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Response to Reviewers - JPMA-D-14-00054

Comments from editor and reviewers	Author's response
From Editor	
load figs and tables separately on a separate sheet at the end of the manuscript	Done
Double line space the references.	Done
From Reviewer #1	
Address 'Why organization learning?' Is it to avoid/manage risk or increase performance or both? Systemic risk is distinct and the lit review/model discussion may be sharper by drawing a distinction between project risk and enterprise risk, for example.	Insightful questions – thanks. This has been addressed in two parts; in defining the problem (top of page 9 - line 3-6) and in the literature review (pages 10 and 11 – p10 line 20-23; p11 line 1-6).
How could organizations use the model to get smarter? For example, is it action learning, reducing the risk of each decision (or making them smaller), better coordination? Since this is a model, the author should make clear why organizations may use their model to enhance performance.	Another good question, and allowed us to hint at future research. This has been addressed at the end of the discussion section on page 28 (line 10-17).
From Reviewer #3:	
No amendments to be made	Acknowledged.

Added Acknowledgements (section 10)

Developing a Systemic Lessons Learned Knowledge Model for Organisational Learning through Projects

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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 is usually concerned with lessons identification rather than organisational learning taking place. It appears that there are limited practical models for general management to use to conceptualize what organizational 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 can 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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1. 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 (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 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 are 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 while 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 per cent were dissatisfied (Milton, 2010). In another study, 62 per cent of 522 project practitioner responded that they had a process for learning lessons, and of those only 11.7 per cent 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 et al., 1998; O'Dell and 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. Learning in organizations 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 organisations 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) points 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 is 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 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 decisions 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 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 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 organizational 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-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 (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 provide 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 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 the identification practices and tools that are often mistaken as complete lessons learned processes.

On dissemination: Disseminating and transfer often refers to codification, verification, storing, searching, retrieving, knowledge sharing and training (Boh, 2007; Firestone and McElroy, 2003; O'Dell et al., 1998; O'Dell and Hubert, 2011; 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) suggests 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 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 per cent of the knowledge management solution with the remaining 90 per cent 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 programs, and programs 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 identify precursors, disseminate 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 HRO's 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' program 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 programs 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 (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 armor, 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 organizational practices" (Carroll, 2004, p. 134).

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

FIGURE 1 GOES HERE

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 (Figure 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 are 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 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, 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 (Figure 1b). This version highlights the people, process, learning 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 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 (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 &

Kyngäs (2008)). This process assisted in the development of the first Syllk model (Figure 2) that contained the most common lessons learned elements acknowledge by the literature.

FIGURE 2 GOES HERE

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.

TABLE 1 GOES HERE

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 fourth (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 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 is 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, while 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, participants were able to build on and refine the Syllk model (see Figure 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.

FIGURE 3 GOES HERE

6. Discussion

The Syllk model (figure 3) builds on Reason’s (1997) comprehensive ‘Swiss cheeses model of defences’ (figure 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 organisation’s 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), Bakker et al. (2011), Duhon and Elias (2008), Hislop (2005) and 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 are working and that organisations are learning from their experiences when in fact only the first part of the process (lessons identified - observed) are 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.

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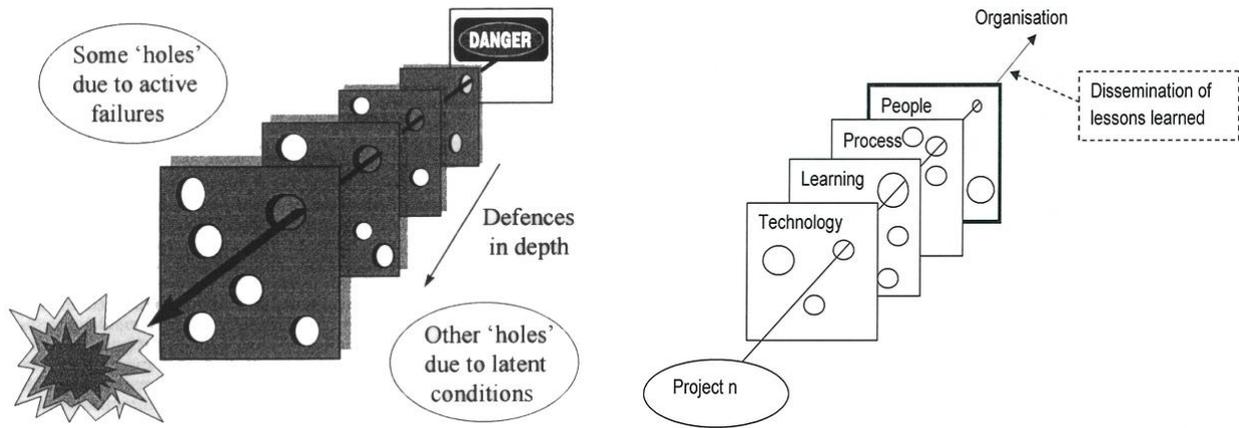


Figure 1 – 1a The Swiss cheese model of defences – 1b Initial Syllk model of facilitators

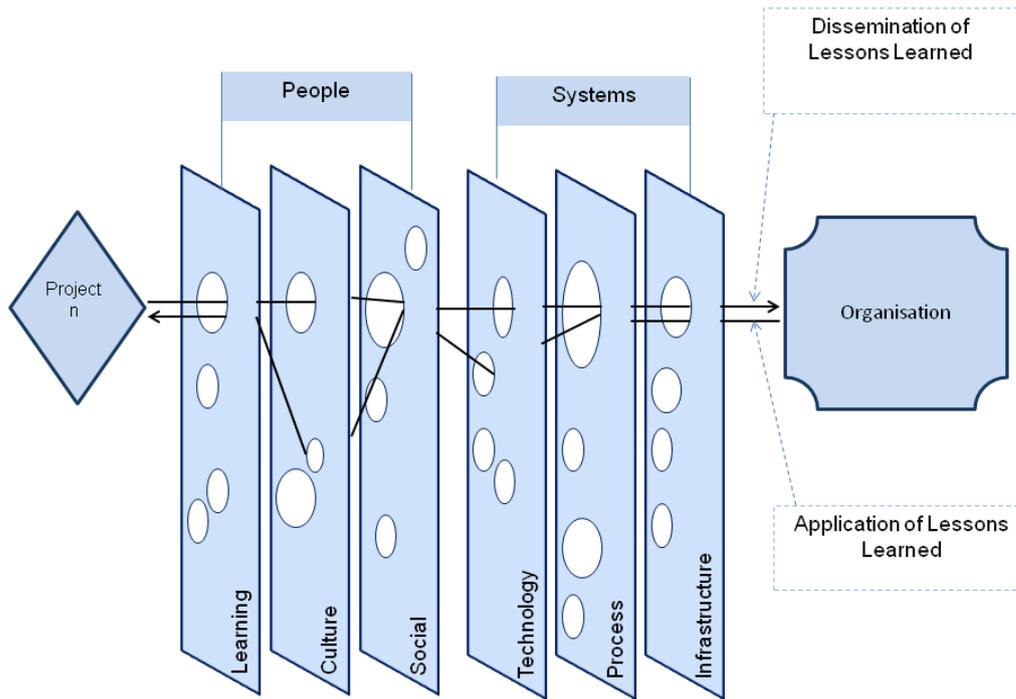


Figure 2 – The first Systemic Lessons Learned Knowledge Model

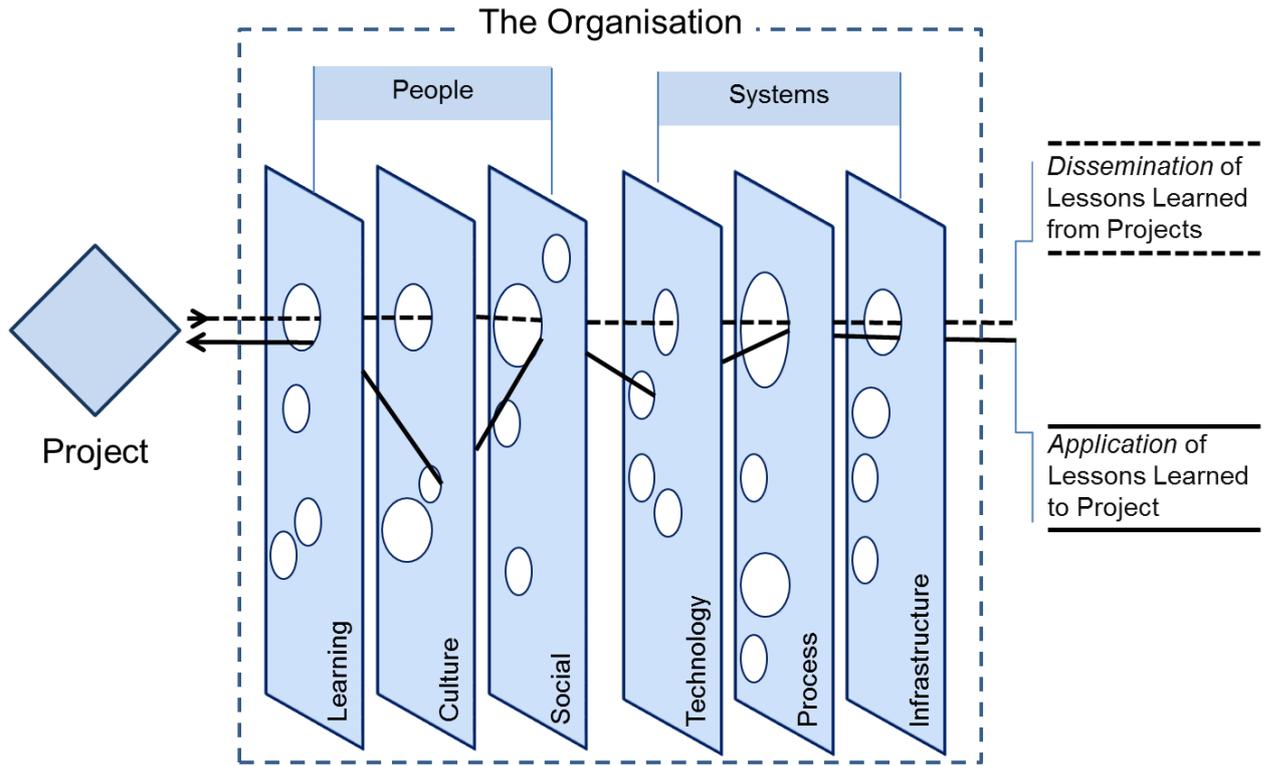


Figure 3 – A refined ‘systemic lessons learned knowledge (Syllk) model’

Table 1

Lessons learned facilitators and associated practices

Facilitators (identified by focus group)	Lessons learned practices
<p><u>People Learning</u></p> <ul style="list-style-type: none"> • Mentoring (and one-on-one coaching) • Small workshops (in-house) same skill level. • 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. 	<p>Stories and lessons through storytelling</p> <p>Communities of Practice</p> <p>Mentoring / Coaching</p>
<p><u>People Culture</u></p> <ul style="list-style-type: none"> • Value and encourage people to contribute • Providing support to those who want to increase their knowledge • Regular updates on organisation focus 	<p>Positive and supportive tone from Leadership teams</p> <p>Link to organisational objectives</p>
<p><u>People Social</u></p> <ul style="list-style-type: none"> • Acknowledge individual/group/team activities • Reward and recognition of work achieved 	<p>Communities of Practice</p> <p>Promoting conversation</p>
<p><u>Systems Technology</u></p> <ul style="list-style-type: none"> • Dashboard - knowledge capture 	<p>Intranet site</p> <p>Knowledge libraries, portals, intranets</p>
<p><u>Systems Process</u></p> <ul style="list-style-type: none"> • Guidelines for process to achieve an ‘across the board’ consistent approach • Drives and delivers best practice 	<p>Knowledge Management Framework</p>
<p><u>System-Infrastructure</u></p> <ul style="list-style-type: none"> • Co-location of teams and staff 	<p>Communal knowledge work areas</p>

Highlights

- Organisations are failing to learn from their past project experiences
- The Swiss cheese model is successful at promoting safety and accident prevention
- We adapt this model for organisations to learn from past project experiences
- Our adaption is called the Systemic Lessons Learned Knowledge model or Syllk Model
- Management can see how project know-how is spread across organisational systems

1 Organisations are **failing to learn** from their past project experiences



2 the **Swiss Cheese Model** has been successful in promoting safety and accident prevention

