



Knowledge management

Barriers to capturing lessons learned from Australian construction contractors perspective

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Abstract

Purpose – A research study has been undertaken at the University of South Australia to introduce application of lessons learned process in construction contractors' bidding process in the context of knowledge management. The study aims to identify barriers to effectively capture lessons learned in Australian construction industry and how knowledge management can benefit from lessons learned application.

Design/methodology/approach – The research study has been undertaken through conducting a “methodological triangulation” and “interdisciplinary triangulation”. This involved an extensive literature review of knowledge management, organisation learning, lessons learned and associated processes and administration of a questionnaire to a sample of construction contractors operating in Australia to elicit opinions on the main barriers to capturing lessons learned, practices such as existence and retention of documentation procedures. A total of 81 useable responses were received from 450 organisations. Response data were subjected to descriptive and inferential statistics with correlation analysis to examine the strength of relationship among the barriers.

Findings – The top-3 barriers to the effective capturing of lessons learned were “lack of employee time”, “lack of resources” and “lack of clear guidelines”, whereas, “lack of management support” was the least ranked barrier. The study established that despite the majority of the ACCs having formal procedures for recording the tenders submitted and their outcomes, only a minority actually retained the lessons learned documentation for each project. The larger contractors were found to be more aware of the importance of lessons learned documentation. A comparative analysis with previous studies also found a disparity in the ranking of the barriers.

Research limitations/implications – The majority of the participants were small construction contractors in Australia. The reason is that the researchers were not aware of the contractors' size prior to inviting them for participation in the research study. Second the findings may not generalize to other industries or to organisations operating in other countries.

Originality/value – The findings of this survey help ACCs to understand the importance of lessons learned documentation as part of lessons learned implementation and identify the barriers to effectively document their lessons learned. The study provides insights on the barriers and proposes advocated solutions in form of drivers and enablers (critical success factors) of organisational learning capturing among the Australian construction contractors. By reviewing the current literature, “post-project reviews” and “lessons learned” as important elements of organisation learning knowledge transfer, are addressed. Finally, contribution of this study to knowledge and practice has been discussed in this paper.

Keywords Australia, Barriers, Knowledge management, Lessons learned, Bidding decision, Construction management

Paper type Research paper



Introduction

Knowledge management (KM), as stated by Zou and Lim (2002), is:

[...] the management processes of creating, capturing, transferring, sharing, retrieving, and storing of data, information, knowledge experiences, and skills by using appropriate information and network technology, with the endorsement of total involvement, in organisational learning to enable knowledge acquisition throughout the processes.

Polanyi (1962) classified knowledge into tacit (internal) and explicit (external). In one of the seminal studies, Nonaka (1991) created a model for organisational knowledge creation based on close relationship between tacit and explicit knowledge. Switzer (2008) noted that the success of any organisation depends on how effectively it manages the internal and external knowledge. Simon (1991) pointed out that organisations learn by either their members' learning or new members who can bring new knowledge. Ladika (2008) noted that organisations must integrate past experiences into their current and future projects. Kerzner (2006) recognised this process as "continuous learning and improvement" and placed it as the highest level of project management maturity model.

According to Cohen and Levinthal (1990), "lesson learned" process overlaps with the broader areas of KM and organisational learning and Kerzner (2006) recognised this process as "continuous learning and improvement" and placed it as the highest level of project management maturity model. This study attempts to identify the barriers to capturing lessons learned from the perspective of Australian construction contractors (ACCs). The following section presents and summarises brief discussions on the reviews of the extant literature on lessons learned in the construction industry, capturing the lessons learned and the barriers to capturing lessons learned, with the main focus on some of the key barriers. The literature review is followed by an explanation of the research methodology adopted for this research study. Subsequently, the statistical methods employed as well as the interpretations of the findings are presented. The latter section particularly focuses on comparing the findings with the earlier global study in the area of lessons learned documentation ascertaining the similarities and differences.

Literature review

Lessons learned in the construction industry

Rezgui *et al.* (2010) described lessons learned as one of the main sources of knowledge in construction industry, alongside recorded documents, experiences and interactions. Hinds *et al.* (2001) noted that organisations must consider how to transfer expertise and knowledge from experts who have it to novices who need to know. Researchers such as Kazi and Koivuniemi (2006) believed that knowledge is not transferred across the organisation for reuse in future projects and it unfortunately remains stored in the minds of project team members especially in construction industry. According to Maqsood *et al.* (2006), the construction industry is a heuristic environment in which personnel prefer to fulfil their tasks on the basis of their past experiences rather than on analytical methods. Graham and Thomas (2008) advised that the temporal nature of construction projects and project teams also leads to lack of continuity of staff and subsequent knowledge loss. According to Kanapeckiene *et al.* (2010), in the coming years, the construction industry is expected to lose a large portion of its skilled

and knowledgeable workforce and there is no single strategy by which problems can be solved. Therefore, there is an urgent need for establishment of KM frameworks with construction companies to systematically capture lessons learned.

Capturing lessons learned: post-project reviews

Among different types of lessons learned capturing techniques, post-project review (PPR) is one of the most effective reviews as it aims to capture project knowledge (Von Zedtwitz, 2003) and systematically improves performance in subsequent projects (Von Zedtwitz, 2002). According to Oakes (2008), a PPR is conducted once a project closes down and the review assesses the overall project success and identifies what did or did not work during the project time. Von Zedtwitz (2003) advised that PPRs should capture learning from failed projects as well as from successful projects. Nevertheless, in real life, despite its dramatic influence on the performance of companies and their future projects, PPRs and capturing lessons learned are not being prioritised (Anbari *et al.*, 2008; Carrillo *et al.*, 2012; Chan *et al.*, 2005; Huysman, 2000; Kotnour and Vergopia, 2005; Oakes, 2008; Newell *et al.*, 2006; Udeaja *et al.*, 2006; Von Zedtwitz, 2002; Williams, 2004). Some studies such as Carillo (2005) however reported the benefits associated with capturing lesson learned.

Among those reported by Carillo (2005) was the ability of organisations to readily recall what went well on a project and attempt to recreate those successes; and most importantly, the ability of avoiding the repetition of past mistakes. The study argued that this approach offered the commercial sense. It should be noted that this study was conducted among the Canadian engineering, procurement and construction (EPC) companies. However, despite the noted benefits of capturing lesson learned and associated potential importance of KM and organisation learning, recent studies undertaken within the context of the Spanish construction sector, e.g. Forcada *et al.* (2013), have demonstrated that construction firms have done little to formally introduce these concepts of KM and organisation learning.

It should be noted that a number of studies have proposed different approaches to capturing and analyzing lessons-learned from projects, as well as the benefits and limitations. While it is beyond the scope of this study to list all the studies, the following section highlights the selection of recent studies by providing an overview of these approaches, the motivation behind the selection of the noted approaches as well as limitations and benefits. The studies in question which are drawn from developed and developing economies include the following: Carillo (2005), Williams (2007), Kululanga and Kuotcha (2008), Fuller *et al.* (2011) and Henderson *et al.* (2013).

Similarly, Collinson and Parcell (2001) cited in Carillo, 2005, pp. 239) recommended the following 12 steps approach to capturing lessons learned:

- (1) call the meeting;
- (2) invite the right people;
- (3) appoint a facilitator;
- (4) revisit the objectives and deliverables of the project;
- (5) revisit the project plan;
- (6) ask "what went well?";

- (7) find out why these aspects went well; and express the learning as advice for the future;
- (8) ask “what could have gone better?”;
- (9) find out what the difficulties were;
- (10) ensure that the participants leave the meeting with their feelings acknowledged;
- (11) determine “what next”; and
- (12) record the meeting.

The only drawback identified in the 12 steps is the limited advice on how the lessons learned should be stored and disseminated. Williams (2007) suggested the use of mapping techniques as they had the potential in showing the chains of causality set up in a project. Furthermore, this provides scope for identifying “hard”, non-intuitive lessons.

Kululanga and Kuotcha (2008) developed a structured management tool for measuring project review process which had the following nine variables:

- (1) timing for project reviews;
- (2) project review team;
- (3) systems approach to a project review;
- (4) use of TQM tools in project reviews;
- (5) recording experiences in project review;
- (6) project review depositories for lessons;
- (7) specific lessons learned from project reviews;
- (8) sharing lessons learned from project reviews; and
- (9) implementation plan for lessons learned in a project review.

According to Fuller *et al.* (2011), another approach for capturing lesson-learned is through using an event-based approach to project knowledge integration that propagates deutero-learning, and generates outputs that codify lessons learnt as well as promotion of benefits measurement. This approach which is cyclic in nature is composed of the following seven main elements:

- (1) identification of lessons;
- (2) prioritisation;
- (3) selection of best ideas;
- (4) benefits card preparation;
- (5) review;
- (6) implement (post-event); and
- (7) personal reflection (pre-work).

Elements (5) and (6) are also denoted as “looking back” and “looking forward”. Recent studies (Henderson *et al.*, 2013) highlighted the limitations of the existing prevalent KM and organisation learning practices such as after action reviews (AARs) and post-occupancy evaluations (POE) in addressing buildability-related issues

and proposed the need for adopting “double-loop learning”. One reason put forward for the limitation of POE was that it was more focused on assessing the final product’s functionality in use rather than capturing lessons learnt on how the design could be improved (Henderson *et al.*, 2013). Similarly, despite the noted benefits of AARs in capturing “lesson learnt”, according to Henderson *et al.* (2013), one of the drawbacks was that it was restricted to the construction phases only. Examination of the above approaches reveals some similarities in that both the 12 steps approach proposed by Collinson and Parcell (2001, cited in Carillo (2005)) and Fuller *et al.* (2011) employed the “facilitators” in undertaking some of the tasks as “benefits card preparation” (Fuller *et al.*, 2011) and the appointments (see Step 3 of the 12 Steps approach). Similarly, despite acknowledging the benefits associated with PPRs such as employees learning from others and assembling of the different experiences, Carillo (2005) highlights the concerns around the lengthy time-lag between a lesson being learned and recorded, as well as timing of the review when project participants have transferred to new projects renders the process to be lacking in detail.

Barriers to lessons learned documentation

The existing studies in the construction industry have mainly focussed on discovering the barriers to conducting lessons learned in terms of capturing the knowledge rather than the barriers associated with transferring, sharing, retrieving, and string of lessons learned (Collinson and Parcell, 2001; Disterer, 2002; Julian, 2008; Schindler and Eppler, 2003). It is worthwhile to note that the barriers to capturing lessons learned may be different to other aspects and processes of KM, yet they may be interdependence among them. As evidenced by several of researchers, lessons learned capturing process and PPRs have not been prioritised in many construction organisations. Several researchers undertook a number of studies and collected information through conducting questionnaire-assisted surveys to ascertain the barriers to successfully undertake reviews and lessons learned. While this study is focussed on identifying the barriers, these cannot be discussed in isolation without making reference to some enablers or critical success factors (CSFs) for implementing KM and organisation learning within the construction organisations. The rationale being that the presence of these CSFs would act as strategies for overcoming the noted barriers. Against that background, the approach undertaken in this review and subsequent discussion of the findings will be by making appropriate references to the CSFs identified in literature as potential solutions to overcoming the identified barriers.

Table I presents a number of barriers to the lessons learned process, which were identified by Williams (2007) through a survey participated by organisations around the globe. While William’s (2007) study is used for comparison purposes and focussed on the UK, the USA and China, it should be noted that the barriers as identified in this current study are also grounded in an extensive literature review. This refers to some research studies undertaken in other parts of the world, both developed and developing economies; e.g. Singapore (Pan and Flynn, 2003), the UK (Carillo *et al.*, 2004; Senaratne and Sexton, 2008), Canada (Carillo, 2005), Spain (Forcada *et al.*, 2013), sub-Saharan Africa (SSA), and Malawi (Kululanga and Kuotcha, 2008; Kululanga, 2009).

Some of the key barriers are discussed in the following paragraphs. Where appropriate, reference is made to the appropriate enablers or CSFs that could be applied in overcoming these barriers.

Barrier	Responses (%)
Lack of employee time	67.0
Lack of management support	62.5
Lack of incentive	53.7
Lack of human resources	53.1
Lack of clear guidelines	52.3
Lack of support from others in organization	32.2
Our process does not capture useful lessons	21.9
Data repository too hard to search	20.9
Lessons are not transferable	13.3
Wrong people are involved	8.8
We already put in enough effort	8.4

Source: Williams (2007, p. 85)

Table I.
Barriers to lessons
learned process

Lack of employee time. According to Williams (2007), lack of time available to undertake capturing lessons learned is a barrier that was identified by Keegan and Turner (2001) and Von Zedtwitz (2002). Based on a qualitative analysis of 44 semi-structured interviews with members of 19 European organisations, the study by Keegan and Turner (2001) which was aimed at identifying practices used to promote learning through projects concluded that time pressure constraints were the biggest hurdles in limiting the use of PPRs.

Similarly, in the survey conducted by Carillo *et al.*'s (2004), 67.9 per cent of the respondents identified "not enough time" as a main barrier to learning which is similar to Williams' (2007) statistics (67 per cent). Pan and Flynn (2003) quoted that lack of time is a reason for a failed lessons learned exercise. Some researchers underwent further studies and ascertained the reasons causing lack of employee time. For example, it was difficult to coordinate project debriefings since the employees are already engaged in multiple projects (Disterer, 2002; Egbu *et al.*, 2003; Schindler and Eppler, 2003; Senaratne and Sexton, 2008; Wiewiora *et al.*, 2009). Schindler and Eppler (2003) pointed out that there is particular time pressure towards the projects' end and this enhances the chance of failure in documenting the lessons learned. "Employees may be willing to share knowledge, however the pressure to deliver under tight project schedules does not often permit a knowledge sharing culture" (Davenport and Prusak, 1998).

Zollo and Winter (2002) advised that despite the obvious advantages of the process, the likelihood that a project team affords the time to document project debrief is low; since the costs for the learning investments dedicated to that specific task is high as the activity level in execution of the task is high. Pitagorsky (2000) also explained that a common barrier is the lack of awareness of the connection between process review, lessons learned, and process improvement and this causes workers not to be willing to allocate time.

The recommended strategy for overcoming this barrier involves the freeing up time for their employees to perform KM and organisation learning activities such as knowledge sharing (Wong, 2005). "Time" has also been identified as one of the critical elements in the creation and implementation of a KM strategy (Martensson, 2000).

Recent studies such as Fuller *et al.* (2011) have proposed new approaches such as “project learning processes” to overcoming problems associated with obtaining management and staff buy-in.

Lack of human resources. Human resources are so critical in the learning process that Bresnen *et al.* (2002) considered them as one of the key factors enabling organisational learning. Researchers have identified the following human resource related causes which result in not having eligible human resources to capture constructive lessons learned:

- inadequate resources (Keegan and Turner, 2001);
- employee egos due to defensive routines (Argyris, 1992);
- employee resistance (Carillo *et al.*, 2004);
- lack of attention, personal interest and ability (Von Zedtwitz, 2002);
- insufficient willingness for learning from mistakes of the person involved (Schindler and Eppler, 2003);
- lack of incentives (Bresnen *et al.*, 2002);
- inadequate communication (Carrillo *et al.*, 2012); and
- the process is not included in formal job description (Wang and Noe, 2010).

In overcoming this barrier, the study by Wong (2005) identified 11 CSFs for implementing KM in small and medium enterprises (SMEs). “Human resources management” (HRM) was among the CSFs identified, and Wong (2005) identified effective recruitment of employees as a crucial element and mechanism would enable employees knowledge and competences being brought to the organisations. This view is also supported by earlier studies such as Mayo (1998, cited in Martensson (2000)) which suggested that recruiters should look for capabilities to share knowledge with new employees, as well as assessing what new knowledge they can bring to an organisation. Similarly, Pathirage *et al.* (2007) highlighted the need of nurturing the valuable human resources. According to the study, valuable human and knowledge resources will be wasted unless organisations make better use of these prime resources.

Lack of clear guidelines/processes. Selected by 96.8 per cent of participants, having no proper guideline or process for lessons learned documentation was identified by Carillo *et al.* (2004) as the most important barrier to KM in the UK. Furthermore, more than half of the participants in the survey conducted by Williams (2007) confirmed lack of guideline as a barrier to lessons learned documentation. Lack of lack of lessons learned related processes were highlighted by researchers (Newell *et al.*, 2006; Schindler and Eppler, 2003). Advocated strategies for overcoming this barrier include having a better process of sharing knowledge as this would benefit the firm or organisation (Martensson, 2000). It is also suggested that appropriate interventions and mechanisms such as technological networking tools would facilitate knowledge sharing (Wong, 2005). However, recent studies such as Wang and Noe (2010) have developed a framework of knowledge sharing which highlights the five areas that need to be considered in this regard. These are as follows:

- (1) organisational context;
- (2) interpersonal and team characteristics;

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- (3) cultural characteristics;
 - (4) individual characteristics; and
 - (5) motivational factors.

The issues of lack of guidelines and established criteria also extend to conducting project reviews (Kululanga and Kuotcha, 2008). As opined by Fuller *et al.* (2011), finding appropriate ways of capturing and embed learning emerging from projects is important.

Lack of senior management support. Management support for knowledge sharing has been shown to be positively associated with employees' perceptions of a knowledge sharing culture and willingness to share knowledge (Lin, 2007). Lack of senior management support which may directly cause or magnify the other learning barriers, is one of the major barriers to organisational learning and it has been noted by some researchers (Carillo *et al.*, 2004; Crosman, 2002; Pan and Flynn, 2003). According to Collier *et al.* (1996) establishing reviews and lessons learned process requires management commitment and support. There are also emerging areas such as the harnessing and managing of cognitive power where mission-pertinent learning and knowledge activities should be nurtured by construction executives or senior management (Kululanga, 2009). Evidence of senior management support as an enabler or CSFs for knowledge sharing is also provided by Holsappe and Joshi (2000, cited in Wong (2005)) who argued that, leaders establish the necessary conditions for effective KM. "Support from top management" as critical element in the creation and implementation of a KM strategy has been also acknowledged in other studies (Martensson, 2000; Pan and Flynn, 2003).

Lack of money. As noted earlier by Zollo and Winter (2002), "lack of money" is directly dependant on "lack of time". In Carillo *et al.*'s (2004) survey, "lack of money" was selected by 62.3 per cent of the participants as another critical learning barrier. This barrier of "lack of money" can also be constructed as a CSF when viewed as a "financial resource". According to Wong (2005), successful KM implementation is dependent upon financial recourses.

Organisational culture. An underlying factor causing most of the above-mentioned barriers is "organisational culture". In Carillo *et al.*'s (2004) survey, 75.5 per cent selected organisational culture as a barrier. Glanville (2003) claimed that "fear of failure", "ambition", "unwillingness to speak about difficult issues", "threat that the project might be stopped or curtailed", and a "desire to justify the past rather than manage the future", which are embedded in the culture of organisations, can dramatically limit the effectiveness of project status review. An organisational climate that emphasises individual competition may pose a barrier to knowledge sharing (Schepers and van den Berg, 2007). Potential negative legal consequence was also been recognised as a strong barrier by Carrillo *et al.* (2012). In addition, according to Schindler and Eppler (2003), project work can be found in the conflicting aims between a project and the surrounding organisation. "Companies do not always recognise the value of lessons learned and in some cases only do them when requested by clients (Carrillo *et al.*, 2012)." Carillo *et al.* (2004) also explained that business units operate in isolation with little communication and this is enforced by organisational structures and unwillingness to admit the existence of a problem. One of the seminal studies undertaken by Scott and Harris (1998) among the UK construction organisations, also highlighted the need of a learning culture as a mechanism for gaining feedback

about the efficacy of their designs. One way enhancing effective organisational culture, given its numerous facets, Wong (2005) recommends “collaboration” as a mechanism that would foster and contribute to knowledge creation. Pan and Flynn (2003) identified an “open and forgiving corporate culture” as one of the CSFs for a project post-mortem analysis.

Summary of literature review

The literature review examined a vast amount of literature on lessons learned in the construction industry, capturing lessons learned and common barriers to capturing lessons learned and its documentation focusing on two survey based studies undertaken by Carillo *et al.* (2004) and Williams (2007). The justification for conducting the literature review was to gain an insight into the research area and to identify the data that needed to be collected. Due to losing skilled workforce in the construction industry in the near future, there is an urgent need for construction companies to regularly capture lessons learned. Lessons learned are mainly captured through PPRs. However, this process has not been prioritised in the construction industry. Despite of some differences on the importance of the barriers from participants’ perspective, certain barriers to organisational lessons learned process (i.e. “lack of employee time”, “human resource related issues”, “lack of clear guidelines/processes”, “lack of senior management support”, “lack of money” and “organisational culture”) were identified critical and accordingly elaborated from the perspective of a number of researchers.

A selection of recent studies advocating the usage of PPRs as mechanisms for capturing lessons learned further highlighted some similarities in their approaches.

Based on the identified barriers, a series of advocated solutions in form of enablers and CSFs that could be used to overcome these barriers were suggested. Furthermore, a range of supporting literature is included where applicable to provide support and validity of the proposed solutions.

Following is the methodology on which a research study has been conducted in Australia to identify the barriers to lessons learned from Australian perspective and compare with those of other parts of the globe found in the existing literature.

Research methodology

The current research study has been conducted by the authors at the University of South Australia (UniSA) to identify main barriers to lessons learned documentation from the perspective of ACCs. The main questions of this study were as follows:

- What are the common barriers to effectively capture lessons learned in the Australian construction industry?
- Are the results in alignment with results of other research studies undertaken outside Australia?

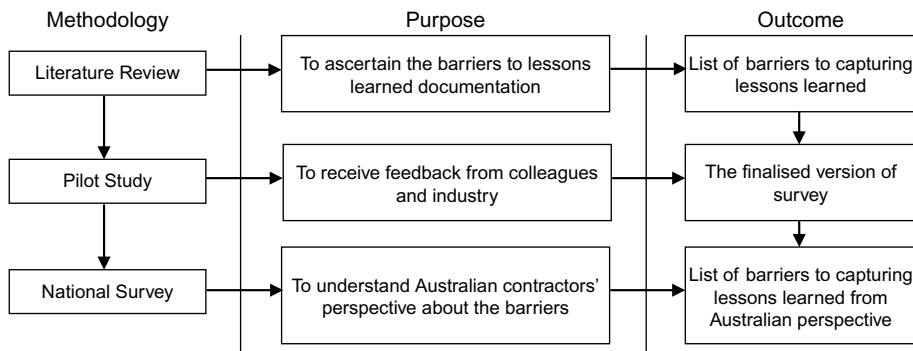
The researchers started conducting the research study by reviewing the existing literature on lessons learned and barriers to capturing them. The researchers accordingly designed a comprehensive national survey to ascertain Australian contractors’ perspective on lessons learned documentation barriers. As the study was focused on capturing the barriers associated with the application of lessons learned process among the construction contractors, the unit of analysis was identified as that of an organisation. Flynn *et al.* (1990, cited in Forza (2002)) pointed that the unit of

analysis in organisation management (OM) could either be individuals, dyads, groups, plants, divisions, companies, projects, systems, etc. It is against the background that, in presenting the profile of the respondents with the subsequent “survey results and discussions” sub-section, the data aggregation emphasis be rather on the organisations than individual respondents. It should however be pointed out that the questionnaires were targeted at key personnel with knowledge about the subject matter, namely “knowledge management and organisation learning”. The schematic version of the research methodology of the study is shown in Figure 1.

It should be noted that the methodology as adopted is a mixed method or “triangulation”. The rationale for adopting triangulation was to benefit from its two main objectives highlighted by Ammenwerth *et al.* (2003), namely “validation of results (convergence)” and “completeness of results (complementary)”. As previously noted by Chileshe and Watson (2005), despite the view that academic arguments can be strengthened through the utilisation of triangulation, this premise or concept of “triangulation” had received less attention in construction management research. A number of definitions for triangulation are widely available in literature. For instance, Denzin (1989) advocated the following four types of triangulation:

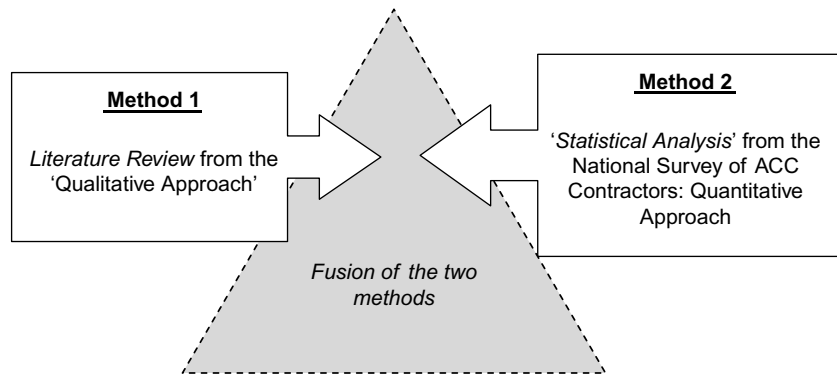
- (1) data triangulation;
- (2) investigator triangulation;
- (3) methodological triangulation; and
- (4) inter-disciplinary triangulation.

This study adopted the “methodological triangulation” as defined by Denzin (1989) where multiple methods of data collection and analysis are used; and “interdisciplinary triangulation” where the research process is informed not only for example by KM and organisational learning as drawn from the “project management discipline”, but also by other disciplines such as “organisational behavior” and “human resource management” in addressing the “cultural” and training issues’ associated with barriers to lessons learned. As an illustration of the “methodological triangulation”, through adoption of the “quantitative” and “qualitative” approaches, Figure 2 shows the achievement of validation process as advocated by Ammenwerth *et al.* (2003).



Source: Adopted from Yang *et al.* (2009)

Figure 1.
The research framework
of the study



Note: The shaded grey area highlights the fusion of the two methods or approaches

Figure 2.
Validation process of
the methodological
triangulation

As can be seen from Figure 2, the capturing of the two “elements” of methods 1 and 2, namely the “literature review” and “statistics analysis” analysis are highlighted. The linkages in achieving the triangulation from the literature review (qualitative approach) and statistics analysis (quantitative approach) are depicted by the arrows. The shaded area within the triangle represents the region of fusion of the two methods.

Based on the above explanations, it can be inferred that this study adopts the “convergence model” from the different triangulation models. According to Creswell and Plano Clark (2007) in a convergence model the researcher collects and analyses quantitative and qualitative data separately on the same phenomenon and then the different results are converged (by comparing or contrasting the different results) during interpretation. In additional, the mixed method design falls in the middle of the spectrum between the two distinct methods of qualitative and quantitative methods incorporating the philosophical elements of both (Creswell, 2009). It should also be noted that, another rationale for using a mixed methods design in this study was to increase the reliability and validity of the research (Easterbrook *et al.*, 2008). Examination of Figure 1 shows that the qualitative data is collected via the “literature review”, whereas the “national survey” forms the basis of the quantitative data. Furthermore, by comparing the results of this study with those of William’s (2007) in relation to the barriers is indicative of convergence of the results.

Before considering the research methodological issues associated with the research instrument (questionnaire or survey), it was necessary to define the terms “ACC”. As the population of interest was identified from the existing listing provided by the Masters Building Association (MBA), it is only appropriate to use that as the benchmark. Furthermore, contractors also undertake civil engineering works, and these “civil contractors” are normally affiliated with organisations such as the Australian Civil Contractors Federation (CCF). According to the definition provided by the CCF, its members are responsible for the construction and maintenance of Australia’s infrastructure, including roads, bridges, pipelines, drainage, ports and utilities.

On the other hand, the MBA defines the “building contractors” as an organisation that coordinates the construction of homes and other buildings. For the purpose of

this research, the ACC is thus defined as organisations that coordinate either the construction of homes and other buildings, or civil engineering infrastructure (such as highways, roads, bridges, etc.).

Having provided the definition, some selection attributes and requirements for the targeted became feasible. Despite being globally applicable, this research study aimed to engage a certain community of participants. One of the attributes which was expected of the participants was that, they had to known as a “construction contractor” which undertakes construction projects including building, industrial and civil engineering projects. The second requirement was that, the participants projects might vary from residential and commercial projects to highways, bridges or even power plants and refineries. In addition, the participants were required to be Australian which meant that they had to be registered as an ACC. However, the exception to the requirements was that the participants or respondents did not need to solely be performing in Australia, and therefore, they might or could undertake their projects overseas. Finally, the participants were required to be active, which meant that they must currently be operating their business within the Australian construction market.

Research instrument: the questionnaire

The questionnaire distributed to the construction contractors comprised three distinct sections as follows:

- *Section 1.* Questions 1-9 encompassed general demographics of the ACCs (e.g. type, organisation size, location, project size, contract value).
- *Section 2.* Criteria 1-26 + Questions 10-14. The first part covered rating the bid/no bid decision criteria and the second part was designed to collect data on bid/no bid decision processes of the ACCs. Each item (bid/no bid criteria) was measured on a five-point Likert format where 1 – very low; 2 – low; 3 – medium; 4 – high; and 5 – very high. Thus, (3) represented indifference, i.e. neither high nor low.
- *Section 3.* Questions 15-21 started focusing on lessons learned documentation process of the ACCs. In this section, post-project process was further subdivided into the following two measurement instruments:
 - (a) lesson learned which included the identification of the barriers (Question 18); and
 - (b) lessons learned based bid/no bid decision making process (Question 19-21).At the end of this section, the respondents were required to state whether they applied their lessons learned to future project selection or not.

The results presented here and discussed in this paper are related to the first section dealing with the demographics and subdivision (a) of Section 3 of the questionnaire, where the respondents were asked to identify barriers to effectively capture lessons learned from a list of barriers previously found in the literature. It is beyond the scope of this paper to report on all issues that were covered within the broader research project (Section 1 through 3).

Pilot survey

As shown in Figure 1, the second stage of the methodology involved conducting a pilot study. To evaluate the effectiveness of the survey questionnaire, a pilot study was

conducted and feedback from the respondents was received and subsequently applied in the process of revising the survey questionnaire. An exploratory survey was selected and conducted to collect the required data. To validate the appropriateness of the questionnaire, and fit into the conditions of Australian construction, a pilot test was undertaken by administering the instrument to ten experts comprising seven individuals and three practitioners drawn from the academia and construction industry, respectively. The rationale for this is articulated by Forza (2002) who acknowledged and identified the role of industry experts as one of preventing the inclusion of some obvious questions that might reveal avoidable ignorance of the investigator in some specific areas (Forza, 2002). As a result of this pilot survey, the contents of the questionnaire dramatically changed through increasing the clarity of questions that enabled them [questions] to be easily understood by practitioners from the construction industry.

Survey administration and sampling strategy

As the purpose of this study was descriptive, and the research question involved establishing the opinions of respondents on the barriers to capturing lessons learned, the recommended research strategy is that of an analytical survey. Furthermore, Saunders *et al.* (2007) noted that the questionnaire is one of the most widely used data collection techniques within the survey strategy, because each person is asked to respond to the same set of questions thereby it provides an efficient way of collecting responses from a large sample prior to quantitative analysis.

Relative to the sampling strategy, the following two different techniques were used to design and distribute the questionnaires:

- (1) developing an electronic questionnaire under the UniSA web site and requesting two Australian building bodies to distribute it; and
- (2) preparing a hard-copy questionnaire and sending it directly to ACCs by mail.

The web link to the electronic questionnaire was sent to Australian Institute of Building (AIB) and Master Building Association (MBA) to distribute it to their members. However, based on the initial response (return) rate of 18 questionnaires, this was discounted as it was difficult to ascertain how many contractors had actually received the survey link from the above-mentioned professional bodies. Furthermore, it was anticipated before sending the questionnaire that the result might not be desirable as the participants may not be willing to complete the survey. In order to increase the number of respondents and possibility of success, the final version of the national survey questionnaire was sent to the 450 potential respondents working with active ACCs as previously defined within the “definitions, background and selection of targeted participants” subsection. As shown in Figure 1, according to Pinsonneault and Kraemer (1993), the rationale for conducting the exploratory national survey was to become familiar with the topic and to discover the range of responses likely to occur in some population (ACCs in this case) of interest.

Determination of sample size

In determining the sample size for finite population (where the population is less than 50,000), the final population size of 450 respondents was derived by determining the actual number of registered contractors. According to the Master Builders Association,

it has over 33,000 member companies with representation in every state and territory in Australia, whereas Australian CCF has around 2,000 contractor and associate members nationally. As recommended by Forza (2002), based on the total population of the contractors, the sample size from infinite population, taking the variance of the population elements, and in comparison with previous surveys of similar populations, the sample size from finite population was determined. This resulted in the selected number of questionnaires (450) as sent to be deemed appropriate.

Geographical distribution of ACCs

In terms of the geographically distribution of the ACCs around Australia, the greatest number (90) of questionnaires were sent to New South Wales and Victoria (90) followed by Queensland (85), as these states accommodate the greatest number of construction contractors (ABS, 2007). The remainder of the distribution of the survey questionnaires by states were as follows: Australian Capital Territory (ACT), 25; South Australia (SA), 45; Tasmanian (TAS), 40; Northern Territories (NT), 20; and Western Australia (WA), 55. The data distribution period was over a month (May-June 2010) and the responses as received over a period of July through end of August 2010 were recorded as received in batches.

Out of the 450 questionnaires, 27 (6 per cent) were not received by the ACCs as these were returned to sender. In addition, from the remaining 423 questionnaires, 63 (14.9 per cent) were returned as incomplete by the ACCs. A total of 81 usable responses were obtained for an overall response rate of 19 per cent which was more than the targeted number of 18 per cent.

The response rate was, therefore, deemed almost adequate for the purpose of data analysis. Akintoye and Fitzgerald (2000, cited in Odeyinka *et al.* (2008)) argued that 20-30 per cent response is the norm of rate in most postal questionnaire of the construction industry.

Statistical analysis of data

The data collected were analysed using the IBM statistical package for social sciences (SPSS) computer programme version 17.0.0. Three types of analysis were conducted. Descriptive statistics were generated from the “frequencies” and “ranking” type of analysis whereas correlation analysis was conducted to explore the strength of relationships between the barriers (Forza, 2002). However, as data analysis is governed by statistics, the personal beliefs of the researchers will have minimal impact on the study findings and this approach may result in artificial categorisation of phenomena that has little correlation with the real world (Libarkin and Kurdziel, 2002).

Reliability analysis

The reliability and internal consistency of the sub-survey instrument comprising the six barriers listed in Table II was examined using the Cronbach’s α coefficient. The Cronbach’s α value was 0.772 (F -statistic = 14.488, $p < 0.001$), α greater than 0.7 thus indicating a high reliability of scales (Nunnally, 1978).

Examination of the values or figures shown in the “corrected item-total correlation” (see Table II, Column 4) were all greater than 0.3. These values provided an indication of the degree to which each of the six items correlated with the total score. This result indicated that none of the items were measuring something different from the scale as

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a whole (Pallant, 2005). Furthermore, the values of the “Cronbach’s α if Item deleted” for the six items as illustrated in the last column were less than the final Cronbach’s α value obtained ($\alpha = 0.772$). According to Pallant (2005), this indicated that none of the six items required to be deleted from the scale measuring the barriers to capturing of organisational lessons learned.

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Survey results

The survey results are divided into the following two sections according to the survey instrument: Section 1 describes the demographics of the participating ACCs, Section 3 is comprised of the following three subsections: the first two subsections (3.1 and 3.2) examines the retention and procedures of the lessons learned documentation, Section 3.3 investigates the barriers to capturing of organisational lessons learned, Section 3.4 determines the strength of relationships among the barriers through usage of correlation analysis. Section 3.5 identifies the benefits associated with the lessons learned documentation and the last subsection 3.6 is aimed at extending the current knowledge on this topic, namely barriers to lessons learned through the comparison of the results of the current study with that of Williams (2007).

Section 1: the participating ACCs

Table III presents participating ACCs’ type. As it is shown in Table III 78 participants (96.4 per cent) can at least be classified a building contractor.

In the research study the ACCs are divided into three groups namely “small”, “medium” and “large” based on their annual turnover. Small ACCs are the ones having annual turnover of less than A\$20 million and medium ACCs are the contractors which

Table II.
Results of reliability
analysis conducted
on data

Barriers	Scale mean if item deleted	Scale variance if item deleted	Corrected item- total correlation	Cronbach's α if item deleted
Lack of clear guidelines	11.69	11.639	0.509	0.740
Lack of employee time	12.43	11.901	0.404	0.769
Lack of resources	12.03	11.622	0.432	0.763
Lack of incentive	11.63	11.483	0.563	0.727
Lack of management support	11.49	11.123	0.735	0.690
Our process does not capture useful lessons	11.60	11.809	0.519	0.738

Table III.
Participating ACCs’ type

Type	Frequency	%	Cumulative
Building	73	90.2	90.2
Engineering	1	1.2	91.4
Industrial	1	1.2	92.6
Building and engineering	1	1.2	93.8
Building and industrial	2	2.5	96.3
Engineering and industrial	1	1.2	97.5
Building and engineering and industrial	2	2.5	100.0
Total ACCs	81	100.0	

have annual turnover of between A\$20 and A\$100 million whereas the large ACCs have annual turnover of higher than A\$100 million. The demographical information of the respondents according to the organisation size (turnover or financial size) are summarised in Table IV.

As it is shown in Table IV, the majority (63 per cent, $n = 51$) of the participants are small contractors. The inclusion of this control variable such as organisation is of particular importance as previous studies have linkages between application of lessons learned or being a “learning organisation” and size. For example, the study undertaken by Kululunga and Kuotcha (2008) in Malawi, one of the countries in the sub-Saharan region showed that size and experience played a significant role in the way that construction contractors appropriate lessons from the various constructs of project reviews.

Section 3.1: documented procedures for recording the tenders

One of the questions the ACCs were required to clarify was whether they (organisations) have a documented procedures for recording the tenders submitted and their outcomes. Seventy-three participants (90.1 per cent) responded to this question and the results according to organisational size are shown in Table V.

According to the results, 72.6 per cent of the participants record the tenders submitted and the outcomes. The percentage for large and medium contractors is around 80 per cent while two out of three small contractors document such information. This finding is highly encouraging as having documented procedures is evidence of the “awareness” of the need of capturing lessons learned. As pointed out by Crossan (1995, cited in Kululunga and Kuotcha (2008)), the concepts of capturing “practice” and “awareness” are the principal elements for management tool development for effecting improvements.

Section 3.2: retention of lessons learned documentation

One of the questions required the ACCs to clarify whether or not they document their lessons learned. The respondents were asked the following question: “Does your organisation retain lessons learned documentation for each project?”. Seventy ACCs (86.4 per cent) responded to this question and the results are shown in Table VI.

Contractor's size by turnover		Frequency	%	Cumulative
Size	Turnover			
Small	Less than A\$20 m	51	63.0	63.0
Medium	A\$20 m-A\$100 m	18	22.2	85.2
Large	More than A\$100 m	12	14.8	100.0
Total ACCs		81	100.0	

Table IV.
The participating ACCs' financial size

Documented procedures	Small	Medium	Large	Total
Yes	30 (66.7)	15 (83.3)	8 (80.0)	53 (72.6)
No	15 (33.3)	3 (16.7)	2 (20.0)	20 (27.4)
Total ACCs	45	18	10	73

Table V.
ACCs' lessons learned documentation procedures

Note: Figures in parentheses are the frequency of responses by percentage

Despite the fact that the percentage of the contractors that record their lessons learned is higher among large contractors (50 per cent), only 34.3 per cent of the contractors document their lessons learned. Although this result supports the claim that lessons learned documentation has not been prioritised in organisations, it shows that the larger the ACCs, the more importance that is given to lessons learned documentation. Furthermore, review of literature indicates that there is little advice on how lesson learned should be stored and disseminated (Carillo, 2005).

Section 3.3: barriers to capturing of organisational lessons learned

As part of the survey, the respondents were asked to identify the barriers to successful documentation of their organisational lessons learned after completing each construction project. The researchers requested the ACCs to select the barriers from among a list of six common barriers drawn from the literature review (i.e. lack of resources, lack of incentive, inefficiency of the process, lack of clear guidelines, lack of employee time and lack of management support). Fifty-eight out of total eighty-one ACCs (71.6 per cent) responded to the question. Table VII presents the responses from different ACCs based on their financial size.

According to Table VII, regardless of the financial size of the ACCs, “lack of employee time”, which was the highly rated barrier by almost two-thirds (38 out of 58) of the respondents, is by far the most important factor preventing the ACCs from making more effort to document organisational lessons learned. Examination of Table VII shows that the majority of the small and medium ACCs ranked this barrier highly. Similarly, the same conclusion could be drawn with regards to the large ACCs. However, while interpreting the findings, reference should be made to the different samples sizes of the respondents (Table IV) as the majority were predominantly

Table VI.
ACCs’ retention of
lessons learned
documentation

Retention of lessons learned documentation	Small	Medium	Large	Total
Yes	12 (28.6)	7 (38.9)	5 (50.0)	24 (34.3)
On occasions	18 (42.9)	6 (33.3)	4 (40.0)	28 (40.0)
No	12 (28.6)	5 (27.8)	1 (10.0)	18 (25.7)
Total ACCs	42	18	10	70

Note: Figures in parentheses are the frequency of responses by percentage

Table VII.
The barriers to the
lessons learned process
by ACCs based
on their size

R*	Barriers	Small	Medium	Large	Total
1	Lack of employee time	25 (65.8)	8 (72.7)	5 (55.6)	38 (65.5)
2	Lack of resources	19 (50.0)	4 (36.4)	1 (11.1)	24 (41.4)
3	Lack of clear guidelines	9 (23.7)	2 (18.2)	1 (11.1)	12 (20.7)
4	Lack of incentive	6 (15.8)	1 (9.1)	3 (33.3)	10 (17.2)
5	The process does not capture useful lessons	6 (15.8)	1 (9.1)	2 (22.2)	9 (15.5)
6	Lack of management support	2 (5.3)	1 (9.1)	2 (22.2)	5 (8.6)
	Total ACCs	38	11	9	58

Notes: Figures in parentheses are the frequency of responses by percentage; R* – ranking based on the overall sample (*n* = 58 respondents)

smaller contractors according to turnover. Furthermore, the small and medium sized contractors had almost a similar ranking of the remainder of the barriers in contrast to the large ACCs. For instance, “lack of incentive”, which was been noted by merely 15.8 per cent of Small ACCs and less than 10 per cent medium ACCs, is considered important by one-third (33.3 per cent) of the large contractors. Moreover, “lack of resources”, was ranked second by both the small and medium ACCs suggesting that it was a critical barrier. On the contrary, this barrier was among the least ranked by the large contractors. This finding confirms the human resourcing issues affecting the SMEs and is in line with literature (Wong, 2005).

Section 3.4: correlation analysis

The barriers to successful documentation of organisational lessons learned were further analysed through correlation analysis and by means of the Spearman's correlation test. The purpose of this analysis was to determine the existence and strength of relationships between the barriers (Forza, 2002). Table VIII presents Spearman's correlation test in regards to the barriers to the capturing lessons learned.

Examination of Table VIII shows that all the six barriers are positively associated with one another. The values of the spearman correlation ranged from 0.478 to 0.132 with the strongest relation ($r = 0.478$, $n = 81$, $p < 0.01$) between “lack of senior management support” and “lack of clear guidelines” which was also significant at the 0.01 level (two-tailed). This was followed by the relationship between “lack of senior management support” and “lack of human resources” with $r = 0.412$ which was also significant at the 0.01 level (two-tailed). The lowest and not significant relationship was between “lack of employee time” and “organisational culture” ($r = 0.132$, $n = 81$).

Section 3.5: benefits associated with lessons learned documentation

Finally, the ACCs were required to mention if they believed that possessing lessons learned documentation will help them to select more feasible projects to bid for (Question 21). Seventy ACCs (86.4 per cent) responded to this question and the results of the responses are summarised in Table IX.

According to Table IX, which presents the results from this question, 82.9 per cent of the ACCs believe that possessing lessons learned documentation will enable them to choose a better project to bid for. This idea is fully supported by all of the large companies. While this finding is encouraging, there is a need for the participating ACCs to be preparing practising the aspect of “benefits card preparation” as part of the project learning cycle (Fuller *et al.*, 2011).

Barriers to documentation of organisational lessons learned	Time	Guidelines	Resources	Incentive	Support	Process
Time	1.000	0.197	0.372 **	0.341 **	0.399 **	0.132
Guidelines	0.197	1.000	0.234	0.256 *	0.478 **	0.277 *
Resources	0.372 **	0.234	1.000	0.165	0.412 **	0.129
Incentive	0.341 **	0.256 *	0.165	1.000	0.328 **	0.475 **
Support	0.399 **	0.478 **	0.412 **	0.328 **	1.000	0.442 **
Process	0.132	0.277 *	0.165	0.475 **	0.442 **	1.000

Note: Correlation is significant at: * $p < 0.05$ and ** $p < 0.01$ levels (two-tailed)

Table VIII.
Spearman's ρ correlation
test for lessons learned
barriers

Section 3.6: comparison of current survey to Williams (2007) on the barriers to capturing lessons learned

In regards to ascertaining the barriers to capturing lessons learned. Table X presents a comparison between the results from the current survey and results from an earlier extensive global survey undertaken by Williams (2007).

Examination of Table X shows that the top ranked (65.5 per cent) barrier by the ACCs respondents was “lack of employee time”. This barrier was also ranked top by the comparative study (Williams, 2007) by 67.0 per cent of the respondents. As discussed earlier, this factor (or barrier) may be caused by other factors including pressure on employees, high activity level in execution, lack of awareness and organisational culture.

The second most important barrier in the current survey was “lack of resources” as evidenced by the number of responses (41.4 per cent). This barrier to capturing of organisational lessons learned was ranked fourth by Williams (2007) survey. Despite the low ranking, it had slightly a higher response (53.1 per cent) rate in comparison to this current ACCs survey. Interestingly, the second highest ranking (with 62.5 per cent) barrier in William’s (2007) survey was “lack of management support”. Despite the importance attached to this barrier by William’s (2007) survey, it was the least ranked (sixth) with less than 10 per cent of the total responses in this current ACCs survey. The possible explanation for the disparity in the ranking of this barrier which is viewed among the most critical in literature, the reason might be that the ACCs representatives, who participated in the current survey, are the decision makers of the organisations and perhaps the company managers/directors and that is why they do not believe in accepting lack of management support as a barrier.

Examination of Table X further demonstrates that there was a disparity in the ranking of the remaining barriers. However, what is notable is that William’s (2007) had higher responses across all the barriers in comparison to the ACCs survey.

Table IX.
ACCs’ ideas about if lessons learned documents enable them to select a more feasible project to bid

Will it be beneficial?	Small	Medium	Large	Total
Yes	34 (81.0)	14 (77.8)	10 (100)	58 (82.9)
No	8 (19.0)	4 (22.2)	0	12 (17.9)
Total ACCs	42	18	10	70

Note: Figures in parentheses are the frequency of responses by percentage

Table X.
Comparison between the result of the current survey and Williams (2007)

Barriers	The current study (2013)		Williams (2007)	
	Frequency ^a (%)	Rank	Frequency ^a (%)	Rank
Lack of employee time	65.5	1	67.0	1
Lack of resources	41.4	2	53.1	4
Lack of clear guidelines	20.7	3	52.3	5
Lack of incentive	17.2	4	53.7	3
The process does not capture useful lessons	15.5	5	21.9	6
Lack of management support	8.6	6	62.5	2

Note: ^aFrequency of responses

For example, with regards to the barrier of “lack of incentive”, which was previously considered a very important barrier by more than half of William’s (2007) participants, was identified by less than one-fifth of the participants of the current survey.

Table X further highlights one of the objectives of “triangulation” namely that of “validation of results”. According to Ammenwerth *et al.* (2003), this (validation of results) is achieved when results from one part of the study are confirmed by congruent (not necessarily equal) results from other parts of the study. This is clearly evident with the equal ranking of the barriers “lack of employee time” as established through the “quantitative approach” and those by William’s (2007) study from the “qualitative approach” (Figure 2).

Discussion

This paper focussed on ascertaining ACCs’ perspective about lessons learned documentation and barriers which prevent ACCs from making more effort to capture and document their lessons learned. The following subsection now presents a discussion of the survey findings combined with the review of the literature (findings).

The results demonstrate that, although ACCs believe that having lessons learned documents is crucial, as shown in Table IX, only one-third of them regularly document their lessons learned. This shows that lessons learned documentation either has not been given the due importance by ACCs or it has not been introduced to them and the benefits have not been realised. However, the data analysis clarifies that large contractors are aware of the notion of lessons learned documentation and they seem to either regularly or occasionally apply them. This finding is also consistent with literature from different countries such as Spain (Forcada *et al.*, 2013) and Canada (Carillo, 2005). For instance, Forcada *et al.* (2013) argued that despite construction firms recognising the potential importance of KM and organisational learning, little had been done to introduce the practices of KM and organisation learning. One possible solution for addressing this problem would be for improved management support. According to Wong (2005), leaders establish the necessary conditions for effective KM.

One of the most notable finding in this study is that the majority 58 (82.9 per cent) of the respondents acknowledge the linkages between “possessing lessons learned documentation” and “effective selection of feasible projects to bid for” (Table IX). This finding is also consistent with previous studies (Love *et al.*, 2003; Von Zedtwitz, 2003; Anbari *et al.*, 2008). For example, the study by Love *et al.* (2003) which was Australian construction industry specific, demonstrated that PPRs and project schedule growth were highly correlated. Similarly, Anbari *et al.* (2008) suggested that PPRs contribute to the overall performance of the organisation and its long-term competitive position. Prior studies, e.g. Carillo *et al.* (2004), Egbu *et al.* (2003) and Nonaka and Takeuchi (1995), also regarded knowledge as a critical source for organisations contributing to managerial decision-making, organisation innovations and project success; providing market leverage and enhancing the competitive advantage. Despite the noted benefits of PPRs, the ACCs would need to improve with their retention of “lessons learned” documentation as only a third (Table VII) of the respondents actually do (retain) that. According to Anbari *et al.* (2008), the value of PPR is only derived from effective flow of information concerning lessons learned in various projects. The findings of this current study suggest that the lack of retention of the “lessons learned” by the ACCs might constrain them from reaping the noted benefits such as enhancement of current

and future projects. Furthermore, to ensure that any mistakes made during the projects can be easily traced and clearly identified during the project review process, good documentation is of paramount importance (Pan and Flynn, 2003).

Conclusion

The aim of this research was to contribute to deepening the understanding of the barriers to the capturing of organisational learned, and highlights the existing practices associated with documentation procedures for lessons learned. As part of KM, organisational learning, tacit and explicit knowledge transfer and organisational lessons learned process have been addressed by several researchers. In addition, PPRs, as one of the most effective learning tools, have extensively contributed to the learning process of organisations. However, in real life project such a process has not been prioritised and there have always been barriers to the implementation of lessons learned. This study adopted the “methodological triangulation” (Figure 2) which involved the review of existing literature of lessons learned in the context of KM and conducting the national survey of ACCs. Accordingly, the study identified the major barriers to capturing organisational lessons learned from an Australian construction perspective and compared them with the existing studies in the field.

In terms of barriers to capturing lessons learned, it was found that “lack of employee time” and “lack of resources” were the major issues affecting the ACCs (Table VII) whereas, “lack of management support” was the least ranked barrier. The findings also showed that despite the majority of respondents having documented procedures for recording the tenders, thereby capturing lesson learned (Table V), only a minority of the ACCs actually retained the lessons learned documentation for each project (Table VI).

In this study the three different sizes of construction companies (Small, Medium and Large) were asked to provide the research with information on their lessons learned documentation process. The findings showed that larger contractors are more aware of the importance of the lessons learned documentation and they are more willing to practice it regularly (Tables V and VI).

Furthermore, the study demonstrates that the majority of the respondents are aware of the benefits associated with lessons learned documentation (Table IX). Having discussed the analysis and linked that to the aim/purpose of the study, the following subsection highlights some implications for research, practice and society; and finally, recommendations that might benefit practitioners are examined.

In relation to contribution to current research, the study contributes to knowledge by conducting an extensive literature review on lessons learned and associated barriers; identifying similarities and differences between the results of this study and an earlier global study in this area, and ascertaining the impact of organisational size on capturing lessons learned and identifying the barriers. In addition, the current research study provides participating contractors as part of the construction industry with a deeper understanding of the concepts associated with the lessons learned documentation and its notions. The study confirms that there is lot to be done to encourage and convince construction organisations to adopt lessons learned processes.

Relative to the barriers affecting the capturing of lessons learned, which in turn benefits future projects, the study has a number of managerial implications for

the researchers, policy makers and practitioners (top management) within the Australian construction related contracting organisations. The following four can be singled out as having major implications.

First, the findings may help practitioners in reviewing and identifying the barriers to effective implementation and capturing of lessons learned strategies. Through this process, the possible ways in which the barriers can be addressed could form the basis of appropriate strategies, enablers or CSFs which would be considered when implementing lessons learned. Furthermore, the identified CSFs could be used as a road map for the successful capturing, adoption and subsequent implementation of lessons learned. Second, the findings can have an impact upon society through influencing public attitudes and perceptions through the positive aspects that arise from the effective adoption and subsequent implementation of lessons learned. Some of noted benefits are improving overall performance in subsequent projects (Von Zedtwitz, 2002; Huemann and Anbari, 2007); improved project performance through minimisation of delays, an issue strongly associated with negative images of the construction industry. Third, researchers could use these identified barriers as a sound basis to develop organisational learning strategies that are tailored to the practice of ACCs; fourth, the current study provides the participating contractors with a deeper understanding of the practices of lessons learned documentation. In addition, in spite of being overlooked in industry, lessons learned documentation is considered an important outcome of any project which can play a critical role in the future decisions of the construction companies where decision makers need to evaluate the next opportunities encountered, and finally, one way to manage knowledge is conveying it within an organisation in the form of lessons learned to maximise performance and minimise losses. Application of KM in organisations operations in this way may result in drastic improvements. This may particularly be substantial when the application of knowledge is associated with decision making areas of the organisations as the decision makers represent the organisations' corporate strategies. While there are no clear tailored solutions to the identified barriers, this study proposes the following recommendations which will be of benefit to practitioners within the Australian construction industry.

First, while the scope is narrowed down to only identifying the barriers in Australian construction industry and deciding whether or not they are considered generic in other parts of the globe. The next step will be focusing on how to tackle (strategies) each barrier in Australian construction context. Second, further studies need to be conducted to ascertain the barriers to other aspects of KM such as transferring, sharing, retrieving, and storing of lessons learned hence their interdependence will be identified and more effective framework will be introduced and implemented. The investigation of lessons learned beyond Australia will confirm whether these are practiced differently from what is currently being undertaken in Australia. Such studies may reveal whether the results achieved in this study are generic or they may vary from one region to another. Third, in response to addressing the barrier related to "lack of employee time", as suggested by Wong (2005), it is recommended that the ACCs should consider freeing up time for their employees to perform KM and organisation learning activities such as knowledge sharing (Wong, 2005).

However, given that the majority (63 per cent, see Table IV) of the respondents within this study are small organisations (by turnover); this study acknowledges that key factors need to be taken into account such as alignment with the business

environment and strategic decisions prior to making such commitments. Fourth, there is a need for conducting further research case studies in order to draw the highlighted implications of the study. Fifth, due to the resources (lack of) and employee time issues, the ACCs are encouraged to utilise facilitators when undertaking PPR as well as undertake activities such as “benefits card preparation” if the full benefits of project learning, and PPR are to be gained, and finally, in addition, future studies need to be conducted to identify the underlying human resource factors causing resistance to application of lessons learned.

There were certain limitations in conducting the current research study. First and foremost, the research was conducted in Australia in order to analyse the Australian perspective on barriers to capturing lessons learned. Moreover, the researcher targeted the construction sector and specifically focused on construction contractors. The participants were aimed to be of different size (small, medium and large). However, the majority of participants were small contractors (Table IV). The reason is that the researchers were not aware of the contractors’ size prior to inviting them for participation in the research study.

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