KNOWLEDGE MANAGEMENT PROCESSES IN SOUTH AUSTRALIAN INFRASTRUCTURE PROJECTS: ALIGNING KEY STAKEHOLDERS EXPECTATIONS AND PRACTICES

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Abstract: Despite its scale and complexity, infrastructure projects have constantly challenged public sectors, and the manifestation of project success lies in one of the most critical facets in modern project management practice, i.e. knowledge-centred culture. How effectively an organisation or team manages its knowledge and experience impacts how successful the projects are. There has been a significant amount of research into knowledge management theory and strategies however, little has been given to the understanding of core practical characteristics, processes and practices by multiple key actors or stakeholder organisations with vested roles and interests. Many studies have focused on an organisation or from one discipline point of view, not in project environments. The principal objective of this paper is to highlight findings of small-scale exploratory research conducted to identify the extent of implementation and effectiveness of knowledge management process, transfer, practice and its culture in three different key stakeholders organisation involved in the delivery of infrastructure projects in South Australia. A concise review of the literature and semi-structured interviews served as the basis for analysis and identification of what knowledge management processes are used, how effective they are, what factors affected the process selected, and their effectiveness. The findings show that organisations involved in projects recognised the importance of knowledge management but were not as effective at implementing it, and the processes varied across the large organisations. The organisation's core business area or discipline is the primary factor impacting the knowledge management process, thus setting the "culture" of its implementation.

Keywords: Project management, knowledge management, stakeholders, infrastructure projects

1. INTRODUCTION

It is well-understood that knowledge management is an essential factor in organisations' success in delivering infrastructure projects. The management, storage and dissemination of knowledge and experience in an organisation can reduce costs and improve efficiency by eliminating the need to reinvent the wheel, avoiding repeat mistakes, and reinforcing what has previously worked well (Caldas et al., 2009; Fernie et al., 2003). The temporary and discontinuous nature of construction projects (including infrastructure projects) makes capturing and transferring knowledge and experience gained during a construction project a problematic task (Forcada et al., 2013). However, unless knowledge management processes such as lessons learnt are implemented effectively, stakeholders involved in delivering infrastructure projects are destined to repeat previous mistakes. These mistakes cost both time and money and are often avoidable.

There have been plenty of studies into developing an understanding of knowledge management processes, assessing their effectiveness, and recommending improvements, limited to a single organisation perspective and not a project team setting. Although knowledge management is gaining a grasp at different levels of public sector areas, empirical evidence for the process and practices is still limited, especially in the local context of South Australia (SA). Many previous pieces of research have also focused solely on an organisation rather than across the range of the different stakeholders or parties involved, particularly in public infrastructure projects. In addition, with the construction and infrastructure professionals being most versatile in developing their technical, leadership and strategic business management skills, it creates a pressing need to understand how knowledge management can be managed across an organisation and even across industries and translated into acquiring necessary skills and retaining them, hence, to contribute to the overall project success of projects.

This study aims to identify the knowledge management processes used by stakeholders of different disciplines involved in delivering public infrastructure projects and assess how effectively these processes are utilised. It is also aimed to identify what factors impact the effectiveness of these processes and how these factors vary across the different disciplines. The findings from this research will practically be used to provide insights on improving the

effectiveness of knowledge management implementation and processes in stakeholder organisations or project teams. Data of this research were collected from participants from three different organisations, from each of the three key stakeholder groups, i.e. asset owners (client), construction companies (contractor) and designers (consultant). A case study design, interview, inductive approach was used. This broad approach enables the identification and comparison of the factors influencing the effectiveness of knowledge transfer in the different stakeholder organisations or project teams. Analysis of the data aims to increase the understanding of knowledge transfer in a local infrastructure project context and provide recommendations to improve the effectiveness of knowledge transfer processes in stakeholder organisations.

This paper is structured as follows: the next section provides an overview of relevant literature in the field of knowledge management in infrastructure projects. The subsequent section describes the research methodology utilised in this study and then followed by the results and discussion. The last section presents the conclusions, limitations, and opportunities for further research.

2. LITERATURE REVIEW

In literature, it is commonly understood that knowledge management is an important asset and essential factor in the success of organisations and stakeholders involved in the delivery of construction projects. Not only within projects but also knowledge across different projects and knowledge about projects are strongly dependent on the environment of the projects being conducted in an organisation or team. In addition, the complex and fragmented nature of the construction industry and the temporary ad hoc nature of construction, engineering and infrastructure projects makes the capture and reuse of knowledge gathered during a construction project a difficult task (Carrillo et al., 2013; Dave & Koskela, 2009; Forcada et al., 2013; Williams, 2008). The temporal nature of construction projects leads to a lack of continuity of staff, as often once a project has been completed, the team is dissolved, and unless processes are in place, the knowledge and experience gained in that project will be lost (McClory et al., 2017; Shokri-Ghasabeh & Chileshe, 2014). The systematic securing and disseminating of knowledge and experience are even more important in multi-project management organisations (Disterer, 2002), such as government infrastructure agencies where multiple projects that could benefit from this knowledge can be progressing at any one time.

Many definitions exist around knowledge management. In broad yet practical terms, knowledge management is about formal or informal dissemination of knowledge and experience that enables long-term benefits to an individual or organisation. Dave and Koskela (2009) define knowledge management as a systematic and organised approach to storing experience and extending knowledge to improve performance. The knowledge area from and between projects can be referred to as expert knowledge, methodological knowledge, procedural knowledge, and experience knowledge and, the knowledge from and between projects contributes to the organisational knowledge base (Hanisch et al., 2009).

In general, there are two types of knowledge, i.e. tacit and explicit. Explicit knowledge is the most basic form of knowledge, and it can be easily expressed, defined, and passed along as they are usually written or codified in procedures, documents, instructions, and standards (Duffield & Whitty, 2016; Fernie et al., 2003). Typically, explicit knowledge that is readily identified can be transferred using formal knowledge management processes. The codified knowledge can be catalogued and electronically stored to be readily accessible, easily applied, and shared. The construction, infrastructure, and engineering project team or organisations rely heavily on storage and use of explicit knowledge (through procedures and standards), yet limited in modelling effective practice on capturing, filtering, and reusing tacit knowledge and experience (Dave & Koskela, 2009).

Rezgui et al. (2010) and Duffield and Whitty (2016) define tacit knowledge as knowledge that cannot be expressed easily and attained from personal experience. It is subjective, cognitive, challenging to share and codify, and typically learned by experience, hands-on and/or undertaking an apprenticeship. It is also best shared through using direct social and personal communication and through joint activities, observation, imitation and practice (Senaratne & Sexton, 2009). The challenge faced by individuals with tacit knowledge is that it remains stored in the minds of project team members, is often is not captured, recorded, or transferred across the organisation for future use, and is then lost when they leave (Carrillo et al., 2013; Schindler & Eppler, 2003). Fernie et al. (2003) and Senaratne and Sexton (2009) believed that even though complex process, tacit project knowledge possessed by individuals can be converted to explicit knowledge, secured, stored and utilised across organisations involved. According to the findings of a study by Senaratne and Sexton (2009), for the successful transfer of knowledge, there needs to be a balance of codification knowledge management strategies and soft strategies that stimulate and support social interaction to disseminate tacit project experience. It also needs to include both formal and informal learning to enable the sharing of explicit and tacit knowledge (Jugdev, 2012). It is also need to be appropriately supported by systems such as information and communication technology, formal procedures, structures and methods (Herbst, 2017). It can said that the most common goal organisations thus are whether to focus on the process of converting tacit knowledge to explicit knowledge and whether to implement formal and/or informal knowledge management processes.

In brief, informal knowledge management processes do not have set procedures but are generally a more organic and social way of facilitating the transfer of tacit knowledge. Hartmann and Dorée (2015) states that social interactions are important channels or tools for the transmission of knowledge. These findings aligned with Jugdev (2012), who states that over 80 per cent of workplace learning occurs through informal knowledge sharing processes, such as mentoring, role modelling, lunch and learn sessions, staff placements, and early on-boarding. Communities of Practice (CoP), as described in Williams (2008), are another effective informal way of facilitating the sharing of tacit knowledge. CoPs are communities of interest that cut across project teams and enable sharing within the permanent organisation, partly overcoming the problems related to the temporary nature of projects. CoPs promote informal learning as tacit knowledge is acquired within a communal context, providing opportunities for participants to ask questions about relevant knowledge (Duffield & Whitty, 2016). In a study by Keegan and Turner (2001), it is found that CoPs created informal networks that are an essential conduit for transferring knowledge between individuals. In another study, Dave and Koskela (2009) found organisations are starting to use innovative ways to transfer knowledge through social web technologies such as wikis, blogs, folksonomies, web-based forums, and social networking sites. The informal and unstructured format of these technologies makes it ideal for capturing tacit knowledge and being searchable and available anywhere/anytime.

Studies around the informal knowledge management processes have revealed the great strengths of the approach. However, formal knowledge management processes are also often cited have the power to transfer valuable project knowledge, including lessons learned sessions, after-action reviews, project debriefings, closeout meetings, post-project appraisals/reviews, case study exercises, project reviews, project histories, project health checks and project audits (Carrillo et al., 2013; Jugdev, 2012). For example, a precondition for a successful project reflection session or lessons learned workshop can be used to transfer valuable project knowledge gained from both positive and negative experiences in an open, constructive atmosphere of generosity, freedom, and safety between project team members (Disterer, 2002). Once identified and validated, lessons learned must be appropriately documented in a searchable, readily accessible repository using set keywords and reported to stakeholders. Disterer (2002) and Carrillo et al. (2013) also suggested that a lesson learned record must have complete and detailed descriptions and explanations of the problem and solution implemented and actively maintained and communicated to staff, not just staff stored and searched for as required.

Information technology is the key to providing a knowledge library home, a communication medium, links to process/templates, links to where knowledge can be found in an organisation and learning development tools (Duffield & Whitty, 2016). However, it can cause confusion and information overload if the information is unstructured, disorganised, and ad hoc (Dave & Koskela, 2009). Several studies agree that the crux of knowledge management includes organisational context, culture, process and technology. Shokri-Ghasabeh and Chileshe (2014) identified numerous barriers to effective lessons learned and transfer but found lack of employee time, lack of resources, and lack of clear guidelines as the main barriers. Paver and Duffield (2019) supported this with findings of lack of consistency in policy, procedures and methods, with some organisations leaving it to only the discretion of the project manager as the standard approach. Due to stretched to fit the currently executing workload, the project manager is unable to update lessons learned databases, thus making them obsolete.

Furthermore, project organisation structures are often temporary and slow to respond to changes. It is reflected by infinite variations of informal and formal collaborations and is sometimes collectively used ad hoc organisational overlays (engineers, sub-contractors, suppliers, manufacturers team, fabricators and so on) and integrates separate areas of knowledge on specialist subjects isolated from one group to another. For example, if team members

are not receptive to change, perceive knowledge as power, or an organisation has a blame culture or silo mentality, then there will not be an open and constructive atmosphere to make lessons learned processes effective (Hartmann & Dorée, 2015; Schindler & Eppler, 2003). In addition, lessons learned processes most often occur at the end of a project, meaning that considerable time may have passed between the issue happening and being documented as a lesson learned, making recall more difficult and less accurate (Keegan & Turner, 2001; Schindler & Eppler, 2003; Shokri-Ghasabeh & Chileshe, 2014).

These literature and insights provide valuable contributions to current theory on knowledge management in a project setting more generally. It is mainly understood that knowledge management and sharing can not be explained or effectively implemented solely by individual actions such as project managers. Instead, it is team-based, as it involves the interaction between individual learning and others' learning, whether formal or informal, within the framework or process the project organisation advises. Developing an understanding of the current processes used by the stakeholders/project team in delivering knowledge management and sharing strategies is then crucial for the purpose of cross-organisational learning in project-based organisations.

3. RESEARCH METHODS

As mentioned earlier, this study aims to identify the knowledge management processes used by project organisations/teams involved in delivering public infrastructure projects and assess their effectiveness. A case study design and an inductive approach were conducted in a project organisation in South Australia. The selected research design is ideal for achieving the aim of this research as it is essential to pay attention to factors/aspects that do not necessarily show in literature, especially when the only contribution and focus on highly specific areas/projects. The perspective or understanding of the local context or imposed group (SA local organisations, disciplines and participants involved) may become isolated from the broader literature, therefore, be worthy of an in-depth understanding.

Due to research direction and time constraints, the scope of this study was restricted to one single project organisation whose mission is to deliver and undertake a major public infrastructure project. The project organisation had teams ranging from the asset owner/client, local public agencies, contractors (local, national and international), sub-contractors, civil and design consultants, traffic engineering consultants. We conducted semi-structured interviews and applied the purposive sampling method to collect data. Purposive sampling is where a researcher with relevant experience makes a deliberate choice of the participant due to the knowledge or expertise the participant possesses (Etikan et al., 2016).

In the interview with the project team members and leaders, this study used a combination of multiple-choice, open-ended, and five-point Likert-type scale question format on current knowledge transfer and lessons learned practices. The pre-defined questions were asked, such as: What knowledge transfer/lessons learned processes are used? How successful are these processes? What limits their effectiveness? How much time is dedicated to the processes? When do they take place? And who is involved?

4. RESULTS AND DISCUSSION

A total of nine participants were selected and agreed to participate in the interview. The nine participants were chosen based on industry experience, having long-standing familiarity in managing complex infrastructure projects. Interviews were recorded and transcribed verbatim and then were analysed using thematic analysis to identify common themes, differences, opportunities, and patterns in knowledge transfer processes used, their effectiveness, and barriers to their success across the different disciplines.

Data consisted of three participants from different organisations in each of the three stakeholders/disciplines involved in the delivery of major infrastructure projects in South Australia such as asset owner/client (road, electricity and water organisation), construction companies (local, national and international), and design/consultancy (local civil/design engineering consultant, local traffic engineering consultant, design team within asset owner organisation). The participants in this research were all professionals with working experience in the industry ranging from 9 years to 30 years, providing an accurate and evidence-based understanding of infrastructure projects. In addition, the participants had been employed at their current organisations for between 3.5 years and 16 years, so all participants also had a good understanding of their organisation's knowledge management processes and procedures. Figure 1 shows each participant's years of experience in the industry and years of employment/service in their current organisation. The reported results present generalised findings based on the nine interviews under the headings drawn from the analysis and the abovementioned pre-defined questions.

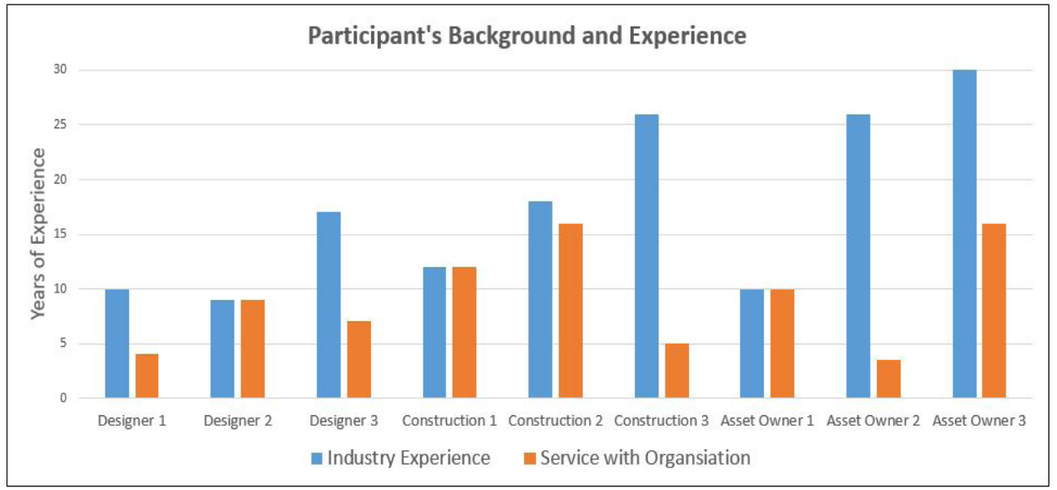

FIGURE 1: PARTICIPANT'S YEARS OF EXPERIENCE AND SERVICE WITH ORGANISATION

4.1 The Importance and Value of Knowledge Management and Experience

The first question in the interview asked each participant to give their rating as to the importance and value of knowledge and experience as an organisational asset. The extensive experience in the industry of the participants would give them a good understanding of the potential benefits and value of knowledge management and experience in delivering infrastructure projects. All of the participants strongly recognised the importance and value; this was rated on a five-point Likert-type scale ranging from 1 ("not significant at all") to 5 ("critical"). As shown in Figure 2, seven of the nine participants gave it the maximum rating of 5 ("critical"), and the remaining two participants rated 4.

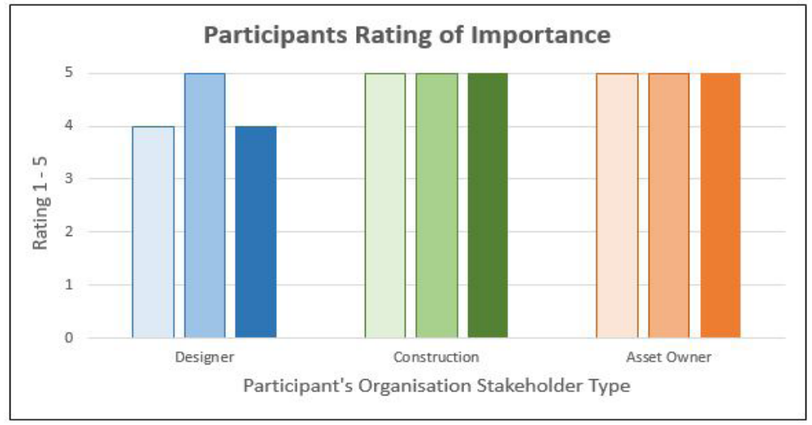

FIGURE 2: PARTICIPANTS RATING OF VALUE AND IMPORTANCE OF KNOWLEDGE AND EXPERIENCE

The participants were also asked about their opinion on and rate their organisation's recognition of the importance and value of knowledge and experience. Figure 3 showed that all the organisations recognised the importance of knowledge management, but generally, not all to the same level as the participants. Over half the organisations had the maximum rating of 5, with only one organisation having the lowest rating of 3.

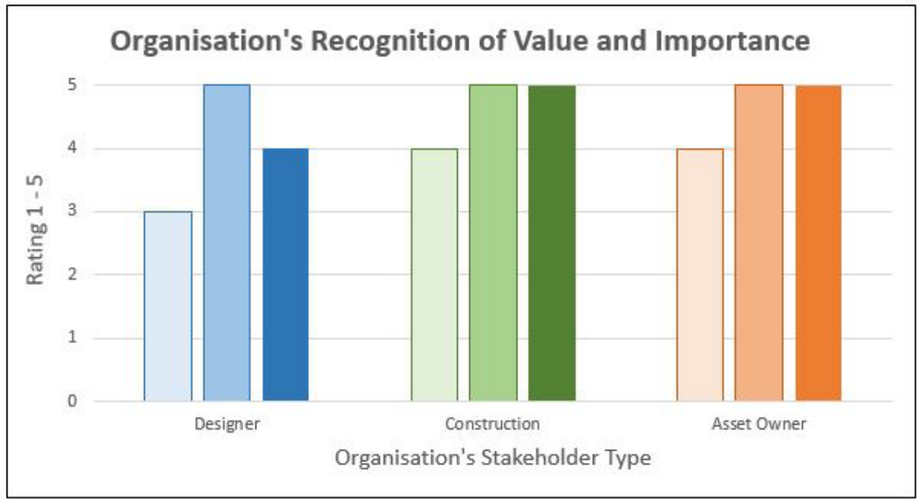

FIGURE 3: ORGANISATION'S RECOGNITION OF VALUE AND IMPORTANCE OF KNOWLEDGE AND EXPERIENCE

This data indicates that the importance and value of knowledge management and experience are clearly recognised in the infrastructure project delivery industry both by organisations and professionals involved, which is these findings united with Caldas et al. (2009) and Forcada et al. (2013) who stated that knowledge management is an important factor in the success of organisations and stakeholders involved in the delivery of construction projects. The challenge faced by organisations is how effectively they manage and utilise knowledge and experience to obtain maximum benefit. The participant's ratings of the effectiveness of their organisation's knowledge management and utilisation were lower than the rating of their recognition of its importance, with only one organisation rated at a maximum value of 5. The majority were rated at 4, so they were effective, with potential opportunities for improvement and three organisations rated at 3 or lower, meaning they were at best not very effective (see Figure 4). These results show that just because an organisation recognises the critical importance of knowledge and experience, being able to effectively manage and utilise them is much more difficult. These findings also confirm previous research, which found that few organisations manage to systematically identify, integrate or transfer knowledge and experience successfully (Disterer, 2002; Keegan & Turner, 2001; Schindler & Eppler, 2003).

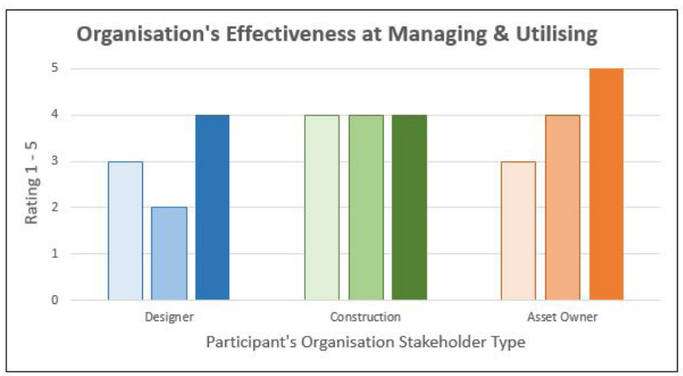

FIGURE 4: ORGANISATION'S EFFECTIVENESS AT MANAGING AND UTILISING KNOWLEDGE MANAGEMENT AND EXPERIENCE

4.2 Knowledge Management Processes Currently Utilised

It was found that the organisation's size has a major impact on the knowledge management processes utilised. The larger organisations rely on robust and regularly audited processes supported by specialist software data and file management systems to manage knowledge and information. Whereas smaller organisations do not have the same level of resources and so utilise less structured processes, with minimal auditing and only basic standard "off the shelf" file and data management software. However, the smaller organisations have a greater awareness and reliance on informal processes to manage knowledge and experience. They utilise their flatter structure to have increased direct management involvement across projects to transfer knowledge and the closer relationships and awareness between staff to promote informal knowledge transfer.

However, the organisations also need to recognise that even focusing on the knowledge management processes that complement their organisation's characteristics, this does not mean that the other processes can be ignored. Small organisations in spite of their focus on informal processes, still need to have basic procedures and audits in place, and large organisations need to consider the importance of informal knowledge management processes to complement its robust audited processes.

4.3 Processes and Factors Impacting Knowledge Management

In the context of this study, as shown in Figure 5, the knowledge management process and factors impacting it have a diverse emphasis. The knowledge management processes appeared to be implemented throughout out based on the organisation's discipline area, core business, organisation size, and maturity.

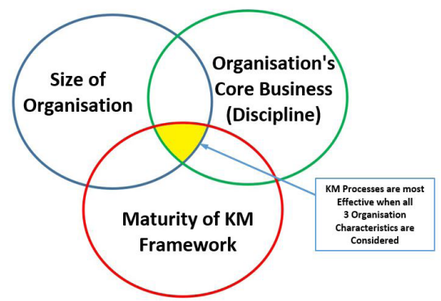

FIGURE 5: ORGANISATIONAL CHARACTERISTICS THAT IMPACT ON KNOWLEDGE MANAGEMENT PROCESSES

4.3.1 Stakeholder Discipline and Core Business

The first factor identified as having a significant impact on the knowledge management processes used by a stakeholder organisation is its discipline or core business. As Fernie et al. (2003) recognised, different industries may well possess different ways of thinking, impacting the knowledge management processes utilised. The stakeholder's discipline determines the type, purpose and outcomes required from the knowledge, information and associated processes. The data collected during the interview revealed the following themes/differences between the stakeholders/organisations of different discipline types.

The designer/consultant organisation in an infrastructure project aims to produce an accurate, cost-efficient and constructible design compliant with the necessary design standards and specifications. The participants interviewed identified that their organisation's ability to achieve these aims successfully required them to be able to undertake the following knowledge management activities:

risk identification and management in design
storage/dissemination of design standards/specifications
storage of design data and drawings.

The construction organisation in an infrastructure project aims to safely undertake the works required for the project in line with the time cost and quality requirements. In order for the organisations to be able to achieve these aims successfully, most participants agreed that they must be able to undertake the following knowledge management activities:

construction methodology learnings (cost, quality, efficiency)
understanding of costs to facilitate competitive estimating
safety in construction.

The role of the asset owner organisation in an infrastructure project is to accept and manage the project outcomes, including the completed infrastructure and associated asset data. The asset owner organisation must be able to effectively undertake the below knowledge management activities to achieve these aims:

storage and management of asset data;
construction verification data storage; and
financial data storage and management (asset/project costings and budgets).

In addition, although it was initially anticipated that the

core business would significantly impact the knowledge management activities and associated processes or tools used by the organisation. However, through the course of the interviews, the majority of the participants agreed that there was no relationship between the knowledge management tools and processes used and the discipline of the organisation.

4.3.2 Organisation Size

All nine participants described the relevance and impact of the size of the organisation on the knowledge management tools and processes being used. The tools and processes used appeared to be driven by the characteristics, opportunities and limitations presented by the size of the organisation. However, it did not necessarily mean that the organisation's size determined the effectiveness of its knowledge management processes. The effectiveness relies on the organisation's ability to recognise the weaknesses and strengths or opportunities associated knowledge management process.

Small and medium-sized organisations typically have three main characteristics that impact the knowledge management processes utilised. These characteristics are that they have a small number of employees, limited financial resources and typically are not dispersed across widespread geographic locations. As a result, the organisations do not have the staff resources or financial capacity to implement robust knowledge management processes. However, small and medium-sized organisations had greater awareness and reliance on informal approaches to manage knowledge and experience. Several participants highlighted that small and medium-sized organisations heavily relied on informal knowledge transfer either within project teams or through Communities of Practice. Team members of similar roles from different projects interact and share knowledge and experience. This was found to be particularly effective where a project team is located on a project worksite, working together to deliver the same project. The team members were motivated to share knowledge to achieve the shared goal of successfully delivering the project. Keegan and Turner (2001) noted that informal networks within an organisation are the most important conduit for transferring knowledge and experience between individuals and project teams.

Furthermore, in the small and medium-sized design organisations, the staff members sat together in groups working on similar projects so that informal knowledge sharing was also taking place through a Community of Practice process, where staff members were undertaking similar duties, located together talk and ask each other about their projects, issues and solutions during the course of undertaking their normal work duties. The effectiveness of this process however, is heavily dependent on the culture of the organisation, individual perceptiveness about it and attitude. One of the participants highlighted that their small organisation was almost like a family where all the staff members knew each other well enough that communication between staff took place with minimal effort, increasing the effectiveness of the transfer of knowledge. These findings correlated with Fernie et al. (2003) that strong ties between employees, identified by high trust, lengthy and close relationships are ideal for sharing informal and complex knowledge. This study also found that the direct involvement of senior managers across different projects due to the flat organisational structure also influences and would bring experience and learnings from other projects to encourage knowledge transfer, and these are very similar to Disterer's (2002) findings.

There are also a number of challenges that small organisations face. The lack of robust formal processes and procedures reinforced by a thorough auditing process means there is a greater reliance on the project manager and team members to ensure knowledge management processes are effective. The interview participants revealed that if there are not regularly audited procedures in place, knowledge management processes are more susceptible to not being thoroughly implemented, turning it into a 'tick and flick' exercise or not being carried out at all. This can be an issue if the project team leader does not see the value in knowledge management processes such as lessons learned, or if workloads increase and other priorities take precedence.

The lack of audited robust formal processes and procedures to store knowledge and the small number of employees means that the smaller organisations are more heavily reliant on team stability. With fewer staff in the organisation, there is a greater overall impact from the loss of experience and knowledge when there is staff turnover. Especially when it is a senior member or a number of staff leave in a short space of time. In one of the organisations it was identified that the 'stability of the workforce' improved knowledge management processes. Stability of the workforce means that the staff knew each other's experience and previous projects, which along with close working relationships, greatly increased knowledge sharing in the organisation. The organisation went to great lengths to ensure employees felt valued and part of the team to minimise staff turnover (majority of staff had over ten years of service with the organisation), and as a result, the management of knowledge and experience was effective even though there was a lack of formal knowledge management processes.

The limited resources in a smaller organisation also mean that the effectiveness of its knowledge management processes is more susceptible to high workloads, which limit the time available for knowledge management processes. This is because the organisation has less capacity to allocate additional resources, so activities that do not produce visible, measurable outcomes, such as knowledge management processes, are the first to be reduced or ceased. The smaller organisations do not utilise a specific software to store and manage knowledge and information as the organisation may not have the volume of information to justify or the financial capacity to invest in. The impact of this may be relatively minor, as the use of simple file storage and spreadsheet software can be sufficiently effective however, it does put further emphasis on the importance of informal knowledge management processes in a small organisation.

On the other hand, larger-sized organisations have opposing characteristics impacting their knowledge management processes. Large organisations typically have a much larger number of employees, often in a diverse range of discipline or business units. Large organisations have greater financial capacity and resources than small-medium organisations. They can be spread across a wide range of geographical locations, either statewide, nationally or even internationally. As a result, large organisations tend to rely on more systematic, standardised, documented and audited formal knowledge management processes and procedures, yet complemented by informal processes.

The regular auditing of robust processes utilised by larger organisations ensured that project teams undertook knowledge management processes, such as lessons learned or project reviews, at the required times and delivered effectively. If any processes are missed or poorly delivered, they would be identified during the audit process. It allows the organisations to undertake actions to correct any issues. It could include allocating additional resources, which is much easier to do in a large organisation with a much larger pool of staff resources.

During the interviews, it became evident that the larger organisations were more likely to utilise specialised file systems and electronic data storage systems rather than the basic file storage software that comes with most computers. The information management (IT) software systems specialise in file storage, drawing storage, documenting project communications, estimating, and storage procedures and standards. This finding correlates with Forcada et al. (2013), who found that mainly large construction organisations were at the cutting edge of using IT systems for knowledge and information management. IT systems are more commonly used in larger organisations for many reasons. For example, in a larger organisation, the volume of information and knowledge being managed is much greater, so a specialist system that is searchable and ensures that information is stored correctly to be easily located is important. In a larger organisation, specialist systems enable more effective data and knowledge recording, making it available across different business units with different functions that may be geographically diverse in location. The confidentiality of knowledge and data protection becomes an issue that must be managed. There may be external contracted employees embedded in the business that need to have access only to certain files, or business units that handle confidential or sensitive information that needs to have controlled access and security. Specialist file and data storage systems have a greater level of security and much better control over restricting who has access to specific files and data.

Another challenge faced by large organisations is separate business units 'doing their own thing' by either modifying the organisation's knowledge management processes or by tailoring their own processes. The use of robust audited knowledge management processes and procedures supported by specialist IT systems helps to ensure consistency and quality of delivery across the organisation. In addition, it does not matter how thorough the procedure and auditing process is, lack of staff ability, motivation or high workloads can result in reduced effectiveness of knowledge management processes. It was also identified that where knowledge management processes are failing to perform in a project, once identified during the audit process, larger organisations have a greater capacity to implement actions to make improvements. For example, in large organisations, additional resources are more readily available (than in small organisations), to undertake immediate unplanned reviews or workshops to identify the causes of ineffectiveness and identify actions to address them. Also, larger organisations have a greater financial capacity to implement additional training or engage external knowledge management specialists to improve

the effectiveness of knowledge management processes such as lessons learned workshops.

It is important to highlight that even large organisations implement robust processes and regular auditing, they still rely on informal knowledge management processes, such as regular team and cross-project meetings, mentoring, project team selection and CoP involving staff or similar roles. There is also top management involvement across projects to facilitate the transfer of knowledge and experience, but with the more hierarchical management structure of a larger organisation, this is much more restricted than in small organisations.

4.3.3 Maturity Of The Knowledge Management Framework

As the interviews progressed, it became apparent that the effectiveness of knowledge management processes across the larger organisations varied. The implementation of robust audited knowledge management processes and the availability of greater resources (financial and staff) does not necessarily guarantee the knowledge management processes will be effective. The three most similar large organisations appeared to have varying levels of effectiveness in spite of having implemented similar robust audited knowledge management processes.

However, it was noted that of these three organisations, the one with the least effective knowledge management processes had only recently implemented a new knowledge management framework. This implies that the organisation must have sufficient experience, readiness or 'maturity' with a knowledge management framework or process for it to be most effective. This closely aligns to research by Williams (2008) who found that organisations with a mature project management framework are more likely to be effectively using knowledge management processes to identify, store and disseminate knowledge and experience. Until the organisation has gained this 'maturity' there will be a greater reliance on unregulated informal knowledge management processes.

CONCLUSIONS

This research investigated the knowledge management processes used by organisations involved in the delivery of mega infrastructure projects in South Australia. The aim was to understand what knowledge management processes are utilised, how effective they are and what factors impact their effectiveness. It was anticipated that the discipline of the organisation would have the most significant impact on the knowledge management activities and associated processes used by the organisation. However, through the course of the interviews, it became apparent that the discipline of the organisation was just one characteristic that impacted on the knowledge management processes used, and it didn't appear to be the most significant. Informal knowledge management processes require less financial and human resources but rely more heavily on the diligence of the organisation's management team to ensure the right people are in the right role to ensure the optimum conditions for knowledge to be informally transferred.

In addition, there is a reliance on the organisation's management team to promote a culture in the organisation that empowers staff to work collaboratively with each other and to thoroughly follow knowledge management processes while promoting job satisfaction to minimise staff turnover. The most significant implication to be drawn from this study is that if the impacts of the organisation's characteristics are recognised and managed, the informal knowledge management processes in a small organisation can be just as effective as the robust formalised processes in a larger organisation. Even with the emphasis on different processes used by small and large organisations, the majority of participants indicated their organisations were effectively managing knowledge experience. It was found that the key to the effectiveness of an organisation's knowledge management processes relies on its ability to recognise its characteristics, strengths and weaknesses so it can select and tailor the processes implemented to maximise their effectiveness.

While the findings of this case study are promising, there is a limitation related to the sample size. A larger sample size involving participants from a broader range of organisational sizes and discipline areas should be interviewed to gain a more thorough understanding of the factors effecting knowledge management processes. The participants involved in this research were all selected because they had extensive experience in the delivery of infrastructure projects. However, they were from varying roles and levels of management within the organisation. Further research could be undertaken into how this perception varies across different roles or levels in an organisation, and further explore the concept of organisational knowledge management maturity.

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KNOWLEDGE MANAGEMENT PROCESSES IN SOUTH AUSTRALIAN INFRASTRUCTURE PROJECTS: ALIGNING KEY STAKEHOLDERS EXPECTATIONS AND PRACTICES