled workforce to provide stories, and even more experienced workforce to capture, record and make appropriate stories available for dissemination in a usable format. A recorded story may or may not be effective, depending on the skills of the storyteller. Suppiah and Sandhu (2011) suggest that storytelling training should be provided to people in the organisation to help with sharing knowledge voluntarily; however explicating tacit knowledge may be challenging.

2.2. 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).

In line with complex adaptive systems theory, the Syllk model (see Fig. 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 various 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
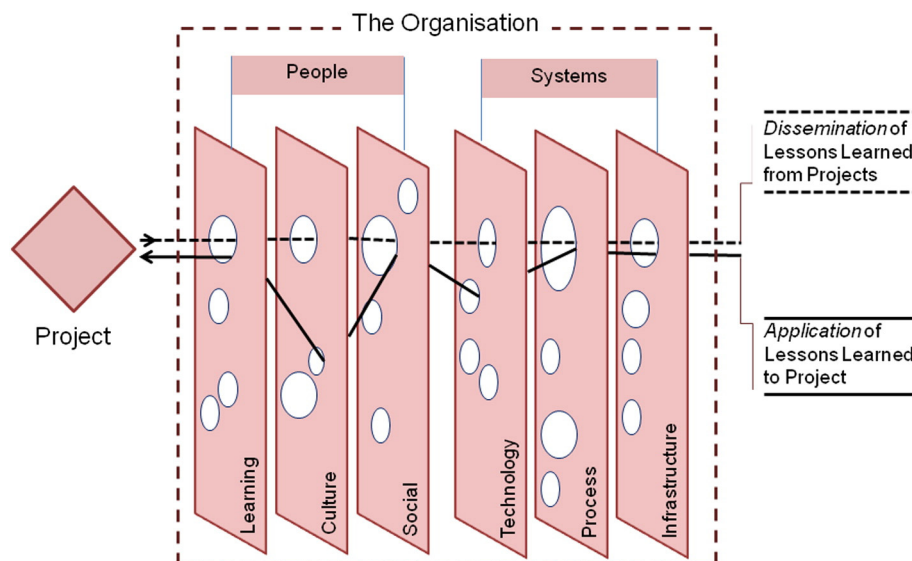

Fig. 1. The Systemic Lessons Learned Knowledge model.
Source: (Duffield and Whitty, 2015).

assist in identifying these (Duffield and Whitty, 2012; Duffield and Whitty, 2015; Leal-Rodríguez et al., 2014; Virolainen, 2014).

Leal-Rodríguez et al. (2014) have shown how the 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.

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 *of storytelling* can be distributed across organisational systems and people. With this in mind the overarching research question is:

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

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 effective 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, 2007; Walker and Sankaran, 2014) 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. Kotnour and Vergopia (2005) applied action research on an NASA Kennedy Space Center lessons learned study where the approach actively engaged participants in the development and application of new knowledge.

4.2. Problem solving (action research) project

This study took place at a large division of an Australian state government organisation. The division identified a commitment plan to develop productive partnerships, share learning's and project knowledge. A change management programme (*Champions of Change programme*) was implemented with a focus on storytelling (*Storytelling project*) embracing improvement while thinking laterally and trialling new methods. The division identified that the intervention and implementation of the Syllk model would benefit the organisation, and consequently the action research study was endorsed by executive management in September 2013. The storytelling project duration was for 12 months.

4.3. The action research approach

The action research method applied to this study, consisted of 2 spiral action research cycles (6 steps) of the 4 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 Fig. 2.

The initial planning stage (Fig. 2, step 1) for this study consisted of 1 interview with a divisional director followed by a focus group of project practitioners (7 participants) with diverse professional skills related to the functions of the state government division. The interview and focus group was used to construct and verify the initial Syllk model variables based on the questioning and structuring of the problem of how organisational learning from storytelling could be enabled across the various systems of the division. The focus group identified the barriers and facilitators that impact the Syllk model within the government division (Table 1). KM practices identified in KM literature (APQC, 2012; Brown et al., 2005; Duffield and Whitty, 2015) were then aligned with each of the Syllk elements to facilitate learning and address the identified barriers (Table 2). The KM practices were further refined by the project team into storytelling independent variables (interventions and initiatives) to support the storytelling project plan (Table 3, Fig. 3) and associated dependent variables (as shown in Tables 4 and 6). Following the focus group session the first action research cycle (Fig. 2, step 2) commenced. During the action step, the storytelling independent

Initial Planning

- Construct and verify the Syllk model variables
- 1 focus group - 7 participants; 1 Interview
- Identification of the barriers and facilitators that impact the Syllk model (Table 1)
- Alignment to KM practices (Table 2) and further refined into storytelling independent variables [interventions and initiatives] (Table 3) that formed the action items (Figure 3)

1

Action / Observe (cycle 1)

- Implementation of storytelling interventions and initiatives (core 7 participants and wider organisation)
- Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations
- Storytelling interventions and initiatives were observed, monitored and evaluated

2

Reflect / Plan (cycle 1)

- After action review activity (core 7 participants) Highlighted the changes to the project identified dependent variables and the impact of the Syllk model
- Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations
- Review expectations and identify-plan areas of improvement and changes to the independent variables for cycle 2 (Table 4 and 5)

3

Action / Observe (cycle 2)

- Commenced planned activities from step 3 (core 7 participants and wider organisation)
- Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations.
- Storytelling interventions and initiatives and revised step 3 implemented actions were observed, monitored and evaluated

4

Reflect (cycle 2)

- After action review activity (core 7 participants)
- Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations.
- Changes to the project identified dependent variables and the impact of the Syllk model were evaluated (Table 6 and 7)

5

Exit
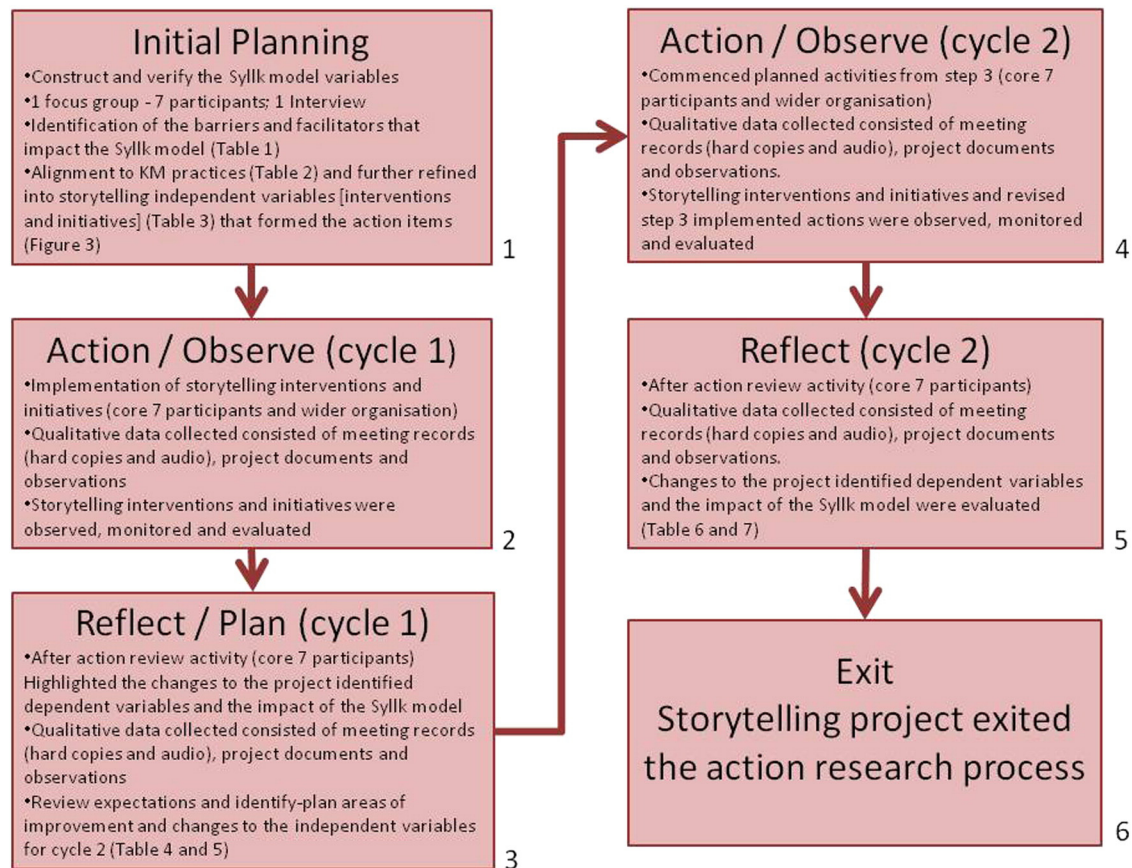## Storytelling project exited the action research process

6

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

variables (interventions and initiatives) were implemented. Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations. The implemented storytelling independent variables (interventions and initiatives) were observed, monitored and evaluated. The reflection stage (Fig. 2, step 3) consisted of an after action review (AAR) activity (Collison and Parcell, 2004) and highlighted the changes to the project identified dependent variables and the impact of the Syllk model (Tables 4 and 5). Expectations were reviewed, and areas of improvement and changes to the independent variables were planned for the next action research cycle.

Cycle 2 commenced with planned activities that addressed the expectations (Fig. 2, step 4). Qualitative data collected consisted of meeting records (hard copies and audio), project documents and observations. The implemented actions were observed, monitored and evaluated. The reflection stage (Fig. 2, step 5) consisted of an AAR activity where the changes to the project identified dependent variables and the impact of the Syllk model were evaluated (Tables 6 and 7). Following the AAR activity the storytelling project exited the action research process (Fig. 2, step 6). Every month the storytelling project team met with the researcher to discuss the steps/actions/outputs/plans at various stages of the action research cycle.

4.4. Action research methods of analysis

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 the coding of all collected data (after action reviews (AAR), focus groups, interviews, meetings, project materials and stories) for words, phrases, expressions or statements related to the research coding categories (dependant (Tables 4 and 6) and independent (Table 3) variables, project activities (Fig. 3, Table 3) and Syllk model elements (Tables 1, 2 and 3)) (Bazeley, 2013; Bazeley and Jackson, 2013). The research issues (results of AAR reflection activities — Fig. 2 steps 3 and 5) guided the data analysis as did the existing (KM practices — Table 2) literature to enable the generation of valuable results (evidence through

Table 1
Facilitators & barriers [in terms of Syllk elements] to organisational learning through storytelling.

Syllk elements	Facilitators	Barriers
People learning	Listening skills	Adapt stories for the department
	Comfortable and personal medium	Not in general/usual format
	Motivational stories, Identify goals, goals driven	Too outside the box
	Open to learning	Can't find the story link to add the value, intent,
	Any story is a good story	and change (can't find the Aha)
	Growing organisation learns	They want to know but won't ask
	Emotional moment	Fear (unknown and being wrong)
	Aha moment	Shared understanding in the team about purpose
	Easy to remember	and focus of stories
	Training different needs for different people	Sick of learning and changing
	Get to the emotional connection	Agenda
People culture	Growing organisation learns	Challenging external and internal environments
	Developing organisation (supportive, drive and resourcing)	We always do it this way
	Strong leadership	UGRs (unwritten ground rules)
	Champions of change	Resistance to change; losing people/skills/knowledge;
	The need to change to survive	change management ineffective
	Comfortable with problem issues/stories	Long term culture (will the change last)
	(positive and negative stories)	Fear of being wrong, lack of risk taking
	Public service values	Most staff will be in the middle (safe)
	Division commitment, values and behaviours	Competing workload/no time/busy doing job
	Short-term culture 1–5 years	*Sanitised stories/risk/newspaper test/agendas/senior management test*
		Only big outcome stories valued, perfect stories
		Staff have no connection head office
People Social	Stories capture hearts and minds of staff.	Use of social media
	Project is given scope of publishing stories	Team members (volunteer story gatherers) are diverted by
	Tell lessons not just stories	day to day business
	Desire to change	No one wants to tell their story
	Generation Y open communication	Public perception/newspaper test
	Use of social media	Department is not social
	Get people socialising (did you read that one …)	Tall poppy syndrome, rejection
	Storytelling day/month/book week	Childish
	Team based story telling	Long stories
	Competition, participation, want to share	Get back to work
	Toolbox	
Systems technology	Intranet	*Access to communications team*
	Email, newsletters online	*Intranet — approval to change edit/publishing process*
	End to end digital story recording + editing equipment	Latest technology (i.e. windows)
	that can be used by team	Many different versions of systems
	and others — democratic story gathering	Technology does not fit stories and audience e.g. written stories, digital
	(use of iPhone/iPad technology)	Not all have access
	Real time information sharing	Lack of training
	Visual stories	Not all have access to Intranet, bandwidth
	Mobile technology	
	Technology supporting disabilities	
Systems process	Open to change (division embracing change)	Lack of processes
	Project plan/project management	Publishing process (capture, edit, publish)
	Change process provides a voice for stories,	
	reflective process	Paralysis by analysis
	Process driven organisation	Story process (short, long, simple, complex stories)
	Process leads to improvements (measures)	Project plan (off plan direction changes)
	Alignment to fairy stories	Bureaucratic/involvement of hierarchy
		Lack of clear direction/outcomes
Systems infrastructure	New ICT technologies	*Competing workload*
	Open minds	*Access to communications team*
	Assistance from experts (e.g. communications team)	*ICT resourcing/priority*
	Storytelling courses, toolbox	*Silos of operations*
	Resources (large division/department)	*Organisation structure*
	Environment of change	*Workloads (day-to-day, lack of resources, no help)*

reflection — Tables 4, 5, 6 and 7) (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

Table 2
KM practices addressing facilitators & barriers mapped to the Syllk elements.

Syllk elements	KM practices
People learning	Stories and lessons
	Storytelling
	Individual learning interviews
	Communities of practice
	Lunch & learn session
	Breakfast sessions
	Forums
	Skills & toolkits
People culture	Tone from leadership teams
	Team KM sharing events
	Identifying and promoting champions
	Reward and recognition
	Link to organisation objectives
	Align culture and business
	Performance appraisals — leadership
People social	Promoting conversation: communal knowledge areas, online conversation, town hall and roundtable meetings, lunch & learn/breakfast sessions
	Knowledge cafe
	Communities of practice
	Stories and lessons, storytelling forums
Systems technology	Intranet site
	Story 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	Framework/process/templates
	Post project reviews/peer assists/reviews/after action reviews
	Employee development
	Conduct a knowledge network analysis
	Conduct story (KM) audit
Systems infrastructure	Promoting conversation, open plan office, communal knowledge areas
	Intranet availability
	Performance appraisals & employee development
	Toolbox assistance from experts

Table 3
Identified storytelling independent variables mapped against Syllk elements.

Number	Storytelling independent variables (interventions and initiatives)	Syllk element
1	Turn the storytelling presentation into a 'promotion story' and take it to branch/unit team meetings	People: culture, social. Systems: infrastructure
2	Do a recorded version and use as a trailer media clip	People: social. Systems: technology
3	Actively participate in the division dynamic communication forum	People: learning, culture, social
4	Division intranet co-ordination	Systems: technology, infrastructure
5	Multimedia links	Systems: technology
6	Communications (posters/links) to visit story page	Systems: technology, infrastructure
7	Champions of Change (story)	People: culture
8	Executive storytelling example & alignment to executive leadership	People: culture, social. Systems: technology
9	Ice breaker (story of pictures)/story month/storytelling day	People: learning, social
10	Storytelling CoP (CHAMPS — Champions of Change team)	People: learning, social
11	Develop a process on how to do a story and publish	Systems: process
12	Gather stories	People: learning, culture, social. Systems: technology
13	After action review	People: learning. Systems: process

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 rigour 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 are essential in action research (Dick, 1993).

5. Findings

5.1. Step 1) Initial planning

The focus group activity identified the barriers and facilitators that impact the Syllk model within the government division (Table 1). Participants reinforced the benefit of a focus group in that the activity had "... been really insightful. It has helped us form as [a team] well, and it is all forming for us at the moment". Another participant stated that:

The process has been really helpful. ... as it was leading up to today, I was thinking, ... I am really glad we have a workshop because I think there's a bit of a danger in us getting into just the weekly meeting, you know, business focused. I think this is a useful methodology. We need to think about how we use this kind of methodology, as we go forward as a team, where we are think-tanking together, rather than, you know, sitting in a meeting making decisions. ... I absolutely agree with you on that one. I was looking forward to today, to putting that different context around everything.
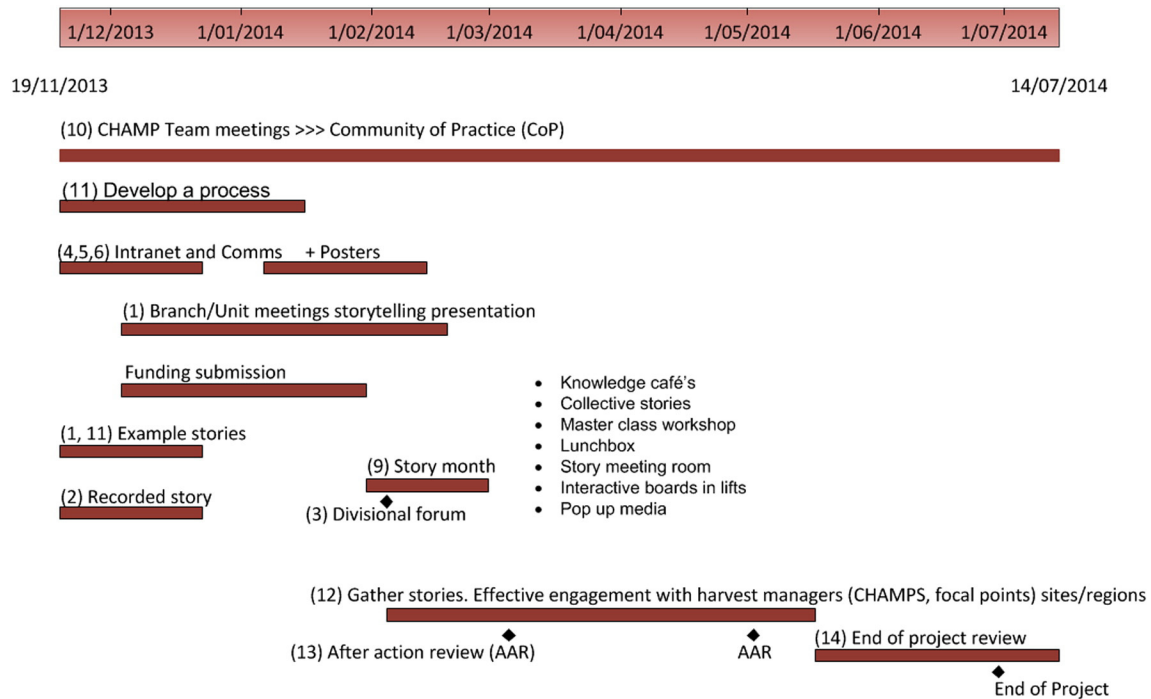
Fig. 3. Storytelling project plan (action items) — cycle 1.

KM practices identified in the literature (APQC, 2012; Brown et al., 2005; Duffield and Whitty, 2015) were then aligned with each of the Syllk elements to facilitate the best learning and address the identified barriers (Table 2). The KM practices were further refined into storytelling independent variables (interventions and initiatives) (Table 3) to support the development of a storytelling project plan (Fig. 3). The interventions and initiatives were developed by the project team in discussion with the researcher.

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

The storytelling independent variables developed in step 1 (Table 3) formed the action items of the storytelling project plan highlighted in Fig. 3. Various meetings and activities took place with a focus on holding CoP team meetings, developing a process, engaging communications, presenting storytelling and holding a story month.

The holding of a storytelling day during the story month was a major event that aligned with a divisional forum focussed on dynamic communications. One participant noted that storytelling day "… as a promotion of storytelling, putting it out there was successful". A leader who attended the storytelling day stated that:

It was really fascinating watching people go, oh, is this what I have to do … and then really getting engaged in it, and actually completely involved in it. People were immersed in telling their story through pictures, and people that you would not expect to see going, 'Oh yeah', and really

getting into it. It was fantastic. … People did want to come, and they did want to not only tell their story, but read other stories, and try to be creative about the message that they left behind in the room, because all the messages stayed behind. So I thought that it was very effective, and it was very well put together. It also gave people a lot of scope to tell a story in the way they wanted to tell it. So I thought that was terrific.

Significant support also came from the senior executive officer as part of a cultural renewal strategy to improve communications by creating more opportunities for leaders to connect with their teams, strengthen communication networks and increase employee consultation. One of the activities identified was to share, celebrate and leverage success stories by face to face and digital channels (Champions of Change programme) which provided a direct alignment with the storytelling activities.

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

Tables 4 and 5 highlight the (significant) evidence of participant contribution during the action research reflection activity. The reflection activity used the knowledge management AAR process. Participant's comments were captured to reflect on both the study research variables and the Syllk model.

There was evidence that some dependent variables expectations (refer to Table 4) were partially met, and others were identified as work in progress. The systems changes

Table 4
Cycle 1 – storytelling dependent variables – expectations.

Dependent variables	Expectations	Evidence through reflection	Met expectations
How many changes to our systems (technology and processes)	Increase	Communications and process tools developed	Partial Website to be established
Number of serious anecdotes about the value of KM	Increase	Aha moments, barriers been broken down a little and I think people are talking to each other that didn't know each other	Partial Need to engage executive officer support and focus on removal of identified barriers in Table 1.
Number of success stories and lessons learned published	Increase	We have had a certain success … across the three sites, [leader] uses story telling with his team … Friday afternoon where they tell success stories of how have you succeeded this week … they have developed their own award	
Telling stories Leaders telling stories	Increase	[Executive officer] very supportive … and recorded a story Story board around a breakfast session [Executive officer] supporting the success of stories by face to face and digital channels (Champions of Change)	Yes
Story telling forums	Increase	Story telling in meetings Story telling day	Yes
Story telling day	Hold an event	We had our story day, that was our biggest event Story day was part of the whole dynamic communications week	Yes

consisted of the development of process tools in preparation of a website. There was some success in storytelling, however, the participants highlighted a number of barriers (highlighted in Table 1) were still causing issues and that they needed to engage with executive management to help address the barriers. At this stage of the action research cycle, the Syllk model had a positive influence (refer to Table 5) and also confirmed the impact the identified barriers (highlighted in Table 1) were having on the project outcomes. New and revised actions were then planned with a significant focus on *a need to engage executive officer support*, the *establishment of a website*, and *continue removal of identified barriers* identified in Table 1.

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

The storytelling project team commenced engagement with executive officers and leaders within the division. A story template and process was established, followed by a *go-live* website. Storytelling skills, processes, examples of stories and storytelling were uploaded on the website. The team then focussed on the removal of the remaining Syllk culture, technology and Infrastructure barriers (highlighted in Table 1: *Sanitised stories*, *Senior management test*, *Intranet publishing process*, *Competing workload*, *Access to communications team*, *ICT resourcing/priority*, *Silos of operations*, *Organisation structure* and *Workloads*).

Table 5
Cycle 1 — Syllk model impact on capability of storytelling.

Syllk elements	Expectations	Evidence through reflection	Met expectations
Syllk model	Positive influence	So back to the Swiss cheese … learning happening for you, culture not happening for you, social happening, technology — you are getting there with the web, process you have in place	YesConfirmation of impact of barriers
People — learning	Positive influence	Clearly people still want to learn, for them to want to go to that story day, they are wanting to get involved in that learning, so the learning factors launched the lunch box session … close on a hundred people maybe … so that reiterates that people want to learn, they want the information if it is there	Yes
People — culture	Positive influence	Sanitised stories Sharing success stories Telling stories	Yes Confirmation of impact of barriers
People — social	Positive influence	Social path very strong What is going on in Facebook is all very positive and there are lots of good stories.	Yes
System — technology	Positive influence	We have got content for the website and the structures there; it is just approval processes [that are needed]	Work in progress
System — process	Positive influence	Process on the website Story telling template	Work in progress
System — infrastructure	Positive influence	Posters … which have got a good story around them Infrastructure … the barriers; completing work load; access to communications; ICT resourcing; silos of operation; organisations structure; workloads	Yes Confirmation of impact of barriers

Table 6
Cycle 2 – storytelling dependent variables – expectations.

Dependent variables	Expectations	Evidence through reflection	Met expectations
Contributions over time	Increase	leadership stories, stories are growing … leaders that will encourage it along story count	Work in progress
How many changes to our systems (technology and processes)	Increase	Internet web page with process toolkit developed	Yes
Number of serious anecdotes about the value of KM	Increase	Creating awareness for people that what they are actually doing is knowledge management by telling; people now hear of stories — they are not just hearing a story, and sort of subconsciously taking the learning They are actually saying 'I have just heard a story which I know now is a powerful management tool in transferring knowledge'. More recognition of the story for what it is … not just the outcomes They look forward to [leader] stories. They are making that link that it is a story and stories are great tools for transferring knowledge.	Yes
Number of success stories and lessons learned published	Increase	I think we have made a massive amount of awareness. At the end of the day, the (Executive Management Team) sponsored these projects and agreed to them, so there was an acceptance I am positive that people are now hearing stories and making that click that they have told a story We are a storytelling organisation, it is just that the idea is now that we take that and become better at it, through it being part of learning development	Yes
Policy, systems & process changes	Increase	How do we storytell … training course … learning and development is the key	Yes
Telling stories Leaders telling stories	Increase	We had a forum last week … where the chief officer spoke … gave a 40-minute presentation … and as she does each meeting, tied that back into a personal story … and how these two linked together There is a real 'going public' barrier … had not quite anticipated that … just give people an opportunity and they will all just jump at it. But no, it is in fact almost the reverse of that. They are quite private about their stories. It is very localised for a lot of people … sense of safe, localised environments where it is okay to tell stories, but think about taking it out of that, and there are a lot of barriers … the technical barriers (Senior Officer) it is hard to stop him telling stories sometimes, in meetings. And I think there are a few (Senior Officer) trying now. He is not a natural storyteller though, but he is starting to try … and that is where we think our internet page, rather than capturing and regurgitating stories, becomes a page about why it is important, what you need. You need your toolkit of stories. Here is a course to go on	Yes
Storytelling forums Storytelling day	Increase	Storytelling day, again as a promotion of storytelling, putting it out there was successful	Yes
Storytelling skills	Increase	We capture specific samples of people that seem to be telling stories, and are good at it … we can allude to people that are telling stories, and are not good at it … just because you are a leader, it does not mean you are a good storyteller. And I think that was the question we put out on very early on … whether leaders are naturally good at storytelling, or whether it is still a learned skill. And I think we are seeing that it is definitely a learned skill The harvesting, capture, and dissemination of actual stories is not so much the issue, as producing leaders and managers that are good storytellers in their daily business Storytelling and the skill of storytelling … part of management development … website becomes more about the learning of storytelling and skills of storytelling … is definitely a learned skill.	Yes

5.5. Steps 5) and 6) Reflect and exit (cycle 2)

Tables 6 and 7 highlights the evidence of 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. Some significant findings came out in the reflection activity. The Syllk model had a positive influence (refer to Table 7) on the organisation capability of storytelling. The participants realised that by using the Syllk model this helped to identify how the capability of storytelling operates and is embedded in the various systems of the organisation. One participant stated that:

When you think about a slice of cheese … and how storytelling works … all those [Table 1] barriers and infrastructure just were there still. They were not going away … so now you perhaps reshape your whole storytelling focus around the ones that are working. … I can see all this stuff working. I mean, you have got top-level coverage; you have got all the support. … you have got all the processes in place; you have got the tools in place.

In addition to the Syllk model alignment, the participants identified that leaders telling stories, people hearing stories, storytelling in team meetings and understanding the importance of storytelling learning and development skills were important

Table 7
Cycle 2 — Syllk model impact on capability of storytelling.

Syllk elements	Expectations	Evidence through reflection	Met expectations
Syllk model	Positive influence	When you think about a slice of cheese ... and how storytelling works ... all those [Table 1] barriers and infrastructure just were there still. They were not going away ... so now you perhaps reshape your whole storytelling focus around the ones that are working ... I can see all this stuff working. I mean, you have got top-level coverage; you have got all the support ... you have got all the processes in place; you have got the tools in place. When you look at the storytelling Syllk diagram ... that is what she is doing. You are learning, she has got the culture, she is getting people to talk ... using technology as part of that. She has got a process. She is using infrastructure	Yes
People — learning	Positive influence	Recommendations that probably point to learning, storytelling and the skill of storytelling, being part of management development, and the website becomes more about the courses and learning of storytelling, and skills of storytelling	Yes
People — culture	Positive influence	[Yammer] it is a bit of a cultural thing, whether it is an organisation, whether it is your age Cultural support from executive management	Yes
People — social	Positive influence	[Yammer] adds to your workload probably as much as it assists [Yammer] is getting traction out there. Some departments are now sending staff-wide updates in Yammer. So it is happening	Yes
System — technology	Positive influence	Presentation and video recording; we cannot publish the YouTube video, because of our constraints ... rules and guidelines and barriers to translating a story that is presented in a small audience into a bigger audience ... a technological barrier We have a website that is been published ... not going to be so much a story [capture] thing but as tools for people to go to ... how can I find out how I can do better at my presentation, or get my message across better ... becomes a page about why it is important, what you need ... toolkit of stories ... learning and development is the key	Yes
System — process	Positive influence	All the processes and tools in place	Yes
System — infrastructure	Positive influence	We need a physical environment and a social environment that promotes storytelling; we need the water cooler ... a good lunch room, intranet availability, toolkits, storytelling experts	Yes

findings (refer Table 6). An example of a very effective leader who uses stories was discussed and identified which led to an additional interview. Finally, the learning skills of storytelling need to be part of management development, and the website becomes more about the training courses and learning's of storytelling rather than a collection of stories. The timing of the reflection activity coincided with the end of the research project that enabled an exit in the action research cycle.

5.6. Leadership interview

A key finding identified those leaders that are telling stories have an impact on the audience that is in line with the leadership aims of the leader creating the story. The moral of the story is in effect the essence of the message that the listener takes away. Storytelling when presenting to a large group is, as one leader put it "a way of connecting ... it is far more inspirational to people, and it is far more real". The leader stated that they used stories "to visualise what the change would look like, identifying that it was going to be a big shift from where they were". The leader explained that people could identify with stories, "stories are good. When I get a chance, if I am explaining something, I will tell it in a bit of a story fashion". The leader stated that "telling stories is not easy. You know, I have to think it through really carefully to make sure that the story being told is not too over the top, is not too unbelievable ... It always has to be tied back into the work concept that I am trying to get across." The skill of storytelling was seen as a

hurdle to storytelling becoming an effective tool. The interviewed leader identified that:

> Stories, like everything else, have to have some characters, and they have to have a purpose, and they have got to build up, and then they have got to come down, and there has to be a message at the end. So the stories have to be carefully chosen. So I think sometimes people can tell a story, and it might fall flat because they do not see it in the context of their whole story. So, I think people are embarrassed or a bit self-conscious about telling stories. I think it goes along with the public speaking, in general, that revealing something of yourself, because every story has something to do with you.

6. Discussion

The findings are now considered regarding 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 storytelling

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 storytelling. Understanding organisational facilitators and barriers and the associated KM practices and tools offers an
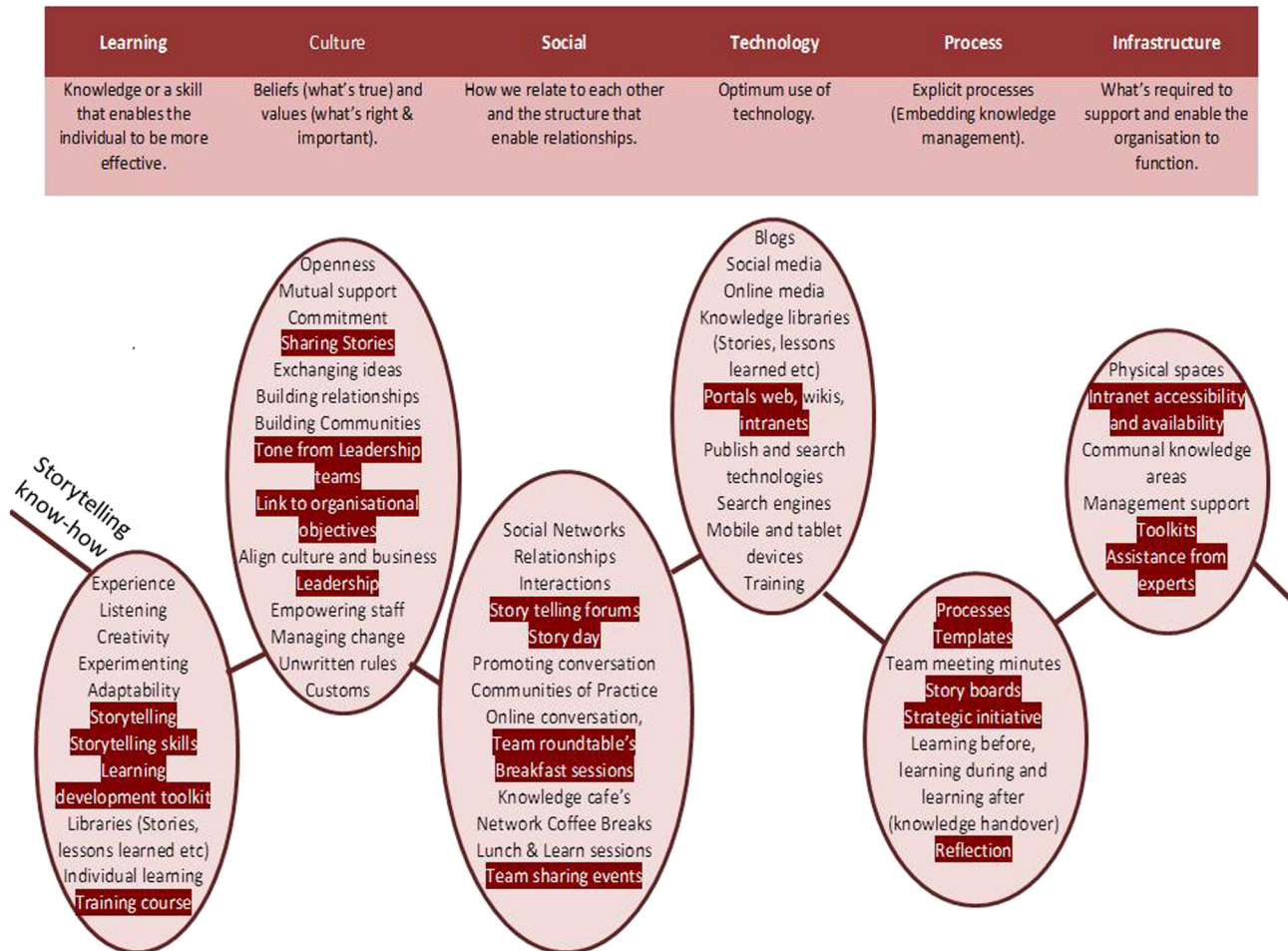
Fig. 4. A Syllk model for the capability of storytelling.

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 storytelling. Fig. 4 is an example of how the Syllk model can enable the executive and senior management to conceptualise how organisational know-how for storytelling is distributed across various systems of the organisation. The highlighted knowledge variables of the Syllk model elements shown in Fig. 4 were found to be the most influential for the organisation participating in the action research.

The storytelling know-how commences with learning where storytelling and storytelling skills come together. The knowledge or skill of telling a good story is in the heads and gestures of employees and those who have the skill should be acknowledged and identified and those that need the skill should be provided with a learning and development toolkit and training courses. Stories also need to be collected somewhere, and that can be many formats as well as in the heads and practices of individuals. For one to be good at storytelling, there needs to be a supportive (facilitative) and encouraging culture for stories across the organisation. Storytelling needs to be valued, and stories are to be regarded as valuable. This value becomes evident in the discourse and actions of senior management as they demonstrate that they believe storytelling is important, and they fund (within

reason) activities that enable it, such as storytelling days. Having a strong storytelling link to organisational objectives as part of a cultural renewal strategy to 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* stories and anecdotes about our experiences, and we are going to make time and create space for that activity. Social is where the organisation invests in socialising structures and practices that enable storytelling to take place. These might be regular or periodical storytelling forums. There might be other structures such as breakfast sessions or team meetings with their own storytelling rituals and practice. A storytelling 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 storytelling know-how and in this organisation a website intranet portal met this need. Technology provides a storytelling communication medium, links to process/templates, links to where storytelling can be found in the organisation and learning development tools. The process helps to embed knowledge management through strategic initiatives and the provision of a framework, process and templates. The use of storyboards in team meetings and storytelling forums worked well in this organisation. Identifying

that learning through storytelling happens before, during, and after, and that reflection activities have a major impact on learning. Having the right infrastructure in place enables and facilitates open and frank storytelling. Without the physical space for valued and open (these were cultural values and beliefs) to take place, all the other activities will go to waste. Without high-quality intranet accessibility and availability, the storytelling sharing medium would be affected. There is a need for physical and digital space to keep learning development toolkits and having access to organisational storytelling experts and leaders enable the learning, culture and social elements.

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). Pässilä et al. (2013) also found the use of storyboards and images as a way of telling a story is an effective know-how medium to facilitate the learning process. From an organisation culture perspective, Boyce (1996) states that stories are used to develop and sustain the corporate culture and that leaders and managers should possess storytelling skills when dealing with change and organisational knowledge. The skill of storytelling and having appropriate storytelling learning and development tools available were important capabilities that enabled storytellers to be effective at communicating lessons learned (Denning, 2011). According to Swap et al. (2001), if a story is effectively clear it will almost certainly stimulate connections to the listener's personal experiences providing a vivid experience that increases the likelihood of being remembered. Storytelling skills are easily improved. Brown et al. (2005) suggest we all tell stories, and once we realise this, we can learn to become better storytellers. Brown et al. (2005, p. 167) report that "experience shows that skills in storytelling can be quickly improved even with people with little apparent aptitude".

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 (storytelling project) and the research (Syllk model application) was chosen for this research project to address potential consultant and rigour issues.

7. 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 knowledge management researchers and practitioners.

8. 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. The skill of storytelling and having appropriate storytelling learning and development tools available were important factors that enabled storytellers to be effective at communicating lessons learned. This study shows 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. 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 enhancing the capability of storytelling. Finally, the findings contribute to the project and knowledge management literature for researchers and practitioners and provide an opportunity to improve project organisational knowledge through the application of the Syllk model in wiring an organisation for (knowledge, lessons learned) storytelling capability.

Conflict of interest

There is no conflict of interest.

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References

Altrichter, H., Kemmis, S., McTaggart, R., Zuber-Skerritt, O., 2002. The concept of action research. Learn. Organ. 9, 125–131.

APQC, 2012. Putting Knowledge in the Flow of Work. APQC, Texas.

Atkinson, R., Crawford, L., Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. Int. J. Proj. Manag. 24, 687–698.

Avison, D.E., Lau, F., Myers, M.D., Nielsen, P.A., 1999. Action research. Commun. ACM 42, 94–97.

Baskerville, R.L., 1999. Investigating information systems with action research. Commun. AIS 2, 4.

Baskerville, R.L., Wood-Harper, A.T., 1996. A critical perspective on action research as a method for information systems research. J. Inf. Technol. 11, 235–246.

Bazeley, P., 2013. Qualitative Data Analysis: Practical strategies. Sage.

Bazeley, P., Jackson, K., 2013. Qualitative Data Analysis with NVivo. Sage Publications Limited.

Boje, D.M., 1991. The storytelling organization: a study of story performance in an office-supply firm. Adm. Sci. Q. 106–126.

Boyce, M.E., 1996. Organizational story and storytelling: a critical review. J. Organ. Chang. Manag. 9, 5–26.

Brown, J.S., Denning, S., Groh, K., Prusak, L., 2005. Storytelling in Organizations: Why Storytelling is Transforming 21st Century Organizations and Management. Elsevier Butterworth-Heinemann, Oxford, UK.

Burr, T., 2009. Helping Government Learn. In: Comptroller and Auditor General, N.A.O. (Eds.), The Stationary Office, London.

Cepeda, G., Martin, D., 2005. A review of case studies publishing in management decision 2003–2004. Manag. Decis. 43, 851–876.

Coan, H., 2002. Risk, error and blame in organizations: a communication approach. Corp. Commun. Int. J. 7, 232–240.

Collis, J., Hussey, R., 2009. Business Research: A Practical Guide for Undergraduate & Postgraduate Students. 3rd ed. Palgrave Macmillan, Hampshire, UK; New York, NY.

Collison, C., 2006. Avoiding the typical barriers to effective KM. KM Rev. 9, 16–19.

Collison, C., Parcell, G., 2004. Learning to Fly Practical Knowledge Management from Leading and Learning Organizations. Capstone Publishing Limited (a Wiley Company).

Coughlan, P., Coghlan, D., 2002. Action research for operations management. Int. J. Oper. Prod. Manag. 22, 220–240.

Dalkir, K., 2013. Knowledge Management in Theory and Practice. Routledge.

Day, K., Orr, M., Sankaran, S., Norris, T., 2006. The reflexive employee: action research immortalised? ALAR Action Learn. Action Res. J. 11, 5.

Denning, S., 2011. The Leader's Guide to Storytelling: Mastering the Art and Discipline of Business Narrative. Jossey-Bass.

Desouza, K., Dingsoyr, T., Awazu, Y., 2005. Experiences with conducting project postmortems: reports vs. stories and practitioner perspective, system sciences, 2005. HICSS '05. Proceedings of the 38th Annual Hawaii International Conference on, p. 233c.

Dick, B., 1993. You Want to do an Action Research Thesis? http://www.aral.com.au/resources/arthesis.html.

Dick, B., Swepson, P., 1994. Appropriate Validity and its Attainment Within Action Research: An Illustration Using Soft Systems Methodology AEROL. http://www.aral.com.au/resources/sofsys2.html.

Duffield, S., Whitty, S.J., 2012. A systemic lessons learned and captured knowledge (SLLCK) model for project organizations. In: PMglobal (Ed.), 9th Project Management Australia Conference (PMOz 2012), Melbourne, Australia.

Duffield, S., Whitty, S.J., 2015. Developing a systemic lessons learned knowledge model for organisational learning through projects. Int. J. Proj. Manag. 33, 311–324.

Duhon, H., Elias, J., 2008. Why it is difficult to learn lessons: insights from decision theory and cognitive science. SPE Prod. Facil. Constr. 3, 1–7.

GAO, 2002. GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned. In: Office U.S.G.A. (Ed.) Washington, DC.

Goffin, K., Koners, U., 2011. Tacit knowledge, lessons learnt, and new product development. J. Prod. Innov. Manag. 28, 300–318.

Greenwood, Levin, 2007. An epistemological foundation for action research: introduction to action research. Introduction to Action Research. SAGE Publications, Inc, Thousand Oaks, CA.

Harris, J., Barnes, B.K., 2006. Leadership storytelling. Ind. Commer. Train. 38, 350–353.

Hayes, J., 2009. Incident reporting: a nuclear industry case study. In: Hopkins, A. (Ed.), Learning from High Reliability Organisations. CCH Australia Limited, Sydney.

Hayes, J., Maslen, S., 2014. Knowing stories that matter: learning for effective safety decision-making. J. Risk Res. 18, 714–726.

Hedman, S., Påhlman, L., Törnby, A., 2015. The production of comfort — how financial auditors experience that they become comfortable with IT-auditors. Department of Business Studies. Uppsala University.

Hoegl, M., Schulze, A., 2005. How to support knowledge creation in new product development: an investigation of knowledge management methods. Eur. Manag. J. 23, 263–273.

Hyde, P., 2008. Working with stories: diverse tales of organizational life. Qual. Res. Organ. Manage. Int. J. 3, 147–158.

Kerzner, H., 2009. Project Management: A Systems Approach To Planning, Scheduling, and Controlling. 10th ed. John Wiley & Sons, Hoboken, N.J.

Klakegg, O., Williams, T., Walker, D., Andersen, B., Magnussen, O., 2010. Early Warning Signs in Complex Projects. Project Management Institute Inc, Newtown Square, Pennsylvania.

Klakegg, O.J., Williams, T., Shiferaw, A.T., 2015. Taming the 'trolls': major public projects in the making. Int. J. Proj. Manag. http://dx.doi.org/10.1016/j.ijproman.2015.03.008.

Kotnour, T., Vergopia, C., 2005. Learning-based project reviews: observations and lessons learned from the Kennedy Space Center. Eng. Manag. J. 17, 30–38.

Leal-Rodríguez, A.L., Roldán, J.L., Ariza-Montes, J.A., Leal-Millán, A., 2014. From potential absorptive capacity to innovation outcomes in project teams: the conditional mediating role of the realized absorptive capacity in a relational learning context. Int. J. Proj. Manag. 32, 894–907.

Lewin, K., 1946. Action research and minority problems. J. Soc. Issues 2, 34–46.

Linde, C., 2001. Narrative and social tacit knowledge. J. Knowl. Manag. 5, 160–171.

Macrae, C., 2014. Close Calls: Managing Risk and Resilience in Airline Flight Safety. Palgrave Macmillan.

Mau, M., 2005. Action research: connecting knowledge in the Australian public sector organization. actKM Online J. Knowl. Manag. 2, 58–69.

McKay, J., Marshall, P., 2001. The dual imperatives of action research. Inf. Technol. People 14, 46–59.

McNiff, J., Whitehead, J., 2002. Action Research: Principles and Practice. 2nd ed. RoutledgeFalmer, New York.

Melrose, M.J., 2001. Maximizing the rigor of action research: why would you want to? How could you? Field Methods 13, 160–180.

Miles, M., Huberman, M., 1994. Qualitative Data Analysis: An Expanded Sourcebook. Sage Publications, Thousand Oaks, CA.

Milton, N., 2010. The Lessons Learned Handbook: Practical Approaches to Learning From Experience. Chandos Publishing, Oxford, UK.

Ministry of Defence, 2010. Major Projects Report: Overview & Assessment. In: Ministry of Defence, N.Z.D.F., the Office of the Auditor-General (Eds.), Ministry of Defence, Wellington.

NASA, 2012. Review of NASA's Lessons Learned Information System. Office of Inspector General, Washington, DC.

Orr, M., 2006. The Implementation of Electronic Health Knowledge Management Systems. Southern Cross University.

Orr, M., Sankaran, S., 2007. Mutual empathy, ambiguity, and the implementation of electronic knowledge management within the complex health system. Emerg. Complex. Organ. 9.

Parry, Hansen, 2007. The organizational story as leadership. Leadership 3 (SAGE), 281–300.

Pässilä, A., Oikarinen, T., Kallio, A., 2013. Creating dialogue by storytelling. J. Work. Learn. 25, 159–177.

Peet, M., 2012. Leadership transitions, tacit knowledge sharing and organizational generativity. J. Knowl. Manag. 16, 45–60.

Prusak, L., 2005. Storytelling in organizations. In: Denning (Ed.), Storytelling in Organizations: Why Storytelling is Transforming 21st Century Organizations and Management. Elsevier Butterworth-Heinemann.

Raelin, J.A., 1998. Work-based learning in practice. J. Work. Learn. 10, 280–283.

Ragsdell, G., 2009. Participatory action research: a winning strategy for KM. J. Knowl. Manag. 13, 564–576.

Reason, J., 1997. Managing the Risks of Organizational Accidents. Ashgate, Aldershot, Hants, England, Brookfield, Vt., USA.

Reason, J., 2000. Human error: models and management. Br. Med. J. 320, 768.

Riege, A., 2005. Three-dozen knowledge-sharing barriers managers must consider. J. Knowl. Manag. 9, 18–35.

Sankaran, S., 2009. Applying action research to conduct practitioner research in knowledge management. In: NA (Ed.), Enhancing Organisational Capability Through Knowledge Management. Southern Cross University Press, Lismore, pp. 23–40.

Sankaran, S., Tay, B.T., Orr, M., 2009. Managing organizational change by using soft systems thinking in action research projects. Int. J. Manag. Proj. Bus. 2, 179–197.

Sanne, J.M., 2008. Incident reporting or storytelling? Competing schemes in a safety-critical and hazardous work setting. Saf. Sci. 46, 1205–1222.

Schindler, M., Eppler, M., 2003. Harvesting project knowledge: a review of project learning methods and success factors. Int. J. Proj. Manag. 21, 219–228.

Sims, Huxham, Beech, 2009. On telling stories but hearing snippets: sense-taking from presentations of practice. Organization 16 (SAGE), 371–388.

Snowden, D.J., 2000. The art and science of story or 'are you sitting uncomfortably?'. Bus. Inf. Rev. 17, 215.

Sole, D., Wilson, D.G., 2002. Storytelling in Organizations: The Power and Traps of Using Stories to Share Knowledge in Organizations. LILA, Harvard, Graduate School of Education.

Suppiah, V., Sandhu, M.S., 2011. Organisational culture's influence on tacit knowledge-sharing behaviour. J. Knowl. Manag. 15, 462–477.

Susman, G.I., Evered, R.D., 1978. An assessment of the scientific merits of action research. Adm. Sci. Q. 582–603.

Swap, W., Leonard, D., Shields, M., Abrams, L., 2001. Using mentoring and storytelling to transfer knowledge in the workplace. J. Manag. Inf. Syst. 18, 95–114.

Taylor, S., Fisher, D., Dufresne, R., 2002. The aesthetics of management storytelling: a key to organizational learning. Manag. Learn. 33, 313–330.

Thomas, D.R., 2006. A general inductive approach for analyzing qualitative evaluation data. Am. J. Eval. 27, 237–246.

Virolainen, T., 2014. Learning from projects: a qualitative metasummary. School of Industrial Engineering and Management. Lappeenranta University of Technology.

Walker, S., 2007. What are the Major Barriers to the Successful Implementation of Knowledge Management Projects in the Telecommunications Industry?: A Participatory Action Research Study. Southern Cross University.

Walker, D., Sankaran, S., 2014. A participatory action research study of knowledge management implementation in a large European telecommunication company in their UK office. Gibaran J. Appl. Manag. 6, 36–63.

Williams, T., 2008. How do organisations learn lessons from projects—and do they? IEEE Trans. Eng. Manag. 55, 248–266.

Williams, T., Klakegg, O.J., Walker, D.H.T., Andersen, B., Magnussen, O.M., 2012. Identifying and acting on early warning signs in complex projects. Proj. Manag. J. 43, 37–53.

Zuber-Skerritt, O., Perry, C., 2002. Action research within organisations and university thesis writing. Learn. Organ. 9, 171–179.

7.   PROJECT C

Paper Four "*Application of the Syllk model wiring an organisation for the capability of an online Community of Practice*" reports on the application of the Syllk model to enable management to conceptualise how organisational capability (know-how) for an online CoP is wired (distributed) and networked across various people and system elements of an organisation (Duffield 2016). 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.

The results from this research show 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. The paper demonstrates an application of the Syllk model, and that action research can benefit project and knowledge management researchers and practitioners. This study contributes to practice by highlighting how to use the Syllk model to "wire" an organisation for some capability (know-how). This study applies a conceptual model enabling management to understand how organisational capability (know-how) is distributed (wired) across various systems of an organisation for an online CoP.

7.1.   Project background

Project C took place in an Australian government organisation. The organisation KM steering committee approved the trial of an online Community of Practice (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.

7.2. Extended literature review

A CoP is different from other organisation structures as highlighted in Table 7-1. Often organisations are confused with the role of a CoP with the normal team structures.

Table 7-1 Comparison between a CoP with other organisational structures.

Structure	What's The Purpose?	Who Belongs?	What Holds Them Together?	How Long Do They Last?
CoP	To create, expand, and exchange knowledge, and to develop individual capabilities	Self-selection based on expertise or passion for a topic	Passion, commitment, and identification with the group and its expertise	Evolve and end organically (last as long as there is relevance to the topic and value and interest in learning together)
Formal Departments	To deliver a product or service	Everyone who reports to the groups manager	Job requirements and common goals	Intended to be permanent (but last until the next reorganization)
Operational Teams	To take care of an ongoing operation or process	Membership assigned by management	Shared responsibility for the operation	Intended to be ongoing (but last as long as the operation is needed)
Project Teams	To accomplish a specified task	People who have a direct role in accomplishing the task	The projects goals and milestones	Predetermined ending (when the project has been completed)
Communities of Interest	To be informed	Whoever is interested	Access to information and sense of like-mindedness	Evolve and end organically
Informal Networks	To receive and pass on information, to know who is who	Friends and business acquaintances, friends of friends	Mutual need and relationships	Never really start or end (exist as long as people keep in touch or remember each other)

Source: (Wenger, McDermott & Snyder 2002, p. 42)

7.3. Project C data extracts

Appendix G contains extracts of the coded data as supplementary information in support of Paper Four.

- Figure G-1: Sample interview sheets
- Figures G-2 and G-3: Collaboration tool data metrics
- Figure G-4: Project C Syllk online CoP variables/interventions - KM practices and measures (working template).

7.4.   Paper Four: Statement of authorship

Duffield, S., (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE Journal of Information and Knowledge Management Systems, vol. 46, no. 2, pp.267-94.

Conception and design of the project:
      PhD Candidate 100%

Data collection, analysis, and interpretation of research data:
      PhD Candidate 100%

Drafting significant parts of the work, or critically revising it so as to contribute to the interpretation:
      PhD Candidate 100%

Editing and preparation of final submission:
      PhD Candidate 100%

PhD Candidate Signature
Stephen M Duffield
Date: 22 March 2017

Application of the Syllk model wiring an organisation for the capability of an online community of practice

Stephen Mark Duffield
Department of Business, Education, Law and Arts,
University of Southern Queensland, Springfield, Australia

Abstract

Purpose – This paper aims 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 Communities of practice, Learning organization, Action research
Knowledge management, Lessons learned, Swiss cheese model

Paper type Research paper

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 healthcare, 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 (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). 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) suggests 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 per cent 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 per cent of the community. A large part of community members (65-75 per cent) 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 CoP 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 CoP (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) report that online CoPs can maximise productivity of the employees of an organisation through better time management (saves meeting and travel time), human capital (sharing resources and generating dialogue), leadership development (engage leaders and allow leaders to emerge), practice and policy (identification, development and implementation of good and best practice) and outcomes (better, smarter, deeper, faster and sustainable outcomes) (Woolis *et al.*, 2008, pp. 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 programmes 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, the more 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 model

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).

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

272
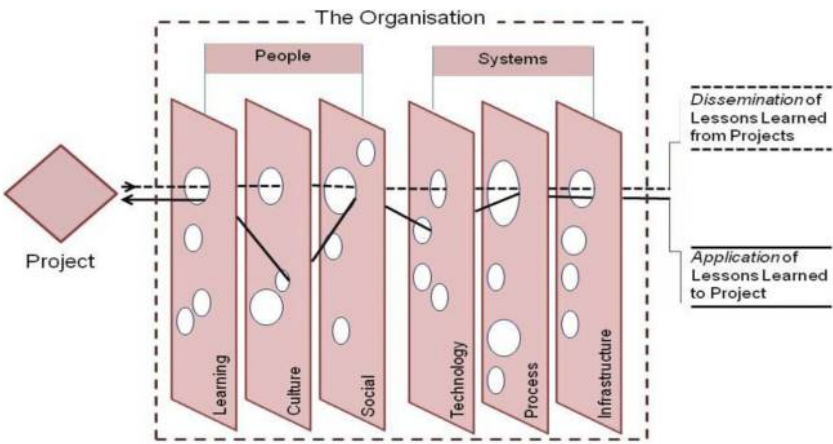
Source: Duffield and Whitty (2015)

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 the 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) need 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:

RQ1. 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 Lewin (1946) towards 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), KM 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 that the adoption of action research on KM 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 (six 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.

4.4 Action research methods of analysis
During the action research cycles, both qualitative and quantitative data were 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 were 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 were 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 are 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,

Initial Planning

•Establish the IT platform
•Introduction meeting – 13 participants; 2 focus group - 12 participants; 4 Interviews
•Identification of the barriers and facilitators that impact the Syllk model {Table I}. Alignment to KM practices (Table II) and further refined into online CoP independent variables [interventions and initiatives] (Table III) that formed the activity items (Figure 3)

1

Action / Observe (cycle 1)

•Implementation of online CoP interventions and initiatives {20 participants and wider organisation)
•Qualitative & Quantitative data collected consisted of online records, project documents, observations and a survey
•Online CoP interventions and initiatives were observed, monitored and evaluated

2

Reflect / Plan (cycle 1)

•After action review activity (8 participants) Highlighted the changes to the project identified dependent variables and the impact of the Syllk model
•Qualitative data collected consisted of online records, project documents and observations
•Review expectations and identify-plan areas of improvement and changes to the independent variables for cycle 2 (Table IV, V and VI)

3

Action / Observe (cycle 2)

•Commenced planned activities from step 3 (25 participants and wider organisation)
•Qualitative & Quantitative data collected consisted of online records, project documents, observations and a survey (Table VII)
•Online CoP interventions and initiatives and revised step 3 implemented actions were observed, monitored and evaluated

4

Reflect (cycle 2)

•After action review activity (10 participants)
•Qualitative data collected consisted of online records, project documents and observations
•Changes to the project identified dependent variables and the impact of the Syllk model were evaluated (Table VIII, IX and X)

5

**Exit
On-line CoP project exited
the action research process**

6

Source: 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

2001). Melrose (2001) states that triangulation of data increases qualitative rigor where data are collected from multiple sources to establish trends and patterns as is the case with this action research project. Data have 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 have been coded for themes and patterns. The data collected have 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 are 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.

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 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 – VI highlight the evidence of participant contribution during the action research reflection activity. The reflection activity used the KM after action review process (Collison and Parcell, 2004). Eight participants' comments were captured from a survey and an 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.

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

(continued)

Syllk elements	Facilitators	Barriers
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 are not fit for purpose or do not 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 I.

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 participants actively participated, contributed and absorbed knowledge, creating value to the organisation by way of improving communication channels to increase staff efficiency. Ten new forum posts and topics were established covering process, tools and

Syllk elements	KM practices (Independent variables)
People learning	Stories and lessons, storytelling
	Communities of practice
	Skills and 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, Web portals, 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 and employee development
	Toolbox assistance from experts
	Wireless

Table II.
KM practices
addressing
facilitators and
barriers mapped to
the Syllk elements

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

Table III.
Identified online CoP independent variables mapped against Syllk elements
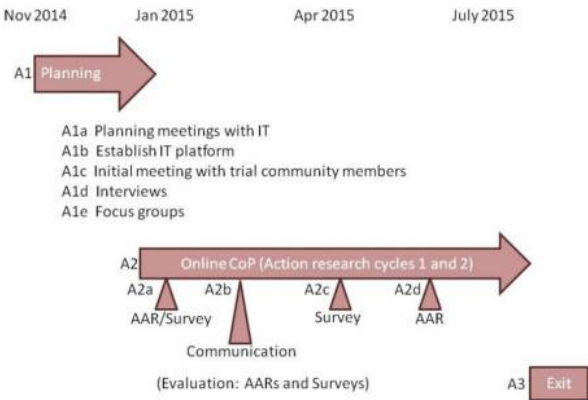
Figure 3.
Trial online CoP project plan (activity items)

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 community of practice 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

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 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	Partial New pages/topics started 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 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	Partial Regular updates/topic prompts sent out Organisation communications and follow up on benefits of CoP

Table IV.
Cycle 1 – Dependent variables (outcome measures)

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

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 V.
Cycle 1 – dependent variables (system measures)

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

Table VI.
Cycle 1 – Syllk model impact on capability of online CoP

Collaboration Tool	Lee et al (2015), p. 48				Organisation-Trial on-line CoP			
	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

Sources: Skype was not included in Lee et al. (2015); adapted from Lee et al. (2015), p. 48

Table VII.
Web 2.0
collaboration tools

is frequently used for achieving personal objectives; however, it 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, pp. 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.

Fourteen 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 five) used by the respondents were internal company social media, blogs and Dropbox. The organisation trial online CoP top five 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 – X highlight 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 (Table IX).

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 VIII.
Cycle 2 – Dependent variables (Outcome measures)

The Syllk model had a positive influence (Table X) on the organisation capability of an online CoP. The participants emphasised that the barriers identified in Table I to 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, as just having an electronic medium will not enable effective knowledge sharing CoPs (Hildreth *et al.*, 2000).

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.

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

Table IX.
Cycle 2 – dependent variables (System measures)

Syllk model	Expectations	Evidence through reflection	Met expectations
Syllk model impacts Learning Culture Social	Positive influence	Time constraint, completing priorities, different levels of knowledge … all these things are the real barriers to making a community of practice work 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 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	Yes

Table X.
Cycle 2 – Syllk model impact on capability of 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 community of practice

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 encouraged to share their learnings on an online CoP. Knowledge needs to
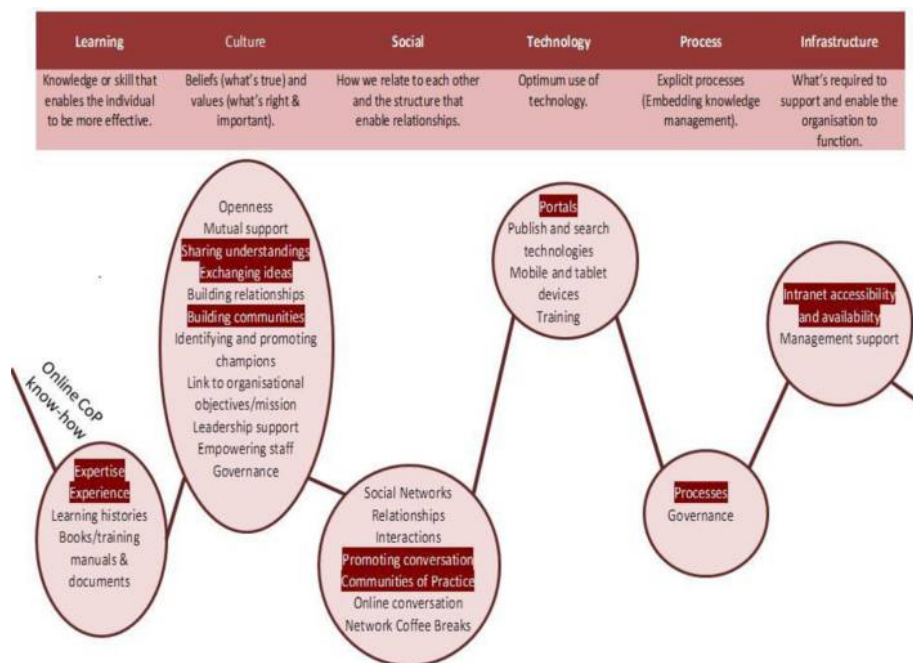
Figure 4.
A Syllk model for the capability of an online CoP

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 that 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 KM 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.

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) highlight 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 KM 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.

References
Altrichter, H., Kemmis, S., McTaggart, R. and Zuber-Skerritt, O. (2002), "The concept of action research", *The Learning Organization*, Vol. 9 No. 3, pp. 125-131.

APQC (2012), *Putting Knowledge in the Flow of Work*, APQC, Houston, TX.

Association for Project Management (2012), *APM Body of Knowledge*, 6th ed., Imprint Digital, Buckinghamshire.

Atkinson, R., Crawford, L. and Ward, S. (2006), "Fundamental uncertainties in projects and the scope of project management", *International Journal of Project Management*, Vol. 24 No. 8, pp. 687-698.

Avison, D.E., Lau, F., Myers, M.D. and Nielsen, P.A. (1999), "Action research", *Communications of the ACM*, Vol. 42 No. 1, pp. 94-97.

Baek, E.O. and Barab, S.A. (2005), "A study of dynamic design dualities in a web-supported community of practice for teachers", *Educational Technology & Society*, Vol. 8 No. 4, pp. 161-177.

Baskerville, R.L. (1999), "Investigating information systems with action research", *Communications of the AIS*, Vol. 2 No. 1, p. 4.

Baskerville, R.L. and Wood-Harper, A.T. (1996), "A critical perspective on action research as a method for information systems research", *Journal of Information Technology*, Vol. 11 No. 3, pp. 235-246.

Bazeley, P. (2013), *Qualitative Data Analysis: Practical Strategies*, Sage, London.

Bazeley, P. and Jackson, K. (2013), *Qualitative Data Analysis with NVivo*, Sage Publications, London.

Boyce, M.E. (1996), "Organizational story and storytelling: a critical review", *Journal of Organizational Change Management*, Vol. 9 No. 5, pp. 5-26.

Brown, J.S. and Duguid, P. (1991), "Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation", *Organization Science*, Vol. 2 No. 1, pp. 40-57.

Burr, T. (2009), "Helping government learn", *Comptroller and Auditor General*, National Audit Office (N.A.O.) (Ed.), The Stationary Office, London.

Cepeda, G. and Martin, D. (2005), "A review of case studies publishing in management decision 2003-2004", *Management Decision*, Vol. 43 No. 6, pp. 851-876.

Chou, C.H., Wang, Y.S. and Tang, T.I. (2015), "Exploring the determinants of knowledge adoption in virtual communities: a social influence perspective", *International Journal of Information Management*, Vol. 35 No. 3, pp. 364-376.

Collis, J. and Hussey, R. (2009), *Business Research: A Practical Guide for Undergraduate & Postgraduate Students*, 3rd ed., Palgrave Macmillan, Hampshire, New York, NY.

Collison, C. (2006), "Avoiding the typical barriers to effective KM", *KM Review*, Vol. 9 No. 4, pp. 16-19.

Collison, C. and Parcell, G. (2004), *Learning to Fly Practical Knowledge Management from Leading and Learning Organizations*, Capstone Publishing Limited (A Wiley Company), Minnesota.

Corso, M., Giacobbe, A. and Martini, A. (2009), "Designing and managing business communities of practice", *Journal of Knowledge Management*, Vol. 13 No. 3, pp. 73-89.

Coughlan, P. and Coghlan, D. (2002), "Action research for operations management", *International Journal of Operations & Production Management*, Vol. 22 No. 2, pp. 220-240.

Creswell, J. (2009), *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3rd ed., Sage Publications, London.

Day, K., Orr, M., Sankaran, S. and Norris, T. (2006), "The reflexive employee: action research immortalised?", *ALAR: Action Learning and Action Research Journal*, Vol. 11 No. 2, p. 5.

Dick, B. (1993), "You want to do an action research thesis?", available at: www.aral.com.au/resources/arthesis.html

Dick, B. and Swepson, P. (1994), "Appropriate validity and its attainment within action research: an illustration using soft systems methodology AEROL", available at: www.aral.com.au/resources/sofsys2.html

Duffield, S. (2015), "Application of a systemic lessons learned knowledge model for organisational learning through projects", *Australian Institute of Project Management National 2015 Conference*, AIPM, Hobart, pp. 56-69.

Duffield, S. and Whitty, S.J. (2012), "A systemic lessons learned and captured knowledge (SLLCK) model for project organizations", in PMglobal (Ed.), *9th Project Management Australia Conference (PMOz 2012)*, Melbourne.

Duffield, S. and Whitty, S.J. (2015), "Developing a systemic lessons learned knowledge model for organisational learning through projects", *International Journal of Project Management*, Vol. 33 No 2, pp. 311-324.

Duffield, S. and Whitty, S.J. (2016), "How to apply the systemic lessons learned knowledge model to wire an organisation for the capability of storytelling", *International Journal of Project Management*, Vol. 34 No. 3, pp. 429-443.

Duhon, H. and Elias, J. (2008), "Why it is difficult to learn lessons: insights from decision theory and cognitive science", *SPE Projects, Facilities & Construction*, Vol. 3 No. 1, pp. 1-7.

Egbu, C.O. (2004), "Managing knowledge and intellectual capital for improved organizational innovations in the construction industry: an examination of critical success factors", *Engineering, Construction and Architectural Management*, Vol. 11 No. 5, pp. 301-315.

GAO (2002), *GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned*, Office, U.S.G.A. (Ed.), Washington, DC.

Greenwood, D.J. and Levin, M. (2007), "An epistemological foundation for action research: introduction to action research", *Introduction to Action Research*, Sage Publications, Thousand Oaks, CA.

Hayes, J. (2009), "Incident reporting: a nuclear industry case study", in Hopkins, A. (Ed.), *Learning from High Reliability Organisations*, CCH Australia, Sydney.

Hayes, J. and Maslen, S. (2014), "Knowing stories that matter: learning for effective safety decision-making", *Journal of Risk Research*, Vol. 18 No. 6, pp. 714-726.

Hedman, S., Påhlman, L. and Törnby, A. (2015), *The Production of Comfort – How Financial Auditors Experience that they Become Comfortable with IT-auditors*, Department of Business Studies, Uppsala University, Uppsala.

Hesse-Biber, S. and Johnson, R.B. (2013), "Coming at things differently: future directions of possible engagement with mixed methods research", *Journal of Mixed Methods Research*, Vol. 7 No. 2, pp. 103-109.

Hildreth, P., Kimble, C. and Wright, P. (2000), "Communities of practice in the distributed international environment", *Journal of Knowledge Management*, Vol. 4 No. 1, pp. 27-38.

ISO (2015), *ISO/FDIS 9001 Quality Management Systems – Requirements*, Switzerland, available at: www.iso.org

Jassbi, A., Jassbi, J., Akhavan, P., Chu, M.T. and Piri, M. (2015), "An empirical investigation for alignment of communities of practice with organization using fuzzy Delphi panel", *VINE*, Vol. 45 No. 3, pp. 322-343.

Johnson, C.M. (2001), "A survey of current research on online communities of practice", *The Internet and Higher Education*, Vol. 4, pp. 45-60.

Jugdev, K. (2012), "Learning from lessons learned: project management research program", *American Journal of Economics and Business Administration*, Vol. 4 No. 1, pp. 13-22.

Jugdev, K. and Mathur, G. (2013), "Bridging situated learning theory to the resource-based view of project management", *International Journal of Managing Projects in Business*, Vol. 6 No. 4, pp. 633-653.

Kerzner, H. (2009), *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 10th ed., John Wiley & Sons, Hoboken, NJ.

Kim, J., Song, J. and Jones, D.R. (2011), "The cognitive selection framework for knowledge acquisition strategies in virtual communities", *International Journal of Information Management*, Vol. 31 No. 2, pp. 111-120.

Kimble, C., Hildreth, P.M. and Bourdon, I. (2008), *Communities of Practice: Creating Learning Environments for Educators*, IAP, Charlotte, North Carolina.

Klakegg, O., Williams, T., Walker, D., Andersen, B. and Magnussen, O. (2010), *Early Warning Signs in Complex Projects*, Project Management Institute, Newtown Square, PA.

Klakegg, O.J., Williams, T. and Shiferaw, A.T. (2015), "Taming the 'trolls': major public projects in the making", *International Journal of Project Management*, available at: http://dx.doi.org/10.1016/j.ijproman.2015.03.008

Kotnour, T. and Vergopia, C. (2005), "Learning-based project reviews: observations and lessons learned from the Kennedy space center", *Engineering Management Journal*, Vol. 17 No. 4, pp. 30-38.

Lave, J. and Wenger, E. (1991), *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press, Cambridge, MA.

Leal-Rodríguez, A.L., Roldán, J.L., Ariza-Montes, J.A. and Leal-Millán, A. (2014), "From potential absorptive capacity to innovation outcomes in project teams: the conditional mediating role of the realized absorptive capacity in a relational learning context", *International Journal of Project Management*, Vol. 32 No. 6, pp. 894-907.

Lee, L., Reinicke, B., Sarkar, R. and Anderson, R. (2015), "Learning through interactions: improving project management through communities of practice", *Project Management Journal*, Vol. 46 No. 1.

Lewin, K. (1946), "Action research and minority problems", *Journal of Social Issues*, Vol. 2 No. 4, pp. 34-46.

McKay, J. and Marshall, P. (2001), "The dual imperatives of action research", *Information Technology & People*, Vol. 14 No. 1, pp. 46-59.

McNiff, J. and Whitehead, J. (2002), *Action Research: Principles and Practice*, 2nd ed., RoutledgeFalmer, New York, NY.

Mau, M. (2005), "Action research: connecting knowledge in the Australian public sector organization", *actKM Online Journal of Knowledge Management*, Vol. 2 No. 1, pp. 58-69.

Melrose, M.J. (2001), "Maximizing the rigor of action research: why would you want to?", *How Could You? Field Methods*, Vol. 13 No. 2, pp. 160-180.

Miles, M. and Huberman, M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook*, Sage Publications, Thousand Oaks, CA.

Milton, N. (2010), *The Lessons Learned Handbook: Practical Approaches To Learning From Experience*, Chandos Publishing, Oxford.

Ministry of Defence (2010), *Major Projects Report: Overview & Assessment*, Ministry of Defence, N.Z.D.F. and the Office of the Auditor-General (Ed.), Ministry of Defence, Wellington.

Mohamed, M.S. (2007), "Cyberinfrastructure: an emerging knowledge management platform", *VINE*, Vol. 37 No. 2, pp. 126-132.

NASA (2012), *Review of NASA's Lessons Learned Information System*, Office of Inspector General, Washington, DC.

O'Dell, C. and Hubert, C. (2011), *The New Edge in knowledge: How Knowledge Management is Changing the Way We Do Business*, John Wiley & Sons, New Jersey.

O'Reilly, T. (2007), "What is Web 2.0: design patterns and business models for the next generation of software", *Communications & Strategies,* Vol. 65 No. 1, p. 17.

Orr, M. (2006), *The Implementation of Electronic Health Knowledge Management Systems*, Southern Cross University Press, Lismore.

Orr, M. and Sankaran, S. (2007), "Mutual empathy, ambiguity, and the implementation of electronic knowledge management within the complex health system", *Emergence: Complexity & Organization*, Vol. 9 Nos 1/2, pp. 44-55.

Pässilä, A., Oikarinen, T. and Kallio, A. (2013), "Creating dialogue by storytelling", *Journal of Workplace Learning*, Vol. 25 No. 3, pp. 159-177.

Raelin, J.A. (1998), "Work-based learning in practice", *Journal of Workplace Learning*, Vol. 10 Nos 6/7, pp. 280-283.

Ragsdell, G. (2009), "Participatory action research: a winning strategy for KM", *Journal of Knowledge Management*, Vol. 13 No. 6, pp. 564-576.

Reason, J. (1997), *Managing the Risks of Organizational Accidents*, Ashgate, Aldershot, Hants, Brookfield, VT.

Reason, J. (2000), "Human error: models and management", *British Medical Journal*, Vol. 320 No. 7237, p. 768.

Riege, A. (2005), "Three-dozen knowledge-sharing barriers managers must consider", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 18-35.

Sankaran, S. (2009), "Applying action research to conduct practitioner research in knowledge management", in Xu, J. (Ed.), *Enhancing Organisational Capability Through Knowledge Management*, Southern Cross University Press, Lismore, pp. 23-40.

Sankaran, S., Tay, B.T. and Orr, M. (2009), "Managing organizational change by using soft systems thinking in action research projects", *International Journal of Managing Projects in Business*, Vol. 2 No. 2, pp. 179-197.

Schindler, M. and Eppler, M. (2003), "Harvesting project knowledge: a review of project learning methods and success factors", *International Journal of Project Management*, Vol. 21 No. 3, pp. 219-228.

Susman, G.I. and Evered, R.D. (1978), "An assessment of the scientific merits of action research", *Administrative Science Quarterly*, Vol. 23 No. 4, pp. 582-603.

Thomas, D.R. (2006), "A general inductive approach for analyzing qualitative evaluation data", *American Journal of Evaluation*, Vol. 27 No. 2, pp. 237-246.

Virolainen, T. (2014), *Learning from Projects: A Qualitative Metasummary, School of Industrial Engineering and Management*, Lappeenranta University of Technology, Lappeenranta.

Walker, D. and Sankaran, S. (2014), "A participatory action research study of knowledge management implementation in a large European telecommunication company in their UK office", *Gibaran Journal of Applied Management*, Vol. 6 No. 2, pp. 36-63.

Walker, S. (2007), *What are the Major Barriers to the Successful Implementation of Knowledge Management Projects in the Telecommunications Industry? A Participatory Action Research Study*, Southern Cross University, Lismore, New South Wales.

Wenger, E. (1998a), *Communities of Practice: Learning As A Social System*, Systems Thinker, Westford, MA, p. 9.

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Wenger, E. (1998b), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge University Press, Cambridge, MA.

Wenger, E. (2000), "Communities of practice and social learning systems", *Organization*, Vol. 7 No. 2, pp. 225-246.

Wenger, E., McDermott, R.A. and Snyder, W. (2002), *Cultivating Communities of Practice: A Guide to Managing Knowledge*, Harvard Business Press, Boston, Massachusetts.

Wenger, E. and Snyder, W. (2000), "Communities of practice: the organizational frontier", *Harvard Business Review*, Vol. 78 No. 2, pp. 139-146.

Williams, T. (2007), *Post-Project Reviews to Gain Effective Lessons Learned*, Project Management Institute, Newtown Square.

Williams, T. (2008), "How do organisations learn lessons from projects – and do they?", *IEEE Transactions in Engineering Management*, Vol. 55 No. 2, pp. 248-266.

Williams, T., Klakegg, O.J., Walker, D.H.T., Andersen, B. and Magnussen, O.M. (2012), "Identifying and acting on early warning signs in complex projects", *Project Management Journal*, Vol. 43 No. 2, pp. 37-53.

Woolis, D., Restler, S. and Thayer, Y. (2008), "Education leadership for a networked world", in Kimble, C., Hildreth, P.M. and Bourdon, I. (Eds), *Communities of Practice: Creating Learning Environments for Educators*, IAP, Charlotte, North Carolina.

Zhao, L., Lu, Y., Wang, B., Chau, P.Y.K. and Zhang, L. (2012), "Cultivating the sense of belonging and motivating user participation in virtual communities: a social capital perspective", *International Journal of Information Management*, Vol. 32 No. 6, pp. 574-588.

Zuber-Skerritt, O. and Perry, C. (2002), "Action research within organisations and university thesis writing", *The Learning Organization*, Vol. 9 No. 4, pp. 171-179.

About the author
Stephen Mark Duffield is a University of Southern Queensland Confirmed PhD Candidate and has a research interest in organisational knowledge and lessons learned. Stephen has 35 years experience with both public and private sector organisations with a major focus on program management, governance, risk and safety management. Stephen Mark Duffield can be contacted at: stephen@invictaprojects.com.au

8. DISCUSSION

The thesis is structured around five published journal papers collectively making significant contributions to knowledge about the development of the Syllk model (Paper One) and application of the Syllk model (Papers Two, Three and Four) and the research methodology (Paper Five). This chapter seeks to synthesise the information provided in these papers and earlier chapters. First, with a brief summary of the proceeding chapters and associated papers, and then a discussion of the research question and conclusions will be provided. Next, the implications of the research and practice will be discussed, followed by a discussion on the Syllk capability network diagrams and the implementation of the Syllk model in organisations. Finally, I will complete this chapter with an examination of how the Syllk model can support quality management systems and the integration of the Syllk model within the project management body of knowledge.

8.1. Chapter summary

This thesis consists of nine core chapters, and each chapter will now be briefly summarised. Chapter 1 provided an outline of the background to the research, identified the scope and research setting and described the research problem. The research problem identified that there is a general trend in project organisations of failing to learn from their past experiences while at the same time being surrounded by 'lessons learned' models and guides (Brouwer 2011; Schindler & Eppler 2003; Shergold 2015). Cultural and social factors can be both a problem and solution to organisational learning and there is a need for a new paradigm for organisational learning that conceptualises and articulates how organisational capability (know-how) is distributed in practice across the organisation (Duhon & Elias 2008; Wideman 2011). A model is needed (Syllk capability network diagrams) to demonstrate and explain to management the wiring of an organisation so as to maximise the potential capability of KM and lessons learned.

Chapter 2 provided a detailed literature review supported by a published paper (Paper One). It was noted that the literature review continues in Papers Two, Three and Four. Chapter 2 also presented an extended literature review ensuring an in-depth understanding of knowledge, knowledge management, knowledge conversation, learning and organisational learning, lessons learned models and culture. At the end of Chapter 2 a section on the Syllk model was further explored which is also the key outcome of Paper One. Chapter 3 presented the thesis research questions.

Chapter 4, supported by Paper Five, explained the chosen research methodology (action research) and the results of managing the action research projects. The chapter showed how action research is suitable for this research and described the action research approach, methods, data collection and data analysis. The role of the researcher was discussed in all three projects, followed by the research quality outcomes and how researcher bias was addressed. Paper Five describes how action research was applied in practice and then a summary discussion of the useful insights and implications for action researchers were discussed.

Chapters 5, 6, and 7 comprise the body of the thesis and support the results and discussions of published Papers Two, Three and Four (respectively). Each of the following chapters briefly describes the project background and highlights any extended literature review and supporting data contained in the associated appendices. Chapter 5 has a focus on the application of the Syllk model for organisational learning through projects (Paper two, Appendix E) the largest of the research projects. Chapter 6 has a focus on the application of the Syllk model for storytelling (Paper Three, Appendix F) and chapter 7 has a focus on the application of the Syllk model for an online community of practice (Paper Four, Appendix G). In all three papers, 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. The studies suggest that by reconceptualising knowledge and lessons learned the Syllk model can influence organisation learning. The studies show how the Syllk model enables management to conceptualise (and illustrate) how organisational know-how is wired (distributed) across various people and system elements of an organisation. The studies establish that the alignment of the Syllk people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence organisation learning.

This chapter (Chapter 8) summarises the overall discussion of the research findings and discussion of the research questions followed by the implications for research and practice. Chapter 9 provides the conclusions from the research and also presents the academic contribution, the significance of research and a discussion on further research.

8.2.   Addressing the research questions

Through the analysis of the program data, I have been able to report on the research issues and associated questions based on the new outcomes with reference to the literature in chapters 2, 5, 6 and 7. How these findings answer the research questions will be highlighted in this part of the chapter. In chapter 3, I identified that what is missing from the literature is a conceptual model for project organisations that clearly articulates how lessons from past project experiences can be embedded in organisational artefacts, processes, practices, and culture. With this in mind, and considering that some organisations such as aviation do effectively learn in terms of safety and accident prevention experiences, the high-level research question proposed was:

> *[RQ 1]. How can the 'lessons learned' concepts of Reason's Swiss cheese model be broadened beyond safety and accident prevention to enable organisations to learn [repeatedly embed beneficial practices] from past project experiences?*

Chapter 2 proposed the Syllk model described in Duffield and Whitty (2012; 2015b). Paper One developed and proposed that the Syllk model, grounded in the literature reviewed represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the organisation (Duffield & Whitty 2012; Duffield & Whitty 2015b). Conceptually it is an adaptation of the Swiss cheese model; the various elements or structures in the model represent the various modes of social and cultural learning, along with the organisational processes, infrastructure and technology that support them (Duffield

& Whitty 2012; Duffield & Whitty 2015b). The high-level research question was further decomposed into three sub-research questions as described in Chapter 3.

Duffield and Whitty (2016b) in project A, focussed on how a tool such as the Syllk model could be practically used by a project organisation to capture knowledge and lessons from its project work and successfully distribute this capability (know-how) across its organisational systems and people. With this in mind, the research question was:

[RQ 1a] {How} Can the Systemic 'Lessons Learned' Knowledge (Syllk) model enable a project organisation to learn from past project experiences?

The research of Duffield and Whitty (2016b) highlights the importance in organisational knowledge facilitators and barriers and the associated KM practices to understand how well they support or hinder learning lessons. This study shows how the Syllk model enables management to conceptualise (and importantly illustrate) how organisational know-how is wired (distributed) across the 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 organisation learning.

Duffield and Whitty (2016a) in project B, focussed on a conceptual model for organisations that clearly and simply articulates how lessons learned and day to day business activity experiences through the capability of storytelling can be distributed across organisational systems and people. With this in mind, the research question was:

[RQ 1b] {How} Can the Systemic 'Lessons Learned' Knowledge (Syllk) model be used by a project organisation to conceptualise (and enhance) its capability of storytelling?

The research of Duffield and Whitty (2016a) highlighted the importance of understanding organisational knowledge facilitators and barriers and the associated KM practices to understand how well they support or hinder learning lessons. The skill of storytelling and having appropriate storytelling learning and development tools available were important factors that enabled storytellers to be effective at communicating the lessons learned. This study showed 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. 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, thereby enhancing the capability of storytelling.

Duffield (2016) in project C, focussed on 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 through the capability of an online Community of Practice (CoP). With this in mind, the research question was:

[RQ 1c] How can the Systemic 'Lessons Learned' Knowledge (Syllk) model be used by an organisation to conceptualise (and enhance) its capability of an online CoP?

The research of Duffield (2016) highlighted 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.

In summary, the three sub-research questions effectively show how the applied Syllk model (which is a variation of Reason's Swiss cheese model) can enable organisations to learn from past project experience/s.

8.3. Systemic lessons learned knowledge [model] capability

The research has provided insights into how an organisation learns and how it can be effectively wired to acquire, accumulate, disseminate and apply knowledge and lessons learned. The thesis highlights that the knowledge variables of the Syllk model (learning, culture, social, technology, process and infrastructure) were found to be the most dynamic and influential for the organisation participating in the action research. The action research outcomes showed that an organisation is not a simple structure but rather a systemic complex interweaving and coupling (through the Syllk elements) of people and systems. This research supports the premise that to manage successfully project work and day to day business activities the learning process is challenged by many barriers (Duffield & Whitty 2012; Duffield & Whitty 2015b; Pinho, Rego & Cunha 2012).

The action research cycles, highlighted during the reflection stages, have shown that the identified Syllk model facilitators and barriers need to be well understood and managed to connect effectively or couple up (or conceptually wire) organisational systems together. Understanding organisational facilitators/barriers and the associated KM practices and tools offer an opportunity to reflect and learn from past experiences (Kotnour & Vergopia 2005; Pinho, Rego & Cunha 2012).

The manner in which management and organisational members view knowledge and lessons learned has implications for management decision making for KM initiatives (Pinho, Rego & Cunha 2012). Recognising knowledge as cultural and socially distributed, contextually-bounded and closely related to the activities of people (individuals and groups) in the organisation (as highlighted in this thesis), is quite a different view of approaching knowledge and lessons learned as an item able to be captured by people, stored in databases and easily moved between people and teams within the organisation. Having a more systemic complex adaptive systems approach to knowledge and lessons learned means that working with knowledge processes is an ongoing commitment that influences and aligns many different management practices.

The organisation should aim to build forums for learning where people have the possibility to meet and the time to reflect and share stories about their experiences to share knowledge and lessons learned. The cultural message is, we think there is significant value in sharing stories and anecdotes of our experiences,

and we are going to make time for that activity. The changing of the culture means management and leaders walk the 'knowledge' talk at all levels, communicating and increasing employee consultation. From a culture perspective, fostering care, respecting others and working in an open and honest environment will allow for teams to reflect over the group behaviours, build relationships and mutual support and empower staff to share knowledge and lessons learned.

The research outcome highlighted that knowledge processes and technology (tools) do not have to be complex and/or complicated to create or use. This is where processes in the organisation need to align with the learning, culture and social aspects of the Syllk model. Facilitating knowledge and lessons learned through social networks, storytelling forums, CoPs, on-line conversations, "lunch and learn" sessions and knowledge cafes need to be seen as a natural way to share experiences and develop the competitive organisation edge. This thesis shows that the inner processes and knowledge of the organisation needs to be aligned with the Syllk knowledge facilitators and barriers that exist within the organisation. It could be argued that using action research is one possible way forward. It is important that one understand how the organisation is wired for knowledge and lessons learned.

The learning aspect of the Syllk model identifies that there is a need to introduce concepts of work-based learning theories and situated learning to the field of project management (Raelin 2000). The processes of learning and contributing are organic and flowing and not mechanical and inflexible, with learning taking place within and between projects, noting the facilitators and barriers. Knowledge is a people-social process, and it is embedded in the practice of the people, their technology and culture.

8.3.1. Syllk capability network diagram

A major outcome of the three research projects was the formulation of the Syllk capability network diagrams (Paper Two-Figure 3, Paper Three-Figure 4, Paper Four-Figure 4). Figure 8-1 shows the overlay of the capability network relationships between the three research projects. In a way, this is where an organisation can be shown as a complex adaptive network that is associated with distributing capability (know-how) like the human body and brain (Bennet & Bennet 2003; Bullmore & Sporns 2009; Gabora 1997; Holland 1992; Whitty 2009). There were some KM practices (interventions) that all three projects required to be effective, then two projects shared some practices. Finally, some practices were only needed by one project. This leads to the initial shaping and development of the Syllk model where there are different KM practices and associated barriers/facilitators (holes) that may be required to support the dissemination and application of various lessons learned (Duffield & Whitty 2012; Duffield & Whitty 2015b; Pinho, Rego & Cunha 2012).

This was supported by comments in the early focus group sessions where "people make it happen"; "people learn in different ways"; "everybody learns differently"; and "different mediums are needed for people to learn" (Duffield & Whitty 2015b). Reason (1997, p. 9) describes the Swiss cheese model's 'holes' "as shifting around, coming and going, shrinking and expanding in response to operator actions and local demands". For the Syllk model, the holes will also shift around, come and go, shrink and expand in response to knowledge management actions and

organisational and project demands. Figure 8-1 has validated the early Syllk model of Duffield and Whitty (2015b).

The findings from this action research program provide evidence that an organisation can be effectively wired to acquire and accumulate capability and organisational learning. Figure 8-1 is an example of how the Syllk model can enable executive and senior management to conceptualise and illustrate how organisational capability (know-how, i.e. project delivery capability) is wired across various systems of an organisation for knowledge/lessons learned (Pinho, Rego & Cunha 2012). The highlighted knowledge variables of the Syllk model elements shown in Figure 8-1 were found to be the most dynamic and influential for two organisations participating in the action research program. The action research outcomes showed that an organisation is not a simple structure, but rather a dynamic and complex interweaving and coupling (through the Syllk elements) of people and systems.
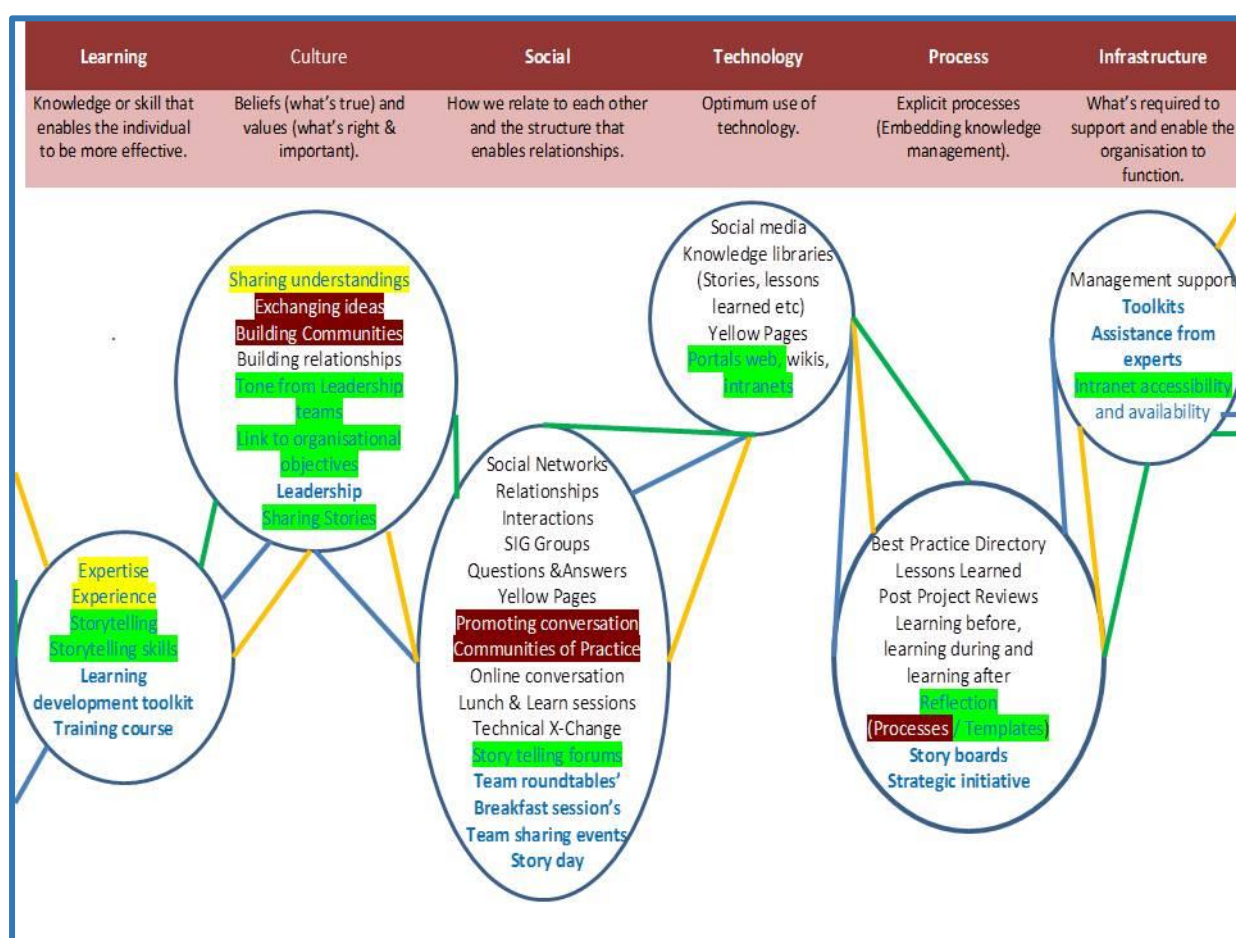
Figure 8-1 Combined capability network diagnosis of Projects A, B and C

8.3.2. Implementing the Syllk model in organisations

The implementation of the Syllk model in organisations involves the organisation teams to identify the barriers and facilitators that exist in the organisation against the Syllk model elements. KM practices are aligned (synthesised) with these elements. Figure 8-1 is an example of the combined Syllk aligned KM practices for an organisation. However, this alignment will be different

for each organisation and project work within the organisation. The Syllk model implementation process within an organisation is best shown in Figure 8-2. Figure 8-2 provides a flow diagram of the Syllk model implementation process and Table 8-1 support the process with an explanation of each process step. For this thesis program, Project A (Paper Two) research project followed the divisions / teams / programs / projects process flow. Project B (Paper Three) and Project C (Paper Four) research projects followed the functions/capability process flow.

Table 8-1 Syllk model implementation process steps

ID #	Explanation of process step
1	Using a workshop, brainstorm or focus group techniques, participants identify and record the facilitators and barriers to knowledge/lessons learned with their organisation against each of the Syllk model elements (learning, culture, social, technology, process and infrastructure).
2	KM practices are mapped (synthesised) with each Syllk element. This is where KM expertise aligns KM practices to address the facilitators and/or barriers that are highlighted in each of the Syllk elements. This step requires participants to have a reasonable, mature level and understanding/skill in KM. Participants may need to consider external assistance. When identifying KM practices, it is important to address both the facilitators and barriers to the organisation.
3	The outcomes of ID2 can be presented in the Syllk capability network diagram format showing those KM processes that work well (dark shade) and those KM processes that sometimes work in certain situations (shown as light shade). *This is where KM practices need to align across the Syllk elements for successful knowledge\lessons learned organisational capability know-how.*
4	Repeat ID1 for Functions and/or Capability.
5	Repeat ID2. When identifying KM practices, it is important to address both the facilitators and barriers of the Functions and/or Capability.
6	The outcomes of ID5 can be presented in the Syllk capability network diagram format as discussed in ID3.
7	Repeat ID1 for Division/s and/or Team/s / Programs and/or Projects.
8	Repeat ID2. When identifying KM practices, it is important to address both the facilitators and barriers of the Division/s and/or Team/s / Programs and/or Projects.
9	The outcomes of ID5 can be presented in the Syllk capability network diagram format as discussed in ID3.
10	Often participants will find that existing KM practices are in place. Some might be effective; others may not be effective. This is where the application of Action Research cycles (plan, action, observe and reflect) may be required to assist in improving the implementation of existing KM processes.
11	If there are new KM practices that are required to be established, it is recommended to use the Action Research cycles (plan, action, observe and reflect) to help establish and implement the KM practices.
12	Application of the Action Research process if required.

Figure 8-2 Syllk model implementation process

9. CONCLUSION

The thesis is built on five published journal papers that collectively make significant contributions to extant knowledge about the development of the Syllk model (Paper One) and application of the Syllk model (Papers Two, Three and Four) and the research methodology (Paper Five). Here I will discuss the contributions to theory, methodology, practice and policy and conclude with further research. Figure 9-1 presents the conclusion of this thesis.
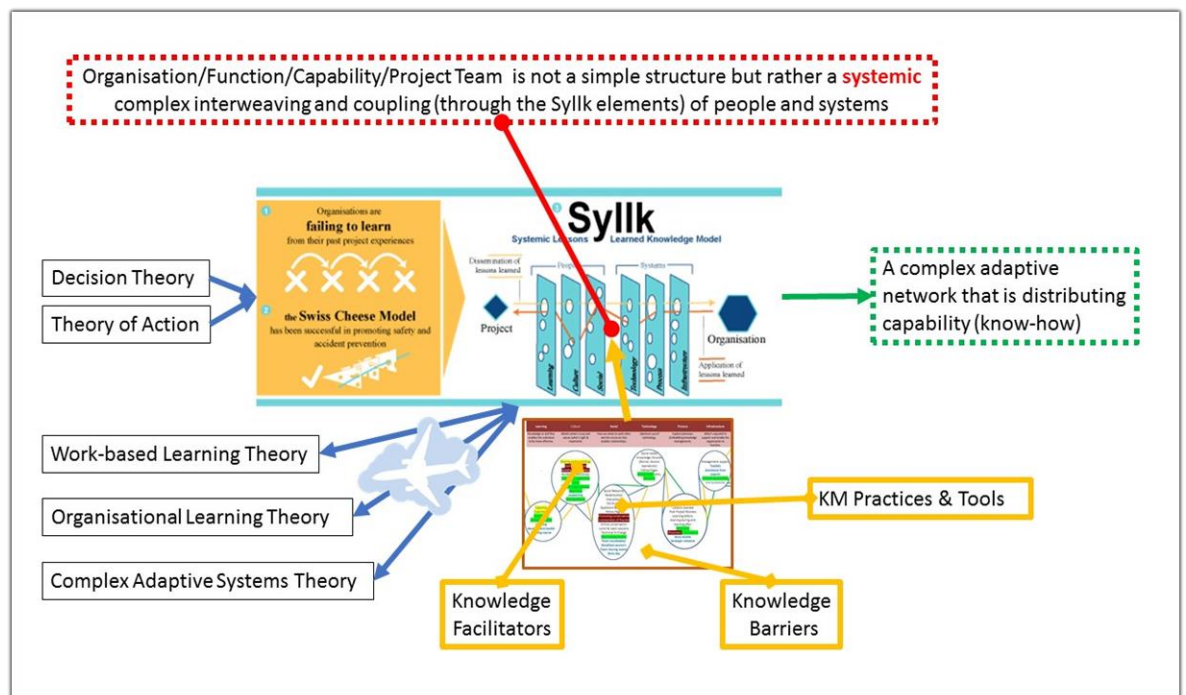
Figure 9-1 The conclusion of the thesis

9.1. Contributions to Theory

In chapter 2, I reported on the theories that are associated with the Syllk model. KM is the mixture of several disciplines and therefore may be impacted by many theories which provide a challenge to the researcher. However, I found that the action research spiral cycles, and the reflection step, a helpful process to review the impact on the relevant theories.

The Syllk model draws-on:

- Decision theory (Duhon & Elias 2008)

- Theory of action (Argyris 1999; Duhon & Elias 2008)

- Organisational learning theory (Duhon & Elias 2008; Garvin 1993; Simon 1991; Strang 2003)

- Theory of work-based learning (Raelin 2000)

- Complex adaptive systems theory (Bennet & Bennet 2003; Bullmore & Sporns 2009; Holland 1992).

The Syllk model is able to contribute to the following theories:

- Organisational learning theory (Duhon & Elias 2008; Garvin 1993; Simon 1991; Strang 2003)

- Theory of work-based learning (Raelin 2000)

- Complex adaptive systems theory (Bennet & Bennet 2003; Bullmore & Sporns 2009; Holland 1992).

Feedback from scholars and peers:

"exceptional adaptation of a framework and model to KM initiatives"

"The contribution is critical, significant and will broaden the field of KM"

"The researcher built upon other researchers work, and the outcomes have added to an existing conversation in the KM field"

"The researcher has provided interesting and different insights into a phenomenon that may otherwise have been ignored. The results construct a common-sense method for discovering, interpreting and explaining a phenomenon by using language and ideas that include previous agreement on its meanings"

"The insightful analysis, alternative perspectives, and new literatures presents a cogent conceptual framework for studying the "problem." I thought I was familiar with the field of KM, but here was new thinking and investigation that was not simply more of the same. I'm challenged to rethink some of the concepts that I take for granted and appreciate adding interesting and new outcomes to what I already apparently know"

"The candidate outlined his research contributions through re-contextualization of an existing model, which he applied in a new context; testing the underlying theory and model in a new setting; and showing the applicability of the model to a new situation. This outcome confirmed and expanded upon an existing model. The candidate demonstrated the underlying concepts by proving that the new SYLLK model was both feasible and useful"

Managing knowledge and learning is a challenge and this is accentuated when there is no simple and clear model, or framework for managing knowledge and lessons learned. Accordingly, if practitioners and researchers should adopt the Syllk model to champion their knowledge management implementation, there is potential to communicate the scope of the Syllk *Swiss cheese model* and close the gap between theory and practice.

9.2. Contributions to Methodology

Since KM became a fashionable phrase in the mid-1990s, the KM practice has modest experience of experimental research methods. Most of the KM literature is descriptive or derived from best practices (Firestone & McElroy 2003; O'Dell & Hubert 2011). The research in this thesis has been experimentation with action research methods coupled with existing methodologies practices. The action research component of reflection and intervention is fundamental to an action research thesis (Dick 1993).

Journal Paper Five (Duffield Forthcoming 2017) provides a direct and personal account of the issues and challenges that occurred in three action research projects that were part of a doctoral research program. The focus of the paper is on the general methodological issues and problems of action research. The insight and implications for action researchers were focused on the following areas:

- Role of the researcher

- Dual cycle (parallel) process of action research

- Reflection

- External constraints

- Ethics

- Project size

Feedback from scholars and peers:

"The researcher has taken risks, and mitigated the risks to make the results manageable, credible, valid, authentic, and highly useful. The researcher has justified his original contribution through the insights he has proposed"

"by using Action Research the candidate executed research based practices, where questions, problems, and challenges were identified and formed by the subsequent needs of the practice and practitioners"

The PhD candidate *"demonstrated that the study was definitely worth undertaking, and the questions were valuable to ask. The outcomes demonstrated why anyone should care and why the study mattered. Although in a qualitative study limitations exist associated with generalizability, the candidate, through the Action Research method exhibits the probability that lessons learned are repeatable"*

9.3. Contributions to Practice

Proof of the practical and real-world significance of this research is the uptake and interest by organisations and practitioners. A project management *project controls book chapter* will widen the interest in KM and 'lessons learned' and the application of the Syllk model (Duffield Forthcoming, 2017) (Appendix H).

Following a *presentation at KM Australia 2015* (Duffield 2015a), I experienced considerable engagement from the attendees. Appendix I presents an extract of the KM Australia Congress program.
The following feedback highlighted effective engagement with KM practitioners:
- Took a bit of idea (sic) away from this
- Stephen presented engaging material and was very amiable
- Swiss cheese model was good – would also be good for a workshop
- It is nice to see someone cracking open the 'lessons learned' myth
- Well thought through and made me want to research more about Syllk
- Will follow up with presentation provided – interested in content
- Great references and clearly a huge amount of subject matter expertise
- I would be interested in more information on the KM practices
- Learned a lot about a different evoking LL framework.

At the Australian Institute of *Project Management (AIPM) National 2015 Conference* (Duffield 2015b) a large multi-national expressed an interest in applying the Syllk model to the supply functions of the business (motor vehicle manufacturing). Appendix J shows the poster presentation that was utilised at the AIPM USQ exhibitors stand (Duffield & Whitty 2015a). Following the AIPM conference, two large multi-national energy, oil and gas companies have both expressed an interest in applying the Syllk model to knowledge management and safety management. The engagement with the energy, oil and gas companies continues to the present day.

Integration of the Syllk model with other models: Appendix K presents the ANZAM Conference Paper which discusses a new, integrated tool-set for managing a project. This tool-set is a response to calls for project managers to be able to apply new project managing thinking "in practice". The tool-set integrates the project-space model and the Syllk model (van der Hoorn, Duffield & Whitty forthcoming, 2016). Together, they bring visibility to enablers and constraints to project delivery capability, and these learnings can then be integrated into the organisations systems to build (in a tailored) manner ongoing project management capability. Specifically, the tool-set highlights the hindrances to project delivery and what capabilities need to be "wired" into an organisation to overcome them. This tool-set integrates the learnings from concrete "lived experiences" of project managing into future organisational initiatives.

Syllk 'knowledge flow' opportunity with ISO 9001:2015(E): In Chapter 5, Project A was encouraged to hold an interactive workshop (We really need to talk about (sub-Branch) Community of Knowledge and lessons learned – Appendix E, Figure E-1) showing the participants how the Syllk model can be applied to their organisational setting and the wider supply chain. As suppliers to the government are required to hold ISO 9001 quality management certification, there is potential for the flow of knowledge between both industry and government through the organisations adapting and aligning with the Syllk model. This opportunity is not only with Government and contractor relationships. The opportunity exists for any two or more organisations (through alliancing), to now work together on a common knowledge platform (Walker 2015).

Project management body of knowledge changes: The research has provided insights into how an organisation can learn and how it can be effectively wired and networked to acquire, accumulate, disseminate and apply knowledge and lessons learned capabilities. The PMBOK® Guide has advanced to successfully dominate our business project environments (Whitty 2011). Future work should now be focussed on the development and recommendation of changes to the future editions of the PMBOK® Guide for consideration by the PMBOK® Guide committee. Important consideration should be that the new Manage Project Knowledge process is included in all process groups, not just the executing process group. As stated, the Manage Project Knowledge process supports organisational learning, and this would be an ideal application of the Syllk model.

There is also a real potential here to show how projects have unique systemic knowledge and 'lessons learned' drivers that interact in a complex way. This practical process of extending and adapting the Syllk model to the PMBOK® Guide will widen the understanding of KM with the Project Management profession.

Generic application of the Syllk model: Whitty (2015) presented the Syllk model at an executive insights webinar highlighting how to power up your organisational capability with the Syllk model. An example used that most of us are familiar with is the coffee shop (refer to Appendix M).

Feedback from scholars and peers:

"The thesis displays original and critical thought when examining a systemic lessons learned knowledge model for public sector project organisations in Australia. The candidate demonstrates the capacity to undertake independent research that has direct impact on practice"

9.4. Contributions to Policy

As previously stated the PMBOK® Guide is process focused on *what* and *how* to do it. There is no focus on the *why* to do a process. Future research could provide an alignment of the PMBOK® Guide with the Syllk model noting the focus on people (learning, culture and social) and systems (technology, process, and infrastructure). This would make an important transformation of the PMBOK® Guide, recognising the knowledge needed to deliver projects successfully.

Feedback from scholars and peers:

"Further application to develop policy was discussed in reference to the international default standard for managing projects - the PMBOK® Guide. The candidate provided review comments for the next edition of this guide, and there is an opportunity to further embed the candidate's suggested approach through Government policy"

9.5. Further research

The findings from this research form a sound structure for future research studies based on the application of the Syllk model. This research supports the premise that to successfully manage projects and day to day business activities the learning process is challenged by many barriers (Pinho, Rego & Cunha 2012). Future research themes could focus on how to use the Syllk model to conceptualise the wiring of an organisation for any capability. The thesis demonstrates that action research can benefit project management and knowledge management researchers and practitioners. The research program serves to support dialogue on the primacy of people (learning, culture and social) and systems (technology, process, and infrastructure).

Syllk model journal and conference papers status: Papers One, Two, and Four have had 11,802 downloads (at 22 March 2017). Appendix L provides a detailed list of the thesis papers and their citations, views, reads and downloads as identified by various research information sources. The downloads that have taken place since publication and the feedback received via Research Gate is encouraging in that the research outputs have raised an interest in the research community. There has been a noted factor in the citing of the systemic and capability network features of the Syllk model (Diaz & Mosquera 2016; Heaton, Slok & Kovela 2012; Kaszás, N, Keller, K & Birkner, Z 2016; Leal-Rodríguez et al. 2014; Maier et al. 2016; Rolstadås & Schiefloe 2017; Walker 2015).

There are always limitations with research, and in addition to the previously mentioned action research limitations, there is a limitation that should be noted. The

research in this thesis was limited to sampling of problem-solving projects that comprised three public sector projects conducted by Australian state and federal government departments and agencies from late 2012 through to late 2015. Opportunities for providing further related research include repeating the research study with private sector projects. I came close to working with three organisations (mining information technology, health project management office, and an enterprise resource software company). The timing of the study became an issue for all three organisations.

My goal in this thesis has been to open some closed doors in the complex process of knowledge management, lessons learned and project management. To open the closed doors, this thesis provides a practical simple model that could be used in discussions to further examine how project organisations can learn how lessons from past projects experiences can be embedded in organisational artefacts, processes, practices, and culture. The research has enhanced the practices in the participating organisations and linked academia with industry in enhancing knowledge across both parties to the research, but the intention of all this is so we can successfully manage projects and day to day business activities, capture, disseminate and apply lessons learned.

10. REFERENCES

Abaunza, GRC & Kirytopoulos, K 2016, 'Lessons Learnt from Delivering Oil and Gas Projects in Australia: An Empirical Research', in *Proceedings of the 20th International Symposium on Advancement of Construction Management and Real Estate*, Springer, pp. 851-62.

Ackoff, R 1989, 'From data to wisdom', *Journal of Applied Systems Analysis*, vol. 16, pp. 3–9.

Adams, P 2010, 'Action Research', in Salkind (ed.), *Encyclopedia of Research Design*, SAGE Publications, Inc., Thousand Oaks.

Ahern, T, Byrne, P & Leavy, B 2015, 'Developing complex-project capability through dynamic organizational learning', *International Journal of Managing Projects in Business*, vol. 8, no. 4.

Ajmal, M, Kekäle, T & Takala, J 2009, 'Cultural impacts on knowledge management and learning in project-based firms', *VINE*, vol. 39, no. 4, pp. 339-52.

Ajmal, M, Helo, P & Kekäle, T 2010, 'Critical factors for knowledge management in project business', *Journal of Knowledge Management*, vol. 14, no. 1, pp. 156-68.

Ajmal, M & Koskinen, K 2008, 'Knowledge transfer in project based organizations: An organizational culture perspective', *Project Management Journal*, vol. 39, no. 1, pp. 7-15.

Alavi, M 2000, 'Managing organizational knowledge', Framing the domains of IT management: Projecting the future through the past, pp. 15-28.

Ale, M, Toledo, C, Chiotti, O & Galli, M 2014, 'A conceptual model and technological support for organizational knowledge management', *Science of Computer Programming*, vol. 95, Part 1, pp. 73-92.

Alavi, M & Leidner, D 2001, 'Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues', *MIS Quarterly*, pp. 107-36.

Algeo, C 2014, 'Exploring Project Knowledge Acquisition and Exchange Through Action Research', *Project Management Journal*, vol. 45, no. 3, pp. 46-56.

Almeida, M & Soares, A 2014, 'Knowledge sharing in project-based organizations: Overcoming the informational limbo', *International Journal of Information Management*, vol. 34, no. 6, pp. 770-9.

Altrichter, H, Kemmis, S, McTaggart, R & Zuber-Skerritt, O 2002, 'The concept of action research', *The Learning Organization*, vol. 9, no. 3, pp. 125-31.

Anbari, F, Carayannis, E & Voetsch, RJ 2008, 'Post-project reviews as a key project management competence', *Technovation*, vol. 28, no. 10, pp. 633-43.

Andersen, A 1996, 'The American productivity and quality center', The knowledge management assessment tool: External benchmarking version.

Andrew, C, Shang, G & Pheng, S 2015, 'An Institutional Approach to Understanding Post-Project Reviews in the Construction Industry', *International Surveying Research Journal*, vol. 5, no. 1, p. 1.

Andriessen, J & Fahlbruch, B 2004, How to manage experience sharing: from organisational surprises to organisational knowledge, 1st edn, Elsevier, Amsterdam; Boston.

APQC 2012, *Putting Knowledge in the Flow of Work*, ISBN-13: 978-1-60197-178-4, APQC, Texas.

Argyris, C 1994, 'Good Communication That Blocks Learning. (cover story)', *Harvard Business Review*, vol. 72, no. 4, p. 77.

Argyris, C 1999, *On organizational learning*, 2nd edn, Blackwell Business, Oxford; Malden, Mass.

Association for Project Management 2012, *APM Body of Knowledge* 6th edn, Imprint Digital, Buckinghamshire.

Atkinson, R, Crawford, L & Ward, S 2006, 'Fundamental uncertainties in projects and the scope of project management', *International Journal of Project Management*, vol. 24, no. 8, pp. 687-98.

Avison, D, Lau, F, Myers, M & Nielsen, P 1999, 'Action research', *Communications of the ACM*, vol. 42, no. 1, pp. 94-7.

Bakker, R, Cambré, B, Korlaar, L & Raab, J 2010, 'Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer', *International Journal of Project Management*.

Baron, J 1998, Judgment misguided : intuition and error in public decision making, Oxford University Press, New York.

Basili, V, McGarry, F, Pajerski, R & Zelkowitz, M 2002, 'Lessons learned from 25 years of process improvement: the rise and fall of the NASA software engineering laboratory', in *ICSE* Published by the IEEE Computer Society, Orlando, Florida.

Baskerville, RL 1999, 'Investigating information systems with action research', *Communications of the AIS*, vol. 2, no. 3es, p. 4.

Baskerville, RL & Wood-Harper, A 1996, 'A critical perspective on action research as a method for information systems research', *Journal of Information Technology*, vol. 11, no. 3, pp. 235-46.

Bazeley, P 2013, Qualitative Data Analysis: Practical strategies, Sage.

Bazeley, P & Jackson, K 2013, *Qualitative data analysis with NVivo*, Sage Publications Limited.

Bennet, A & Bennet, D 2003, 'Designing the knowledge organization of the future: the intelligent complex adaptive system', in *Handbook on Knowledge Management*, Springer, pp. 623-38

Bennet, A & Bennet, D 2004, Organizational survival in the new world, Routledge.

Best, J 1989, Cognitive psychology, 2nd edn, West Pub. Co., St. Paul.

Blackman, D & Henderson, S 2001, Does a learning organisation facilitate knowledge acquisition and transfer? Waikato Management School (WMS) at the University of Waikato, New Zealand.

Boh, W 2007, 'Mechanisms for sharing knowledge in project-based organizations', *Information and Organization*, vol. 17, no. 1, pp. 27-58.

Booker, L, Bontis, N & Serenko, A 2008, 'The relevance of knowledge management and intellectual capital research', *Knowledge and Process Management*, vol. 15, no. 4, pp. 235-46.

Boyce, M 1996, 'Organizational story and storytelling: a critical review', *Journal of Organizational Change Management*, vol. 9, no. 5, pp. 5-26.

BP 2010, *Deepwater Horizon Accident Investigation Report*, BP, viewed 14 November 2016. http://www.bp.com/content/dam/bp/pdf/sustainability/issue-reports/Deepwater_Horizon_Accident_Investigation_Report.pdf>.

Bransford, J, Brown, A, Cocking, R, Donovan, S & Pellegrino, J 2000, *How people learn brain, mind, experience, and school*, Expanded ed., National Academy Press, Washington DC, <http://ezproxy.usq.edu.au/login?url=http://site.ebrary.com/lib/unisouthernqld/Doc?id=10038789>.

Bratianu, C. 2010, 'A Critical Analysis of Nonaka's Model of Knowledge Dynamics', *Electronic Journal of Knowledge Management Decision*, vol. 8, no. 2, pp. 193-199, <www.ejkm.com>.

Bresnen, M, Goussevskaia, A & Swan, J 2004, 'Embedding new management knowledge in project-based organizations', *Organization Studies*, vol. 25, no. 9, p. 1535.

Bresnen, M, Edelman, L, Newell, S, Scarbrough, H & Swan, J 2003, 'Social practices and the management of knowledge in project environments', *International Journal of Project Management*, vol. 21, no. 3, pp. 157-66.

Brouwer, G, *Own motion investigation into ICT-enabled projects,* 2011, VA-G Victorian Ombudsman, Victorian Ombudsman, Melbourne, Australia.

Brown, J, Denning, S, Groh, K & Prusak, L 2005, Storytelling in organizations: Why storytelling is transforming 21st century organizations and management, Elsevier Butterworth-Heinemann, Oxford, UK.

Brydon-Miller, M, Greenwood, D & Maguire, P 2003, 'Why action research?', *Action research*, vol. 1, no. 1, pp. 9-28.

Bukowitz, W & Williams, R 2000, The knowledge management fieldbook, Financial Times/Prentice Hall.

Bullmore, E & Sporns, O 2009, 'Complex brain networks: graph theoretical analysis of structural and functional systems', *Nature Reviews Neuroscience*, vol. 10, no. 3, pp. 186-98.

Burford, S & Ferguson, S 2011, 'The Adoption of Knowledge Management Standards and Frameworks in the Australian Government Sector', *Journal of Knowledge Management Practice*, vol. 12, no. 1.

Burr, T, *Helping Government Learn,* 2009, NAO Comptroller and Auditor General, The Stationary Office, London.

Busby, J 1999, 'An Assessment of Post-Project Reviews', *Project Management Journal*, vol. 30, no. 3, p. 23.

Calvo-Mora, A, Navarro-García, A & Periañez-Cristobal, R 2015, 'Project to improve knowledge management and key business results through the EFQM excellence model', *International Journal of Project Management*, vol. 33, no. 8, pp. 1638-51.

Carberry, P 2001, 'Are Science Rigour and Industry Relevance both Achievable in Participatory Action Research?', in *Australian Agronomy Conference*: *Proceedings of the Australian Agronomy Conference* Hobart.

Cepeda, G & Martin, D 2005, 'A review of case studies publishing in management decision 2003-2004', *Management Decision*, vol. 43, no. 6, pp. 851-76.

Chaves, M, de Araújo, C, Teixeira, L, Rosa, D, Júnior, I & Nogueira, C 2016, 'A new approach to managing Lessons Learned in PMBoK process groups: the Ballistic 2.0 Model', Developing and enforcing internal information systems standards: InduMaker's.

Chesterman, R, 2013, Queensland Health Payroll System Commission of Inquiry, The State of Queensland.

Choo, C 1996, 'The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions', *International Journal of Information Management*, vol. 16, no. 5, pp. 329-40.

Chou, C.-H., Wang, Y.-S., Tang, T.-I., 2015. Exploring the determinants of knowledge adoption in virtual communities: A social influence perspective. *International Journal of Information Management*, 35.

Chrissis, M, Konrad, M & Shrum, S 2003, CMMI® : guidelines for process integration and product improvement, Addison-Wesley, Boston.

Chronéer, D & Backlund, F 2015, 'A Holistic View on Learning in Project-Based Organizations', *Project Management Journal*, vol. 46, no. 3, pp. 61-74.

Cleveland, C 2011, *Macondo: The Gulf Oil Disaster*, Encyclopedia of Earth, viewed 14 November 2016, <http://editors.eol.org/eoearth/wiki/Macondo_well_(Macondo:_The_Gulf_Oil_Disaster)>.

Coghlan, D & Shani, A 2008, 'Insider Action Research: The Dynamics of Developing New Capabilities', in P Reason & H Bradbury (eds), *Handbook of action research: Participative inquiry and practice*, Sage, ch 45, pp. 643-55.

Collis, J & Hussey, R 2009, *Business Research: A Practical Guide for Undergraduate & Postgraduate Students*, 3rd edn, Palgrave Macmillan, Hampshire, UK; New York, NY.

Collison, C 2006, 'Avoiding the typical barriers to effective KM', *KM review, Volume 9 Issue 4, 16-19*, vol. 9, 4.

Cooke-Davies, T, Cicmil, S, Crawford, L & Richardson, K 2007, 'Mapping the Strange Landscape of Complexity Theory, and Its Relationship to Project Management', *Project Management Journal*, vol. 38, no. 2, pp. 50-61.

Coughlan, P & Coghlan, D 2002, 'Action research for operations management', *International Journal of Operations & Production Management*, vol. 22, no. 2, pp. 220-40.

Cowles, T 2004, *Criteria for Lessons Learned (LL)*, Denver, Colorado, 16 November.

Creswell, J 2005, Educational research: Planning, conducting, and evaluating quantitative and qualitative research, 2nd edn, Pearson.

Creswell, J 2009, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* 3rd edn, SAGE Publications, Inc., <http://ebookbrowsee.net/gdoc.php?id=490055839&url=bf3c2f8288b9d76e2275437ffc448717&c=490055839>.

Creswell, J 2012, Educational research: Planning, conducting, and evaluating quantitative and qualitative research, 4th edn, Pearson.

Dalkir, K 2005, Knowledge management in theory and practice, Elsevier Butterworth-Heinemann, Oxford.

Davenport, T & Prusak, L 1998, Working knowledge: How organizations manage what they know, *Harvard Business Press.*

Day, K, Orr, M, Sankaran, S & Norris, T 2006, 'The reflexive employee: action research immortalised?', *ALAR: Action Learning and Action Research Journal*, vol. 11, no. 2, p. 5.

Day, R 2005, 'Clearing up "implicit knowledge": Implications for knowledge management, information science, psychology, and social epistemology', *Journal of the American Society for Information Science and Technology*, vol. 56, no. 6, pp. 630-5.

de Vasconcelos, JB & Rocha, Á 2016, 'A special section on knowledge management and engineering', *International Journal of Information Management*.

Dekker, S 2007, *Just culture : balancing safety and accountability,* Ashgate, Aldershot, England ; Burlington, VT.

Diaz, E & Mosquera, F 2016, 'Integrating Knowledge through Project Lessons Learned: A Case Study of Global NPD Projects in Company X in the Automotive Industry', Umea University.

Dick, B 1993, *You Want to do an Action Research Thesis?*, viewed 14 November 2016, <http://www.aral.com.au/resources/arthesis.html>.

Dick, B 2001, 'Qualitative evaluation for program improvement', in *IIR conference on evaluation*: *Proceedings of the IIR conference on evaluation,* Brisbane.

Dick, B 2002, 'Postgraduate programs using action research', *Learning Organization, The*, vol. 9, no. 4, pp. 159-70.

Disterer, G 2002, 'Management of project knowledge and experiences', *Journal of Knowledge Management*, vol. 6, no. 5, pp. 512-20.

Dixon, N 2000, Common Knowledge - How Companies Thrive by Sharing What They Know, *Harvard Business School Press*, Boston, Massachusetts.

Drucker, PF 1993, *Post-capitalist society*, Butterworth Heinemann, Oxford.

Duffield, S 2013, 'An advanced systemic lesson learned and captured knowledge model for project organisations (Poster presentation)', in *USQ Research Colloquia and Showcase symposium*, USQ, Springfield, Qld, Australia.

Duffield, S 2015a, 'Application of a Systemic Lessons Learned Knowledge model for organisational learning through projects', in *Knowledge Management Australia 2015*, Ark Group, Melbourne, 4-6 August 2015.

Duffield, S 2015b, 'Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects', in *Australian Institute of Project Management National 2015 Conference*, AIPM, 978-0-646-93699-4, Hobart, pp. 56-69.

Duffield, S 2016, 'Application of the Syllk model wiring an organisation for the capability of an online Community of Practice', *VINE Journal of Information and Knowledge Management Systems*, vol. 46, no. 2, pp. 267-94.

Duffield, S Forthcoming, 2017, 'Using Action Research in Practice: Useful Insights and Outcomes.', *ALAR: Action Learning and Action Research Journal*, vol. 23, no. 1.

Duffield, S Forthcoming, 2017, 'Manage Project Knowledge and Lessons Learned', in RA Group. & L Bowman (eds), *Project Controls Drumbeat*, First, Taylor and Francis Group, United Kingdom, ch 12.

Duffield, S & Whitty, SJ 2012, 'A systemic lessons learned and captured knowledge (SLLCK) model for project organizations.', in *9th Project Management Australia Conference (PMOz 2012)*, Eventcorp Pty Ltd, Melbourne, Australia.

Duffield, S & Whitty, SJ 2015a, 'Organisations - Wiring for Capability (Poster presentation)', in *AIPM 2015*, Hobart.

Duffield, S & Whitty, SJ 2015b, 'Developing a systemic lessons learned knowledge model for organisational learning through projects', *International Journal of Project Management*, vol. 33, no. 2, pp. 311-24.

Duffield, S & Whitty, SJ 2016a, 'How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling', *International Journal of Project Management*, vol. 34, no. 3, pp. 429-43.

Duffield, S & Whitty, SJ 2016b, 'Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects', *International Journal of Project Management*, vol. 34, no. 7, pp. 1280-93.

Duhon, H 2009, 'Why We Do not Learn All We Should From HAZOPs', in *SPE Americas, E&P Environmental and Safety Conference*, San Antonio, TX.

Duhon, H & Elias, J 2008, 'Why It Is Difficult To Learn Lessons: Insights from Decision Theory and Cognitive Science', *SPE Projects, Facilities & Construction*, vol. 3, no. 3, pp. 1-7.

Dvir, D & Shenhar, A 2011, 'What great projects have in common', *MIT Sloan Management Review*, vol. 52, 3, pp. 18-21.

Edwards, J, Handzic, M, Carlsson, S & Nissen, M 2003, 'Knowledge management research & practice: visions and directions', *Knowledge Management Research & Practice*, vol. 1, no. 1, pp. 49-60.

EEC 2006, REVISITING THE « SWISS CHEESE » MODEL OF ACCIDENTS, EUROCONTROL EXPERIMENTAL CENTRE, http://publish.eurocontrol.int/eec/gallery/content/public/document/eec/report/2006/017_Swiss_Cheese_Model.pdf>.

Elo, S & Kyngäs, H 2008, 'The qualitative content analysis process', *Journal of Advanced Nursing*, vol. 62, no. 1, pp. 107-15.

Fernie, S, Green, S, Weller, S & Newcombe, R 2003, 'Knowledge sharing: context, confusion and controversy', *International Journal of Project Management*, vol. 21, no. 3, pp. 177-87.

Firestone, J & McElroy, M 2003, *Key Issues in New Knowledge Management*, Elsevier Science, Burlington, MA.

Fong, P 2003, 'Knowledge creation in multidisciplinary project teams: an empirical study of the processes and their dynamic interrelationships', *International Journal of Project Management*, vol. 21, no. 7, pp. 479-86.

Frické, M 2009, 'The knowledge pyramid: a critique of the DIKW hierarchy', *Journal of Information Science*, vol. 35, no. 2, pp. 131-42.

Gabora, L 1997, 'The origin and evolution of culture and creativity', *Journal of Memetics: Evolutionary Models of Information Transmission*, vol. 1, no. 1, pp. 1-28.

Garon, S 2006, 'Space project management lessons learned: a powerful tool for success', *Journal of Knowledge Management*, vol. 10, no. 2, pp. 103-12.

Garvin, D 1993, 'Building a learning organization', *Harvard Business Review*, vol. 71, no. 4, pp. 78-91.

Gasik, S 2011, 'A Model of Project Knowledge Management', *Project Management Journal*, vol. 42, no. 3, pp. 23-44.

Gasik, S 2015, 'An Analysis of Knowledge Management in PMBOK® Guide', *PM World Journal,* vol. IV, no. 1.

Grant, & Qureshi, U 2006, 'Knowledge Management Systems--Why So Many Failures?', in *Innovations in Information Technology, 2006*, IEEE, pp. 1-5.

Greenwood, D & Levin, M 2007, An Epistemological Foundation for Action Research: Introduction to Action Research., SAGE Publications, Inc., Thousand Oaks, CA.

Guba, E. & Lincoln, Y. 1994, *Competing Paradigms in Qualitative Research*, Sage, Thousand Oaks, CA, USA.

Gustavsen, B, Hansson, A & Qvale, TU 2008, 'Action Research and the Challenge of Scope', in P Reason & H Bradbury (eds), *Handbook of Action Research: Participative Inquiry and Practice*, 2nd, SAGE London, pp. 63-76.

Harkema, S 2003, 'A complex adaptive perspective on learning within innovation projects', *Learning Organization, The*, vol. 10, no. 6, pp. 340-6.

Hartmann, A & Dorée, A 2015, 'Learning between projects: More than sending messages in bottles', *International Journal of Project Management*, vol. 33, no. 2, pp. 341-51.

Hasan, H & Handzic, M 2003, *Australian Studies in Knowledge Management,* University of Wollongong Press.

Hayes, J & Maslen, S 2014, 'Knowing stories that matter: learning for effective safety decision-making', *Journal of Risk Research*, vol. 18, no. 6, pp. 714-26.

Heaton, K, Skok, W & Kovela, S 2016, 'Learning lessons from software implementation projects: an exploratory study', *Knowledge and Process Management*.

Hedman, S, Påhlman, L & Törnby, A 2015, 'The Production of Comfort - How Financial Auditors Experience that they Become Comfortable with IT-auditors', Uppsala University.

Herr, K & Anderson, G 2005, The action research dissertation: A guide for students and faculty, Sage Publications.

Hesse-Biber, S & Johnson, R 2013, 'Coming at Things Differently: Future Directions of Possible Engagement With Mixed Methods Research', *Journal of Mixed Methods Research*, vol. 7, no. 2, pp. 103-9.

Hislop, D 2005, Knowledge management in organizations : a critical introduction, Oxford University Press, Oxford ; New York.

Hoegl, M, Parboteeah, KP & Munson, CL 2003, 'Team Level Antecedents of Individuals' Knowledge Networks*', *Decision Sciences*, vol. 34, no. 4, pp. 741-70.

Holian, R & Coghlan, D 2013, 'Ethical issues and role duality in insider action research: Challenges for action research degree programmes', *Systemic Practice and Action Research*, vol. 26, no. 5, pp. 399-415.

Holland, J 1992, 'Complex Adaptive Systems', *Daedalus*, vol. 121, no. 1, pp. 17-30.

Holland, J 1996, Hidden order : how adaptation builds complexity, *Helix books,* Addison-Wesley, Reading, Mass.

Holste, J & Fields, D 2010, 'Trust and tacit knowledge sharing and use', *Journal of Knowledge Management*, vol. 14, no. 1, pp. 128-40.

Hopkins, A 2005, Safety, culture and risk : the organisational causes of disasters, 1st edn, CCH Australia, Sydney, N.S.W.

Huang, J & Newell, S 2003, 'Knowledge integration processes and dynamics within the context of cross-functional projects', *International Journal of Project Management*, vol. 21, no. 3, pp. 167-76.

ISO 2015, ISO 9001:2015(E) Quality Management systems -- Requirements, www.iso.org, Switzerland.

Jassbi, A., Jassbi, J., Akhavan, P., Chu, M.-T., Piri, M., 2015. An empirical investigation for alignment of communities of practice with organization using fuzzy Delphi panel. *VINE*, 45, pp. 322-343.

Johnson-Laird, P 1983, Mental models : towards a cognitive science of language, inference, and consciousness, *Cognitive science series 6,* Harvard University Press, Cambridge, Mass.

Johnson, R, Onwuegbuzie, A & Turner, L 2007, 'Toward a definition of mixed methods research', *Journal of Mixed Methods Research*, vol. 1, no. 2, pp. 112-33.

Jugdev, K 2012, 'Learning from Lessons Learned: Project Management Research Program', *American Journal of Economics and Business Administration*, vol. 4, no. 1, pp. 13-22.

Julian, J 2008, 'How project management office leaders facilitate cross-project learning and continuous improvement', *Project Management Journal*, vol. 39, no. 3, pp. 43-58.

Kaszás, N, Keller, K & Birkner, Z 2016, 'The Role of Transferring Knowledge in Case of Non-Business Sector Projects', *Procedia-Social and Behavioral Sciences*, vol. 221, pp. 226-35.

Keegan, A & Turner, J 2001, 'Quantity versus Quality in Project-Based Learning Practices', *Management Learning*, vol. 32, no. 1, pp. 77-98.

Keegan, B & Griner, C 2000, *Enhancing Mission Success – A Framework for the Future* (A Report by the NASA Chief Engineer and the NASA Integrated Action Team), viewed 25 March 2012 <http://history.nasa.gov/niat.pdf>.

Keen, P & Tan, M 2007, 'Knowledge fusion: A framework for extending the rigor and relevance of knowledge management', *International Journal of Knowledge Management*, vol. 3, no. 4, pp. 1-17.

Kemmis, S & McTaggart, R 2000, 'Participatory Action Research', in N Denzin & Y Lincoln (eds), *The SAGE Handbook of Qualitative Research*, 2nd, SAGE, California, pp. 567-606.

Kemmis, S, McTaggart, R & Nixon, R 2014, The Action Research Planner: Doing Critical Participatory Action Research, Springer.

Kerzner, H 2009, Project Management: *A Systems Approach to Planning, Scheduling, and Controlling,* 10th edn, John Wiley & Sons, Hoboken, N.J.

Keshavarz, N, Nutbeam, D & Rowling, L 2010, 'Social complex adaptive systems. A response to Haggis', *Social Science & Medicine*, vol. 70, no. 10, pp. 1478-9.

Kim, J., Song, J., Jones, D., 2011. The cognitive selection framework for knowledge acquisition strategies in virtual communities. *International Journal of Information Management*, 31, 111-120.

Klakegg, O, Williams, T, Walker, D, Andersen, B & Magnussen, O 2010, Early Warning Signs in Complex Projects., Project Management Institute Inc, Newtown Square, Pennsylvania.

Koners, U 2005, 'Learning from research and development projects/the role of post-project reviews', Cranfield University.

Kotnour, T & Vergopia, C 2005, 'Learning-Based Project Reviews: Observations and Lessons Learned from the Kennedy Space Center', *Engineering Management Journal*, vol. 17, no. 4, pp. 30-8.

Krammer, C 2010, *Knowledge Management in Project Management*, VDM Verlag Dr. Muller GmbH & Co. KG.

Kumar, M 2012, 'Use of Action Research to Institutionalize Organizational Learning Within TQM', *Quality Management Journal*, vol. 19, no. 3, pp. 51-68.

Lambe, P 2014, 'Knowledge Management Special Issue: Connecting Theory And Practice', *Journal of Entrepreneurship Management and Innovation* (JEMI),, vol. 10, no. 1.

Lange, T. (2206), "The creation and management of knowledge: what can we learn from applying the principles of economics?", *International Journal of Knowledge Management Studies*, Vol. 1 Nos 1/2, pp. 7-17.

Leal-Rodríguez, A, Roldán, J, Ariza-Montes, J & Leal-Millán, A 2014, 'From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context', *International Journal of Project Management*, vol. 32, no. 6, pp. 894-907.

Lee, L., Reinicke, B., Sarkar, R., Anderson, R. 2015. Learning Through Interactions: Improving Project Management Through Communities of Practice. *Project Management Journal*, 46.

Leistner, F 2010, Mastering organizational knowledge flow how to make knowledge sharing work, *Wiley & SAS business series,* John Wiley & Sons, Hoboken, N.J.

Leonard-Barton, D 1995, 'Wellsprings of knowledge: Building and sustaining the sources of innovation'.

Lewin, K 1946, 'Action research and minority problems', *Journal of Social Issues*, vol. 2, no. 4, pp. 34-46.

Li, A 2001, GAO-01-1015R *Survey of NASA's Lessons Learned Process*, Washington DC, GAO-01-1015R.

Li, A 2002, GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned, Washington, DC.

Liebowitz, J & Megbolugbe, I 2003, 'A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives', *International Journal of Project Management*, vol. 21, no. 3, pp. 189-98.

Lincoln, Y & Guba, E 1985, *Naturalistic Inquiry*, SAGE, California.

Lindner, F & Wald, A 2011, 'Success factors of knowledge management in temporary organizations', *International Journal of Project Management*, vol. 29, no. 7, pp. 877-88.

Lipshitz, R, Popper, M & Friedman, V 2007, *Demystifying organizational learning*, SAGE Publications, Thousand Oaks, CA.

Lotti-Oliva, F 2014, 'Knowledge management barriers, practices and maturity model', *Journal of Knowledge Management*, vol. 18, no. 6, pp. 1053-74.

Love, P, Edum-Fotwe, F & Irani, Z 2003, 'Management of knowledge in project environments', *International Journal of Project Management*, vol. 21, no. 3, pp. 155-6.

Love, P, Fong, P & Irani, Z 2005, Management of knowledge in project environments, Elsevier/Butterworth-Heinemann, <http://ezproxy.usq.edu.au/login?url=http://www.USQ.eblib.com.au/EBLWeb/patron?target=patron&extendedid=P_269932_0&>.

Love, P, Teo, P, Davidson, M, Cumming, S & Morrison, J 2016, 'Building absorptive capacity in an alliance: Process improvement through lessons learned', *International Journal of Project Management*, vol. 34, no. 7, pp. 1123-37

Lucier, C 2003, 'When knowledge adds up to nothing - Why knowledge management fails and what you can do about it', *Development and Learning in Organizations*, vol. 17, no. 1, pp. 32-5.

Macrae, C 2014, Close Calls: Managing Risk and Resilience in Airline Flight Safety, Palgrave Macmillan.

Madden, J, R 1996, One Hundred Rules for NASA Project Managers.

Maier, E, Bruns, W, Eschenbach, S & Reimer, U 2016, 'Experience–the neglected success factor in enterprises?'.

Maqsood, T 2006, 'The Role of Knowledge Management in Supporting Innovation and Learning in Construction', RMIT University.

Maqsood, T, Walker, D & Finegan, A 2004, 'Project histories and project learning–a knowledge management challenge', in *20th Annual ARCOM Conference*, Association of Researchers in Construction Management, Heriot Watt University, pp. 561-70.

Marshall, P, de Salas, K & McKay, J 2006, 'Action research in practice: balancing the dual imperatives', *ACIS 2006 Proceedings*, p. 10.

Marshall, P, Wilson, P, de Salas, K & McKay, J 2010, 'Action research in practice: issues and challenges in a financial services case study', *The Qualitative Report*, vol. 15, no. 1, pp. 76-93.

Mau, M 2005, 'Action research: Connecting knowledge in the Australian public sector organization', *actKM Online Journal of Knowledge Management*, vol. 2, no. 1, pp. 58-69.

Mayoh, J & Onwuegbuzie, A 2013, 'Toward a Conceptualization of Mixed Methods Phenomenological Research', *Journal of mixed methods research*.

McElroy, M 2003, The new knowledge management: Complexity, learning, and sustainable innovation, Routledge.

McKay, J & Marshall, P 1999, 'A Framework for Rigour in Action Research', in *Americas Conference on Information Systems (AMCIS)*, .

McKay, J & Marshall, P 2001, 'The dual imperatives of action research', *Information Technology & People*, vol. 14, no. 1, pp. 46-59.

McNiff, J & Whitehead, J 2011, *All you need to know about Action Research*, 2nd edn, SAGE, London.

McTaggart, R 2005, 'Is Validity Really an Issue for Participatory Action Research?', in B Cooke & JW Cox (eds), *Fundamentals of Action Research:* , SAGE London, vol. Volume III Social Change Applications, The Practitioner, and Action Research Knowledge, pp. 395-421.

Melrose, M 2001, 'Maximizing the rigor of action research: why would you want to? How could you?', *Field Methods*, vol. 13, no. 2, pp. 160-80.

Mertler, C 2013, Action Research: Improving Schools and Empowering Educators, SAGE.

Meyer, M & Zack, M 1996, 'The design and development of information products', *Sloan Management Review*, vol. 37, no. 3, p. 43.

Midha, A 2005, 'How to Incorporate "Lessons Learned" for Sustained Process Improvements', in *NDIA CMMI Technology conference*: *Proceedings of the NDIA CMMI Technology conference*.

Miles, M & Huberman, M 1994, *Qualitative Data Analysis: An Expanded Sourcebook*, Sage Publications., Thousand Oaks, CA.

Milton, N 2005, *Knowledge Management For Teams and Projects,* Chandos Publishing, Oxford.

Milton, N 2010, The Lessons Learned Handbook: Practical Approaches To Learning From Experience, Chandos Publishing, Oxford, UK.

Ministry of Defence, *Major Projects Report: Overview & Assessment,* 2010, NZDF Ministry of Defence, and the Office of the Auditor-General., Ministry of Defence, Wellington.

Mayoh, J., & Onwuegbuzie, A. J. 2013, Toward a conceptualization of mixed methods phenomenological research. *Journal of Mixed Methods Research*, 1558689813505358.

NASA 2011a, *The Deepwater Horizon Accident: Lessons for NASA*, Academy of Program/Project & Engineering Leadership, viewed 9 April 2012, <http://www.nasa.gov/pdf/592629main_BP_Case_Study_29AUG2011_FINAL.pdf>.

NASA 2011b, *LPR 7120.6 Lessons Learned Process for Sustained Process Improvements*, Revised: March 8 2011, ED: December 22 2010, Langley Research Center, LPR 7120.6.

NASA 2014, *Masters with Masters: The Ongoing Evolution of Lessons Learned at NASA*, NASA APPEL News, viewed 1 November, <http://appel.nasa.gov/2014/10/27/masters-with-masters-the-ongoing-evolution-of-lessons-learned-at-nasa/>.

Neef, D 2005, 'Managing corporate risk through better knowledge management', *Learning Organization, The*, vol. 12, no. 2, pp. 112-24.

Nonaka, I 1991, 'The Knowledge-Creating Company', in *Harvard Business Review on Knowledge Management*, 1998, Harvard Business School Publishing, Boston.

Nonaka, I 1994, 'A dynamic theory of organizational knowledge creation', *Organization science*, vol. 5, no. 1, pp. 14-37.

Nonaka, I 2007, 'The knowledge-creating company', *Harvard Business Review*, vol. 85, no. 7/8, p. 162.

Nonaka, I & Takeuchi, H 1995, The knowledge-creating company: How Japanese companies create the dynamics of innovation, *Oxford University Press,* Oxford University Press, Inc, New York.

Nonaka, I & Kono, N 1998, 'The Concept of Ba: Building a Foundation for Knowledge Creation', *California Management Review*, vol. 40, no. 3, pp. 40-54.

Norris, N 1997, 'Error, bias and validity in qualitative research', *Educational Action Research*, vol. 5, no. 1, pp. 172-6.

Nousala, S, Hall, W & John, S 2007, 'Transferring tacit knowledge in extended enterprises', pp. 25-8.

Nousala, S, Miles, A, Kilpatrick, B & Hall, WP 2009, 'Building knowledge sharing communities using team expertise access maps', *International Journal of Business and Systems Research*, vol. 3, no. 3, pp. 279-96.

O'Dell, C & Grayson, C 1997, '*Identifying and Transferring Internal Best Practices*', in APQC (ed.), APQC, Houston, ch 31.

O'Dell, C & Hubert, C 2011, The new edge in knowledge : how knowledge management is changing the way we do business, John Wiley & Sons, New Jersey.

O'Dell, C, Grayson, C & Essaides, N 1998, If only we knew what we know : the transfer of internal knowledge and best practice, Free Press, New York.

O'Dell, C, Elliott, S & Hubert, C 2000, 'Achieving Knowledge Management Outcomes', in APQC (ed.), *Successfully Implementing Knowledge Management*, APQC, Houston, ch 44.

O'Dell, C, Dixon, N, Szulanski, G, Leavitt, P & Skogstad, E 2004, *Facilitated transfer of best practices Consortium Learning Forum best-practice report*, Consortium Learning Forum best-practice report, American Productivity & Quality Center, Houston, Tex. viewed 14 November 2016,

http://ezproxy.usq.edu.au/login?url=http://library.books24x7.com/library.asp?^B &bookid=9679.

Office of Inspector General, Review of NASA's Lessons Learned Information System, IG-12-012 2012, NASA Office of Inspector General, Washington, DC.

OGC 2009, Managing Successful Projects with PRINCE2, TSO, London.

Orr, M 2006, '*The Implementation of Electronic Health Knowledge Management Systems*', Southern Cross University, Southern Cross University Press, Lismore.

Orr, M & Sankaran, S 2007, 'Mutual empathy, ambiguity, and the implementation of electronic knowledge management within the complex health system', *Emergence: Complexity & Organization*, vol. 9, no. 1-2, pp. 44-55.

Pasher, E & Ronen, T 2011, The complete guide to knowledge management a strategic plan to leverage your company's intellectual capital, John Wiley & Sons, Hoboken, N.J.

Pässilä, A, Oikarinen, T & Kallio, A 2013, 'Creating dialogue by storytelling', *Journal of Workplace Learning*, vol. 25, no. 3, pp. 159-77.

Patton, M 1990, *Qualitative Evaluation and Research Methods*, 2nd edn, SAGE Newbury Park, California.

Peet, M 2012, 'Leadership transitions, tacit knowledge sharing and organizational generativity', *Journal of Knowledge Management*, vol. 16, no. 1, pp. 45-60.

Pemsel, S & Wiewiora, A 2013, 'Project management office a knowledge broker in project-based organisations', *International Journal of Project Management*, vol. 31, no. 1, pp. 31-42.

Pettersson, U & Nyce, J 2011, 'Hierarchy and Tacit Knowledge in the Swedish Armed Forces: An Organisational Approach', in *Proceedings of the European Conference on Intellectual Capital, 2011* pp. 328-32.

Pickard, A 2013, *Research Methods in Information*, 2nd edn, Facet, London.

Pinho, I, Rego, A & Cunha, M 2012, 'Improving knowledge management processes: A hybrid positive approach', *Journal of Knowledge Management*, vol. 16, no. 2, p. 3.

Polanyi, M 1958, *Personal knowledge; towards a post-critical philosophy*, University of Chicago Press, Chicago,.

Polanyi, M 2009, *The tacit dimension* (Michael Polanyi ; with a new foreword by Amartya Sen.), University of Chicago Press, Chicago ; London.

Project Management Institute 2004, *A guide to the project management body of knowledge (PMBOK® Guide),* 3rd edn, Project Management Institute Inc., Newtown Square, Pa.

Project Management Institute 2008a, *A guide to the project management body of knowledge (PMBOK® Guide)*, 4th edn, Project Management Institute Inc., Newtown Square, Pa.

Project Management Institute 2008b, *Organizational Project Management Maturity Model (OPM3®)*, 2nd edn, Project Management Institute Inc., Newtown Square, Pa.

Project Management Institute 2013, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 5th edn, PMI Inc., Newtown Square, Pa.

Project Management Institute 2015, *Capturing the value of project management through knowledge transfer*, Project Management Institute, Newtown Square, PA USA

Project Management Institute 2016, Exposure Draft - PMBOK® Guide-Sixth Edition (standard section) Exposure Draft, 6th edn, PMI Inc., Newtown Square, Pa.

Prusak, L 2011, 'Foreword', in C O'Dell & C Hubert (eds), *The New Edge in Knowledge*, Wiley & Sons, New Jersey.

Prusak, L 2015, 'Introduction: Improving performance through knowledge', in Project Management Institute (ed.), *Capturing the Value of Project Management Through Knowledge Transfer*, Project Management Institute, Newtown Square, PA USA.

Pugh, K 2011, Sharing hidden know-how : how managers solve thorny problems with the knowledge jam, *J-b us non-franchise leadership,* 1st edn, Jossey-Bass, San Francisco, CA.

Quintana-Amate, S, Bermell-Garcia, P & Tiwari, A 2015, 'Transforming expertise into Knowledge-Based Engineering tools: A survey of knowledge sourcing in the context of engineering design', *Knowledge-Based Systems.*

Raelin, J 1998, 'Work-based learning in practice', *Journal of Workplace Learning*, vol. 10, no. 6/7, pp. 280-3.

Raelin, J 2000, *Work-based learning: the new frontier of management development*, Addison-Wesley series on organization development, Prentice Hall, Upper Saddle NJ.

Raelin, J 2001, 'Public Reflection as the Basis of Learning', Management Learning, vol. 32, no. 1, pp. 11-30.

Ragsdell, G 2009, 'Participatory action research: a winning strategy for KM', *Journal of Knowledge Management*, vol. 13, no. 6, pp. 564-76.

Reason, J 1997, *Managing the Risks of Organizational Accidents*, Ashgate, Aldershot, Hants, England; Brookfield, Vt., USA.

Reason, J 2000, 'Human error: models and management', *British Medical Journal*, vol. 320, no. 7237, p. 768.

Reason, P & Bradbury, H 2001, Handbook of action research: Participative inquiry and practice, Sage.

Reich, B & Wee, S 2006, 'Searching for knowledge in the PMBOK guide', *Project Management Journal*, vol. 37, no. 2, pp. 11-26.

Reich, B, Gemino, A & Sauer, C 2008, 'Modeling the knowledge perspective of IT projects', *Project Management Journal*, vol. 39, pp. S4-S14.

Richards, L 2009, Handling qualitative data: A practical guide, 2nd edn, Sage, London.

Riege, A 2005, 'Three-dozen knowledge-sharing barriers managers must consider', *Journal of Knowledge Management*, vol. 9, no. 3, pp. 18-35.

Rolstadås, A & Schiefloe, P 2017, 'Modelling Project Complexity', *International Journal of Managing Projects in Business*, vol. 10, no. 2

Rowley, J 2007, 'The wisdom hierarchy: representations of the DIKW hierarchy', *Journal of Information Science*, vol. 33, no. 2, pp. 163-80.

Sankaran, S 2009, 'Applying action research to conduct practitioner research in knowledge management', in J Xu (ed.), *Enhancing organisational capability through knowledge management*, Southern Cross University Press, Lismore, pp. 23-40.

Sankaran, S, Tay, B & Orr, M 2009, 'Managing organizational change by using soft systems thinking in action research projects', *International Journal of Managing Projects in Business*, vol. 2, no. 2, pp. 179-97.

Saunders, F 2015, 'Toward High Reliability Project Organizing in Safety-Critical Projects', *Project Management Journal*, vol. 46, no. 3, pp. 25-35.

Savolainen, P & Ahonen, J 2015, 'Knowledge lost: Challenges in changing project manager between sales and implementation in software projects', *International Journal of Project Management*, vol. 33, no. 1, pp. 92-102.

Schindler, M & Eppler, M 2003, 'Harvesting project knowledge: a review of project learning methods and success factors', *International Journal of Project Management*, vol. 21, no. 3, pp. 219-28.

Senge, P 1990, The Fifth Discipline, The Art & Practice of the Learning Organization, Revised Edition, 2006 edn, Doubleday New York.

Sense, A 2007, 'Learning within project practice: Cognitive styles exposed', *International Journal of Project Management*, vol. 25, no. 1, pp. 33-40.

Shergold, P, 2015, Learning from Failure: Why large government policy initiatives have gone so badly wrong in the past and how the chances of success in the future can be improved., APSC, Australian Public Service Commission

Simon, H 1991, 'Bounded Rationality and Organizational Learning', *Organization science*, vol. 2, no. 1, pp. 125-34.

Smith, P 2001, 'Action Learning and Reflective Practice in Project Environments that are Related to Leadership Development', *Management Learning*, vol. 32, no. 1, pp. 31-48.

Snowden, D 2002, 'Complex acts of knowing: paradox and descriptive self-awareness', *Journal of Knowledge Management*, vol. 6, no. 2, pp. 100-11.

Srikantaiah, T, Koenig, M & Hawamdeh, S 2010, *Convergence of Project Management and Knowledge Management,* Scarecrow Press.

Standards Australia 2005, *Knowledge management - a guide*, *AS 5037-2005,* 2nd edn, Standards Australia, Sydney.

Stastny, P & Garin, A 2004, A Roadmap to a Just Culture: Enhancing the Safety Environment, GAIN Working Group E.

Strang, K 2003, 'Organizational Learning Across Projects', in *PMI Global Congress 2003*, PMI, Baltimore.

Suppiah, V & Sandhu, M 2011, 'Organisational culture's influence on tacit knowledge-sharing behaviour', *Journal of Knowledge Management*, vol. 15, no. 3, pp. 462-77.

Susman, G & Evered, R 1978, 'An assessment of the scientific merits of action research', *Administrative Science Quarterly*, pp. 582-603.

Thomas, D 2006, 'A general inductive approach for analyzing qualitative evaluation data', *American Journal of Evaluation*, vol. 27, no. 2, pp. 237-46.

Thomas, W 2012, The basics of project evaluation and lessons learned, CRC Press, Boca Raton, FL.

Vala-Webb, G 2012, 'The DIKW Pyramid Must Die', in *KM World*, http://www.kmworld.com/, Washington, DC viewed 7 April 2013, <.

van der Hoorn, B & Whitty, SJ 2015, 'Signs to dogma: A Heideggerian view of how artefacts distort the project world', *International Journal of Project Management*, vol. 33, no. 0.

van der Hoorn, B, Duffield, S & Whitty, SJ forthcoming, 2016, 'A 'lived experienced' tool for managing and building project delivery capability', in *ANZAM*: *Proceedings of the ANZAM* Brisbane 6-9 December 2016.

Van der Spek, R & Spijkervet, A 1997, 'Knowledge management: dealing intelligently with knowledge', *Knowledge management and its integrative elements*, pp. 31-59.

Van Gigch, J 1991, System design modeling and metamodeling, *The Language of science,* Plenum Press, New York.

Virolainen, T 2014, '*Learning from projects: a qualitative metasummary*', Lappeenranta University of Technology.

Von Zedtwitz, M 2002, 'Organizational learning through post–project reviews in R&D', *R&D Management*, vol. 32, no. 3, pp. 255-68.

Walker, B & Haslett, T 2005, 'Action Research in Management: Ethical Dilemmas', in B Cooke & JW Cox (eds), *Fundamentals of Action Research Volume II*, SAGE, London, vol. II, ch 57, pp. 287-98.

Walker, D 2015, 'Risk Managing Complex Projects through Alliancing', *The Journal of Modern Project Management*, vol. 2, no. 3.

Walker, S 2007, What are the Major Barriers to the Successful Implementation of Knowledge Management Projects in the Telecommunications Industry?: A Participatory Action Research Study, Southern Cross University.

Walker, S & Sankaran, S 2014, 'A participatory action research study of knowledge management implementation in a large European telecommunication company in their UK office', *Gibaran Journal of Applied Management*, vol. 6, no. 2, pp. 36-63.

Walsh, J & Ungson, G 1991, 'Organizational Memory', *Academy of Management Review*, vol. 16, no. 1, pp. 57-91.

Weick, K 2012, Making sense of the organization, Volume 2: The impermanent organization, vol. 2, John Wiley & Sons.

Wenger, E, McDermott, R & Snyder, W 2002, Cultivating communities of practice: A guide to managing knowledge, *Harvard Business* Press, Boston, Massachusetts.

White, C, *Knowledge Management: A high level mind map,* 2010, JPL NASA, California Institute of Technology, California Institute of Technology.

Whitty, SJ 2005, 'A memetic paradigm of project management', *International Journal of Project Management*, vol. 23, no. 8, pp. 575-83.

Whitty, SJ 2009, 'New philosophy of project management: an investigation into the prevalence of modern project management by means of an evolutionary framework (presented at Univ. of Qld)'.

Whitty, SJ 2011, 'On a new philosophy of project management: An investigation into the prevalence of modern project management by means of an evolutionary framework', *International Journal of Managing Projects in Business*, vol. 4, no. 3, pp. 524-33.

Whitty, SJ 2015, *Executive Insights - Powering up your capability with the Syllk Model*, University of Southern Queensland, viewed 29 October 2015, <https://www.youtube.com/watch?v=snlStqmXVPY>.

Whitty, SJ & Maylor, H 2009, 'And then came Complex Project Management (revised)', *International Journal of Project Management*, vol. 27, no. 3, pp. 304-10.

Wideman, R 2011, '*On the August PMWT Editorial on Lessons Learned by Knowledge Lost*', *PM World Today*, viewed 5 September 2011, <http://www.pmworldtoday.net/letters/2011/sep/LETTER-Wideman.html>.

Wiig, K 1993, 'Knowledge Management Foundations: thinking about-how people and organizations create, represent, and use knowledge', *Arlington, Texas: Schema*.

Wiig, K 1997, 'Knowledge management: an introduction and perspective', *Journal of Knowledge Management*, vol. 1, no. 1, pp. 6-14.

Williams, T 2007, *Post-Project Reviews to Gain Effective Lessons Learned*, Project Management Institute, Newtown Square, USA, viewed 18 April 2017, <http://library.books24x7.com.ezproxy.usq.edu.au/toc.aspx?site=JE61N&bookid=24212>.

Williams, T 2008, 'How do organisations learn lessons from projects–and do they?', *IEEE Transactions in Engineering Management*, vol. 55, no. 2, pp. 248-66.

Williams, T 1999, 'The need for new paradigms for complex projects', *International Journal of Project Management*, vol. 17, no. 5, pp. 269-73.

Wilson, T 2002, 'The nonsense of knowledge management', *Information Research*, vol. 8, no. 1.

Wysocki, R 2004, Project management process improvement, *Artech House Effective Project Management Series,* Artech House, Boston.

Zhao, L, Lu, Y, Wang, B, Chau, PYK & Zhang, L 2012, 'Cultivating the sense of belonging and motivating user participation in virtual communities: A social capital perspective', *International Journal of Information Management*, vol. 32, no. 6, pp. 574-88.

Zhao, D, Zuo, M & Deng, X 2015, 'Examining the factors influencing cross-project knowledge transfer: An empirical study of IT services firms in China', *International Journal of Project Management*, vol. 33, no. 2, pp. 325-40.

Zuber-Skerritt, O & Perry, C 2002, 'Action research within organisations and university thesis writing', *Learning Organization, The*, vol. 9, no. 4, pp. 171-9.

11. APPENDICES

11.1. Appendix A: A Systemic lessons learned and captured knowledge (SLLCK) model

11.1.1. Conceptual model iterations
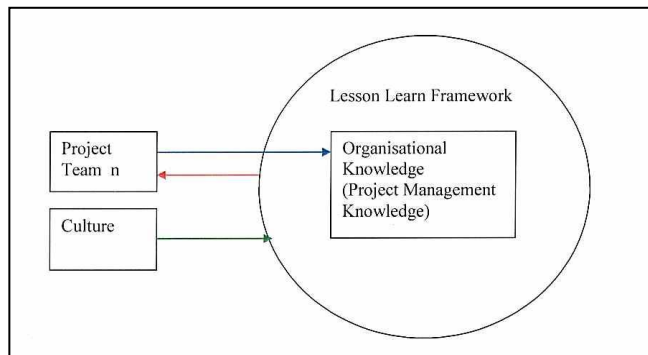
Figure A-1 Early model iteration v1
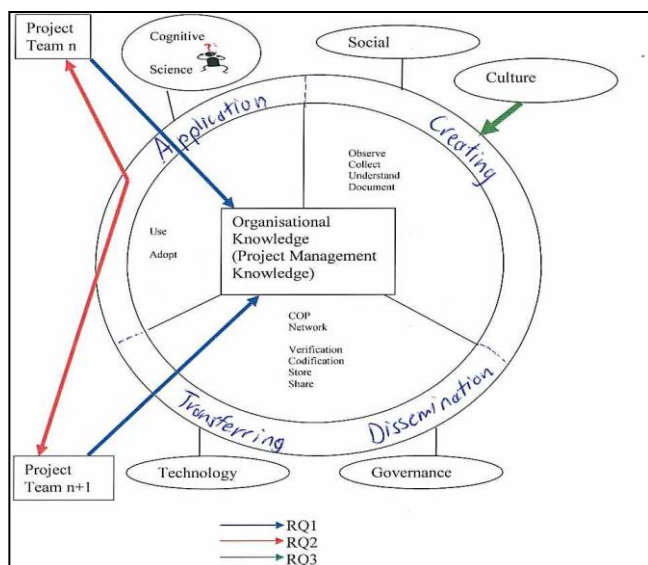
Figure A-2 Early model iteration v2
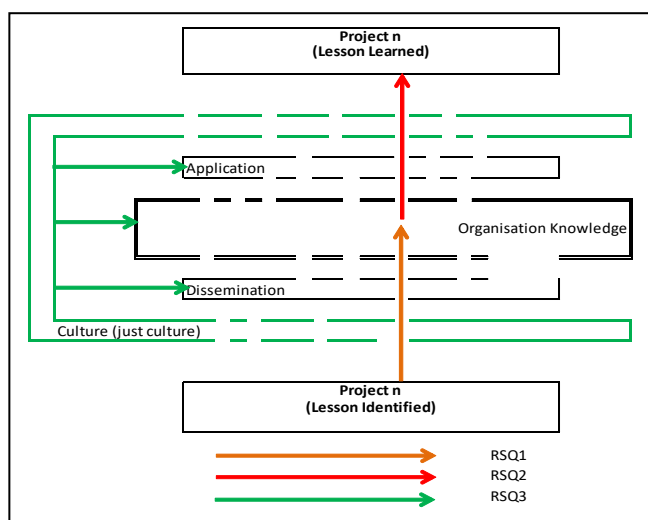
Figure A-3 Early model iteration v3
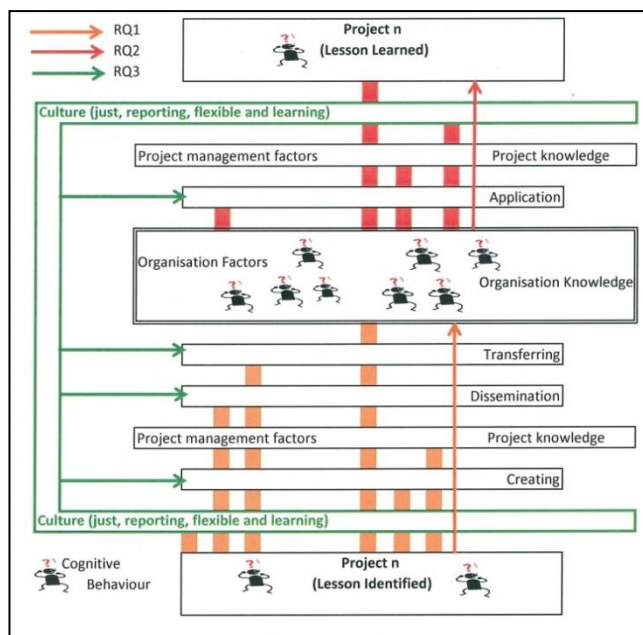
Figure A-4 Early model iteration v4
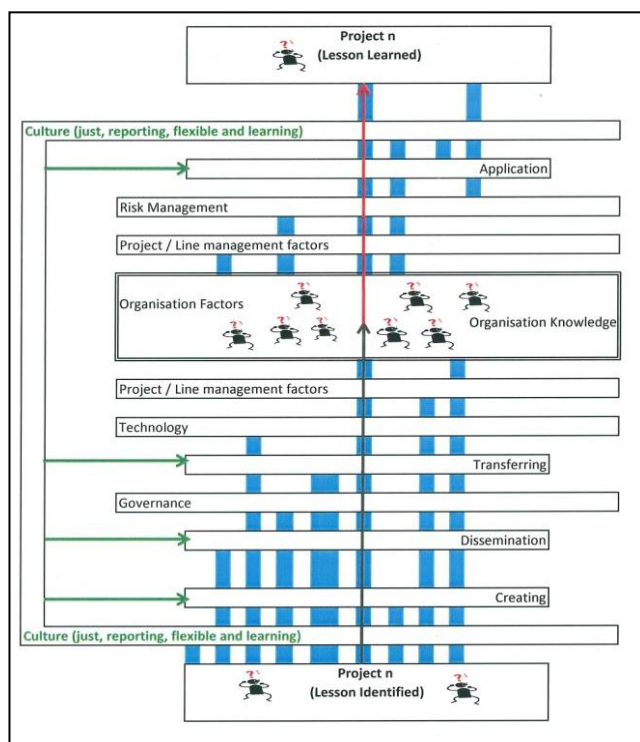
Figure A-5 Early model iteration v5
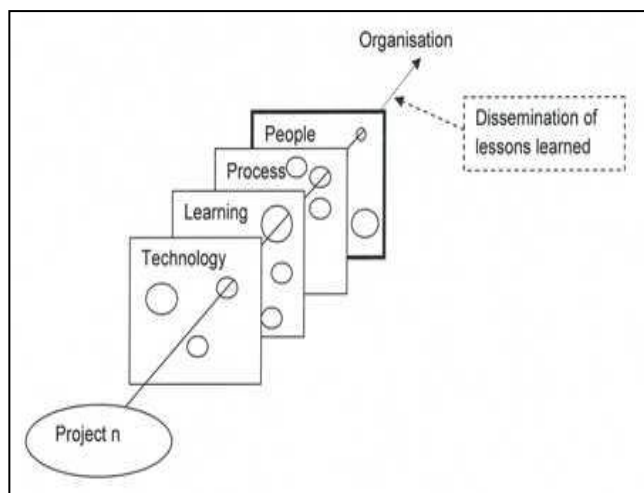
Figure A-6 Preliminary lessons learned model
Source: (Duffield & Whitty 2012)
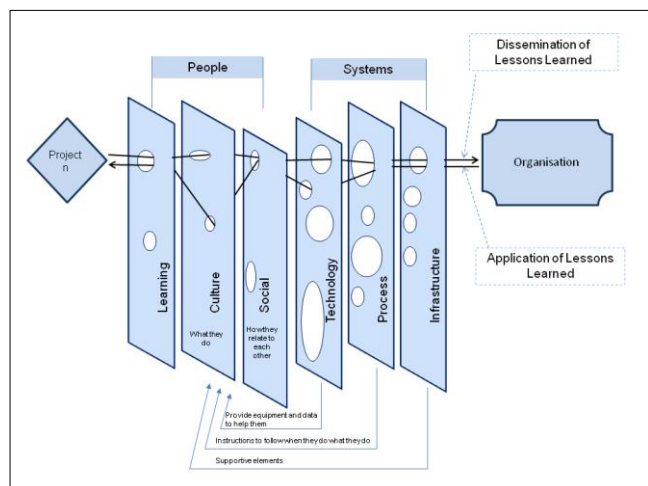
Figure A-7 Systemic lessons learned and captured knowledge (SLLCK) model
Source: (Duffield & Whitty 2012)

11.1.2. A Systemic lessons learned and captured knowledge (SLLCK) model for project organizations

A systemic lessons learned and captured knowledge (SLLCK) model for project organizations.

Stephen Duffield [a*], Dr Jon Whitty [b]

[a] Master of Project Management Research Student, University of Southern Queensland, Springfield Campus, Queensland, 4300 Australia

[b.] Senior Lecturer in Project Management, University of Southern Queensland, Springfield Campus, Queensland, 4300 Australia

Abstract

A significant challenge for government and business project organisations is to ensure that lessons are learned and that mistakes of the past are not repeated. Both the knowledge and project management literature suggests that the lessons learned process in practice rarely happens, and when it does it fails to deliver the intended results. This paper proposes a conceptual systemic project management lessons learned and captured knowledge model derived from the Swiss cheese model for safety and systemic failures, where captured knowledge from lesson learned is distributed and applied across a network of variables such as individual learning, culture, social, technology, process and infrastructure.

Keywords: Project Knowledge Management, Lessons Learned, Learning, Culture

Introduction

There is a government and business need to successfully manage programs and projects, to learn from success and failure, and to capture, disseminate and apply lessons learned [1-4]. The PMI's Project Management Body of Knowledge (PMBOK® Guide) [5] identifies the importance of collecting and documenting lessons learned and implementing process improvements. The PMBOK® Guide knowledge areas also reference the lessons learned process. However, in practice organisational learning from projects rarely happens and when it does it fails to deliver the intended results [6-13].

In this paper we present a research project that has developed and validated a systemic lessons learned and captured knowledge (SLLCK (pronounced Silk)) model, and identified some of the facilitators and barriers to capturing knowledge from lessons learned by projects. In the literature review we provide a broad examination of the key elements of knowledge, people and systems in the context of lessons learned. Next we introduce the SLLCK model and describe its development from the literature. We then present the method and findings of the validation study and a revised SLLCK model is proposed. Finally we discuss the findings within the framework of the literature and speculate on practical applications and future research opportunities.

Literature review

The scope of the literature review is contained to what is known about the efficacy of current organisational lessons learned processes and the nature of organisational knowledge and how it is constituted from the accumulation of individual knowledge and distributed through a living network that comprises individual relationships and social, cultural, and organisational practices and processes.

On lessons learned

The dissemination and application of project management lessons learned is critical to organisational programs and projects achieving success [14]. Williams [11, p262] identifies that there is a need for "...wider research into how lessons can be disseminated throughout an organization and incorporated into organizational practice".

Overall there is a significant dissatisfaction with lessons learned processes as they are. Milton [9] has found that out of 74 organisations that attempted lessons learned, 60 per cent were dissatisfied. Williams [15] found that 62 per cent of 522 project practitioner responses had a process for learning lessons and of those only 11.7 per cent followed the process. Furthermore, O'Dell and Hubert [16] found that whilst the lessons learned process is popular, it fails to deliver the intended results as lessons are identified and are often not followed through and applied within the organisation.

Institutions such as NASA also have issues surrounding lessons learned. Following reviews in 2000 of NASA's Mars Program, Space Shuttle wiring problems and the implementation of NASA's 'Faster, Better, Cheaper (FBC) project, NASA implemented action plans to improve sharing of experiences and lessons learned [17, 4]. In 2002 the Government Accountability Office found that NASA lessons learned were not routinely identified, reviewed and accessed by project managers [1]. A recent 2012

Corresponding Author: Stephen Duffield email: sduffiel@optusnet.com.au

NASA Office of Inspector General audit report highlights that NASA project managers are still not routinely using the lessons learned information system (LLIS) to contribute new information or to search for lessons learned identified by others [4].

A review of the BP Deepwater Horizon accident investigation revealed how lessons learned of previous "well control event incidents" and "lines of communication" were not acknowledge or addressed and was a contributing cause to the failure [18, 19]. NASA today uses the BP Deepwater Horizon incident as a lessons learned case study paying particular attention to communication deficiencies around government oversight, disregard of data, testing, changes to process, safety culture and lessons learned from previous incidents [20].

There are few signs that any lessons are being learnt in the public sector [21]. For example the Australian State Victorian Government Ombudsman examined 10 major ICT business transformation projects during 2011 and identified that despite the extensive guidance, reports and literature available, agencies are still making the same mistakes around planning, governance, project management and procurement.

On knowledge

To identify with organisational lessons learned one needs to understand what organisational knowledge is. Today, in the context of the organisation, knowledge exploration is attributed to Drucker [22] (knowledge as management resource and power), Wiig [23] (knowledge as a form of belief), Polanyi [24, 25] (distinction between tacit and explicit knowledge) and Davenport and Prusak [26, p5]:

> Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. …In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

Polanyi's [24] work formed the foundation for Knowledge Management (KM) theory authors Nonaka and Takeuchi [27, 28]. Tacit knowledge is subjective, environment-specific, personal, and is difficult to communicate. Explicit or codified knowledge is objective, easily communicated and transferred without in depth experience [27]. Polanyi [25, p4] stated "...we can know more than we can tell" and contends that humans create knowledge by involving themselves with objects through a process. Nonaka and Takeuchi [27] propose that tacit knowledge consists of cognitive and technical elements. The cognitive element is based on Johnson-Laird [29] "mental models" (schemata, paradigms, perspectives, beliefs and viewpoints) where humans

create working models of the world in their minds. The technical element is the existing know how and skills.

On networks

The term network is used to describe how the component parts of an emergent useful phenomenon are connected together. Two key examples of what are described as complex adaptive networks that are associated with knowledge distribution are human cultures and the human brain [30, 31]. That is to say that knowledge is not to be found stored in some way in one spot, but rather it is distributed across a network of interconnected component parts.

Projects and organisations are often described as complex adaptive systems which evolve through adaptive exploration and the transformation of information [31-34]. Gabora [31] and Whitty [35, 30] both describe the connection of biological structures and cultural ideas and practices and how they evolve through selection and transmission and the implications for human behaviour with complex adaptive systems such as organisation.

Kaeshavarz et al. [36] and Holland [37] further describe such social complex adaptive systems as comprising individuals and organisations, and as having a distributed network of control rather than a central point of control. Furthermore, Holland [38, p25] point out how complex adaptive system rely on "parallelism, competition and recombination" to adapt to new information within a system. Moreover, Bullmore and Sporns [39] describe the structural and functional makeup of complex networks such as the human brain to comprise nodes, clusters, hubs and module parameters. Human knowledge therefore, which extends beyond the human brain, is not only stored as interconnected cells within the brain [39, 30], but it is also stored across for example organisational cultural artefacts, rituals, and practices [40], that are also interconnected, or for want of another term – networked.

On people

Duhon and Elias [41] reports that failure of learning valuable lessons from projects can be connected to the learning, cultural and social people factors. Maqsood [42], and Duhon and Elias [41] both highlight the need to understand cognitive psychology when examining the effectiveness of tacit knowledge in the learning process. Maqsood [42] further reports that every person has a distinctive learning technique and that learning depends on an individual's capability to effectively acquire and use in a timely manner. Duhon and Elias [41, p1] describe learning as "...any increase in knowledge or skills that enables the learner to be more effective" in achieving their objectives.

Corresponding Author: Stephen Duffield email: sduffiel@optusnet.com.au

From the collective point of view, project teams often know they are in trouble, however they take no or minimal effort to resolve errors as owning up to failure may cause shame [43]. Duhon and Elias [41] report that a protective post lessons learned attitude weakens the process and hides the real problems of the project. When a problem is recognised they are biased to learning the least-threatening lessons. Duhon and Elias [41] argue that all in an industry sector should be learning from the mistakes of others, and that we typically view others as substandard to us and don't believe we can learn from them. Therefore it is often hard to get relevant information on what went wrong.

The literature to date re-enforces that people factors influence the success of the lessons learned process and that a learning organisation culture is critical to successful dissemination of lessons learned [44-47]. The work of Senge [48], Nonaka and Takeuchi [27] both motivated companies to become learning organisations. Simon [49, p125] states that:

> All learning takes places inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have. ...What an individual learns in an organization is very much dependent on what is already known to (or believed by) other members of the organization and what kinds of information are present in the organizational environment. ...Individual learning in organizations is very much a social, not a solitary, phenomenon.

Duhon and Elias [41] argue that an organisation knows something if just one person knows it and that the organisation culture and structure enables that knowledge event to be used effectively. They reference actions such as; individual learning; knowledge storage (checklists and work processes); organisational changes that re-focuses knowledge; culture changes to open and act on problems; and relationship building that enables skills and knowledge to deal with organisational problems. They also state that people learn by processing information using the human central nervous system. An organisation does not have a central nervous system, so they need to create a structure to enable their personnel to learn as a group. Duhon and Elias [41] find that individual learning is a cognitive psychological process and for an organisation the learning process is social. Blackman and Henderson [50] briefly discuss how organisational learning is affected by social and intellectual credibility.

On Culture

Baring in mind what has been said about knowledge being distributed across a network, one can consider culture to be a form of network for like-minded individuals. Culture per se plays a significant part in

KM, organisational learning and in the effectiveness of learning mechanisms [47, 41, 51, 44]. Dvir and Shenhar [52, p20] state that "Great projects create a revolutionary project culture. The execution of great projects often requires a different project culture, which can spread to an entire organization." Williams [15, 11], Hislop [53] and Maqsood [42] all suggest that it is critical to understand the culture of an organisation before implementing or using lessons learned as surveys consistently reveal that the main obstacles to success are organisational people (social and culture) factors.

Reason [54, p195] defines a just culture as "...an atmosphere of trust in which people are encouraged, even rewarded, for providing essential safety-related information – but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour." The other important elements of a safety related culture are to have a strong reporting, flexible and learning culture [54]. Reason [54] further states that the learning culture is the easiest to engineer however is the most difficult to make work. Pettersson and Nyce [55] state that "just culture" is where individuals in an organisation want to be open about failures and mistakes. Lucier [56] argues that if you can encourage team members to document their mistakes with no fear of further action, you will be able to establish a useful knowledge system. Stastny and Garin [57] and Duhon and Elias [41] both discuss the benefits and obstacles in implementing a just culture and there appears to be a lot of similarities with the project management lessons learned process.

The work of Reason [54] with just culture highlights a lot of similarities with project management lessons learned [41]. Reason's [54, 58] Swiss cheese model (Figure 1) argues that organisational accidents are caused by active failures and latent conditions. Reason [54] reports that the Swiss cheese model shows the implementation of "defences in depth", where one identifies that projects have errors (holes) in them, which are brought about by human factors, and there are layers of defences to prevent them from occurring.
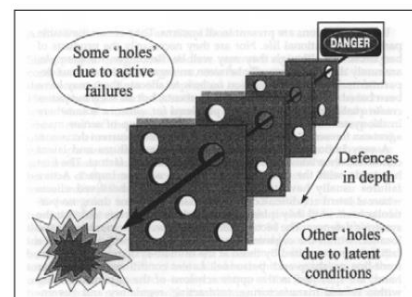
Figure 1 – The Swiss cheese model of defences Source: Reason [54]

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*

On lessons learned processes

The lessons learned process is specifically addressed in various project management guides, standards, methodologies and maturity models. Lindner and Wald [59] note a gap in project management practice as there is a need for more research in understanding the role KM plays in project management methodologies. Over the last 14 years the PMBOK® Guide has increased the references to the term lessons learned. In the PMBOK® Guide 4th edition there is a focus on process improvement as a result of lessons learned [5]. It is important to note that 'lessons learned' is not discussed anywhere except for a glossary description [5].

Reich and Wee [60, p24] recommend that the PMBOK® Guide should be "...transformed into a true knowledge guide - both imparting and recognizing the knowledge needed to complete projects successfully." The Project Management Institute's OPM3 Organizational Project Management Maturity Model [61] references lessons learned. However there is less guidance than that provided in the PMBOK® Guide [5].The Office of Government Commerce PRINCE2 [62, p12] project methodology encourages project teams to "...learn from previous experience: lessons are sought, recorded and acted upon throughout the life of the project". PRINCE2 has a single process for recording lessons learned (lessons learned log) and reporting on them (lessons learned report). The Capability Maturity Model Integration (CMMI) [63] model provides for best practice organisational process improvement. Process improvement proposals and process lessons learned are key work products and sub-processes. Midha [64] discusses the benefits of CMMI and identifies the classic approach of collecting and translating key lessons into processes. Von Zedtwitz [43] developed a capability model for post-project reviews based on the standard five-stage capability model.

O'Dell and Hubert [16, p69] stated that the lessons learned approach typically focuses on a few key questions:
> What was supposed to happen?
> What actually happened?
> Why was there a difference or variation?
> Who else needs to know this information?

The major challenge is to then get employees to participate and reuse the captured knowledge [65, 16, 66]. Milton [66] describes the KM lessons learned process stages as learning before, during and after. The literature on lessons learned processes provides many variations on essentially three process steps 'identification, dissemination (transferring) and application'. Common literature capture techniques found are: reflection, lessons learned sessions; after action reviews; project debriefings; close out meetings; post project appraisals/reviews; case study exercises; community of practices; project milestone

reviews; post mortems, project histories; project health checks; and project audits [67-69, 10, 15]. Literature on knowledge disseminating and transfer often refers to codification, verification, storing, searching, retrieving, knowledge sharing and training [70, 71, 65, 16, 10, 15].

A number of methods are used to disseminate knowledge lessons learned. Two methods of interest are 1) process methods and 2) social based methods. Process based methodologies are those lessons learned where the knowledge is reflected in an organisations policies, processes and procedures [7, 64, 72, 10, 15]. Social based methodologies are those lessons learned that are not easy to break up and transfer knowledge from one person to another [73, 45]. Fernie et al. [45] argue that knowledge sharing is best performed through the communication of individuals. Two identified social-based processes are networking and mentoring [73, 74]. Knowledge application often requires a significant effort, commitment, understanding of people behaviour for both the organisation and individuals, as this is the area where the process typically breaks down and fails [41, 7, 15].

On technology and infrastructure

The literature provides numerous technology solutions of storing, recording and accessing lessons learned, the key is to identify what works for an organisation and constantly monitor, update and keep it current and relevant [15, 11]. Technology is a critical element to knowledge dissemination. Quite often technology is blamed for failure in knowledge dissemination [15]. As with all process flows, ensuring the right people are involved, the right systems and infrastructure (facilities, equipment and materials) is critical in laying the foundation down for lessons learned to be effective [75].

The SLLCK Model

The SLLCK model is grounded in the literature above. It is an attempt to network together by means of an adaptation of the Swiss cheese model, the various features of social and cultural learning with the processes, infrastructure and technology that support them. The model has, over a period of two years, undergone a number of iterations. Initial reviews of the literature pertaining to lessons learned focused on the dissemination of lessons learned and a preliminary model was developed (Figure 2). This version highlighted the people, process, learning and technology variables that influence the dissemination of lessons learned between the project team and the organisation. The model was derived and based on the reverse relationships of the Reason [54] Swiss cheese model where the variables all need to align to effectively disseminate lessons learned.

*Corresponding Author: Stephen Duffield email: sduffiel@optusnet.com.au

Following an extended detailed literature review it became clear that the model needed to focus on both the dissemination and application of lessons learned. The literature already shows that identification of lessons learned appears to be done quite well in most organisations, whereas the dissemination and application of lessons learned fails to deliver the intended results [6-13].
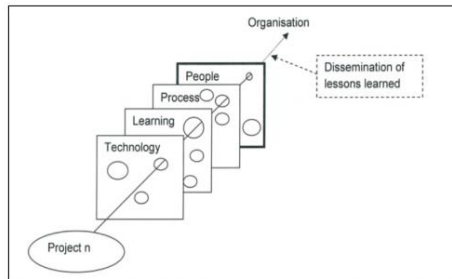

Figure 2 – Preliminary lessons learned model

The extended literature review highlighted the people element (learning, culture and social aspects), the system element (technology, process, and infrastructure) and the integration of the elements that form a knowledge network that captures and therefore influences the dissemination and application of lessons learned between the project team and the organisation. The output of the extended literature review was analysed using a grouping-categorisation matrix and associated mind maps. The deductive content analysis process assisted in the development of a revised SLLCK model (Figure 3).
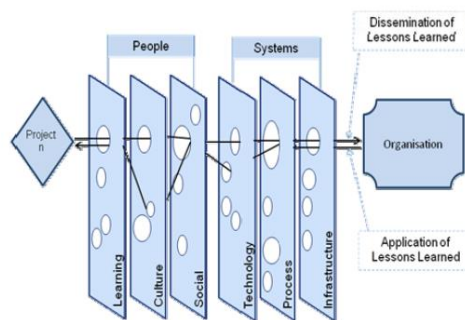
Figure 3 – A 'systemic lessons learned and captured knowledge model'

The model, as with its predecessor, is based on the reverse relationships of the Reason [54] Swiss cheese model where the variables of learning, culture, social, technology, process and infrastructure need to align and be effective to disseminate and apply lessons learned. The reverse relationship refers to the fact that the open holes in the variable layers represent the

various facilitators in each of those areas that enable the dissemination and application of the identified lessons.

Validation Study

Research Methodology

The research method adopted is a qualitative approach using an extended literature review and a range of tools (categorisation matrix, mind and concept maps) to carry out a deductive content analysis of the data [76]. The categorisation matrix, mind and concept maps exercise is based on the three sub-processes of data reduction, data display and conclusion drawing [77]. The purpose of the content analysis is to identify the most common lessons learned elements acknowledge by other researchers which will define the key variables that are synthesised to form a SLLCK model.

To further test the SLLCK model a qualitative exploratory focus group research methodology approach was used. The focus group provides the practical experience and performs as a diagnostic tool to validate the model [78]. It also enables multiple perspectives to be clarified to achieve a solid understanding and interpretation of the model [78]. The SLLCK model was presented to a pilot focus session followed by two focus groups. Ethical approval for this study was granted, anonymity assured, research notes were taken throughout, and audio recordings were destroyed following transcription. The pilot focus session provided a preliminary run through of the focus group exercise to refine the interview structure. The first focus group consisted of five participants, the second had eleven. The participants were project, engineering and knowledge management professionals from local South East Queensland Australia organisations.

The SLLCK model was presented to each of the focus groups and they were encouraged to make comments and provide feedback on their first impressions. The SLLCK model was then broken down into elements (learning, culture, and so on) on separate worksheets. The worksheets were in the form of large sheets of paper placed on desks and walls. The focus group participants were asked to identify positive openings (facilitators) and negative impediments (barriers) that impact the SLLCK model. The worksheets were then reviewed as a group. Following the focus group sessions the audio and worksheet data was analysed and grouped under each of the elements/variables of the model.

The Results

First impressions from the focus group participants were that the SLLCK model does "make sense and

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au**

gels with the reverse of the old adage that a catastrophe has several things lined up to fail". Participants also agreed with the view that technology is seen as an enabler and that culture, social aptitude and a priority to capture knowledge from learning experiences through project is important.

The data generated from the focus group sessions is shown in Table 1. During the focus group sessions the participants were able to validate the model as they felt it supported their experience whilst reconceptualising the topic of lessons learned. Drawing on their experiences, participants were able to identify the facilitators to lessons learned (the holes in the model) and the barriers. Whilst the participants raised much of what has already been identified in the literature, they also identified facilitators (See Table 1: identified with *bold) that have limited coverage in the lessons learned literature, such as;

- The level of knowledge/credibility of individuals
- A culture of helping people; culture of respect, where knowledge/experience is respected
- Where systems are respected and form part of the everyday job
- Where people are committed to credible processes.

Frequently the participants discussed how well the model represented the complexity of the real world, and how all the multiple variables need to align to enable a lesson to be learned and then captured (remembered) in various forms across the organisation. Participants also discussed how each of the variables has a number of subsets and that the model can represent knowledge storage and found some alignment with a complex organisational brain. One participant made the statement "Do people really understand lessons learned, as the concept is thrown around all the time, however often lessons are captured, the job is considered done and lessons are not reinforced."

Across the focus groups, participants agreed that it is the people element that is most likely to negatively influence lesson learned processes and create barriers to the dissemination and application of lessons learned in organisations. Focus group participants clearly stated that "people make it happen". One focus group spent more time discussing culture and process, while the other was more focused on the social aspect. Participants also highlighted how systems should provide a supporting role to the people. Using the SLLCK model as a construct for the discussion, one lesson learned scenario raised demonstrated how the variables of learning, culture, process and infrastructure were opened to capturing knowledge, whereas the variables of social and technology were closed and prevent the dissemination and application of the identified lessons.

The focus groups provided feedback as to how the model can help them. Participants stated that the model helps with the change management process. That the model reflects complexity, as it is "hard to get a lesson learned through, so it is not just about having a database, it is not just about one thing it is about a series of things...I like the way it kind of stacks it up and shows it working". One Project Manager stated that "we were getting lots of push from our KM team to get lessons learned going and get it implemented to meet deliverables, had we had the model we would have been able to present to the Directors to show them what needs to be invested in to do it properly, as it is not just about doing a process." Furthermore, that one problem for organisations is a lack of recognition of this complexity. All the focus groups agreed that the SLLCK model conceptualises the problem well in a way that enables the problems to be discussed, and that it provides a good alignment of what has to be in place to allow the lessons learned process to deliver the intended results.

Discussion

The data generated from the focus group sessions (See Table 1) appears to ground the SLLCK model in the lesson learned and project knowledge management literature [14, 73, 44, 41, 47, 42, 9, 16, 15, 11, 45]. Participants were able to identify their experiences with, and further build and refine the SLLCK model (See Figure 5). The results illustrate that organisational learning is a complex process and it is clear that organisations need to enable the facilitators and remove the barriers and encourage, through their practices and processes, positive cultural, social and learning environments.

Two particular discussion that arose from the focus groups are noteworthy; that of credibility and complexity. The discussions on credibility is notable in that it occurred during both the considerations of facilitators and barriers, and the subject has limited direct references in lessons learned and knowledge management literature apart from Blackman and Henderson [50] and Liebowitz and Megbolugbe [79]. The discussion on complexity is also notable as the focus groups emphasised how the SLLCK model can resemble and conceptualise the network 'brain' of an organisation. This supports the literature of knowledge distribution across complex networks [31, 35, 30].

The amount of discussion time spent during the focus group sessions on culture, social and process emphasises the importance these variables play in the SLLCK model and supports the findings in the literature of Anbari et al. [67], Bakker et al. [68], Duhon and Elias [41], Hislop [53] and Maqsood [42, 69], Schindler and Eppler [10] and Williams [15, 11].

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*

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Positive openings (facilitators) and negative impediments (barriers) within each lessons learned variable:

People-Learning

Facilitators	Barriers
Right skilled people	Takes too much time; time pressures
Right people to hand	Memories fade
Training (effective)	Lessons wont apply to my project
Learning from experience	De-motivated
(failures, challenges, difficulties and success)	Lets learn from our failure – witch hunt...
Staff with a high level of knowledge / qualifications	People learn differently
Willingness/passion to share knowledge	People do not learn and continue to make the same mistakes
Understand that people learn differently	Difficult to teach practitioners in other parts of the organisation
(Training sessions; Technical notes; Technical forums)	Different levels of knowledge and understanding
Education, training and staff development practices	Technical arrogance (credibility)
Reflection	Protecting ones sphere of knowledge
* Knowledge level (credibility)	Poor training practices

People-Culture

Facilitators	Barriers
Tone at the top	Anonymous reports
Routine practices	Blame
Supportive practices / supporting culture	Don't have time
* Help needed (help me to help you)	Rapid change of staff – redeployment
Just Culture (Safety culture, learning culture, reporting culture)	Internal politics (credibility)
Group (work) support in development of learning's	To use lessons would reflect badly on my reputation
Understand that knowledge is power but even more so when it is shared	Lack of incentives, buy-in
* Individual knowledge sharing plans	Knowledge is power
Networking encouraged and supported	Shoot the messenger
Action on positive feedback	Communication gap / miss-understandings
Positive leadership	Delivery culture not learning culture
* Respect	Complex organisations; Operational silos
	No senior sponsorship
	Anxiety about changes
	Poor leadership practices
	Lack of adaptability or resilience
	WIIFM (What is in it for me)
	Fast moving workforce
	Social behaviours
	Old way the only way
	Personal goals different to organisational goals
	Low performance results focus culture
	Financial pressures

People-Social

Facilitators	Barriers
Custom built teams	Same old team
Operate as a team	Not invented here
Custom build the approach (Not one size fits all)	Unwillingness to share /less valuable
Keep trying different approaches	Don't want to appear vulnerable and stupid by admitting mistakes
Do not personalise	Teams wont share mistakes and dirty laundry - reputation
Interact with as many people as possible to capture information	Resistance to change
* (must have credibility)	Not my problem
Teamwork approach	Too stubborn
Honesty and Integrity	Cynical
Provide time for unstructured interaction	Politics
Generally want to improve	Don't understand what it is like to work in other parts of the organisation
Good enterprise social business	Poor communication - anti social behaviour - social interactions
Productive culture	Personality traits
	Blame environment
	Competitive environment
	Perceived credibility and approachability
	Social polices
	Shame personally exposed
	Lack of trust
	Poor coordination

Systems-Technology

Facilitators	Barriers
Intranets	Hard to find / locate lessons
e-libraries	No way to classify lesson for easy retrieval
Wikis	Not trained in use of tools
Multiple channels of information in use	Poor (lack of) ICT systems and processes
Distribution of links to all targeted stakeholders	Done in inconsistent ways
Ease of access through different IT solutions	Too many initiatives
*Systems respected and need to be part of your everyday job	Restrictive audience
	Poor Search facility
	SharePoint 2010 governance and funding issues
	Not everyone uses social media
	Lack of money / funding / expensive
	Too complex
	Set and forget systems
	Too many systems
	Systems are not part of your every day job
	Inappropriate focus on technology
	Not being able to find what you need when you need it
	Collection of data just for the sake of it
	Too structured

Systems-Process

Facilitators	Barriers
Debriefing	Willingness to conduct the process
Reviews	Tick the box process / compliance
Brain Storming	Procedures not being followed, don't exist, are not updated
Case Studies / Tell a story / Keep it 2 pages - simple	Post-Implementation reviews not done
Dissemination (Training, Education)	Takes too much time
Mentoring	Lack of time to mentor
Staff Transfer	Lack of enforcement
Functional management enforcement	No metrics
Alignment to Risk Management	Lack of formalising the process and incorporating new work
Senior management commitment	Lack of consistency in following the process
*Credibility - endorsement of process in place - Imprimatur	WIIFM (What is in it for me)
Simplification	Lack of understanding and commitment
Capability in methodology	Complacency
Contextualised	Don't bother not my problem
	Language (taxonomy)
	Don't exist / fragmented
	Lack of flexibility in approach (no complex adaption)
	Read the process but don't understand the process
	Process/manuals are owned by another organisation
	Processes don't match with IT systems

Systems-Infrastructure

Facilitators	Barriers
Physical space	Legal constraints
Training facilities	Governance
Senior management commitment	Poor facilitation
Good user interface/useability/search	Time poor
	Lack of financial/funding support
	Language (taxonomy) / poor search
	Don't have access to emerging technology
	Remote sites have limited infrastructure (Don't assume everyone has what you may have)

Table 1 – Positive openings (facilitators) and negative impediments (barriers) within each lessons learned variable

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*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*
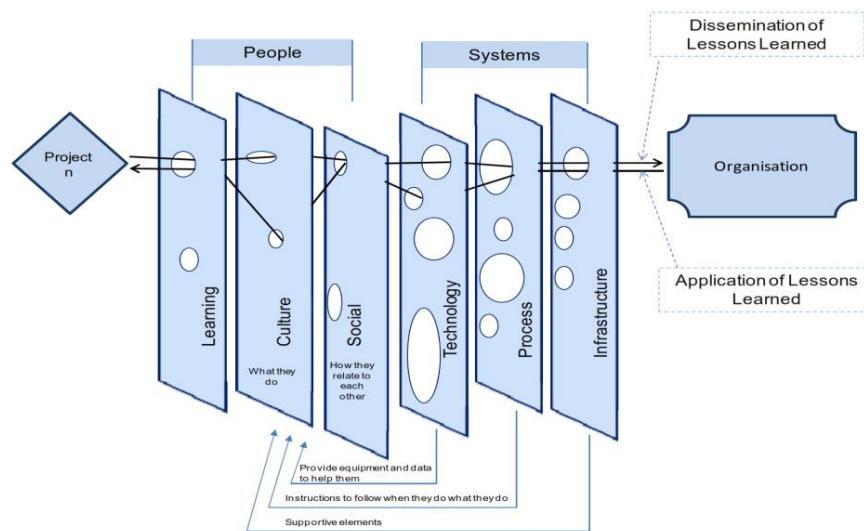
Figure 5 – A refined 'systemic lessons learned and captured knowledge (SLLCK) model'

Many of the facilitators and barriers identified are not directly related to the project management and knowledge management operational processes; however they have significant consequences on how project knowledge is used within an organisation. One clear finding during the focus group sessions was the confirmation that lessons identification processes do exist and seems to work well and that the problem is with the dissemination and application of lessons learned. This causes individuals to believe the lessons learned process is working when in fact only the first part of the process (lessons identified - observed) is working. This separation of the lessons (identification) learned process is seldom discussed in the literature. The study has brought forth supporting evidence that a SLLCK model can influence the dissemination and application of project management lessons learned between the project team and the organisation.

Limitations and challenges

One of the challenges with content analysis is that the process is flexible in nature and there is no simple right way of doing it [76, 80]. The focus group approach does have some limitations and disadvantages. A unique sampling problem could arise as each of the two focus groups had similar backgrounds and experiences. The results could be dependent on the moderator and finally the groups are not intended to represent the larger population [78].

Future research

The information produced from the focus groups forms a good basis and structure for future research

using an appropriate mixture of qualitative case studies and quantitative survey instruments. More consideration should be given to the alignment, interaction and complexity issues of the people and systems elements within the lessons learned organisational environment. This approach is supported by a recent project management PM World Today editorial post on Lessons Learned but Knowledge Lost [81]. In response, Wideman [82, p1] a recognised project management global expert stated:

> ...in spite of all the technology that is available to us today, we have not yet found a presentation format that captures the essence of this wisdom in a way that is relevant to future usage, readily searchable and easy to store. ...we have a serious cultural problem. ...we are probably condemned to continue to throw away the valuable resources.

This open public discussion highlights the significance of project management, knowledge management and the lessons learned practice and the impact a grounded model has on providing solutions to the problem.

Finally the study supports the premise that the project management lessons learned processes today can largely be considered incomplete and misunderstood. Future research themes could focus on how best project management lessons learned is represented to the practitioner community and their organisations, in a way that can be captured in project management reference books, methodologies and bodies of knowledge.

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*

Conclusion

This research study is focussed on exploring whether a SLLCK model can influence the dissemination and application of project management lessons learned between the project team and the organisation. The study suggests that by reconceptualising lessons learned, the SLLCK model can influence the dissemination and application of project management lessons learned. This study has established that the alignment of the people and system elements could positively influence the success of an organisation's lessons learned processes. The study found that the people element and culture factor may well be the most likely to negatively influence lessons learned in organisations. Furthermore, the study also established that several variables of the model and their elements need to align to ensure organisational lessons are learned by means of projects. Finally, the findings contribute to the project and knowledge management literature and provide an opportunity to improve project knowledge sharing, and ensure projects achieve success for organisations to maintain a competitive advantage.

References

[1] Li, 2002, "*GAO-02-195 NASA Better Mechanisms Needed for Sharing Lessons Learned*," Office, U. S. G. A., Ed., ed. Washington, DC.

[2] National Audit Office, 2009, "*Helping Government Learn*," ed. London: The Stationary Office.

[3] New Zealand Government, 2010, "*Major Projects Report: Overview & Assessment*," Ministry of Defence, N. Z. D. F., and the Office of the Auditor-General., Ed., ed. Wellington: Ministry of Defence.

[4] NASA, 2012, "*Review of NASA's Lessons Learned Information System* ", Washington, DC IG-12-012.

[5] Project Management Institute, 2008,*A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 4th ed. Newtown Square, Pa.: PMI Inc.

[6] Atkinson, R*., et al.*, 2006, "*Fundamental uncertainties in projects and the scope of project management*," International journal of project management, vol. 24, pp. 687-698.

[7] Keegan, A. and Turner, J. R., March 1, 2001 2001, "*Quantity versus Quality in Project-Based Learning Practices*," Management Learning, vol. 32, pp. 77-98.

[8] Kerzner, H., 2009,*Project management : a systems approach to planning, scheduling, and controlling*, 10th ed. Hoboken, N.J.: John Wiley & Sons.

[9] Milton, N., 2010,*The Lessons Learned Handbook: Practical approaches to learning from experience*. Oxford, UK: Chandos Publishing.

[10] Schindler and Eppler., 2003, "*Harvesting project knowledge: a review of project learning methods and success factors*," International journal of project management, vol. 21, pp. 219-228.

[11] Williams, T., 2008, "*How do organisations learn lessons from projects–and do they?*," IEEE Transactions in Engineering Management, vol. 55, pp. 248-266.

[12] Wysocki, R. K., 2004,*Project management process improvement*. Boston: Artech House.

[13] Wysocki, R. K. (2009, Accessed 2 May 2011). *Effective project management traditional, agile, extreme (5th ed.)*. Available: http://ezproxy.usq.edu.au/login?url=http://www.USQ.eblib.com.au/EBLWeb/patron?target=patron&extendedid=P_427893_0&

[14] Disterer, G., 2002, "*Management of project knowledge and experiences*," Journal of Knowledge Management, vol. 6, pp. 512-520.

[15] Williams, T. (2007, Date Accessed: 17 July 2011). *Post-Project Reviews to Gain Effective Lessons Learned*. Available: http://library.books24x7.com.ezproxy.usq.edu.au/toc.aspx?site=JE61N&bookid=24212

[16] O'Dell and Hubert, 2011,*The new edge in knowledge : how knowledge management is changing the way we do business*. New Jersey: John Wiley & Sons.

[17] Keegan, B. and Griner, C., 2000, "*Enhancing Mission Success – A Framework for the Future (A Report by the NASA Chief Engineer and the NASA Integrated Action Team)*,"

[18] BP, 8 September 2010, "*Deepwater Horizon Accident Investigation Report*,"

[19] Cleveland, C. (2011, 25 March). *Macondo: The Gulf Oil Disaster*. Available: http://www.eoearth.org/article/Macondo:_The_Gulf_Oil_Disaster?topic=64403

[20] NASA. (2011, 9 April). *The Deepwater Horizon Accident: Lessons for NASA*. Available: http://www.nasa.gov/pdf/592629main_BP_Case_Study_29AUG2011_FINAL.pdf

[21] Brouwer, G., 2011, "*Own motion investigation into ICT-enabled projects*," Ombudsman, V., Ed., ed. Melbourne: Victorian Ombudsman, Victorian Government Printer.

[22] Drucker, P. F., 1993,*Post-capitalist society*. Oxford: Butterworth Heinemann.

[23] Wiig, K., 1997, "*Knowledge management: an introduction and perspective*," Journal of Knowledge Management, vol. 1, pp. 6-14.

[24] Polanyi, M., 1958,*Personal knowledge; towards a post-critical philosophy*. Chicago,: University of Chicago Press.

[25] Polanyi, M. and Sen, A., 2009,*The tacit dimension*. Chicago ; London: University of Chicago Press.

[26] Davenport, T. and Prusak, L., 2000,*Working knowledge: How organizations manage what they know*: Harvard Business Press.

[27] Nonaka, I. and Takeuchi, H., 1995,*The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York.

[28] Nonaka, I., 2007, "*The knowledge-creating company*," Harvard business review, vol. 85, p. 162.

[29] Johnson-Laird, P. N., 1983,*Mental models : towards a cognitive science of language,*

Corresponding Author: Stephen Duffield email: sduffiel@optusnet.com.au

Duffield SM, Whitty S J (2012). A systemic lessons learned and captured knowledge (SLLCK) model for project organizations. In: *Proceedings of the Annual Project Management Australia Conference Incorporating the PMI Australia National Conference (PMOz)*, Melbourne, Australia, 15-16 August 2012.

inference, and consciousness. Cambridge, Mass.: Harvard University Press.

[30] Whitty, S. J., 2009, "*New philosophy of project management: an investigation into the prevalence of modern project management by means of an evolutionary framework (presented at Univ. of Qld)*."

[31] Gabora, L., 1997, "*The origin and evolution of culture and creativity*," Journal of Memetics: Evolutionary Models of Information Transmission, vol. 1, pp. 1-28.

[32] Harkema, S., 2003, "*A complex adaptive perspective on learning within innovation projects*," Learning Organization, The, vol. 10, pp. 340-346.

[33] Williams, T. M., 1999, "*The need for new paradigms for complex projects*," International journal of project management, vol. 17, pp. 269-273.

[34] Cooke-Davies, T., et al., 2007, "*Mapping the Strange Landscape of Complexity Theory, and Its Relationship to Project Management*," Project Management Journal, vol. 38, pp. 50-61.

[35] Whitty, S. J., 2005, "*A memetic paradigm of project management*," International journal of project management, vol. 23, pp. 575-583.

[36] Keshavarz, N., et al., 2010, "*Social complex adaptive systems. A response to Haggis*," Social Science & Medicine, vol. 70, pp. 1478-1479.

[37] Holland, J. H., 1996, *Hidden order : how adaptation builds complexity*. Reading, Mass.: Addison-Wesley.

[38] Holland, J. H., 1992, "*Complex adaptive systems*," Daedalus, vol. 121, pp. 17-30.

[39] Bullmore, E. and Sporns, O., 2009, "*Complex brain networks: graph theoretical analysis of structural and functional systems*," Nature Reviews Neuroscience, vol. 10, pp. 186-198.

[40] Walsh, J. P. and Ungson, G. R., 1991, "*ORGANIZATIONAL MEMORY*," Academy of Management Review, vol. 16, pp. 57-91.

[41] Duhon, H. and Elias, J., 2008, "*Why It Is Difficult To Learn Lessons: Insights from Decision Theory and Cognitive Science*," SPE Projects, Facilities & Construction, vol. 3, pp. 1-7.

[42] Maqsood, T., "*The Role of Knowledge Management in Supporting Innovation and Learning in Construction*," School of Business Information Technology, RMIT University, 2006.

[43] Von Zedtwitz, M., 2002, "*Organizational learning through post–project reviews in R&D*," R&D Management, vol. 32, pp. 255-268.

[44] Andriessen, J. H. E. and Fahlbruch, B., 2004, *How to manage experience sharing : from organisational surprises to organisational knowledge*, 1st ed. Amersterdam ; Boston: Elsevier.

[45] Fernie, S., et al., 2003, "*Knowledge sharing: context, confusion and controversy*," International journal of project management, vol. 21, pp. 177-187.

[46] Sense, A. J., 2007, "*Learning within project practice: Cognitive styles exposed*," International journal of project management, vol. 25, pp. 33-40.

[47] Leistner, F., 2010, *Mastering organizational knowledge flow how to make knowledge sharing work*. Hoboken, N.J.: John Wiley & Sons.

[48] Senge, P., 1990, *The Fifth Discipline, The Art & Practice of the Learning Organization*, Revised Edition, 2006 ed.: Doubleday New York.

[49] Simon, H. A., 1991, "*Bounded Rationality and Organizational Learning*," Organization science, vol. 2, pp. 125-134.

[50] Blackman and Henderson. (2001, viewed 2 January, 2012). *Does A Learning Organisation Facilitate Knowledge Acquisition And Transfer?* . Electronic Journal of Radical Organisation Theory 7(1). Available: http://www.mngt.waikato.ac.nz/ejrot/EJROT(new design)Vol7_1_front.asp

[51] Eskerod, P. and Skriver, H. J., 2007, "*Organizational culture restraining in-house knowledge transfer between project managers—A case study*," Project Management Journal, vol. 38, pp. 110-122.

[52] Dvir, D. and Shenhar, A. (2011) *What great projects have in common*. MIT Sloan Management Review. 18-21.

[53] Hislop, D., 2005, *Knowledge management in organizations : a critical introduction*. Oxford ; New York: Oxford University Press.

[54] Reason, J., 1997, *Managing the risks of organizational accidents*. Aldershot, Hants, England ; Brookfield, Vt., USA: Ashgate.

[55] Pettersson, U. and Nyce, J., 2011, "*Hierarchy and Tacit Knowledge in the Swedish Armed Forces: An Organisational Approach*," in Proceedings of the European Conference on Intellectual Capital, 2011 2011, pp. p328-332.

[56] Lucier, C., 2003, "*When knowledge adds up to nothing - Why knowledge management fails and what you can do about it*," Development and Learning in Organizations, vol. 17, pp. 32-35.

[57] Stastny and Garin, 2004, "*A Roadmap to a Just Culture: Enhancing the Saftey Envirnoment*," Gordon, et al., Eds., First ed: GAIN Working Group E.

[58] Reason, J., 2000, "*Human error: models and management*," British Medical Journal, vol. 320, p. 768.

[59] Lindner, F. and Wald, A., October, 2011 2011, "*Success factors of knowledge management in temporary organizations*," International journal of project management, vol. 29, pp. 877-888.

[60] Reich and Wee, 2006, "*Searching for knowledge in the PMBOK guide*," Project Management Journal, vol. 37, pp. 11-26.

[61] Project Management Institute, 2008, *Organizational Project Management Maturity Model (OPM3®)*, 2nd ed. Newtown Square, Pa.: Project Management Institute Inc.

[62] OGC, 2009, *Managing Successful Projects with PRINCE2*. London: TSO.

[63] Chrissis, M. B., et al., 2003, *CMMI® : guidelines for process integration and product improvement*. Boston: Addison-Wesley.

[64] Midha, A., 2005, "*How to Incorporate "Lessons Learned" for Sustained Process Improvements*," presented at the NDIA CMMI Technology conference, 2005.

[65] O'Dell, et al., 1998, *If only we knew what we know : the transfer of internal knowledge and best practice*. New York: Free Press.

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*

Duffield SM, Whitty S J (2012). A systemic lessons learned and captured knowledge (SLLCK) model for project organizations. In: *Proceedings of the Annual Project Management Australia Conference Incorporating the PMI Australia National Conference (PMOz)*, Melbourne, Australia, 15-16 August 2012.

[66]   Milton, N., 2005,*Knowledge Management For Teams and Projects*. Oxford: Chandos Publishing.

[67]   Anbari, F. T., *et al.*, 2008, "*Post-project reviews as a key project management competence*," Technovation, vol. 28, pp. 633-643.

[68]   Bakker, R. M., *et al.*, 2010, "*Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer*," International journal of project management.

[69]   Maqsood, T., *et al.*, 2004, "*Project histories and project learning–a knowledge management challenge*," in 20th Annual ARCOM Conference, Heriot Watt University, 2004, pp. 561-70.

[70]   Boh, W. F., 2007, "*Mechanisms for sharing knowledge in project-based organizations*," Information and Organization, vol. 17, pp. 27-58.

[71]   Firestone, J. and McElroy, M., 2003,*Key Issues in New Knowledge Management*. Burlington, MA: Elsevier Science.

[72]   O'Dell and Grayson, "*Identifying and Transferring Internal Best Practices*," APQC, Ed., ed Houston: APQC, 1997.

[73]   Bresnen, *et al.*, 2003, "*Social practices and the management of knowledge in project environments*," International journal of project management, vol. 21, pp. 157-166.

[74]   Huang, J. C. and Newell, S., 2003, "*Knowledge integration processes and dynamics within the context of cross-functional projects*," International journal of project management, vol. 21, pp. 167-176.

[75]   Thomas, W. H., 2012,*The basics of project evaluation and lessons learned*. Boca Raton, FL: CRC Press.

[76]   Elo, S. and Kyngäs, H., 2008, "*The qualitative content analysis process*," Journal of advanced nursing, vol. 62, pp. 107-115.

[77]   Miles, M. and Huberman, M., 1994,*Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage Publications.

[78]   Zikmund, W. G., 2010,*Business research methods*, 8th ed. Mason, OH: South-Western Cengage Learning.

[79]   Liebowitz, J. and Megbolugbe, I., 2003, "*A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives*," International journal of project management, vol. 21, pp. 189-198.

[80]   Leedy, P. D. and Ormrod, J. E., 2009,*Practical research : planning and design*, 9th ed. Upper Saddle River, N.J. ; Harlow: Pearson Education.

[81]   Pells, D. (2011, *Lessons Learned but Knowledge Lost! PM World Today 2011(5 September 2011)*. Available: http://www.pmforum.org/library/editorials/2011/PDFs/aug/Editorial-Pells.pdf

[82]   Wideman, R. M. (2011, 5 September 2011). *On the August PMWT Editorial on Lessons Learned by Knowledge Lost. PM World Today*. Available: http://www.pmworldtoday.net/letters/2011/sep/LETTER-Wideman.html

*Corresponding Author: Stephen Duffield *email: sduffiel@optusnet.com.au*

11.2. Appendix B: Example of participant information sheet

USQ | **University of Southern Queensland**
AUSTRALIA | **The University of Southern Queensland**
Participant Information Sheet

HREC Approval Number: H13REA038

Full Project Title: An advanced systemic lessons learned and knowledge capture model for project organisations.

We would like to invite you to take part in this research project.

Who is conducting the research?

Name(s):   Stephen Mark Duffield, PhD Candidate, Researcher
                 Dr Stephen Jonathan Whitty, Senior Lecturer in Project Management, Research Supervisor
School(s):   Faculty of Business, School of Management & Marketing, University of Southern Queensland
                 Springfield Campus, Queensland 4300, Australia
Contact Phone: +61 421 052 135
Contact Email: stephen.duffield@usq.edu.au, whitty@usq.edu.au

Why is the research being conducted and what are the benefits of the research?

A significant challenge for government and business project organisations is to ensure that lessons are learned and that mistakes of the past are not repeated. Both the knowledge and project management literature suggests that the lessons learned process in practice rarely happens, and when it does it fails to deliver the intended results.

A systemic lessons learned and captured knowledge (SLLCK) model has been developed from the literature and validated through a series of facilitated workshops with practitioners who enhanced the model by identifying further facilitators and barriers to capturing knowledge from lessons learned by projects.

The aim of this research is to understand why a high proportion of business and/or project-based organisations do not appear to capture, disseminate and apply lessons learned from completed projects to future projects. This research is expected to contribute to the global project management knowledge base and lessons learned practice by better understanding the significant project technology, learning, process and people factors.

What you will be asked to do

Participants will be asked to take part in action research activities consisting of multiple 'action research' cycles of a 4 stage process (plan, action, observe and reflect). The initial planning stage will consist of interviews (clarifying the SLLCK model based on questioning and structuring of the problem) with members of the leadership team of a project to expand on the barriers and facilitators that impact the proposed SLLCK model. The 2 hour interview sessions will only be held during the initial (1st round) planning stage of the action research cycle process. It is estimated that approximately 5 interviews of 2 hours duration will take place. Following the interviews the action stage will undertake the development of the planned implementation changes (may be changes to procedures, training, social, culture awareness activities etc) and adapt the SLLCK model within the business or project organisation in preparation for lesson learned activities.

The actions will be observed, monitored and evaluated for their impact on key variables identified in business or project organisational company metrics (financial gains, performance, sharing, innovation, stakeholder relationships etc.). Data collection tools will consist of business and project artefacts, value maps, audio recordings, observations, feedback and reflections. The reflection stage will highlight changes to be made for the planning of the next action research cycle or a decision may be made for the cycle to end (exit).The action research cycle will be occurring during the normal working week. The 2 hours each fortnight/month will be when the team meets with the researcher to discuss the steps/actions/outputs/plans at various stages of the action research process. Further communication with participants via email may impose on your time, but again it is not envisaged that this will be more demanding than another 20 minutes at most. The core action research work will be completed with a report verified by the business or project organisation participants.

The basis by which participants will be selected or screened
Participants will be members of 'specific project teams' with the organisations that will be subject to the action research activities. Participants will be recruited with the assistance of the project team managers and team leaders.

Risks to you
We do not anticipate that there is any risk to you as a result of participating in this research. There is a low (negligible) rated research project risk on 'time imposition'. If a time management problem occurs, then meetings with the project teams will need to be re-scheduled to times that suit all affected parties.

Your confidentiality
Your confidentiality is ensured. Any personal data you supply (e.g. via your email correspondence) will not be stored. All electronic data will be stored on The University of Southern Queensland, School of Management & Marketing computer server, which is password protected. Original data will be kept for a minimum of 5 years. Audio recordings will be kept for 5 years following transcription. Participants will not be identifiable in any publication or report resulting from the research. Participants will not be identifiable in any publication or report resulting from the research.

Your participation is voluntary
Your participation in this study is completely voluntary. You are free to withdraw from the study at any time.

Questions / further information
If you would like additional information about this particular study and the literature related to it, please contact a member of the research team using the contact details given above.

Feedback to you
If you would like to be given a summary of the findings of the research when they are available, please contact a member of the research team using the contact details given above.

The ethical conduct of this research
The University of Southern Queensland conducts research in accordance with the *National Statement on Ethical Conduct in Research Involving* Humans http://www.nhmrc.gov.au/publications/synopses/e72syn.htm.

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer
Office of Research and Higher Degrees
University of Southern Queensland
West Street, Toowoomba 4350
Ph: +61 7 4631 2690
Email: *ethics@usq.edu.au*

Privacy Statement

The conduct of this research involves the collection, access and / or use of your identified personal information. The information collected is confidential and will not be disclosed to third parties without your consent, except to meet government, legal or other regulatory authority requirements. A de-identified copy of this data may be used for other research purposes. However, your anonymity will at all times be safeguarded. For further information consult the University's Privacy Plan at http://www.usq.edu.au/aboutsite/~/media/USQ/Policy/Calendar/Part%2011/112pdf.ashx.

11.3. Appendix C: Example of consent form

USQ
AUSTRALIA

University of Southern Queensland

The University of Southern Queensland

Consent Form

HREC Approval Number: H13REA038

Who is conducting the research:

Name(s): Stephen Mark Duffield, PhD Candidate, Researcher
Dr Stephen Jonathan Whitty, Senior Lecturer in Project Management, Research Supervisor
School(s): Faculty of Business, School of Management & Marketing, University of Southern Queensland
Springfield Campus, Queensland 4300, Australia
Contact Phone: +61 421 052 135
Contact Email: stephen.duffield@usq.edu.au, whitty@usq.edu.au

To Participants:

I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.

I understand that my participation is voluntary and that I may withdraw from the research project at any stage and that this will not affect my status now or in the future.

I confirm that I am over 18 years of age.

I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.

Name of participant..

Signed.......................**Date**..........................

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer
Office of Research and Higher Degrees
University of Southern Queensland
West Street, Toowoomba 4350
Ph: +61 7 4631 2690
Email: ethics@usq.edu.au

11.4. Appendix D: Proof of publication

11.4.1. Developing a systemic lessons learned knowledge model for organisational learning through projects.

Duffield, S., Whitty, S.J., (2015b). Developing a systemic lessons learned knowledge model for organisational learning through projects. International Journal of Project Management, vol. 33, no. 2, pp. 311-324.

Thu 17/07/2014 7:20 PM
Ref. No.: JPMA-D-14-00054R1
Title: Developing a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects International Journal of Project Management

Dear Mr. Stephen Mark Duffield,

Thank you for sending your revised paper for possible publication in the International Journal of Project Management. I believe your paper would make an interesting and useful contribution to the Journal, and am therefore pleased to accept it for publication. I have provisionally scheduled it to appear in the 33/2 February 2015 issue...

Thank you for your contribution to the journal.

Yours sincerely,

Rodney Turner
Editor
International Journal of Project Management
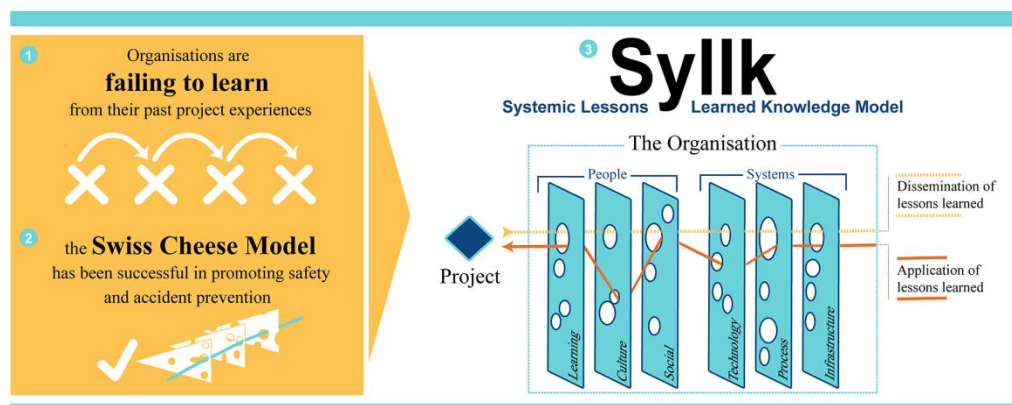
11.4.2. How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling.

Duffield, S., Whitty, S.J., (2016a). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. International Journal of Project Management, vol. 34, no. 3, pp. 429-443.

Tue 17/11/2015 10:22 PM
Ref. No.: JPMA-D-15-00239R2
Title: How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling International Journal of Project Management

Dear Mr. Stephen Mark Duffield,

Thank you for sending your revised paper for possible publication in the International Journal of Project Management. I believe your paper would make an interesting and useful contribution to the Journal, and am therefore pleased to accept it for publication.

... Thank you for your contribution to the journal.

Yours sincerely,

Martina Huemann
Associate Editor
International Journal of Project Management
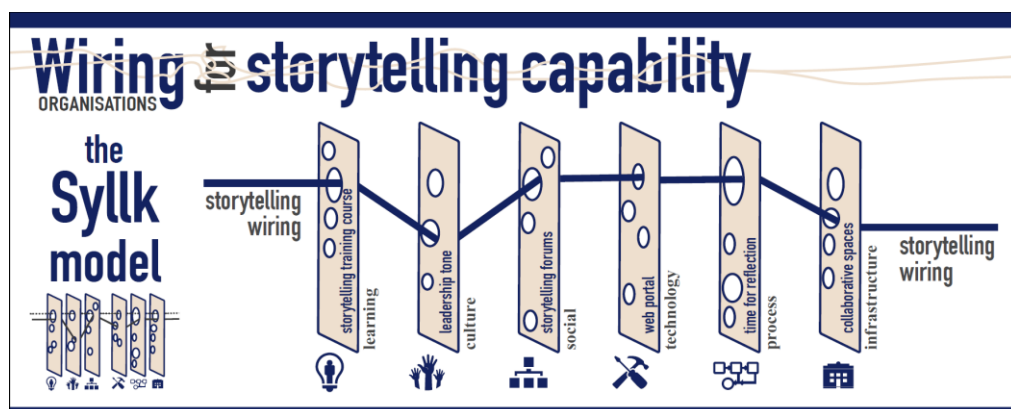
11.4.3. Application of the Syllk model wiring an organisation for the capability of an online Community of Practice.

Duffield, S., (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE Journal of Information and Knowledge Management Systems, vol. 46, no. 2, pp.267-294

doi/abs/10.1108/VJIKMS-09-2015-0052

Wednesday, 2 March 2016 3:24 PM

Dear Mr. Duffield,

It is a pleasure to accept your manuscript entitled "Application of the Syllk model wiring an organisation for the capability of an online Community of Practice" in its current form for publication in VINE Journal of Information and Knowledge Management Systems. The comments of the reviewer(s) who reviewed your manuscript are included at the foot of this letter.

... Thank you for your contribution. On behalf of the Editors of VINE Journal of Information and Knowledge Management Systems, we look forward to your continued contributions to the Journal.

Yours sincerely
Prof. W.B. Lee
Editor, VINE Journal of Information and Knowledge Management Systems

Reviewer(s)' and Associate Editor Comments to Author:

Reviewer: 1, Recommendation: Accept

Comments:
Exceptionally well done! Very useful model for COPS, and can be applied immediately to new or existing initiatives.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: **The Syllk Model is original, unique and well worth sharing with the COP community and the KM stakeholders involved in CoPs**.

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: **The paper demonstrates an excellent understanding of the relevant literature in the field and cites a wide range of appropriate literature sources. I could not locate any significant work that were ignored.**

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? **Are the methods employed appropriate?: Methodology is solid, well designed and applied appropriately.**

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: **Results analysed and presented exceptionally well. The conclusion synthesizes the paper and provides a very useful segue to additional research in the area.**

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: **The Paper clearly identify implications for research, and especially for practice. The paper not only bridge the gap between theory and practice, but presents an exceptionally useful model for COP practice.**

6. a.   Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Is the length of the paper appropriate (this should be no more than 8000 words including references and appendices and allowing 280 words for each figure or table)? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: **The paper is exceptionally well written.**

Reviewer: 2, Recommendation: Accept

Comments:
Great job on the revisions! At my organization, we are about to undergo activity to both revitalize our CoPs and determine improved ways to disseminate program learning. You have shown me interesting considerations.

Additional Questions:
1. Originality: Does the paper contain new and significant information adequate to justify publication?: **Yes, the association of the Syllk model with getting maximum benefits from communities of practice for program learning is a useful topic for publication.**

2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: **Yes, a range of relevant literature is cited and no significant work that I know of is omitted.**

3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: **Yes, the paper appropriately cites theory and concepts as the basis for methodology and arguments.**

4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: **Yes, with the latest revision, the conclusions and other elements of the paper are tied together well.**

5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of

life)? Are these implications consistent with the findings and conclusions of the paper?: **Yes, with the latest revision, the implications are clear for organizations seeking to use CoPs to disseminate program learning.**

<b>6. a.   Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Is the length of the paper appropriate (this should be no more than 8000 words including references and appendices and allowing 280 words for each figure or table)? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: Yes, the most recent edits have improved length and readability.

Associate Editor, Comments to the Author: (There are no comments.)

11.4.4. Application of the Systemic Lessons Learned Knowledge model for organisational learning through projects.

Duffield, S., Whitty, S.J., (2016b). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. International Journal of Project Management, vol. 34, no. 7, pp. 1280-1293

doi.org/10.1016/j.ijproman.2016.07.001

Ms. Ref. No.: JPMA-D-16-00261R1
Title: Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects International Journal of Project Management

Dear Mr. Stephen Mark Duffield,

Thank you for sending your revised paper for possible publication in the International Journal of Project Management. I believe your paper would make an interesting and useful contribution to the Journal, and am therefore pleased to accept it for publication. …

Thank you for your contribution to the journal.

Yours sincerely,

Martina Huemann
Associate Editor
International Journal of Project Management
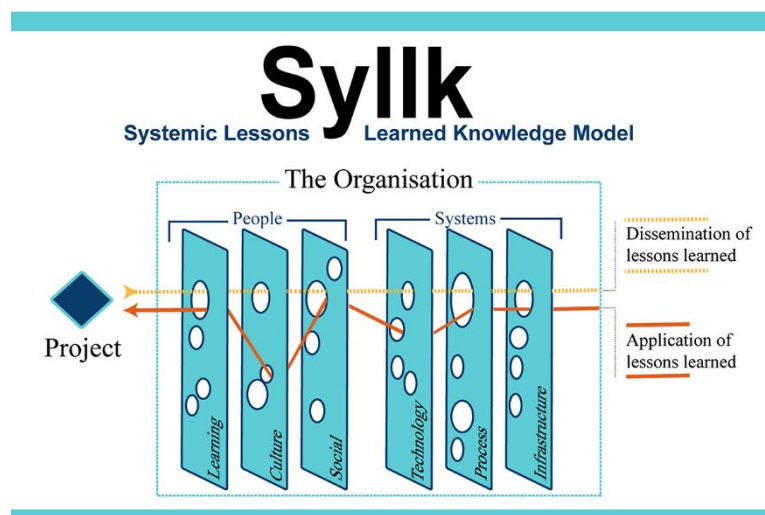
11.4.5. Using action research in practice: useful insights and outcomes.

Duffield, S., (Forthcoming, 2017). Using Action Research in Practice: Useful Insights and Outcomes. ALAR: Action Learning and Action Research Journal, vol. 23, no. 1.

Title changed as part of peer review.

Hello Stephen Mark Duffield:

We have reached a decision regarding your submission to ALARj, "Using Action Research in Practice: Project and Knowledge Management Studies".

Your article was well received, but with several suggestions for modifications and improvements. The following are comments received on your article. …

If you wish to revise the paper and send it to me by mid- to late-April, I would be please to include it in the next issue of the Journal.

Mr Colin Bradley
colinb@change-actions.com.au
Managing Editor
ALARj
http://journal.alara.net.au/index.php/alarj

From: Colin Bradley [mailto:colinb@change-actions.com.au]
Sent: Monday, March 20, 2017 9:35 AM
To: Stephen Duffield
Subject: Re: [ALARj] Using Action Research in Practice: Project and Knowledge Management Studies
Thanks Stephen, and yes, the table reference *[Table 1-2]* is fine.
…
Colin

From: Colin Bradley [mailto:colinb@change-actions.com.au]
Sent: Monday, March 20, 2017 8:44 AM
To: Mr Stephen Mark Duffield
Subject: Re: [ALARj] Using Action Research in Practice: Project and Knowledge Management Studies

…I have sent your paper for review and I am waiting on those reviews. I am planning for a publication of the next issue soon after Easter, but that date, and whether your article is included, will depend on the reviewers (although I am fairly confident in both cases).
Colin

From: Colin [mailto:colinb@change-actions.com.au]
Sent: Friday, July 22, 2016 7:18 PM
To: Stephen Duffield
Subject: Re: [ALARj] Using Action Research in Practice: Project and Knowledge Management Studies

Hello Stephen
 Susan has stepped down as editor, and I am filling in while ALARA seeks a new Managing Editor. We have received your article, and it is scheduled for the second issue this year.
 I am currently putting together the first issue, and expect to publish it next month, with the second issue due late in the year (ideally in November, but possibly December).
 I hope this timing is acceptable for your thesis.
 Colin Bradley

11.5. Appendix E: Project A data extracts

11.5.1. IKnow(Branch) framework

The following IKnow(Branch) framework extract was an important supporting document in the KM Project (Project A: Real-World Problem-Solving interest) associated with Paper Two. As the project progressed, the IKnow(Branch) framework helped the participants to understand the action research process and the KM practices that they were implementing. As the author of the framework, this enabled me to support the project.

As previously discussed, Project A Real-World Problem-Solving interest focussed on a government Branch establishing a KM project to develop and implement a KM framework. The research focus groups provided input into the planning element of the problem–solving KM project. A KM project team meeting was held to identify KM practices from the KM literature. These were then aligned with each of the Syllk elements to facilitate the best learning and address the identified barriers (refer to page 3 of the Iknow(Branch) document).

The KM practices were further refined into KM interventions and initiatives to support the development of what was to be called the "IKnow(Branch) KM framework" and the implementation plan. The interventions and initiatives were developed by the (Branch) KM project team in discussion with me (refer to pages 3-4 and 7 of the IKnow(Branch) framework document).

IKnow(BRANCH)

Stephen Duffield
PhD Candidate
University of Southern Queensland

DRAFT-V1.0

Report delivered under USQ Ethics approval H13REA038.

If you have any ethical concerns with how the research is being conducted or any queries about your rights as a participant, please feel free to contact the University of Southern Queensland Ethics Officer on the following details.

Ethics and Research Integrity Officer
Office of Research and Higher Degrees
University of Southern Queensland
West Street, Toowoomba 4350
Ph: +61 7 4631 2690
Email: ethics@usq.edu.au

Summary - Table of Contents

Front Cover graphic sourced from UK Local Government Association, October 2011

(BRANCH) KM LL (Syllk variables) research outputs

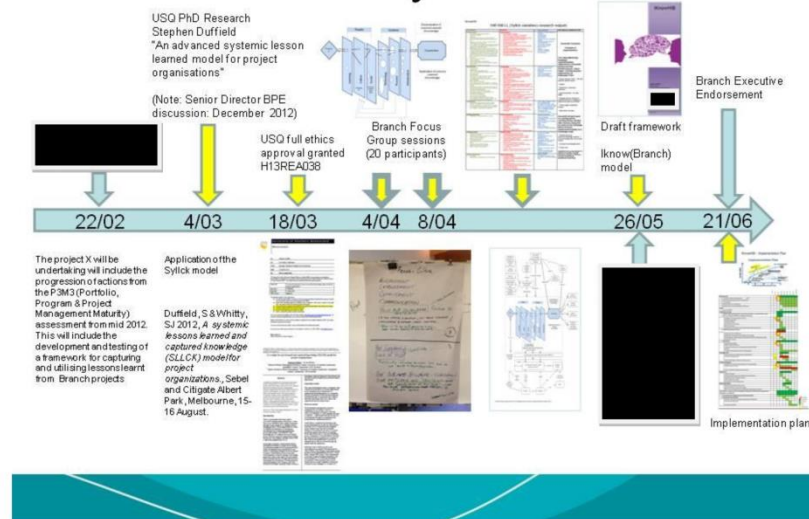| Facilitators	Barriers	• KM practices	KM options suitable for (BRANCH)

People Learning
• Information available when needed
• Relevant information
• Mentoring
• Small workshops (in-house) same skill level.
• Sharing/crossing different people experience (PC, PS)
• Drawing on your own + other's experience from other positions, industries, etc.
• (PC) The length of our program has enabled a structure to develop that complements team strengths and weakness and individual skills.
• Willingness to share and learn from each other; others willing to listen and accept new ideas; for us we have a large and growing multidisciplinary that complement and respect each other. This has led to a willingness to learn from what worked and feel a sense of achievement, and we can do better next time. Lucky given we have had ongoing projects to learn from.
• Evidence-based not opinion
• Lifelong learning
• Resources-diversity to aid learning
• Set the right scene for learning to deliver (positive environment)
• Right tools - right time - right people
	People Learning
	• Loss of people/knowledge
	• People position changing – lost knowledge
	• Time and program pressure to sharing
	• Learning modalities for diff people and the way they hear and learn and timing at the right time
	• Information overload
	• No planned career or succession planning
	• No training plans in place
	• Lack of access to training
	• Funding allocated that matches the technical needs of the job
	• Lack of funding for training workshop etc.
	• Past lessons learnt workshops - shelf ware
	• (PS) Lack of opportunity for networking across areas especially professional networking
	• (PS) Time to be social
	• (SI) Minimal opportunity for training
		• Specific focus group sessions on KM topics
		• Learning before
		  Learning during
		  Learning after
		• Stories and lessons, Storytelling
		• Individual learning interviews
		• Learning histories
		• Communities of Practice
		• Lunch & Learn session
		• B/Fast sessions
		• Forums
		• Technical X-Change
		• Mentoring / Buddying
		• Apprenticeships
			IKnow(BRANCH) Framework
			
			Examples of Implementation:
			
			CoP using (Mentoring / Buddying / Apprenticeships) supported by an IKnow(BRANCH) Intranet site with Stories/Lessons, Yellow Pages, Learning sessions implemented via Employees PAD/PDAs
			
			* Group session (CoP) - KM and lessons learned topics
			
			* Stories
			
			* Mentoring / buddying / coaching
			
			* Apprenticeships - for later stage
			
			* Strategy around reward of sharing positives & negatives - need to include link to PADs
			
			* Yellow pages (expertise locator)
			
			* After action reviews
			
			IKnow(BRANCH) intranet based on Learning before, Learning during, learning after structure using existing KA sheet as the knowledge library structure (implemented initially via a knowledge audit)
			
			* Intranet site as a lessons/knowledge sharing - ? Complemented with some hard copies
			
			* Conduct a knowledge audit
			
			* What's new
			
			Update/revise al processes to reflect IKnow(BRANCH) (Capital Planning, Design & Delivery Process framework, Dashboard reporting)

People Culture • Communication • Engagement • (PS) Emotional intelligence (EQ) • (SP) Communicating other people / units roles • Open disclosure • Empowerment • Value and encourage people to contribute • Encourage and support, don't control • Providing support to those who want to increase their knowledge • (PS) Positive environment • (PS) Colleagues sharing knowledge + experience • Respect at all levels across team, open, promoting learning • Structure and process- is about the sum of all not the individual working in silos. Set up the structure to ensure ownership spread • (SP) Open minds supporting change • (SI) Regular updates on organisation focus • Working in familiar groups • Tune in if you are listen to • Open shared accountabilities • If one employs manager, let them manage • Have diversity across ages, positive culture. The new and the young have come together	**People Culture** • (PL) Poor communication • (SI) Poor change communication • Penalty for disclosure, divulging errors • Poor leadership • Lack of trust (SI) leading to overly complicated + highly inefficient approval/ governance processes • (SI) No shared view about how to maximize the benefits of corporate knowledge • Disparate group • Fear of being replaced • "That's how it's always been" mentality • Blame culture • Knowledge is very specialised limitations to learning; (PL)"It's my knowledge – we worked it out, why share; (PL) If I give it up I will not be the expert, I may not be needed • (SP) People coming from different perspective/ skills/ knowledge • Politically motivated decisions that have no real benefit to project/ organisation • People don't look for truth; it may have consequences • Poor business structure - establishment • Over emphasis on non-compliance or "compliance at all cost" not providing opportunity for variety to achieve goals	• Tone from Leadership teams • Team KM sharing events • Alumni club • Identifying and promoting champions • Reward and Recognition • Link to org objectives • Align culture and business • Expertise List • Performance appraisals - leadership	
People Social • Acknowledge individual/group/team activities • Reward + recognition of work achieved (PL) • (PC) Speed bumps on long the way are managed and addressed across the team, become positive not a negative. Celebrate the milestones.	**People Social** • Lack of recognition • Poor treatment of employees as people i.e. viewed as a necessary factor only not encouraged and treated as a person • (PL)Willingness to share lessons learned across projects and to improve; (PL) Willingness to impart knowledge.	• Yellow Pages (expertise locator list), Knowledge Matrix • Promoting conversation: open plan office, communal knowledge areas, online conversation, town hall and roundtable meetings, lunch 'n' learn/Bfast sessions • Knowledge cafe's • Communities of Practice • Stories and lessons, Storytelling	
Systems Technology • Dashboard - knowledge capture + review	**Systems Technology** • Incompatibility with private sector • Not everyone uses the system (Aconex) • Constrained ICT environment • Easy to add info easy to use, Access • Complexity - dashboard • Lack of tools/ functionality; Lack of modern tools • Tools not linked • Reliability • Email system • Modern + up to date software • (SI)Complex ineffective financial + reporting systems	• IKnow(BRANCH) Intranet site (based around RH"s xls sheet) • Lesson 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 • System process is simple and easily understood • Forms and checklists • Guidelines for process to achieve an "across the board" consistent approach • Implementation training • Innovative approach • Demonstrated active commitment to process at all levels • Flexible and supports innovation • Matches the need of the business • Drives + delivers best practice	**Systems Process** • No training rolled out with new policy • Understanding of the process intent • Poor implementation of new process+ change • Post-occupancy elevation too late in process • Continual change of processes • Length of time between inception + completion (more than 9monnts) • Language not appropriate to audience • Overly complicated; Bureaucratic, rigid+ complex • Too detailed, too perspective, Do what I say • Limited compliance monitoring (lack of resources) • Reliance on areas outside of our business	• IKnow(BRANCH) Framework- (how does the KM work in (BRANCH)) • Process on LL • Post project reviews/ Peer assists/reviews/After action reviews • Knowledge handover, the next step following a retrospect II workshop. • Risk Management • Employee Development PAD/PDAs • Conduct a knowledge network analysis • Conduct a knowledge audit • Types of learning reusable project knowledge	
System-Infrastructure • co-location • Making lessons applicable to current activities	**System-Infrastructure** • Poor accommodation • Unreliable IT systems; No external access to IT • Unstable environment; Disc space loss of data • Poor filing; retrieval • Different: stakeholders; consultants; locations and databases • Changing management structure/ priorities • Current staffing approach is employed only to job no longer term HR approach • General lack of resourcing • Too much churn in people and processes	• Layout of teams • Promoting conversation, Open plan office, communal knowledge areas • Intranet availability • Performance appraisals, Employee Development PAD/PDAs etc	

IKnow(Branch)– Implementation Plan

Implementation Plan
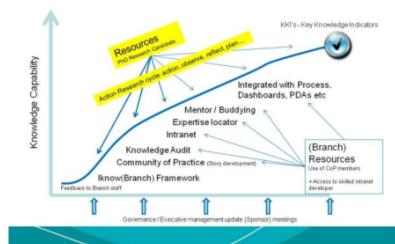
Task	Time	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Ongoing
KM Governance									
LT Sponsor & ▮ for initial approval + KKIs			◯						
(BRANCH) Interface Meeting for input and development									
LT for approval									
Monthly report to LT on KM status									
Monthly report to Interface Meeting on KM status									
Launch									
Launch of (BRANCH) KM									
Community of Practice									
Establish initial working party for to share info & practices on current hot &/or current issues e.g. ▮ issues									
Completion of story templates for 3 events			◯						
Workshop preparation									
Facilitate workshop									
Documentation of outcomes									
After action reviews									
Incorporation of outcomes into processes & other relevant documents									
Establish Community of Practice									
Development of Terms of Reference			◯						
Identify with LT members & seek invitees to first meeting									
Develop agenda including outcomes & feedback from first working party outcome									
Convene first meeting									
Story Process									
Develop Story template			◯						
Publish in (BRANCH) General\Tools									
Incorporate into processes including project reviews and PDAs									
Promote									
Completed stories feed into COP and working parties									
Knowledge Audit									
Develop systems for establishment & implementation									
Undertake Knowledge Audit									
Utilise audit findings to develop Intranet structure									
Intranet development									
Identification of resource with experience in online publishing			◯						
Establish intranet structure									
Launch, promote & incorporate into processes									
Expertise List									
Confirm overall aim									
Develop system & process for establishment & maintenance									
Identification with LT members & others									
Collect expertise list content									
Incorporate use of into (BRANCH) processes									
Mentoring/Buddying									
Research models/options/▮ resources									
Develop (BRANCH) system & associated package									
With LT and use of expertise list, seek/identify internal/external mentors									
Incorporation of capture and use of knowledge management in (BRANCH) activities including PDAs & (BRANCH) projects e.g. Dashboard									
Incorporation into all (BRANCH) processes & relevant documents									
Incorporation into PAD/PDAs									
Develop't of indicators/statements/expectations for PAD/PDAs									
Communicate expectations									
Incorporate into PDAs									

Legend:
- ◯ 1st Priority
- ▮ critical task (red)
- ▮ summary task (dark green)
- ▮ task (light green)
- ▮ commenced (yellow)

Action Research

The story so far...

USQ PhD Research
Stephen Duffield
"An advanced systemic lesson
learned model for project
organisations"

(Note: Senior Director BPE
discussion: December 2012)

Branch Executive
Endorsement

USQ full ethics
approval granted
H13REA038

Branch Focus
Group sessions
(20 participants)

Draft framework

Iknow(Branch)
model

| 22/02 | 4/03 | 18/03 | 4/04 | 8/04 | 26/05 | 21/06 |

The project X will be
undertaking will include the
progression of actions from
the P3M3 (Portfolio,
Program & Project
Management Maturity)
assessment from mid 2012.
This will include the
development and testing of
a framework for capturing
and utilising lessons learnt
from Branch projects

Application of the
Syllck model

Duffield, S & Whitty,
SJ 2012, *A systemic
lessons learned and
captured knowledge
(SLLCK) model for
project
organizations*, Sebel
and Citigate Albert
Park, Melbourne, 15-
16 August.

Implementation plan

1

Research Questions

RQ: Can the Systemic Lessons Learned Knowledge (Syllk) model enable a project organisation to learn from past project experiences?

Action Research cycle

Focus Groups

Planning Interviews
- Director (BI)
- Executive Management
- CoP Members

Iknow(Branch) Framework
Implementation plan

Initial
Planning
Interviews

Plan

Action   Reflect

Observe

Exit, if
questions
are
answered

The reflection stage will
highlight changes to be
made for the planning of
the next action research
cycle or a decision may
be made for the cycle to
end (exit)

The actions will be observed, monitored and evaluated for their impact on KHIs

~1-2 hours a fortnight of Branch Lead (Senior Director) + available CoP members to meet with the
researcher to discuss the steps/actions/outputs/plans at various stages of the action research process

3

Think of an equaliser getting the right KM balance and fit for
(BRANCH)...
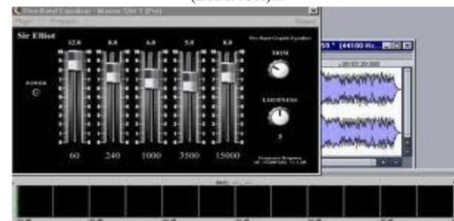
IKnow(Branch)

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IKnow(Branch)

1.IKnow(BRANCH) Framework

Implementation:

KM Practice (Independent Variable) Reference Number	Cycle 1: IKnow(Branch)	
	Interventions and initiatives	**Status**
(1)	Best Practice Directory	Part implemented
(2)	Lessons Learned	Part implemented
(3)	Storytelling	Tried to implement
(4)	Questions and Answers	No implementation
(5)	Communities of Practice	Implemented
(6)	Special Interest Groups	Tried to implement
(7)	Portal	Tried to implement
(9)	Yellow Pages	No implementation
(8)	Knowledge Audit	Tried to implement
(10)	E-learning	No implementation
(11)	Mentoring / buddying	No implementation
(12)	Performance appraisals	Tried to implement

Independent Variables (KM practices) alignment with the Syllk model.

Learning (Explicit & Tacit Knowledge)	Culture (Content)	Social (Structure)	Technology	Process	Infrastructure
Knowledge or a skill that enables the individual to be more effective, and the codified version of this.	Beliefs (what's true) and values (what's right & important).	How we relate to each other and the structure that enables relationships	Optimum use of technology	Explicit processes (Embedding knowledge management)	What's required to support and enable the organisation to function
• Qualification • Competences • Team competencies • ***Expertise (9)*** • Experience • Skill • Creativity • Experimenting • Adaptability • Feedback skills • ***Storytelling skills (3)*** • ***Stories (3)*** • ***Individual learning interviews (3)*** • ***Learning histories (2)*** • Apprentices • Books / Training Manuals / documents • Case studies • Intellectual property • ***Mentoring/buddying (11)***	• Vision/Mission statement • Openness • Mutual support • Collectivism • Language and terms used • Expectation • Commitment • Sharing understandings • Exchanging ideas • Building relationships • ***Building Communities(5)*** • ***Sharing Stories/anecdotes (3)*** • Position descriptions • Unwritten rules • Customs • Tone from Leadership teams • Identifying and promoting champions • Link to organisational objectives • Align culture and business • Develop Leadership • Empowering staff	• Social Networks • Relationships • Interactions • ***SIG Groups (6)*** • Societies • Associations • ***Communities of Practice (5)*** • Organizational structure • ***Story telling forums (3)*** • ***Questions & Answers(4)*** • ***Mentoring/buddying (11)*** • Job shadowing • Job rotation • Support groups • Contracts / agreements • ***Yellow Pages (expertise locator list), Knowledge Matrix (9)*** • Promoting conversation: online conversation, • Town hall and roundtable meetings, • Breakfast sessions • Knowledge cafe's • Do's and don'ts tutorials • Network Coffee Breaks • Specific focus group sessions on KM topics • Lunch & Learn sessions • Technical X-Change • Team sharing events • Alumni club • Reward and Recognition Events	• Computers • Software • Databases • Dashboards • Decision-making tools • Charts/graphs • Concept maps • Cognitive tools • Promotes innovation • Physical tools / machines / equipment • ***Expertise directory, Yellow pages (9)*** • ***Lessons learned database (2)*** • ***E-learning system (10)*** • ***Knowledge libraries, portals web, wikis, intranets (7)*** • Publish and search technologies • Search engines • Blogs • Social media • What is new (post) • Enterprise Content Management	• Governance • Operational system • Processes • Templates • ***Performance appraisal (12)*** • Business methods • Strategic initiative • Financial system • HR System • Procurement system • Quality System • Risk system • ***Best practice directory (1)*** • ***Lessons learned process (2)*** • ***Post project reviews/ Peer assists/reviews/After action reviews (2)*** • Risk Management • ***Conduct a knowledge network analysis (8)*** • ***Conduct a knowledge audit (8)*** • Training programs • Apprenticeship Program • Rewards mechanism • Competences assessment • Learning before, learning during and learning after (knowledge handover)	• Physical spaces • Amenities • Furniture • Supply chain • Wireless • Raw material • Transportation • Layout of teams • ***Intranet accessibility and availability (7)*** • Senior Management • Office plan • Communal knowledge areas

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11.5.2. We really need to talk about (sub-Branch)CK and Lessons Learned

Figure E-1 We really need to talk about (sub-Branch) Community of Knowledge and Lessons Learned

11.5.3. KM Practice (independent variable/interventions)

The following table (Table E-1) and figure (Figure E-2) provides insight into the action research cycle 3. Figure E-2 provided one of the final inputs to Paper Two (Fig.3 Organisational wiring for knowledge) network capability diagram.

Table E-1 KM Practice (independent variable/interventions) status

KM Practice (Independent variable / Intervention and initiatives) Reference Number	Cycle 1: IKnow(Branch)		Cycle 2: (sub-Branch)CK		Cycle 3: (sub-Branch)CK	
	Interventions and initiatives	Status	Interventions and initiatives	Status	Interventions and initiatives	Status
(1)	Best Practice Directory	Part implemented	Best Practice Directory [Capital Infrastructure Requirements]	Implemented	Best Practice Directory [Capital Infrastructure Requirements]	Implemented
(2)	Lessons Learned	Part implemented	Lessons Learned [Project Reviews, Building Performance Evaluations]	Implemented	Lessons Learned [Project Reviews, Building Performance Evaluations]	Implemented
(3)	Storytelling	Tried to implement	Stories [Storytelling part of (sub-Branch)CK-CoP]	Part implemented	Stories [Storytelling part of (sub-Branch)CK-CoP, lunch box talks]	Implemented
(4)	Questions and Answers	No implementation	Questions and Answers [Social Media]	Tried to implement	Questions and Answers [Social Media]	Part implemented
(5)	Communities of Practice	Implemented	Communities of Practice	Implemented	Communities of Practice [(sub-Branch)CK CoP, Interface meetings]	Implemented
(6)	Special Interest Groups	Tried to implement	(sub- Branch)CK [Special Interest Groups/Social Media sub-groups]	Tried to implement	(sub-Branch)CK [Special Interest Groups/Social Media sub-groups]	Part implemented
(7)	Portal	Tried to implement	Portal [Social Media - (sub-Branch)CK]	Tried to implement	Portal [Social Media [Yammer] - (sub-Branch)CK]	Part implemented
(9)	Yellow Pages	No implementation	(sub-Branch)CK Connect [Social Media]	Tried to implement	(sub-Branch)CK Connect [Social Media [Yammer]]	Part implemented
(8)	Knowledge Audit	Tried to implement	(sub-Branch)CK Knowledge Audit	Part implemented	(sub-Branch)CK Knowledge Audit	Not implemented
(10)	E-learning	No implementation	E-learning	Not implemented		
(11)	Mentoring / buddying	No implementation	Mentoring / buddying	Not implemented		
(12)	Performance appraisals	Tried to implement	Performance appraisals	Not implemented		

Learning (Explicit & Tacit Knowledge)	Culture (Content)	Social (Structure)	Technology	Process	Infrastructure
Knowledge or a skill that enables the individual to be more effective, and the codified version of this.	Beliefs (what's true) and values (what's right & important).	How we relate to each other and the structure that enable relationships	Optimum use of technology	Explicit processes (Embedding knowledge management)	What's required to support and enable the organisation to function
• Qualification • Competences • Team competences • Expertise • Experience • Skill • Creativity • Experimenting • Adaptability • Feedback skills • Storytelling skills • Stories • Individual learning interviews • Learning histories • Apprentices • Books / Training Manuals / documents • Case studies • Intellectual property • Mentoring/buddying	• Vision/Mission statement • Openness • Mutual support • Collectivism • Language and terms used • Expectation • Commitment • Sharing understandings • Exchanging ideas • Building relationships • Building Communities • Sharing Stories/anecdotes • Position descriptions • Unwritten rules • Customs • Tone from Leadership teams • Identifying and promoting champions • Link to organisational objectives • Align culture and business • Develop Leadership • Empowering staff	• Social Networks • Relationships • Interactions • SIG Groups • Societies/Associations • Communities of Practice • Organizational structure • Story telling forums • Questions & Answers • Mentoring/buddying • Job shadowing • Job rotation • Support groups • Contracts / agreements • Yellow Pages (expertise locator list), Knowledge Matrix • Promoting conversation: online conversation, • Town hall and roundtable meetings, • Breakfast sessions • Knowledge cafe's • Do's and don'ts tutorials • Network Coffee Breaks • Specific focus group sessions on KM topics • Lunch & Learn sessions • Technical X-Change • Team sharing events • Alumni club • Reward and Recognition Events	• Computers • Software • Databases • Dashboards • Decision making tools • Charts/graphs • Concept maps • Cognitive tools • Promotes innovation • Physical tools / machines / equipment • Expertise directory, Yellow pages • Lessons learned database • E-learning system • Knowledge libraries, portals web, wikis, intranets • Publish and search technologies • Search engines • Blogs • Social media • What is new (post) • Enterprise Content Management	• Governance • Operational system • Processes • Templates • Performance appraisal • Business methods • Strategic initiative • Financial system • HR System • Procurement system • Quality System • Risk system • Best practice directory • Lessons learned process • Post project reviews/ Peer assists/reviews/After action reviews • Risk Management • Conduct a knowledge network analysis • Conduct a knowledge audit • Training programs • Apprenticeship Program • Rewards mechanism • Competences assessment • Learning before, learning during and learning after (knowledge handover) • Reflection	• Physical spaces • Amenities • Furniture • Supply chain • Wireless • Raw material • Transportation • Layout of teams • Intranet accessibility and availability • Senior Management • Office plan • Communal knowledge areas

Figure E-2 KM Practice (independent variable/Interventions) alignment to the Syllk model

11.5.4. KM benefits integrated KM mind map incorporating the Syllk model

To assist in presenting the benefits of Project A, Figure E-3 was presented to the Project A team as a way of showing how the Syllk model integrates with the organisation.
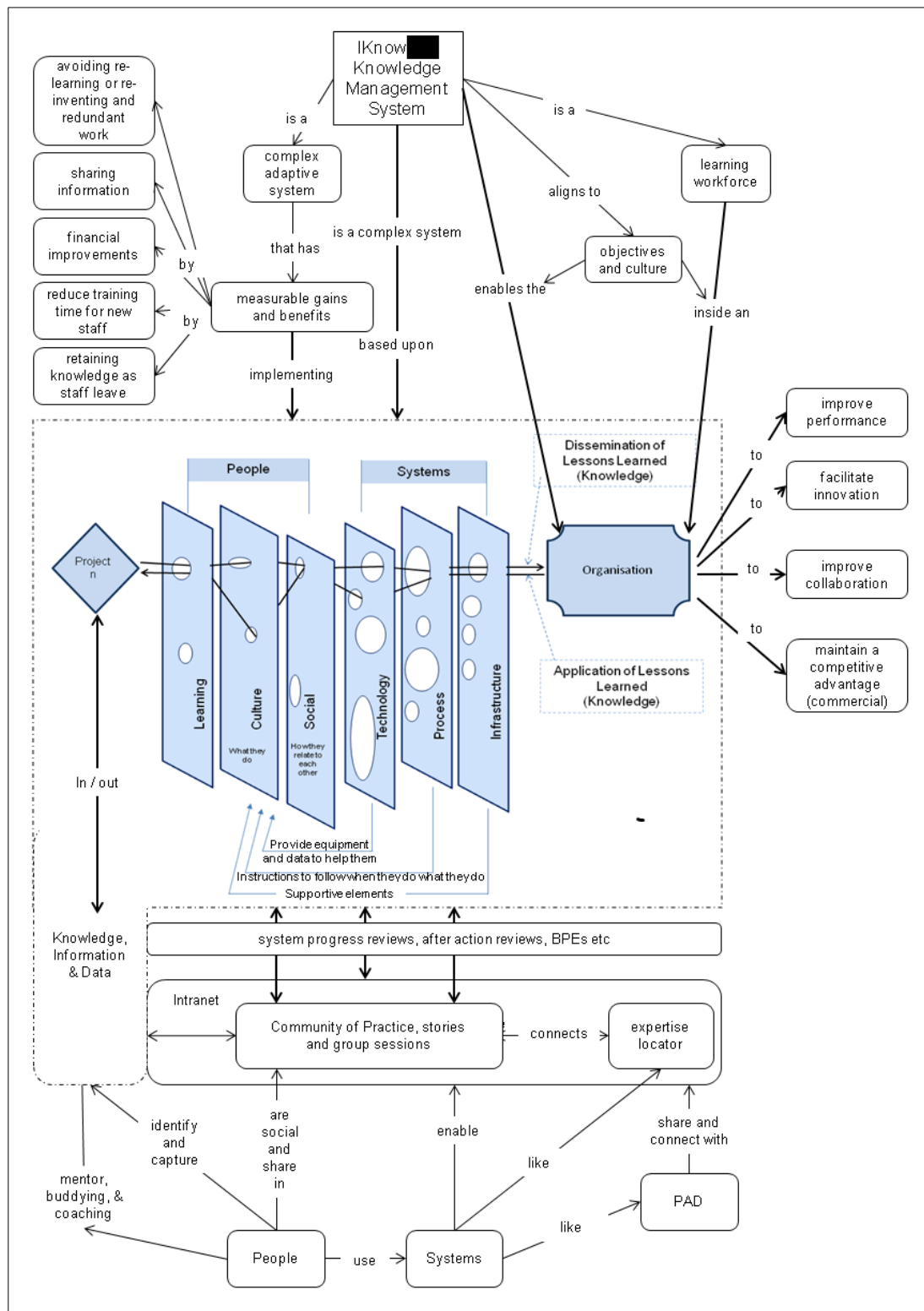
Figure E-3 Integrated KM mind map incorporating the Syllk model
Adapted from: (Duffield & Whitty 2012; Duffield & Whitty 2015b; White 2010)

11.6. Appendix F: Project B data extracts

11.6.1. Project B NVivo example of category nodes and coding

11.6.2. Project B original data set in support of Paper Three table 4

Table F-1 Original data set of Paper Three table 4

Dependent variables	Expectations	Evidence through reflection	Met Expectations
How many changes to our systems (technology and processes)	Increase	Communications and process tools developed	Partial Website to be established.
Number of serious anecdotes about the value of KM	Increase	Aha moment Understand the benefit Barriers been broken down a little and I think people are talking to each other that didn't know each other	Partial Need to engage executive officer support and focus on removal of identified barriers in Table 1.
Number of success stories and lessons learned published	Increase	We've had a certain success ...across the three sites ...want to see stories with a learning in them, like it could be a bad story but we've learnt ...he uses story telling with his team. So, they have a weekly meeting on a Friday afternoon where they have to tell success, where the focus of the meeting is to tell success stories of how have you succeeded this week, and the whole team has to participate, and they've developed their own award...	
Telling stories Leaders telling stories	Increase	(Executive Officer) did one...she got a lot of people there and she liked what she saw and was being very supportive on the day...and she went up to the division and you know really encouraged people to come down and so we then got a second wave of participants based on her telling people you need to go down and do that and she came back down and recorded a story. (team) had a gathering of their team leaders in (location) and the group decided to have a breakfast so (person) from payroll said well okay what are we going to do over the breakfast, so what they decided to do was each prepare a story board with their team...at the breakfast, all the team leaders spoke about, the theme was their team's success. And so, they all came with a story board and then they spoke to their story board around breakfast. ...a new strategy from the (Executive Officer). The cultural renewal strategy, under improving communications and one of the activities is share, celebrate and leverage success stories by face to face and digital channels (i.e. (division) Champions of Change). Now that's us, that's definitely us and it's now in the whole of the department.	Yes
Story telling forums Story telling day	Hold an event	We had our story day, that was our biggest event ...it was an insight to them because a lot of the story boards were about themselves, you know you could look at the story boards and see exactly what it was they were interested in and things like that so it was just another way of doing it. Story day was part of the whole dynamic communications week and so there was a divisional forum the following day...all of the (story day sites) material all went up in the conference room that the divisional forums was in and it lined the walls of both sides of the room because we did banners as well as story boards and it looked really good cause it was very colourful and very dynamic. (Executive officer) made reference to it a couple of times throughout the day, so yeah I think it was good.	Yes

11.6.3. Project B original data set in support of Paper Three table 5

Table F-2 Original data set of Paper Three table 5

Syllk elements	Expectations	Evidence through reflection	Met Expectations
Syllk model	Positive influence	We did right from the start have a look at (the model) where those barriers are and what shape our direction...then we've had to amend it slightly as we've moved through. ...where there's that alignment, where aligning to it or making adjustments. So back to the Swiss cheese... learning happening for you, culture not happening for you, social happening, technology – you're getting there with the web, processing you have in place, infrastructure. Listen to the barriers; completing work load (All) yes; access to communications (All) yes; ICT resourcing (All) yes; silos of operation (All) yes; organisations structure (All) yes; workloads (All) yes; we knew all of those things before. ...yeah we knew it..that says it all ...if this is going to work and go through, you've got the last blockers there right now, and culture blocking and technology...so it's about getting it all aligned, otherwise it just won't (happen), you could have all the great social stuff in the world and all the people willing to learn but without these other elements in place, it isn't going to happen, you know...so things that do work for you, your ICT technologies, we talked about getting the iPad more and using iPhones to try and capture stuff, open minds, getting experts in there, storytelling courses, resources from many people in (department), talking about environmental change and I think that maybe you believe they were sort of working for you in a way but it's those blockers which are going to come back and get you. And you identified them, so now it's about going back and saying we need to try and address these blockers. ...so that's pretty amazing if you know what I mean just sitting back and reflecting on each one of those dot points, are well and truly the things that are causing you pain right now.	Yes Confirmation of impact of barriers.
People - Learning	Positive influence	clearly people still want to learn, for them to want to go to that story day, they're wanting to get involved in that learning, so the learning factors ...social path very strong launched the lunch box session...close on a hundred people maybe...so that reiterates that people want to learn, they want the information if it's there.	Yes
People - Culture	Positive influence	Sanitised stories If they point towards a culture, I think there's a value in that story that for instance it might be culture that there wasn't good communication or consultation Sharing success stories Telling stories	Yes Confirmation of impact of barriers.
People - Social	Positive influence	clearly people still want to learn, for them to want to go to that story day, they're wanting to get involved in that learning, so the learning factors ...social path very strong Team sharing events - weekly meeting on a Friday afternoon where ...focus of the meeting is to tell success stories of how have you succeeded this week; (team) all came with a story board and then they spoke to their story board around breakfast. what's going on Facebook is all very positive and there's lots of good stories	Yes
System - Technology	Positive influence	we've got content for the website and the structures there, it's just approval processes	Work in progress
System - Process	Positive influence	process on the website...Story telling template	Work in progress

Syllk elements	Expectations	Evidence through reflection	Met Expectations
System - Infrastructure	Positive influence	posters out there right which have got a good story around them ...infrastructure. Listen to the barriers; completing work load (All) yes; access to communications (All) yes; ICT resourcing (All) yes; silos of operation (All) yes; organisations structure (All) yes; workloads (All) yes	Yes Confirmation of impact of barriers.

11.6.4. Project B original data set in support of Paper Three table 6

Table F-3 Original data set of Paper Three table 6

Dependent variables	Expectations	Evidence through reflection	Met Expectations
Contributions over time	Increase	Ongoing leadership stories ...stories are growing, but there'll be more done from the leaders that will encourage it along Story count	Work in progress
How many changes to our systems (technology and processes)	Increase	Internet web page with process toolkit developed	Yes
Number of serious anecdotes about the value of KM	Increase	Recommendations that probably point to learnings, storytelling and the skill of storytelling, being part of management development, and the website becomes more about the courses and learnings of storytelling, and skills of storytelling Creating awareness for people that what they're actually doing is knowledge management by telling The amount of awareness I think the project has raised…people now hear of stories – they're not just hearing a story, and sort of subconsciously taking the learnings. They're actually saying, 'I've just heard a story which I know now is a powerful management tool in transferring knowledge'. So, there's more recognition of the story for what it is, and not just the outcomes of the story. They look forward to her stories. They expect a story almost, with the message. …they recognise her...they hear the story and it's a story. Now, I think they're making that link that it's a story and stories are great tools for transferring knowledge. And that's about the awareness that we've generated We're gravitating towards learning development people are now hearing stories and making that click that they've told a story Would you guys all say that you've learned – that you're a believer of storytelling as a true…more than before? I mean, I certainly am. ...I think so. Yeah, I definitely see a power in its linkage.	Yes
Number of success stories and lessons learned published	Increase	...the success is largely qualitative, as you say. You can measure the stories and it's quantitative, but what does it mean? It's just a number. I think we've made a massive amount of awareness. At the end of the day, the (Executive Management Team) sponsored these projects and agreed to them, so there was an acceptance that they were worthwhile to do. And I'm positive that people are now hearing stories and making that click that they've told a story: 'my god, that was really good! I should be doing that', whereas before they'd have been told the story and walked away just with the lesson of the story. People are now hearing stories and making that click that they've told a story Would you guys all say that you've learned – that you're a	Yes

Dependent variables	Expectations	Evidence through reflection	Met Expectations
		believer of storytelling as a true…more than before? I mean, I certainly am. ...I think so. Yeah, I definitely see a power in its linkage. We are a storytelling organisation, it's just that the idea is now that we take that and become better at it, through it being part of learning development.	
Policy, Systems & Process changes	Increase	... 'well, how do we do that?' and, 'how do we story-tell?' and, 'well, here's a training course'. And that's why we think learning and development is the key.	Yes
Telling stories Leaders telling stories	Increase	...maybe the harvesting, capture, and dissemination of actual stories is not so much the issue, as producing leaders and managers that are good storytellers in their daily business. So, it's less about saying, 'here's a great story; how did people later use it?' but that everyone becomes good at telling stories. ...What learning development tools are available? We find that a lot of people are telling stories. We hear it. We're hearing it now, and when we first started it was like nothing was out there. And then once people learned of our project, they would tell us, 'so-and-so told a great story' or 'we're doing this; so-and-so uses stories'. ...it become more about when people are using them, where they're using the various forms to put their point across at that point in time. And I think, you know, there are some examples of people that are good storytellers and people that are probably not so good storytellers We had a forum last week...where the chief officer spoke, and gave a 40-minute presentation, and, as she does each meeting, tied that back into a personal story, and how these two linked together. People do not necessarily volunteer stuff...There is a real 'going public' barrier...hadn't quite anticipated that....just give people an opportunity and they'll all just jump at it. But no, it's in fact almost the reverse of that. They're quite private about their stories. It's very localised for a lot of people. ...sense of safe, localised environments where it's okay to tell stories, but think about taking it out of that, and there are a lot of barriers, both the technical barriers, but also people do not want to be exposed, necessarily, in that way. It is taking another step into a sort of public realm that a lot of people aren't comfortable with. So, the (team) one was probably a good example of that, where they all came and did a team presentation. They felt okay in their own team, but then getting them to volunteer to turn that into a little DVD or a written story and publish it on the website…none of them really translated that. There are some bulletins though, and I guess organisational communication channels that do tell stories about teams, and have a team focus, or even occasionally about individuals. But it's nice and controlled, etc. So, I guess there are a couple of levels of storytelling. There's that professional comms style, and then there's the ad-hoc... I think stories are growing, but there'll be more done from the leaders that will encourage it along, rather than necessarily as a project. For instance, if I reflect back to (Senior Officer) …when she gave her presentation – there have now been two or three – it always forms part of her story, part of her presentation. Each speaker, or just about every speaker who got up there after tried to add onto a story or they added a component that you would say is a story, into their presentation, even if it was to say, 'well, I do not have a story. I do not watch that; I watch MasterChef. I watch cooking programs'. One reflected about – she's quite short – how she was a trombone player, which was all very good, but her arm	Yes

Dependent variables	Expectations	Evidence through reflection	Met Expectations
		was too short. So, they're adding these personal.... (Senior Officer) – he's massive on it. It's hard to stop him telling stories sometimes, in meetings. And I think there are a few – (Senior Officer) trying now. He's not a natural storyteller though, but he's starting to try. And that's where we think our internet page, rather than capturing and regurgitating stories, becomes a…should have been a page, or in the future would be a page about why it's important, what you need. You need your toolkit of stories. Here's a course to go on.	
Story telling forums Story telling day	Increase	...storytelling day, again as a promotion of storytelling, putting it out there was successful.	Yes
Story telling skills	Increase	...we capture specific samples of people that seem to be telling stories, and are good at it. And I think we can allude to people that are telling stories, and are not good at it, and that supports the fact that this isn't…just because you're a leader, it doesn't mean you're a good storyteller. And I think that was the question we put out on very early on. I think you and I debated that, whether leaders are naturally good at storytelling, or whether it's still a learned skill. And I think we're seeing that it's definitely a learned skill. ...is that maybe the harvesting, capture, and dissemination of actual stories is not so much the issue, as producing leaders and managers that are good storytellers in their daily business. So, it's less about saying, 'here's a great story; how did people later use it?' but that everyone becomes good at telling stories. So, how do we get that? How do we grow an organisation? What learning development tools are available? We find that a lot of people are telling stories. We hear it. We're hearing it now, and when we first started it was like nothing was out there. And then once people learned of our project, they would tell us, 'so-and-so told a great story' or 'we're doing this; so-and-so uses stories'. recommendations that probably point to learnings, storytelling and the skill of storytelling, being part of management development, and the website becomes more about the courses and learnings of storytelling, and skills of storytelling Whether leaders are naturally good at storytelling, or whether it's still a learned skill. And I think we're seeing that it's definitely a learned skill.	Yes

11.6.5. Project B original data set in support of Paper Three table 7

Table F-4 Original data set of Paper Three table 7

Syllk elements	Expectations	Evidence through reflection	Met Expectations
Syllk model	Positive influence	When you look at them, the storytelling Syllk diagram...that's what she's doing. You're learning, she's got the culture, she's getting people to talk...using technology as part of that. She's got a process. She's using infrastructure. So, when you think about a slice of cheese, right, and how storytelling works – all those barriers and infrastructure just were there still. They weren't going away....so now you perhaps reshape your whole storytelling focus around the ones that are working. ...I can see all this stuff working. I mean, you've got top-level coverage; you've got all the support. I mean, you've got all the processes in place, you've got the tools in place...	Yes
People - Learning	Positive influence	Recommendations that probably point to learnings, storytelling and the skill of storytelling, being part of management development, and the website becomes more about the courses and learnings of storytelling, and skills of storytelling. We're gravitating towards learning development Whether leaders are naturally good at storytelling, or whether it's still a learned skill. And I think we're seeing that it's definitely a learned skill. We are a storytelling organisation, it's just that the idea is now that we take that and become better at it, through it being part of learning development.	Yes
People - Culture	Positive influence	(yammer) Your group will determine the medium as well. Yeah, that's right. So, it's a bit of a cultural thing, whether it's an organisation, whether it's your age… Cultural support from executive management	Yes
People - Social	Positive influence	(Yammer) It adds to your workload probably as much as it assists. Yeah, then you have to delete them. That's what I do with Yammer. Delete, delete, delete, delete. ...In some ways they've become an impediment to storytelling, not an enabler. I actually think that's true. (Yammer) it's getting traction out there. Some departments are now sending staff-wide updates in Yammer. So, it is happening.	Yes
System - Technology	Positive influence	Presentation and video recording We can't publish the YouTube video, because of our constraints, she couldn't work out how to do her story without the YouTube video. So, we weren't able to deliver it. ...They're the kind of rules and guidelines and barriers to translating a story that is presented in a small audience into a bigger audience. So, you know, that's just really probably a technological barrier... ...we have a website that's been published, with stuff on, and as we were talking about before, it's not going to be so much a story thing but as tools for people to go to, and go, 'oh, how can I find out how I can do better at my presentation, or get my message across better?' or something like that. ...that's where we think our internet page, rather than capturing and regurgitating stories, becomes a page about why it's important, what you need. You need your toolkit of stories. ...and then people would go, 'well, how do we do that?' and, 'how do we story-tell?' and, 'well, here's a training course'. And that's why we think learning and development is the key.	Yes
System - Process	Positive influence	...all the processes in place, ...the tools in place	Yes
System - Infrastructure	Positive influence	We need a physical environment and a social environment that promotes storytelling. We need the water cooler, we need a good lunch room Intranet availability Toolkits Storytelling experts	Yes

11.6.6. Project B impact of Syllk model application – Research interest

The focus on this research (theoretical interest) was to investigate how can the Syllk model be used by a project organisation to conceptualise (and enhance) its capability of storytelling. To understand how the elements of the Syllk model impacted the storytelling project (Project B) a matrix was derived from the project transcripts (Table F-5).

The findings identified that overall the Syllk elements of technology, infrastructure and culture had the highest impact narrowly followed by process, social and learning. The analysis of the data identifies that the barriers associated with the Syllk elements of technology, infrastructure and culture were the most troublesome. Additionally, the rise in the learning element towards the end of the project highlights the centre of attention on storytelling learning and development activities.

Table F-5 Syllk model – coded matrix

Project B - Data sets														
U : <deleted> Duffield Director x2 initial interview	I : 2013.10.15_ 13.26_01_1 40401 Duffield 79_29_focu sgroup	L : 20131112_I Knowxxx_03 _A3 AP : 20131112_I Knowxxx_04 _A4 AQ : 5_project_pil lars_201409 0119253107 2 AZ : story_telling_ champs plan v1	AG : 2013.11.12_ 13.03_01_1 40401 Duffield 59_41 meeting a	AJ : 2013.11.19_ 12.10_01_1 40401 Duffield 80_05 meeting b	AL : 2013.11.26_ 13.08_01_1 40401 Duffield 60_18 meeting c	X : IKnowxxx (Story-telling) ~ LinkedIn	U : 2014.02.14_ 13.26_01_1 40401 Duffield 19_09 <deleted>up date interview	B : 2014.03.05_ 10.07_01_A AR1_revised	1 : AAR1 minutes champions of change	1 : <deleted> minutes champions of change 18th March 2014	2 : <deleted> minutes champions of change 25th March 2014	G : 2014.06.25_ 11.02_01_1 40801 Duffield 54_AAR2_	Q : 2014.07.31_ 13.22_01_1 40801 Duffield 30_08 <deleted> interview

Syllk model - coded matrix															
	Director Interview	Focus Group	Initial Planning	CoP meeting	CoP meeting	CoP meeting	Social Media	Director Interview	AAR1 Reflection	Planning	CoP meeting	CoP meeting	AAR2 Reflection	Leader Interview	Total
Syllk model	1	2	0	3	3	1	1	1	5	1	0	0	4	4	26
People	1	53	7	7	8	4	1	1	11	6	1	1	28	5	134
Learning	1	14	1	1	0	1	0	0	2	1	0	1	10	1	33
Culture	1	19	3	3	3	1	0	1	7	3	1	0	5	2	49
Social	1	19	4	2	4	1	1	0	1	1	0	0	9	2	45
System	1	43	10	12	10	12	2	5	19	7	6	5	21	4	157
Technology	1	13	4	4	5	5	2	2	5	2	2	1	9	2	57
Process	1	17	6	2	2	3	0	3	5	1	1	2	4	1	48
Infrastructure	1	13	4	5	3	3	0	0	9	3	3	2	7	1	54

Figure F-1 and Table F-6 provides a sample of the work sheets used during the analysis and design of the project variables and KM practices (interventions), which led to the development of the Syllk capability network diagram (Figure F-2).

11.6.7. Project B storytelling Syllk independent (KM practices) and dependent (measures) variables (working template)

Figure F-1 Project B Syllk storytelling variables - KM practices and measures (working template)

Table F-6 Project B variable coding outputs

Independent Variables	145
Sharing stories	21
Story telling	29
Story telling forums	40
Storytelling day	28
Story telling skills	36
Dependent Variables	159
Outcome measure:	
Time, money or personnel time saved by applying stories from others	17
Rate of change in operating costs	1
Policy, Systems & Process changes	4
Output measure:	
Time to solve problems	6
Number of serious anecdotes about the value of KM	27
Number of success stories and lessons learned published	17
System measure:	
Total number of contributions	25
Data measure:	
How many changes to our systems (technology and processes)	4
Story documents	14

Learning (Explicit & Tacit Knowledge)	Culture (Content)	Social (Structure)	Technology	Process	Infrastructure
Knowledge or a skill that enables the individual to be more effective, and the codified version of this.	Beliefs (what's true) and values (what's right & important).	How we relate to each other and the structure that enable relationships	Optimum use of technology	Explicit processes (Embedding knowledge management)	What's required to support and enable the organisation to function
	Openness		Blogs		
	Mutual support		Social media		
	Commitment		Online media		
	Sharing Stories		Knowledge libraries		
	Exchanging ideas		(Stories, lessons		
	Building relationships		learned etc)		Physical spaces
	Building Communities		Portals web, wikis,		Intranet accessibility
	Tone from Leadership		intranets		and availability
	teams		Publish and search		Communal knowledge
	Link to organisational		technologies		areas
	objectives	Social Networks	Search engines		Management support
	Align culture and business	Relationships	Mobile and tablet		Toolbox
	Leadership	Interactions	devices		Assistance from
Experience	Empowering staff	Story telling forums	Training		experts
Listening	Managing change	Story day			
Creativity	Unwritten rules	Promoting conversation		Processes	
Experimenting	Customs	Communities of Practice		Templates	
Adaptability		Online conversation,		Team meeting minutes	
Storytelling		Town hall and roundtable		Story boards	
Storytelling skills		meetings		Strategic initiative	
Libraries (Stories,		Breakfast sessions		Learning before,	
lessons learned etc)		Knowledge cafe's		learning during and	
Learning		Network Coffee Breaks		learning after	
development toolkit		Lunch & Learn sessions		(knowledge handover)	
Individual learning		Technical X-Change		Reflection	
Training course		Team sharing events			
		Alumni club			

Figure F-2 Project B Syllk capability network diagram (working template)

11.7. Appendix G: Project C data extracts

11.7.1. Sample interview sheets

Para 5.1 of Paper Four discussed the initial planning step of the project C action research cycle. Four interviews with project stakeholders and senior participants of the online CoP were held. Figure G-1 is a sample interview sheet used in the interviews.

Figure G-1 Sample interview sheet

11.7.2. Collaboration tool data metrics

In support of Paper Four findings (Table V & Table IX) Figures G-2 and G-3 present the system measures (dependent variables) of project C. Figure G-2 highlights the page activity for each user. You will note the leave break in December/January had an impact as to be expected. Figure G-3 highlights the user weekly activates over the period of the trial.
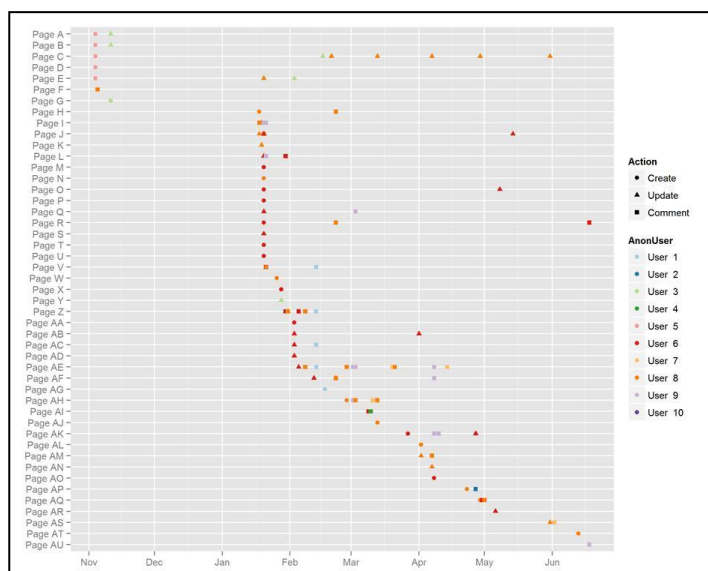
Figure G-2 User activities on online CoP pages
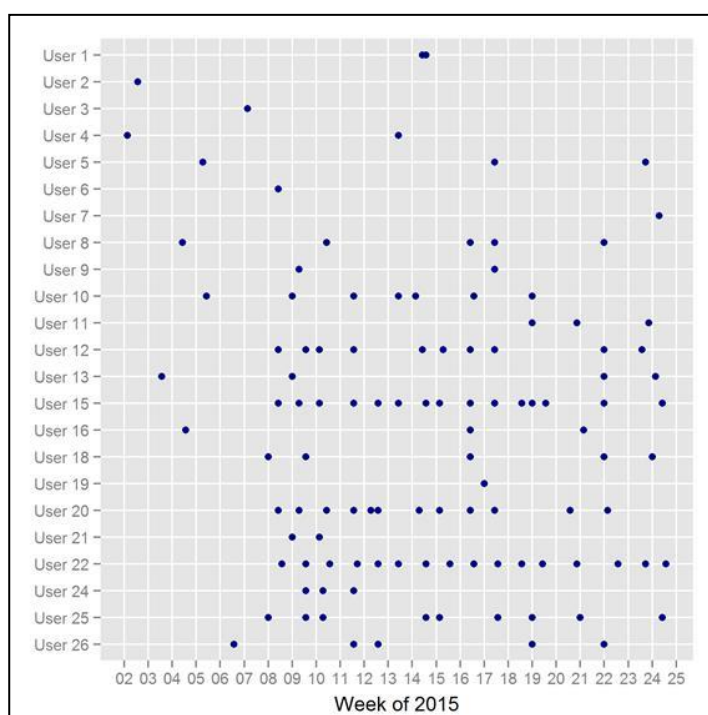
Figure G-3 User activities per week

11.7.3. Project C Syllk online CoP variables/interventions - KM practices and measures (working template)

Figure G-4 highlights the final outcomes of the trial online CoP and provides one of the final inputs to Paper Four (Paper Four: Figure 4: A Syllk model for the capability of an online CoP (network capability diagram)).

Learning (Explicit & Tacit Knowledge)	Culture (Content)	Social (Structure)	Technology	Process	Infrastructure
Knowledge or skill that enables the individual to be more effective, and the codified version of this.	Beliefs (what's true) and values (what's right & important).	How we relate to each other and the structure that enables relationships	Optimum use of technology	Explicit processes (Embedding knowledge management)	What's required to support and enable the organisation to function
• Expertise • Team competences • Experience • Creativity • Experimenting • Adaptability • Feedback skills • Storytelling skills • Stories • Learning histories • Books / Training Manuals / documents • Case studies	• Openness • Mutual support • Collectivism • Sharing understandings • Exchanging ideas • Building relationships • Building Communities • Sharing Stories/anecdotes • Identifying and promoting champions • Link to organisational objectives • Develop Leadership • Empowering staff • Governance	• Social Networks • Relationships • Interactions • SIG Groups • Societies • Associations • Communities of Practice • Story telling forums • Questions & Answers • Mentoring/buddying • Support groups • Promoting conversation • Roundtable meetings • Breakfast sessions • Knowledge cafe's • Do's and don'ts tutorials • Online conversation • Network Coffee Breaks • Specific focus group sessions on KM topics • Lunch & Learn sessions • Technical X-Change • Team sharing events • Reward and Recognition Events • Yellow Pages (expertise locator list), Knowledge Matrix	• Concept maps • Cognitive tools • Promotes innovation • Knowledge libraries • Portals web • Wikis • Intranets • Blogs • Social media • What is new (post) • Publish and search technologies • Mobile and tablet devices • Training	• Processes • Templates • Training programs • Competences assessment • Learning before, learning during and learning after (knowledge handover) • Governance	• Intranet accessibility and availability • Management support

Independent variables (those that cause, influence or affect outcomes)	Dependent variables (those that depend on the independent variables; they are the outcomes or results of the influence of the independent variables)				
KM practices (identified through literature reviews)	Key Outcome Measures (Outcome metrics concern the overall organisation and measure large-scale characteristics)		Key System Measures (System metrics monitor the usefulness and responsiveness of the supporting technology tools)		
Communities of Practice	☐ Captured organisational memory ☐ User satisfaction	☐	☐ Number of contributions ☐ Number of members ☐ Ratio of number of members to number of contributors (conversion rate) ☐ Frequency of use	☐	

Figure G-4 Project C Syllk online CoP variables/interventions - KM practices and measures (working template)

11.8. Appendix H: Project Controls Drumbeat – Manage Project Knowledge and Lessons Learned (Book chapter)

Book chapter has been peer reviewed by practicing professionals.

Currently waiting for book to be completed to enable editorial reviews.

Duffield, S (Forthcoming, 2017), 'Manage Project Knowledge and Lessons Learned', in RA Group. & L Bowman (eds), *Project Controls Drumbeat*, First, Taylor and Francis Group, United Kingdom, ch 12.

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CHAPTER **12**

Stephen M Duffield MPM, CPPD

Manage Project Knowledge and Lessons Learned

In this chapter you will:

Learn about addressing the problems of knowledge management (KM) and lessons learned from the project management and project controls domains.

Discover how the Syllk model can enable management to conceptualise (and illustrate) how organisational know-how is wired (distributed) across various people and system elements of an organisation.

Learn about how storytelling is an effective way of learning lessons.

Most managers, when they start the KM journey, do not even know what KM involves. They may be familiar with the organisation problems from their daily experiences and may have some understanding of the flow of knowledge in the organisation. Managers need to be more involved in learning about KM as the advantages of KM initiatives and practices have overall strategic implications.

There is a well-founded organisational 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 [1]. In today's business environment, ensuring business margin is becoming harder to achieve. Competition keeps margins lean and projects are becoming more complex. As knowledge is taking on a key business role, an increasing number of organisations are expecting their KM to be effective to transform organisational knowledge into a competitive advantage. Organisation's need to become knowledge intensive, effective KM should be able to support the core tasks of project management, including decision-making, planning, control, and production. An organisation will often document its KM experience as lessons learned [2]. The use of lessons learned, capturing and sharing relevant experience and implementing mechanisms to enhancing the reuse and sharing of project knowledge are fundamental elements that can improve project management practices [3].

Organisational learning is a field of practice that is focused on how groups and companies learn. Organisational learning from projects rarely happens, and when it does it typically fails to deliver the intended results [4]. KM should enhance individual, group and organisational learning, improve information circulation and even support innovation. A KM system in an organisation is seen as a means of identifying and exploiting organisation knowledge assets such as individual experiences, lessons learned, and best practices.

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Organisational knowledge plays a key role in the development of both enterprise and project risk management controls and treatments by first searching and learning what others have done (what has worked and what has failed), so the wheel is not reinvented [5]. An organisation cannot manage its risks without managing its knowledge [6]. Projects frequently fail due to a lack of lessons learned from the project team or lack of knowledge sharing. KM tools and techniques can be used to communicate appropriate risk treatments and decision making among members of a project team. It is important that the organisation manage knowledge including the identification, dissemination, and application of knowledge related to potential enterprise, portfolio, program and project risks to contribute to risk assessment and response analysis.

Reflection learning has also been recognised as playing a key part in project learning [7, 8]. Learning is not only about acquiring information and knowledge, but also socialisation [9]. Reflection "is the practice of periodically stepping back to ponder the meaning to self and to others in one's immediate environment about what has recently transpired" [7, p. 11]. Raelin [7] concludes that learning through reflection provides the what, why, and how to do it and that it is pertinent to learning from projects. Single loop learning engages the generation of new actions to achieve governing variables whereas double loop learning involves adaption and modification of the governing variables. Governing variables are the actions of individuals in the organisation [10]. Reflection learning is often used in effective double loop learning as reflection is based on how they think [10]. Organisational learning re-enforces the people factors influence and the success of the lessons learned process and that having a learning organisation culture is critical to successful dissemination of lessons learned.

> All learning takes places inside individual human heads; an organisation learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organisation did not previously have. ...What an individual learns in an organisation is very much dependent on what is already known to (or believed by) other members of the organisation and what kinds of information are present in the organizational environment. ... Individual learning in organizations is very much a social, not a solitary, phenomenon. [11, p. 125]

There are five main activities to becoming a learning organisation [12]:
1) Systematic problem solving (based on quality plan, do, check, act (PDCA) cycle)
2) Experimentation (use of demonstration projects)
3) Learning from what went before (companies need to review both failures and success and document the lessons learned, unfortunately, most fail to learn and allow knowledge to leave)
4) Learning from others (benchmarking and applying best practice)
5) Transferring knowledge (knowledge needs to spread rapidly and efficiently).

Some say that an organisation knows something if just one person knows it and that the organisation culture and structure enables that knowledge event to be used effectively. Individuals learning; knowledge storage (checklists and work processes); organisational changes that re-focuses knowledge; culture changes to open and act on problems; and relationship building that enables skills and knowledge to deal with organisational problems are all effective KM actions. Another way to explain it is that people learn by processing information using the human central nervous system. However, as an organisation does not have a central nervous system, it needs to create analogues structures to enable its personnel to learn as one holistic group [13].

Culture per se plays a significant part in KM, organisational learning, and in the effectiveness of learning mechanisms. As Dvir and Shenhar [14, p. 20] point out, "Great projects create a revolutionary project culture. The execution of great projects often requires a different project culture, which can spread to an entire organization". It is critical to

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understand the culture of an organisation before implementing or using lessons learned processes [4, 15]. Furthermore, surveys consistently reveal that the main obstacles to project success are organisational people (social and culture) factors [16, 17]. In summary, organisational knowledge or know-how of how to respond to the business environment are behaviours and actions that are embedded in and distributed across organisational artefacts, system and processes, and cultural practices and rituals. They are networked elements that together generate a particular organisational response.

Up until the PMBOK® Guide 6th edition (*due for release 2017*) there has been a disregard to KM processes and lessons learned methods. The PMBOK® Guide 6th edition is proposing a new process "Manage Project Knowledge". Manage Project Knowledge "is the process of using existing knowledge and creating new knowledge to achieve the project's objectives and contribute to organisational learning. The key benefit of this process is that existing knowledge and new knowledge are used in the project and knowledge created by the project is available to support organisational operations and future projects or phases" [18]. The author's initial observation of this new process is that this would appear to be a significant step in the right direction as KM is more than lessons learned and the Project Controls Manager should be aware of all the knowledge/lessons learned across the ten knowledge areas of the PMBOK® Guide.

Earned value management (EVM) methodology involves the systematic tracking and recording of project cost and schedule performance. It involves the PDCA cycle at the workpackage level of projects. This includes the identification and recording of root causes of performance anomalies and the identification of mitigation steps. This type of performance knowledge is invaluable to an organisation and should be captured thoughtfully to enhance planning, estimating, management and control of future projects. EVM performance information needs to be linked to other knowledge resources (such as lessons learned, best practices and project manager's expertise) to adapt quickly to making changes to counter adverse trends and resolve project issues. Project performance can be enhanced, when people communicate and share best practices, lessons learned, experiences and insights. With today's data and information processing capabilities the opportunity for EVM performance data to be stored and analysed to provide meaningful insights for future projects is enormous. Earned value data can easily be sliced and diced to create graphical visualisations that can become the backdrop for story telling of what worked well and what has not. Regression analysis can be performed to identify the relationships and correlations between different project parameters and actual performance.

Diverse teams generally have more knowledge to draw on than teams of similar individuals. Organisations are increasingly utilising interdisciplinary organisational structures, such as integrated product teams, in which employees share knowledge and expertise within and between groups to cope with complex tasks. The challenge in a project environment is to capture, reuse and share this knowledge and expertise [9].

We typically see knowledge sharing within an organisation. However, knowledge acquisition from the outside is a competitive factor that the organisation needs to narrate [19]. To be able to use the knowledge acquired from outside the organisation, the organisation first has to have a successful knowledge capability for converting the newly acquired knowledge into action.

Systemic Lessons Learned Knowledge model

Life cycle models are used to organise one's thinking about KM in an organisational environment. There are several KM life cycle models available that outline the key aspects and processes of KM. The model proposed in this chapter describes the key aspects of KM in

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the organisational learning context. A conceptual model is presented, hereafter referred to as the Systemic Lessons Learned Knowledge model or Syllk (pronounced Silk) model (See Figure 1) [9], which is a variation of Reason's [20] Swiss cheese model.
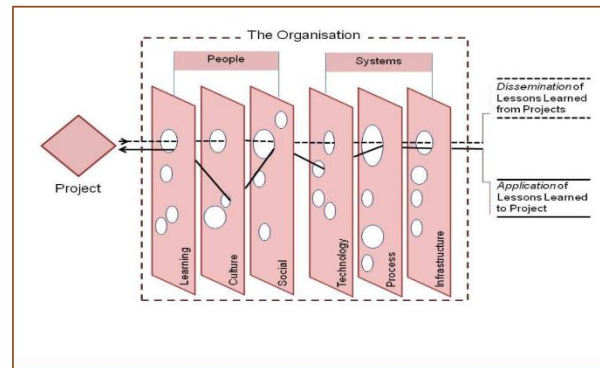
Figure 1. The Systemic Lessons Learned Knowledge model
(*Source: [9]*)

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. In line with complex adaptive systems theory, the Syllk model, represents the various organisational systems or functions (in terms of elements) that collectively drive the overall behaviour and responses of the organisation. The Syllk model replaces Reason's 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). These elements need to be aligned to enable the effective dissemination and application of the lessons learned. Barriers need to be overcome for effective lessons learned, and the Syllk model can assist in identifying these.

An earlier version of the Syllk model [21] supports the construct of information sharing and knowledge integration where information and knowledge are exchanged between an organisation and its suppliers, customers and partners [22]. The Syllk model elements of people and culture play an important role in learning from projects [23]. The alignment of the people and system elements positively influence an organisation's capability for storytelling, and, therefore, learn and accumulate lessons from stories of past project experiences [24]. The Syllk model shows that for organisations to learn, people and systems (processes and technology) needs to be aligned and that this combination is the best way of organisational learning [25]. The Syllk model has been shown to support an online Community of Practice [26] and has also been implemented in an organisation (consisting of 200 capital projects with project budgets ranging from approximately $1 million to $1.7 billion) in implementing a KM framework to manage the knowledge gathered during the planning, design and delivery of capital projects, including lessons learned [27, 28].

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Wiring an organisation with knowledge and lessons learned

It has been shown by action research that the identified Syllk model facilitators and barriers need to be well understood and managed to connect effectively or couple up (or conceptually wire) organisational systems together. Understanding organisational facilitators/barriers and the associated KM practices and tools offers an opportunity to reflect and learn from past experiences [9].

An organisation can be effectively wired to acquire and accumulate knowledge and lessons learned [28]. Figure 2 is an example of how the Syllk model can enable management to conceptualise and illustrate how organisational know-how (project delivery capability) is wired across various systems of an organisation for knowledge and lessons learned. The highlighted knowledge variables of the Syllk model elements shown in Figure 2 were found to be the most dynamic and influential in an organisation under a study. The outcomes showed that an organisation is not a simple structure but rather a complex interweaving and coupling (through the Syllk elements) of people and systems.

To explain Figure 2, the knowledge and lessons learned know-how commences with learning where storytelling and storytelling skills come together. One of the features of story telling is largely to reinforce the values and behaviours that align with the organisations culture. Those in leadership roles should be encouraged and developed to improve their story telling techniques. To implement story telling effectively, we need an identifiable organisation culture. The stories then need to be heard and felt across the organisation. This comes through in the conversations (and actions) from senior management and leaders as they demonstrate that they believe sharing stories, exchanging ideas, building relationships and communities is important, and they invest in activities that enable it.
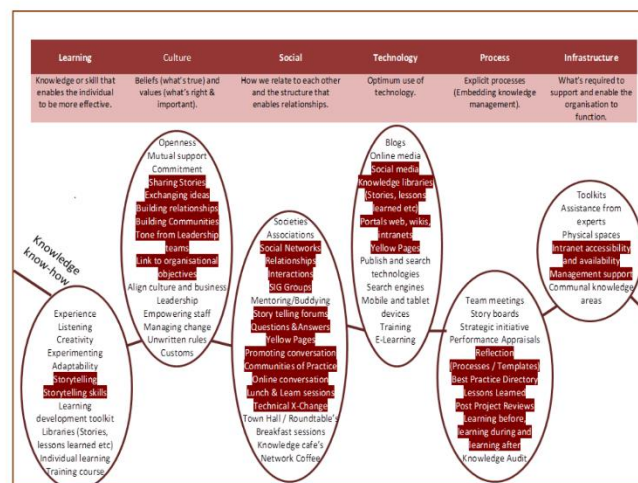
Figure 2. Organisational wiring for knowledge and lessons learned

Having a close connection to organisational objectives as part of a cultural renewal strategy to 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 stories and anecdotes of

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our experiences, and we are going to make time for that activity. Social is where the organisation invests in social structures that enable knowledge and lessons learned to take place. These might be regular or periodical communities of practice meetings, storytelling forums, special interest groups and social media (Yammer) sub-groups. There might be other structures such as lunch and learn sessions (lunch box talks) or team meetings. A technical x-change 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 knowledge and lessons learned know-how and in this organisation, an intranet web portal and Yammer platform met the needs. Technology provides a knowledge library home, a communication medium, links to process and templates, links to where knowledge can be found in the organisation and learning development tools. The process helps to embed knowledge and lessons learned through strategic initiatives and the provision of a framework, process, and templates. The use of best practice directories, lessons learned reviews and building performance evaluation forums works well in this organisation. Identifying that learning happens before, during and after and that reflection activities have a significant impact on learning. Having the data structures and infrastructure in place enables and facilitates open and frank knowledge sharing. Without the physical space for valued and open (remember our cultural values and beliefs) to take place, all the other activities will go to waste. Without high-quality intranet accessibility and availability, the knowledge and lessons learned sharing medium will be affected. There is a need for management support, experts, and leaders to enable the learning, culture, and social elements.

Storytelling

Storytelling is one of the oldest and traditional means of passing on wisdom and culture and is a mechanism for sharing knowledge within organisations. An organisational story is defined as, ''a detailed narrative of past management actions, employee interactions or other intra- or extra-organizational events that are communicated informally within the organization" [29, p. 103]. Stories usually include characters, plots, twists, and narrative perspectives and reflect skills, organisational norms, values, and culture. Well told stories can convey knowledge, information and emotion, both explicit and the tacit and are an influential way to represent and communicate complex, multi-layered thoughts [30]. Stories can increase organisational lessons learned, communicate common values and support a system to capture and share tacit dimensions of knowledge.

The telling of stories is an appropriate social method for identifying and capturing lessons learned, especially those related to tacit knowledge [4]. The social process of storytelling and recording is an effective way to explore project issues, capturing their complexity and behaviours outside organisational norms. Stories are often used in project lessons learned reviews to explain problem-solving, product specifications and project performance management [31]. A story can support a lesson learned by providing valuable background and context, and therefore, stories are easiest to learn from when they carry a lesson learned that is explicit and actionable [17].

The evidence that suggests lesson learned databases alone are not effective in providing learning as learning should include learning from stories, essentially a social process [32]. Where there are successful lessons learned systems, a significant effort has gone into the translation of oral stories or story reports into functional written texts. Leaders who tell stories communicating key messages in an unforgettable way, show a pathway to leadership

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and develop more effective relationships with those they lead, and can generate an inspirational culture in their organisations [33]. Leaders should research their history and experience for lessons learned that can be communicated in the form of a story or narrative and learn to tell them with charismatic and visionary refinement at appropriate times.

> Stories, like everything else, have to have some characters, and they have to have a purpose, and they have got to build up, and then they have got to come down, and there has to be a message at the end. So the stories have to be carefully chosen. So I think sometimes people can tell a story, and it might fall flat because they do not see it in the context of their whole story. So, I think people are embarrassed or a bit self-conscious about telling stories. I think it goes along with the public speaking, in general, that revealing something of yourself because every story has something to do with you [24, p. 439].

Finally, the means by which a story is communicated is also an important factor. Stories are powerful in verbal form; their effect can be enhanced through the use of multimedia such as graphical performance trends, dashboards, pictures, art-based and recorded clips [34]. Although stories flow informally within organisations, it requires a skilled workforce to provide stories, and even more experienced workforce to capture, record and make appropriate stories available for dissemination in a usable format. A recorded story may or may not be effective, depending on the skills of the storyteller [32]. Through the establishment of a well-structured project controls database, including systematic measurement and analysis of trends, an organisation can easily produce graphics and visualisations based on factual performance data as the backdrop for stories. These stories can either celebrate success or provide learning about the root causes of problems and what should have decisions or behaviours should have taken place.

The use of storyboards and images as a way of telling a story is an effective know-how medium to facilitate the learning process [24]. The skill of storytelling and having appropriate storytelling learning and development tools available were important capabilities that enabled storytellers to be effective at communicating lessons learned. Those leaders that are telling stories have an impact on the audience that is in line with the leadership aims of the leader creating the story. The moral of the story is in effect the essence of the message that the listener takes away.

Implementing the Syllk model in project organisations

The implementation of the Syllk model in project organisations involves the organisation teams to identify the barriers and facilitators that exist in the organisation against the Syllk model elements. KM practices are aligned with these elements. Figure 2 is an example of the Syllk aligned KM practices. However, this alignment will be different for each organisation and projects within the organisation. The alignment of the practices across the Syllk elements is the critical part of the process. Often we see only partial alignment and lessons learned become lessons identified and not learned, due to a breakdown of the Syllk elements [9].

During workshops where the Syllk model has been applied, a participant stated that "... when we did our workshop to capture the blockers [barriers] … we then further looked at the Syllk model … for our project what is becoming clear is having a system to capture [stories] and retrieve [stories], because, without that, the project was going nowhere. So for us having a platform was using the Syllk model. The technology became the critical element to get right, then working with the other elements could happen at their timeframe, but without technology, nothing gelled together".

Another workshop participant stated that "when you think about a slice of cheese ... and how storytelling works ... all those barriers and infrastructure just were there still. They were

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not going away ... so now you perhaps reshape your whole storytelling focus around the ones that are working. ... I can see all this stuff working. I mean, you have got top-level coverage; you have got all the support. ... you have got all the processes in place; you have got the tools in place". Once the project team understands how the organisation is wired for knowledge and lessons learned, then KM within project work can be more successful.

Conclusion

The chapter highlights the importance in understanding organisational knowledge facilitators and barriers and the associated KM practices to understand how well they support or hinder knowledge management and lessons learned. The author suggests that by reconceptualising knowledge and lessons learned the Syllk model can influence organisation learning. This chapter and associated references show how the Syllk model enables management to conceptualise (and illustrate) how organisational know-how is wired (distributed) across various people and system elements of an organisation. This chapter suggests that the alignment of the people and system elements (learning, culture, social, technology, process and infrastructure) can positively influence organisation learning within the project management and project controls domains.

References

1. Shergold, P., *Learning from Failure: Why large government policy initiatives have gone so badly wrong in the past and how the chances of success in the future can be improved.*, APSC, Editor. 2015, Australian Public Service Commission
2. APM, *APM Body of Knowledge*. 5th ed. 2006, Buckinghamshire: Association for Project Management.
3. Love, P., P.S.W. Fong, and Z. Irani, *Management of knowledge in project environments*. 2005: Elsevier/Butterworth-Heinemann.
4. Williams, T., *How do organisations learn lessons from projects–and do they?* IEEE Transactions in Engineering Management, 2008. **55**(2): p. 248-266.
5. Liebowitz, J. and I. Megbolugbe, *A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives*. International Journal of Project Management, 2003. **21**(3): p. 189-198.
6. Neef, D., *Managing corporate risk through better knowledge management*. Learning Organization, The, 2005. **12**(2): p. 112-124.
7. Raelin, J., *Public Reflection as the Basis of Learning*. Management Learning, 2001. **32**(1): p. 11-30.
8. Williams, T., *Post-Project Reviews to Gain Effective Lessons Learned*. 2007, Project Management Institute: Newtown Square, USA.
9. Duffield, S. and S.J. Whitty, *Developing a systemic lessons learned knowledge model for organisational learning through projects*. International Journal of Project Management, 2015. **33**(2): p. 311-324.
10. Argyris, C., *On organizational learning*. 2nd ed. 1999, Oxford; Malden, Mass.: Blackwell Business. xv, 464 p.
11. Simon, H.A., *Bounded Rationality and Organizational Learning*. Organization Science, 1991. **2**(1): p. 125-134.
12. Garvin, D.A., *Building a learning organization*. Harvard Business Review, 1993. **71**(4): p. 78-91.
13. Duhon, H. and J. Elias, *Why It Is Difficult To Learn Lessons: Insights from Decision Theory and Cognitive Science*. SPE Projects, Facilities & Construction, 2008. **3**(3): p. 1-7.

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Project Controls Drumbeat

14. Dvir, D. and A. Shenhar, *What great projects have in common*, in *MIT Sloan Management Review*. 2011. p. 18-21.
15. Maqsood, T., *The Role of Knowledge Management in Supporting Innovation and Learning in Construction*, in *School of Business Information Technology*. 2006, RMIT University.
16. O'Dell, C. and C. Hubert, *The new edge in knowledge : how knowledge management is changing the way we do business*. 2011, New Jersey: John Wiley & Sons.
17. Milton, N., *The Lessons Learned Handbook: Practical Approaches To Learning From Experience*. 2010, Oxford, UK: Chandos Publishing.
18. Project Management Institute, *Exposure Draft - PMBOK® Guide-Sixth Edition (standard section) Exposure Draft*. 6th ed. 2016, Newtown Square, Pa.: PMI Inc.
19. Davenport, T.H. and L. Prusak, *Working knowledge : how organizations manage what they know*. 1998, Boston, Mass: Harvard Business School Press. xv, 199.
20. Reason, J., *Managing the Risks of Organizational Accidents*. 1997, Aldershot, Hants, England; Brookfield, Vt., USA: Ashgate. xvii, 252.
21. Duffield, S. and S.J. Whitty. *A systemic lessons learned and captured knowledge (SLLCK) model for project organizations*. in *9th Project Management Australia Conference (PMOz 2012)*. 2012. Melbourne, Australia: Eventcorp Pty Ltd.
22. Leal-Rodríguez, A.L., et al., *From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context.* International Journal of Project Management, 2014. **32**(6): p. 894-907.
23. Virolainen, T., *Learning from projects: a qualitative metasummary*, in *School of Industrial Engineering and Management*. 2014, Lappeenranta University of Technology.
24. Duffield, S. and S.J. Whitty, *How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling.* International Journal of Project Management, 2016. **34**(3): p. 429-443.
25. Hedman, S., L. Påhlman, and A. Törnby, *The Production of Comfort - How Financial Auditors Experience that they Become Comfortable with IT-auditors*, in *Department of Business Studies*. 2015, Uppsala University.
26. Duffield, S., *Application of the Syllk model wiring an organisation for the capability of an online Community of Practice.* VINE Journal of Information and Knowledge Management Systems, 2016. **46**(2): p. 267-294.
27. Duffield, S. *Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects*. in *Australian Institute of Project Management National 2015 Conference*. 2015. Hobart: AIPM, 978-0-646-93699-4.
28. Duffield, S. and S.J. Whitty, *Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects.* International Journal of Project Management, 2016. **34**(7): p. 1280-1293.
29. Swap, W., et al., *Using Mentoring and Storytelling to Transfer Knowledge in the Workplace.* Journal of Management Information Systems, 2001. **18**(1): p. 95-114.
30. Snowden, D., *Storytelling and other organic tools for chief knowledge officers and chief learning officers.* JJ Phillips & D. Bonner (Eds.), 2000: p. 237-252.
31. Goffin, K. and U. Koners, *Tacit Knowledge, Lessons Learnt, and New Product Development.* Journal of Product Innovation Management, 2011. **28**(2): p. 300-318.
32. Linde, C., *Narrative and social tacit knowledge.* Journal of Knowledge Management, 2001. **5**(2): p. 160-171.
33. Harris, J. and B.K. Barnes, *Leadership storytelling.* Industrial and Commercial Training, 2006. **38**(7): p. 350-353.
34. Pässilä, A., T. Oikarinen, and A. Kallio, *Creating dialogue by storytelling.* Journal of Workplace Learning, 2013. **25**(3): p. 159-177.

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11.9. Appendix I: KM Australia congress 2015

Knowledge Management Australia 2015
www.kmaustralia.com

DAY ONE - Tuesday, 4 August 2015

8.30 Registration and refreshments

9.00 Chairperson's opening remarks – Cory Banks, Social Architect, Microsoft
(An experienced KM practitioner, chair of the QKM Forum, committee member of the actKM Forum and board member of the IIM)

9.15 International Keynote: Applying "Agile" in Developing KM Strategies and Implementing Frameworks

"Agile" Development Methods, which are based on solid KM fundamentals, can be effectively applied to the development of KM strategies and implementing frameworks themselves. This session will present and explain a practical, "agile" based methodology for developing "fit for purpose" and context relevant KM strategies and implementing frameworks that (1) incorporate a KM pilot project "up front" as a primary source of insight for strategy development and framework implementation, and (2) are based upon "Fast Learning" fundamentals that need to be taught to the organisation for long term KM success and are part of the foundation for "agile."

- Many of us are familar with the application of "agile" methods to software development. At the heart of agile is "knowledge management." Agile relies on direct communication and intense collaboration across an integrated team of subject matter experts.
- One goal of agile is to focus upon only the knowledge that the developer (who writes the code) needs to know. Transferring and sharing this required knowledge in a team is a difficult task that in the traditional (non-agile) model was tackled by introducing rigorous "waterfall" processes and sequential knowledge transfer.
- Agile focuses on concurrent efforts with learning built into all phases and levels of the effort . Very often this is with incomplete "but enough" knowledge to proceed with development relying on collaboration cross multi-functional and integrated teams and the sharing of tacit knowledge "as part of the way work is accomplished" to get things done.

Bill Kaplan, Founder and Principal, Working Knowledge[CSP] LLC

What The Delegates Will Take Away from the Session:
- Understand "Agile" KM Strategy Development vs. "Common" Development Approach
- Understand Value of the Pilot Project and a method for effective Pilot Project Selection
- Understand an "Agile" based process for KM Strategy and KM Framework development and implementation through continuous learning while piloting

10.15 Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning Through Projects

In practice organisational learning from projects rarely happens, and when it does it often fails to deliver the intended results. Learn how to use the Syllk model (a variation of Reason's Swiss cheese) to wire an organisation for the capability of learning through projects.

Audience Participation: Identify facilitators & barriers to Knowledge Management (Lessons Learned) and associated KM practices with a follow up discussion at the World Cafe.
- Organisations are failing to learn from their past experiences
- The Swiss cheese model is successful at promoting safety and accident prevention
- We adapt the Syllk model for organisations to learn from past experiences

Stephen Duffield, MPM CPPD, PhD Candidate at the University of Southern Queensland

What The Delegates Will Take Away from the Session:
- Gain an understanding of the facilitators and barriers to knowledge management lessons learned.
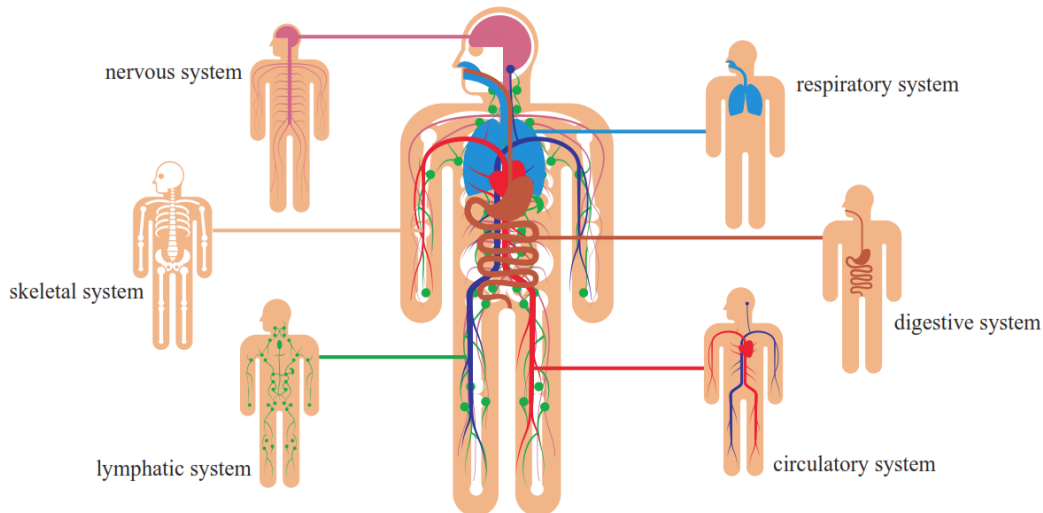- Enable management to conceptualise how learning know-how is distributed across a network of interconnected organisational faculties and systems.

Figure I-1 KM Australia congress 2015 extracts

11.10. Appendix J: AIPM Poster – Wiring organisations for capability

Figure Appendix J-1 AIPM Poster – Wiring organisations for capability

11.11. Appendix K: ANZAM Paper submission

A 'lived experienced' tool for managing and building project delivery capability

Bronte van der Hoorn

School of Management & Enterprise, University of Southern Queensland, Springfield, Australia

Email: info@brontevanderhoorn.com

Stephen Duffield

School of Management & Enterprise, University of Southern Queensland, Springfield, Australia

Email: stephen@invictaprojects.com.au

Associate Professor S. Jonathan Whitty

School of Management & Enterprise, University of Southern Queensland, Springfield, Australia

Email: whitty@usq.edu.au

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**A 'lived experienced' tool for managing and
building project delivery capability**

ABSTRACT: This paper discusses a new, integrated tool-set for project managing. This tool-set is a response to calls for project managers to be able to apply new project managing thinking 'in practice'. The tool-set integrates the project-space model and the Syllk model. Together, they bring visibility to enablers and constraints to project delivery capability, and these learnings can then be integrated into the organisation's systems to build in a tailored manner ongoing project management capability. Specifically, the tool-set highlights the hindrances to project delivery and what capabilities need to be 'wired' into an organisation to remove them. This tool-set integrates into future organisational initiatives the learnings from concrete 'lived experiences' of project managing.

Keywords: Tailoring project management | Project management tools | Lessons learned

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INTRODUCTION

This paper proposes an integrated tool-set to support project managers in delivering their projects and also to adapt and build long-term organisational project management capability. This new tool-set is a response to the sustained call of the research community for new project managing tools and approaches (Svejvig & Andersen, 2015; Winter, Smith, Morris, & Cicmil, 2006). It is also response to the the number of projects that continue to 'fail' (Bloch, Blumberg, & Laartz, 2012; Liebowitz, 2015; Project Management Institute, 2014) , and the need to provide alternative tools which may better meet the realities of project work. Extant discussion of the need for new approaches and tools highlight the need for a *tailored* approach to managing projects (Shenhar & Dvir, 2007; Söderlund, 2004). This paper contributes to responding to this need by coupling the project-space model and the Syllk model as an integrated tool-set for use by project managers and their organisations. The paper provides a practical contribution to enable project managers to utilise new project management thinking (continental and systems) in their project managing. It promotes visibility in the challenges of project delivery and integrates the learning of lessons with everyday project managing practice.

Central to the integrated tool-set is the concept that project work is work for which an organisation (or individual) has some form of lack or hindered capability (van der Hoorn & Whitty, 2016). Subsequently, it is necessary to have project managing tools that enable hindrances to capability to be openly discussed and resolved. The project-space model is a tool which enables the project team to visualise these capability constraints (as well as enablers). This can then encourage discussion with relevant stakeholders and the necessary action. The Syllk model provides a method of integrating the identification of these capability enablers and constraints into the organisation's ongoing 'wiring' or configuration. In summary, the project-space model enables the capturing and discussion of barriers to project management capability in a concrete project situation. The Syllk model then enables these concrete factors to be integrated into an organisation's systems. Consequently, organisational project managing capability is being built and adapted in a tailored manner that reflects a particular organisation's capability needs.

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Firstly, we will define the research problem; a brief examination of relevant literature is then provided. This is followed by the focus of our conceptual research inquiry and the introduction of foundational concepts which underpin the integrated tool-set. The integrated tool-set is then examined and the benefits and limitations outlined in the discussion. The conclusion highlights the contribution of the paper.

RESEARCH PROBLEM

In 2006, the Rethinking Project Management Network, called for new directions in project management research (Winter et al., 2006). Simplistically, it was a call for practice-driven enquiry that reflected the 'lived experience' of project work (or what actually occurs in projects) (Cicmil, Williams, Thomas, & Hodgson, 2006; Winter et al., 2006). Svejvig and Andersen (2015) have reflected on the development of the literature since the setting of these new directions. They find that whilst some progress has been made, there remains a significant gap to provide practitioners with alternative practices (or tools) to support their project managing (Svejvig & Andersen, 2015).

Another key concept that has received considerable attention in the project literature is that 'one size does not fit all'. The premise is that we cannot assume that the employment of particular project processes or tools will lead to universal project success. For example, Söderlund (2004) highlights that it is necessary to consider both the similarities and differences across various projects. Shenhar and Dvir (2007) in discussing their diamond framework, highlight that failing to realise the differences between projects can lead to project failure. Vom Brocke and Lippe (2011) discuss the changing facets of a project over time, and need for different management approaches for various situations. Based on organisational contingency theory, they argue for a context-specific approach for management. In summary, in line with the 'rethinking' agenda we propose that there is a need to develop tools that assist with the actuality of managing project work, and tools which enable a tailored approach to managing and building project delivery capability.

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LITERATURE REVIEW

Project management tools

We will commence our literature review by briefly reflect on existing project management tools. Traditionally, the tools that dominate the extant project management literature reflect the planning focus that underpins the discipline (Maylor, 2001). Gantt charts, earned value management, status reports and other tools specified in the bodies of knowledge are generally associated with planning, or tracking a project against its baselines (set during planning). The agile approach reflects a shift in this thinking. Burn down charts, user stories, sprints and stand-ups are tools and processes commonly associated with this more flexible, execution-focused approach (Pries, 2011; Wysocki, 2012). A more recent tool in the literature is the project-space model that brings a focus to the holistic 'lived experience' of the project and barriers to its progress (van der Hoorn, 2016b).

Tools for capturing lessons learned

We now consider existing tools that are used for lessons learned as we will argue that this is a key tool for developing tailored project management capability. Common lessons identification and capture tools are: reflection, lessons learned sessions; after action reviews; project debriefings; close out meetings; post project appraisals/reviews; case study exercises; community of practices; project milestone reviews; post mortems, project histories; project health checks; and project audits (Bakker, Cambré, Korlaar, & Raab, 2011; Duffield & Whitty, 2015; Schindler & Eppler, 2003; Williams, 2007). O'Dell and Hubert (2011, p. 69) highlight that there are some typical questions that are focused on: "What was supposed to happen? What actually happened? Why was there a difference or variation? Who else needs to know this information?" It is these identification practices and tools that are often mistaken as complete lessons learned processes (Duffield & Whitty, 2015).

The literature provides numerous technology solutions of storing, recording and accessing lessons learned. However, the key is to identify the 'actuality' of what works for an organisation and constantly monitor, update, and keep it current and relevant (Duffield & Whitty, 2015; Williams, 2007). Duffield and Whitty (2015) have shown how the Syllk model represents the various

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organisational systems or functions (in terms of elements) that collectively drive the overall behaviour of the organisation. The Syllk model can therefore represent the required knowledge (or know-how) network of capabilities that enable an organisation to successfully deliver their project work.

RESEARCH INQUIRY

How can the project-space model and the Syllk Model be conjoined in a way that can assist with the actuality of managing project work in a tailored way, whilst also enabling an organsation to continuously adapt and build their project delivery capability?

FOUNDATIONAL CONCEPTS

Projecty: A spectrum of greater or lesser capability

Projectyness is a term in the extant project management literature (van der Hoorn & Whitty, 2016). The term is grounded in the Heideggerian conception of a project (van der Hoorn & Whitty, 2015) and highlights that work is on a spectrum of being more or less projecty. Fundamentally, what makes work 'projecty' is the lack of inherent capability to undertake the various activities that grouped together comprise that work. If we can easily undertake a group of activities, it is operational – not at all projecty. If we find a group of activities challenging it is because there is pressure on our capability – and it will be more projecty. When the term capability is used in this conceptualisation it is not just about skills or experience. Rather it is a distributed and systemic view which includes the social, culture, technology, infrastructure and process systems in an organisation (refer section: 'The Syllk model: A holistic and distribution view of capability'). Additionally, capability is not binary. An organisation (or an individual's) capability to undertake any activity is on a continuum. Therefore, work can be experienced as more or less projecty along a continuum.

van der Hoorn and Whitty (2016) use the metaphor of a rollercoaster and the experience of scariness to explain this projectyness concept (refer Figure 1). A rollercoaster is experienced as being scary because of the rider's history and personal perception of the experience. A rollercoaster that is scary for a child is unlikely to be so for an experienced adult rider. Similarly, no work activity is

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inherently projecty. The activity is only experienced as project work, because the activity is not within the inherent capability of those undertaking it (van der Hoorn & Whitty, 2016).

Insert Figure 1 about here

This conceptualisation of project work being defined in terms of a paucity of capability is a significant shift to the dominant literature. It brings into focus that project managing is about managing (to varying extents) a deficit of (or hindrance to) capability. Subsequently, the expectation that the project work will run smoothly is found futile (van der Hoorn & Whitty, 2016). A projecty (lack of capability) understanding highlights that we need to be able to talk about what is hindering (as well as enabling) our progress towards a project objective. Dominant definitions with their focus on a finite duration and being temporary (Office of Government Commerce, 2009; Project Management Institute, 2013), and project management tools (such as earned value management) critically lack this capability focus. The project management discipline requires tools which enable the areas of lacking capability (or hindrances to progress) to be identified, communicated, and then (hopefully) resolved.

As per van der Hoorn and Whitty (2016), the concept of projectyness does not preclude that project management tools such as Gantt charts and work breakdown structures can be used in work that is operational. In such cases, van der Hoorn and Whitty (2016) argue that there may be some benefit to the person/s to do so. However, the experience of that work is not actually projecty, there is just a choice to use project management tools.

The Syllk model: A holistic and distributed view of capability

The Syllk view of capability (Duffield & Whitty, 2015) underpins the projecty conceptualisation of project work. As such, we will briefly introduce the Syllk model as a systemic view of capability (or 'know-how' to deliver work). The Syllk model can be described as a 'thinking tool' for organisations to map the configuration of their systems to achieve some required set of capabilities (Duffield, 2015; Duffield & Whitty, 2016; Duffield & Whitty, 2015). Drawing on systems theory, the Syllk model proposes that the 'know-how' for an organisation to undertake any activity (e.g. deliver a good or service, hire staff, procure and pay for goods and services) is not just in the skills and experience of its people. Rather, the ability to perform any activity is dependent on an

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organisation's systems (learning, social, cultural, technology, process and infrastructure) being aligned (refer Figure 2) (Duffield & Whitty, 2015). The organisation's systems need to be 'wired' (coupled together) in such a way that all those systems collectively enact a capability.

Insert Figure 2 about here

Duffield and Whitty (2016) and Duffield (2015; 2016) discuss examples of an organisation having the 'know-how' to capture lessons from their projects and to 'learn' (or store and remember) these for future project initiatives. They highlight (amongst other enablers) the need for technical solutions to capture and communicate lessons; a 'just' culture which encourages sharing and avoids blame; social networks through which lessons can be discussed and communicated. The capability to 'learn lessons' (or any other activity) is distributed across organisational systems. If any of these systems are not 'aligned' (or wired) to deliver the capability (for example, lessons learned); the organisation's capability to deliver that activity will be hindered and diminished.

The Syllk model has been successfully used to initiate discussion on the distributed nature of 'know-how' in undertaking lessons learned (Duffield, 2015; Duffield, 2016; Duffield & Whitty, 2016; Duffield & Whitty, 2015). It provides a graphical representation of how the various systems in an organisation need to be coupled together (aligned) to enable a capability to be enacted. We will argue in our proposed co-joined or integrated model (refer section: 'An integrated tool-set for project managing practice') that this tool can also be used within a project (and the organisation more broadly) to understand and manage this 'lack of capability' that is central to the experience of projecty work.

The project-space model: Showing capability 'in the now'

The project-space model is a diagrammatic tool for explaining the current and forecasted enablers and constraints to a project's progress (van der Hoorn, 2016b). The conceptual basis of the tool is explained in detail in van der Hoorn (2016b). Briefly, the project-space model (refer Figure 3) allows a project team to communicate what is enabling them (enablers) to progress towards their project objectives and what are constraints (the hindrances) to progress. There are two grids in the model – a current grid (what is happening 'now') and a forecast grid (what 'may' happen). In both

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these grids, factors that are enabling the work to progress are shown as green triangles and constraints on progress are shown as orange circles (van der Hoorn, 2016b). The size of these shapes indicates relative impact to progress. In the forecast grid the factors are shown where they are expected to be realised in time. The lower the factor is placed in the forecast grid the more likely it is to be realised. In the current grid, the enablers are always shown to the left of a status line. Conceptually these enablers are driving the project to the right – to completion. The constraints are on the right of the status line (preventing the project from moving to completion) (van der Hoorn, 2016b). The higher the enabler or constraint is placed in the current grid the longer it is expected to impact the project if there is no intervention (van der Hoorn, 2016b).

Insert Figure 3 about here

The project-space model has been successfully trialled in an action research case study (van der Hoorn, in press). It was valued for its ability to convey the reasons for a project's status. Also for how it directed management's attention to where action was most required to overcome constraints, and to sustain enablers to ensure project progress. The tool encouraged conversations within the project team and stakeholders about where they were being hindered and what was supporting them in delivering (van der Hoorn, in press). In the case study the project-space model was updated monthly and discussed with the senior stakeholders at their monthly board meeting (van der Hoorn, in press). In our proposal of an integrated tool-set we will propose how the project-space model can be used in conjunction with the Syllk model to assist in managing project work – work for which we lack inherent capability.

AN INTEGRATED TOOL-SET FOR PROJECT MANAGING PRACTICE

We will now propose how the Syllk model and project-space model can be used in an integrated way to assist an organisation in managing activities for which they lack the inherent capability (projecty work). Given our premise that projecty work is work for which we lack inherent (or there are hindrances to) capability, the purpose of the integrated tool-set is to identify and communicate these barriers or hindrances to progress with the hope of their resolution. Furthermore,

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given our research problem highlighting that a 'one-size does not fit all' approach to project work, the integrated tool-set can provide concrete information which is relevant to a specific organisation or project environment.

Simplistically, the Syllk model can provide an ideal (all be it changing ideal) of what is required in terms of 'know-how' delivery capability to deliver a given project. The project-space model is a method of identifying and discussing as the project work progresses what is the 'actual' capability required to deliver the work and what it is likely to be. Central to the integration of the two tools is that capability (in our use) is a systemic term related to multiple coupled organisational systems. Refer Figure 4 for diagrammatic illustration of the integrated model. We will now explain the steps (shown as red numerals on the figure) for a project team to use the integrated tool-set.

Insert Figure 4 about here

1. **Identify the 'ideal' capability at the start of the projecty work:** As introduced in 'The Syllk model: A holistic and distributed view of capability', the Syllk model enables discussion and representation of the required 'know-how' to undertake an activity. In this integrated tool-set, we are proposing that the Syllk model is used to generate a discussion on what capability is required to actually deliver 'this project'. One could argue that this is the purpose of traditional project planning. However, we would propose that the focus traditionally has not been on understanding 'capability' holistically. For example, in the integrated tool-set it is not about simply identifying the number or skill set of staff required to deliver the project's objectives and estimated project duration. It is a broader concept including the necessary processes, cultures and attitudes required to achieve the project's objective.

Pragmatically, in this step, the project team would discuss, within the framework of the Syllk model: 'what capabilities do we need to deliver this project?'. The result is the project team's best estimate of what capability they require to be successful in delivering the project. This can then inform detailed planning on what is required to set-up this 'capability network' to deliver the project.

We note that whether documented formally or not, the organisation will have existing Syllk wiring (of varying degrees of effectiveness) to enable project delivery. This will impact how any

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project progresses. This Syllk for organisational project management capability will be updated in step 5.

2. **Tracking the capability:** In this step, the project-space model is used to prompt discussion regarding what is enabling capability and constraining (hindering) capability. The project-team also forecast what may (in the future) bolster or hinder capability. The Syllk model that has been created in step 1 can be used to prompt discussion and consider whether the identified 'ideal' capabilities are in place. However, the project-space model captures constraints and enablers in a pragmatic 'concrete' manner. Additionally, the project team should feel free to identify new capabilities required to deliver the project work. For example, that timeframes for executive sign offs are too slow; or rising petrol prices are jeopardising the financial solvency of the project.

3. **Responding to the hindrances on capability and sustaining extant capability:** Following the creation of the project-space model by the project team, it is then used to initiate a conversation with stakeholders. The focus is on highlighting barriers to achieving the project objectives and the enablers that need to be sustained. Influential stakeholders and senior management can then take steps to assist the project in overcoming constraints and sustaining enablers. It is highlighted that this is a considerably different conversation to discussing baseline deviations. It is focused on what is required to deliver 'this project', and how we ensure that an integrated and holistic capability is in place.

4. **Updating the Syllk model:** Periodically throughout the project, the Syllk model for the project should be updated to reflect newly identified capabilities required to deliver this type of work. Enablers which are deemed 'not required', should be removed from the Syllk model. This provides a record of what capability was actually required to deliver this type of project.

[Repeat steps 2 – 4 throughout the project's lifecycle]

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5. **Reflection and organisational learning:** At the conclusion of the project (or key milestones), the project's Syllk model should be integrated into the broader organisational consciousness (potentially through the Program/Project Management Office). This allows for similarities in enablers required to deliver projects in this organisation to be captured and for the organisation to build its 'know-how' (capability) for project delivery. Enablers for specific project types can also be captured to provide input for the planning of similar projects. Essentially, this step is establishing the required wiring of organisational systems for a particular organisation to undertake certain activities - a 'capability network' for project delivery.

DISCUSSION

Proposed benefits of the integrated tool-set

We propose that there are several benefits to this integrated tool-set. The foundational benefit is the focus this tool-set brings to both project and organisational capability. The integrated tool-set provides a way for identifying, discussing and resolving (where necessary) the lack of, or hindrances to capability. It is our assumption that the lack of capability is one of the core features of project work and as such we require tools that enable this to lack of capability to be openly discussed and managed.

Secondly, the integrated tool-set provides a mechanism (the project-space model) for dealing with capability challenges during the current actuality of the project work. This assists in bringing visibility to constraints and hindrances and therefore increases the likelihood of successful project delivery. Furthermore, the project-space model is complimented by the Syllk model which enables actual capability requirements for project work to be captured longer-term for broader use across the organisation. Such organisational learnings (or systemic rememberings) come from the concrete experience of project work in the organisation. It is a tool-set which assists each project in its delivery whilst also cultivating specific organisational project management capability relevant more broadly to that organisation. This integrated tool-set enables an organisation to cultivate its specifically required organisational project management capability.

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We also propose that the visual nature of both these tools adds to their value. Visual communication has been widely recognised as having cognitive processing benefits (refer Nelson, Reed, and Walling (1976), Tufte (1983), Larkin and Simon (1987) and Cheng (2004)). When this tool-set is used to generate discussion, the nature of conversation is enhanced because of the cognitive benefits of the information presentation style. For example, it can assist in sensemaking across the project team and stakeholders (van der Hoorn & Whitty, In press) regarding the project's progress.

Finally, we propose that this tool-set is grounded in a systems thinking and continental philosophical approach (van der Hoorn, 2016a) reflective of the calls for new foundations and thinking in the discipline (Cicmil, 2006; Winter et al., 2006). The Syllk model is strongly systemic and the project-space model is focused on enabling the concrete now experience of a project to be communicated pragmatically. Perhaps most importantly, it provides a contribution to practitioners who would like to enact this new project managing thinking in their practice.

Limitations

It is acknowledged that the integration of these tool-sets is currently not tested in the project environment. However, both tools have been individually empirically tested (refer Duffield and Whitty (2016), Duffield (2015; 2016) and van der Hoorn (in press)). Future research to empirically test this integrated tool-set would be valuable.

CONCLUSION

In this paper we have proposed how the project-space model can be conjoined with the Syllk model to deal with the challenges of project delivery and then to incorporate this into an organisation's systems.

We propose that this is an important contribution to practice in that it brings a focus to constraints and enablers to project delivery capability. Firstly, it brings visibility of capability (hindrances and enablers) within an individual project context. It then facilities what is required to enable project delivery (in a particular organisation) to be integrated into the broader organisational systems. Over time, the organisation can build and adapt its systems to increase capability for

undertaking the type of work relevant to its business. It develops (and can continue to evolve) project managing capability relevant to its business context. The tool-set is not dependent on a particular project management method, rather it is focused on the concrete 'lived experience' in a particular environment. It encourages a tailored approach to developing organisational capability in project delivery. In summary, this is a practical tool-set that allows project practitioners to enact new project managing thinking in their practice.

REFERENCES

Bakker, R. M., Cambré, B., Korlaar, L., & Raab, J. (2011). Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer. *International Journal of Project Management, 29*(5), 494-503.

Bloch, M., Blumberg, S., & Laartz, J. (2012). Delivering large-scale IT projects on time, on budget, and on value. Retrieved from http://www.mckinsey.com/insights/business_technology/delivering_large-scale_it_projects_on_time_on_budget_and_on_value

Cheng, P.-H. (2004). Why diagrams are (sometimes) six times easier than words: Benefits beyond locational indexing. In A. Blackwell, K. Marriott, & A. Shimojima (Eds.), *Diagrammatic representation and inference* (Vol. 2980, pp. 242-254). Berlin: Springer

Cicmil, S. (2006). Understanding project management practice through interpretative and critical research perspectives. *Project Management Journal, 37*(2), 27-37.

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: Researching the actuality of projects. *International Journal of Project Management, 24*(8), 675-686. doi:http://dx.doi.org/10.1016/j.ijproman.2006.08.006

Duffield, S. (2015). *Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects.* Paper presented at the Australian Institute of Project Management National 2015 Conference, Hobart.

Duffield, S. (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. *VINE Journal of Information and Knowledge Management Systems, 46*(2), 267-294.

Duffield, S., & Whitty, S. (2016). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. *International Journal of Project Management, 34*(3), 429-443. doi:10.1016/j.ijproman.2015.11.004

Duffield, S., & Whitty, S. J. (2015). Developing a systemic lessons learned knowledge model for organisational learning through projects. *International journal of project management, 33*(2), 311-324. doi:http://dx.doi.org/10.1016/j.ijproman.2014.07.004

Larkin, J. H., & Simon, H. A. (1987). Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science, 11*(1), 65-100. doi:10.1111/j.1551-6708.1987.tb00863.x

Liebowitz, J. (2015). IT project failures: What management can learn. *IT Professional, 17*(6), 8-9.

Maylor, H. (2001). Beyond the Gantt chart: Project management moving on. *European Management Journal, 19*(1), 92-100. doi:http://dx.doi.org/10.1016/S0263-2373(00)00074-8

Nelson, D. L., Reed, V. S., & Walling, J. R. (1976). Pictorial superiority effect. *Journal of Experimental Psychology: Human Learning and Memory, 2*(5), 523-528. doi:10.1037/0278-7393.2.5.523

O'Dell, & Hubert. (2011). *The new edge in knowledge : how knowledge management is changing the way we do business*. New Jersey: John Wiley & Sons.

Office of Government Commerce. (2009). *Managing successful projects with PRINCE2* N. Bennett & C. Bentley (Eds.),

Pries, K. H. (2011). *Scrum project management* J. M. Quigley (Ed.)

Project Management Institute. (2013). *A guide to the project management body of knowledge*

Project Management Institute. (2014). PMI's Pulse of the profession: The high cost of low performance 2014.   Retrieved from http://www.pmi.org/~/media/PDF/Business-Solutions/PMI_Pulse_2014.ashx

Schindler, & Eppler. (2003). Harvesting project knowledge: a review of project learning methods and success factors. *International Journal of Project Management, 21*(3), 219-228.

Shenhar, A. J., & Dvir, D. (2007). *Reinventing project management: The diamond approach to successful growth and innovation*. Boston: Harvard Business School Press.

Söderlund, J. (2004). Building theories of project management: past research, questions for the future. *International Journal of Project Management, 22*(3), 183-191. doi:http://dx.doi.org/10.1016/S0263-7863(03)00070-X

Svejvig, P., & Andersen, P. (2015). Rethinking project management: A structured literature review with a critical look at the brave new world. *International Journal of Project Management, 33*(2), 278-290. doi:http://dx.doi.org/10.1016/j.ijproman.2014.06.004

Tufte, E. R. (1983). *The visual display of quantitative information* (2nd ed.). Cheshire Conn: Graphics Press.

van der Hoorn, B. (2016a). Continental thinking: a tool for accessing the project experience. *International Journal of Managing Projects in Business, 9*(4), 865-891.

van der Hoorn, B. (2016b). The Project-space Model: Visualising the enablers and constraints for a given project. *International Journal of Project Management, 34*(2), 173-186. doi:http://dx.doi.org/10.1016/j.ijproman.2015.10.006

van der Hoorn, B. (in press). Discussing project status with the project-space model: an action research study. *International Journal of Project Management*.

van der Hoorn, B., & Whitty, S. (2015). A Heideggerian paradigm for project management: breaking free of the disciplinary matrix and its Cartesian ontology. *International Journal of Project Management, 33*(4), 721-734.

van der Hoorn, B., & Whitty, S. (2016). Projectyness: A spectrum of greater or lesser capability. *International Journal of Project Management, 34*(6), 970-982. doi:http://dx.doi.org/10.1016/j.ijproman.2016.05.003

van der Hoorn, B., & Whitty, S. (In press). The project-space model: A tool for sensemaking in projects. *International Journal of Managing Projects in Business*.

Vom Brocke, J., & Lippe, S. (2011). *Towards a situational approach in managing collaborative research projects in IT/IS - Finding the right contigency factors.* Paper presented at the PACIS 2011 - 15th Pacific Asia Conference on Information Systems: Quality Research in Pacific.

Williams, T. (2007). *Post-Project Reviews to Gain Effective Lessons Learned* Retrieved from http://library.books24x7.com.ezproxy.usq.edu.au/toc.aspx?site=JE61N&bookid=24212

Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International Journal of Project Management, 24*(8), 638-649. doi:http://dx.doi.org/10.1016/j.ijproman.2006.08.009

Wysocki, R. K. (2012). *Effective project management traditional, agile, extreme* B. K. Gillingham (Ed.) Retrieved from http://ezproxy.usq.edu.au/login?url=http://library.books24x7.com/library.asp?^B&bookid=44339
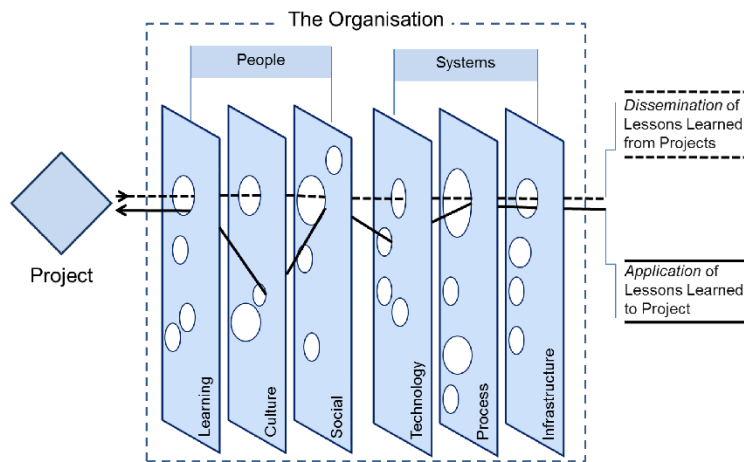
FIGURES

Figure 1: The projecty experience spectrum using the metaphor of a rollercoaster and scariness
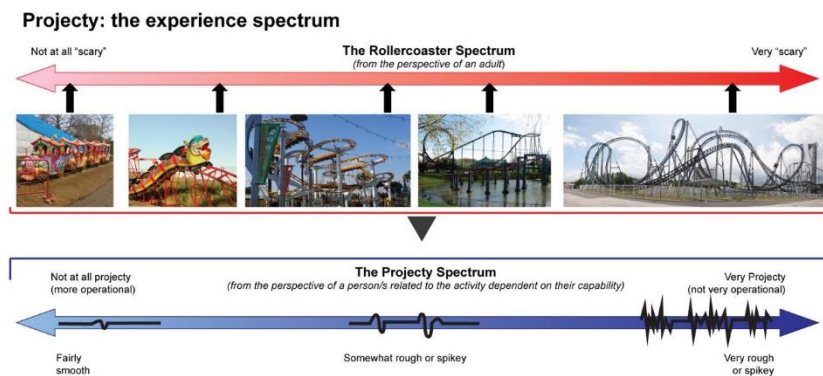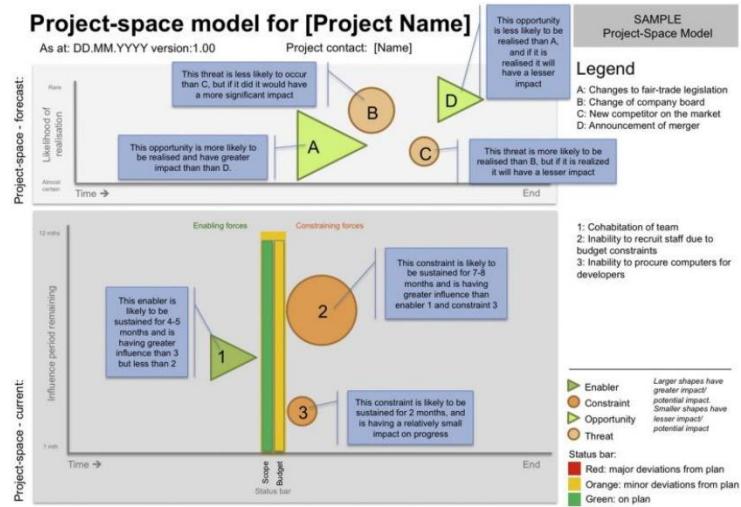

Source: van der Hoorn and Whitty (2016, Graphical abstract)
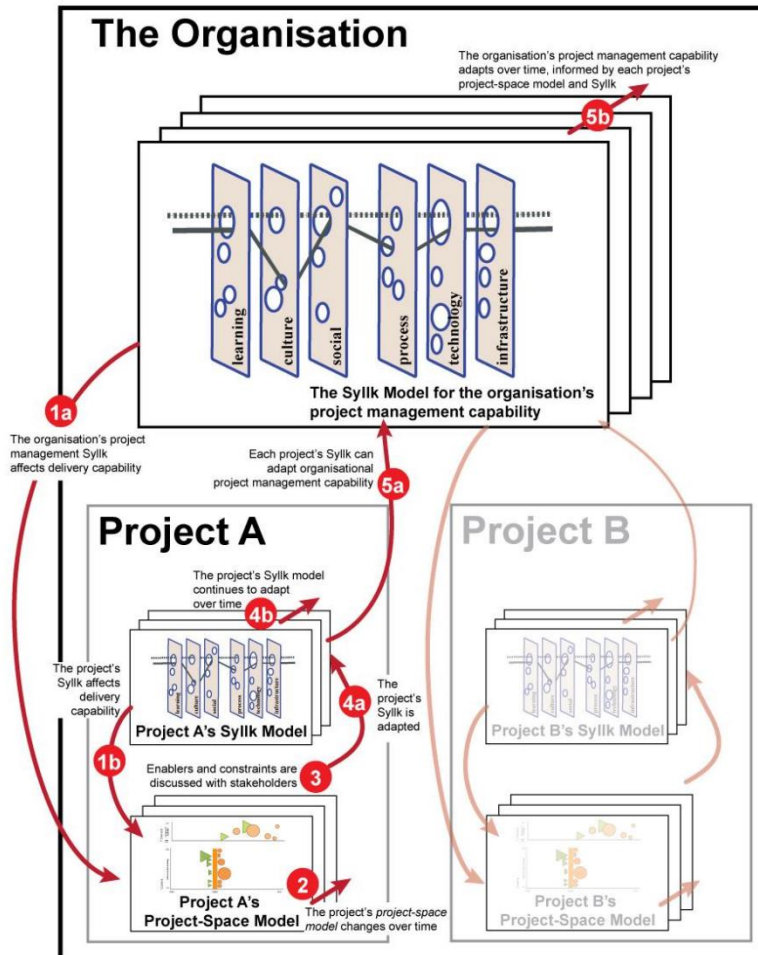
Figure 2: The Syllk model: a systemic view of capability

Source: Duffield and Whitty (2015)

Figure 3: Example of project-space model

Source: van der Hoorn (2016b, section 6)

Figure 4: Integrated tool-set to identify (lack of) capability and provide a tailored approach to organisational project delivery capability

Note: Numbers in red circles correspond to the steps in the paper (refer section:'An integrated tool-set for project managing practice')

11.12. Appendix L: Syllk model journal and conference papers status

Table K-1 Research journal impact

Thesis #	Title (1)	Google Scholar (2)	Research Gate (3)	Academia (4)	Emerald	Scopus / Mendeley Data (5)
Paper One	Duffield, S., Whitty, S.J., (2015b). Developing a systemic lessons learned knowledge model for organisational learning through projects. International Journal of Project Management, 33, 311-324. 2013 ERA Ranking: A 2015 (SJR):1.497 2015 SNIP: 2.569 2015 Impact Factor: 2.885	42 cite	17 cite 426 reads	56 views 1 download		19 cite 189 readers
Paper Two	Duffield, S., Whitty, S.J., (2016b). Application of the Systemic Lessons Learned Knowledge model for Organisational Learning through Projects. International Journal of Project Management, vol. 34, no. 7, pp. 1280-12932013 ERA Ranking: A 2015 (SJR):1.497 2015 SNIP: 2.569 2015 Impact Factor: 2.885	1 cite	5 reads			**11,802 downloads 20-Mar-2017** 219 readers
Paper Three	Duffield, S., Whitty, S.J., (2016a). How to apply the Systemic Lessons Learned Knowledge model to wire an organisation for the capability of storytelling. International Journal of Project Management, 34, 429-443. 2013 ERA Ranking: A 2015 (SJR):1.497 2015 SNIP: 2.569 2015 Impact Factor: 2.885	13 cite	3 cite 46 reads	4 views		5 cite 56 readers
Paper Four	Duffield, S., (2016). Application of the Syllk model wiring an organisation for the capability of an online Community of Practice. VINE Journal of Information and Knowledge Management Systems, 46, 2, pp. 267-294	2 cite	1 cite 101 reads		67 downloads	
Appendix A	Duffield, S., Whitty, S.J., (2012). A systemic lessons learned and captured knowledge (SLLCK) model for project organizations., in: PMglobal (Ed.), 9th Project Management Australia Conference (PMOz 2012), Melbourne, Australia.	9 cite	7 cite 351 reads	345 views 31 downloads		
	Duffield, S., (2015b). Application of a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects, Australian Institute of Project Management National 2015	1 cite	1 cite 65 reads	20 views 8 downloads		

Thesis #	Title (1)	Google Scholar (2)	Research Gate (3)	Academia (4)	Emerald	Scopus / Mendeley Data (5)
	Conference. AIPM, 978-0-646-93699-4, Hobart					
	Duffield, S., (2015a) Application of a Systemic Lessons Learned Knowledge model for organisational learning through projects, Knowledge Management Australia 2015. Ark Group, Melbourne, 4-6 August 2015.		5 reads			

(1) Status at 30 October 2016

(2) Google Scholar citation indices (at 20 March 2017)

Google Scholar

Citation indices	All	Since 2012
Citations	67	67
h-index	3	3
i10-index	2	2

Google Scholar citations: 2013: 2, 2014: 3, 2015: 5, 2016: 52, 2017: 5
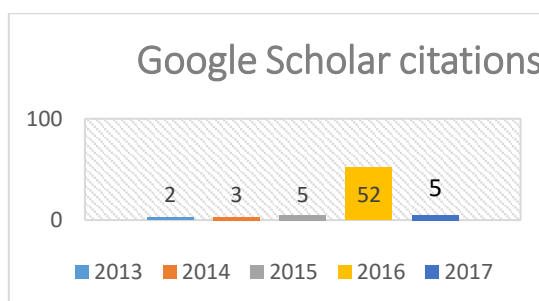
(3) RG Score=8.40; h-index=3

(4) Status at 3 May 2016

(5) Scopus/Mendeley (3 publications: status at 20 March 2017):

h-index: 2 by Scopus
24 citations in Scopus
3 publications in Scopus
11,802 downloads

11.13. Appendix M: Generic application of the Syllk model

Whitty (2015) presented the Syllk model on a YouTube clip highlighting how to power up your organisational capability with the Syllk model. An example used that most of us are familiar with is the coffee shop.

Whitty explains that we do not often talk about capability when we talk about organisations and businesses. But in fact, organisations are capability engines as they are capable of producing the products and services that they sell to you. Whitty uses a coffee shop as an example in that it has the capability of producing a fantastic coffee for Whitty every morning. Whitty introduces a new way of thinking about organisations in terms of capability engines and uses the Syllk model. Whitty explains that you can think of an organisation as a number of systems all coupled together. There are the various tools and technologies used to take my order or actually make my coffee. Even the spike for the receipt is a tool. There is the learning system. There are many people around training people to make coffees. But then to achieve a certain level, it is about experience and training of others. Then there are all the various processes of ordering and sequencing events. Pressing ground coffee, passing water through it, heating the milk and then there is how the order comes through from the customer to the barista.

Culture is a sort of hidden system. It is our system of values and what we believe and think about. There is the need to like coffee as you can taste the coffee to see if it is good to go. Just like the chefs always taste the food. The infrastructure is made up of the space that activities take place in. It is the height of the bench and positioning of equipment that directs people's movements. Then there is the social system. That is about how we divide tasks, how we work together in teams and use particular language and signs to communicate with each other. The capability for producing a product or service as a great cup of coffee is not found in one spot. It is actually distributed across a number of systems.

Such as the learning system; that individual people actually have some knowledge themselves. It is in the culture; the passion for perhaps something like coffee. The social system; their language and the way they interact with each other. The processes; how to go about making it. The technology; the tools that they have and then the infrastructure, the shop in its self. It is the coupling of these systems together that we call the capability engine. Our research at the University of Southern Queensland has developed a model to try to get us to think about this, which we call the Syllk model and that stands for Systemic Lessons Learned Knowledge model. That is a way of thinking about the capability engine.

For organisations to have (know-how) or capability to serve coffee or prepare an aircraft or run a hospital or sell insurance all of those systems need to be in alignment, they need to be coupled together. If any one of those systems is out of alignment, then that is going to have a consequence to the product or service. So, if you're looking for your product or service or trying to solve a problem, one of the things you could do to help resolve this problem is using the Syllk model to help you get those systems in alignment. Time for another coffee I think...

http://www.usq.edu.au/transcripts/jon-whitty
https://www.youtube.com/watch?v=snIStqmXVPY

"Those who cannot remember the past are condemned to repeat it."

George Santayana (1863–1952) in *The Life of Reason*, 1905.