

DEVELOPMENT OF A METHODOLOGY FOR IMPROVING PROJECT KNOWLEDGE DIFFUSION IN CONSTRUCTION ORGANIZATIONS

Paul A. Fuller^{1,2}, Andrew R. J. Dainty¹, Tony Thorpe¹, Stuart Torpy²

paulful@hotmail.com; a.j.r.dainty@lboro.ac.uk;

a.thorpe@lboro.ac.uk; stuart.torpy@downer.com

¹*Department of Civil and Building Engineering, Loughborough University, UK*

²*DownerMouchel, Perth, Australia*

ABSTRACT

Project-based construction organizations are reliant on the expertise of their engineers and their ability to cope with high levels of complexity. Their knowledge is built up over a number of years where they learn the lessons from the projects they are involved in and build up an individual tacit knowledge base. Attempts have been made to capture these lessons and make this knowledge explicit in order to transfer it to a wider audience. Key barriers include the time critical nature of most construction projects, the temporality of project teams, geographical spread and client pressures to reduce costs and timescales. This paper reports on how a methodology for improving lessons learnt and the realisation of related benefits was developed in a construction support services organization. The research was undertaken using action research as part of a longitudinal case study in a single organization. The approach was designed to facilitate capturing lessons learnt and promoting the realisation of benefits through a project's lifecycle. The novelty of this research is in its positioning at the nexus of a number of different theoretical perspectives. The theories mobilised in the evolution of the approach are drawn from organizational learning, knowledge management and action research. The concept of boundary objects was used to understand and improve the diffusion of knowledge between actors and across the case study organization. A model was synthesized through a series of theory building steps to improve the understanding of the dynamics of project learning. Further testing is required to assess the efficacy of the process in terms of establishing the causality and magnitude of the resulting benefits. Overall the methodology developed is highly adaptable and can be tailored to suit different organizational contexts in construction and other settings.

Keywords: Construction, Knowledge Management, Lessons Learnt, Organizational Learning, Project Management

INTRODUCTION

Capturing and applying lessons from past projects has been an ongoing area of debate for many years. This is particularly so in the construction industry where there are many examples of failed projects that did not make use of the learning from past mistakes. Project Management professional bodies have attempted to incorporate best practice into their methodologies (e.g. PRINCE2 (OGC, 2009), PMBOK (PMI, 2008).

Construction companies are organized to deliver projects and therefore are quite different from organizations which have centralized operations. They have dispersed project teams which are based on the project's construction site and which draw on centralized services for Procurement, HR, Finance etc. This gives the management and staff working on projects a certain amount of autonomy and a focus on delivering the project to budget, on-time and to the required quality. Studies by Carrillo (2005) and Gibson *et al.* (2007) found that this delivery focus means that there is little time left for additional activities that are seen as 'nice to have' e.g. lessons learnt, case study production. Even if they are mandated in procedures they can often be carried out in a less than robust manner if they are perceived not to directly contribute to the delivery of the project. Often the lessons are learned by individuals but they are not properly captured and shared. Once a project is completed the teams disband to join other projects and the opportunity to capture lessons is lost.

Therefore, in project-based organizations learning lessons from past projects and actually implementing the learning successfully on future projects is commonly acknowledged as difficult to achieve (Anbari *et al.*, 2008, Carrillo, 2005; Julian, 2008; Newell and Edelman, 2008; Sense, 2007; Schindler and Eppler, 2003; von Zeditz, 2002; Williams, 2004). Finding new ways to capture and embed the learning emerging from projects is important to assist in developing mitigations for recurrent problems which can occur in such environments.

This paper reports on the final stage of a longitudinal case study in the support services sector focusing on the improvement of project learning processes that commenced in 2006. The paper commences with a review of the relevant literatures. Sections then follow which outline the research methodology, describe the case study activity, report on the results and key findings from the case study. The key findings and the development of a model to improve the understanding of learning in projects are then discussed. The final section covers the overall conclusions and makes recommendations for areas of further research.

LEARNING IN PROJECT-BASED ORGANIZATIONS

Organizational learning

Organizational learning researchers, Argyris and Schön (1978), introduced the concept of duetero-learning which they described as occurring when organizations' members learn from previous learning activity i.e. applying organizational learning concepts to the learning process itself. This leads to a focus on analysing reasons for successes and failures from which the barriers to learning can be identified. In addition, Argyris (1992) identified a conflict arising from the way in which individuals use their defensive reasoning processes. He found that what individuals said they believed (i.e. their 'espoused values') and what they actually believed and did as a result (i.e. their 'theories in use') could be quite different resulting in unintended outcomes.

Action learning

Research by McNiff (1998) into action learning in the field of education resulted in a model that represents the reflective learning of teachers using a spiral as the visual metaphor which is reproduced in Fig 1. It is designed to show how problems outside

the main problem being investigated can "...be explored as and when they arise without losing sight of the main focus of the enquiry". The loops are based on an action-reflection-plan-observe cycle and the main spiral is designed to show the main area of enquiry and the smaller loops problems related to the main area of focus. The diagram has a three dimensional effect which results in bringing some form of implied temporal or spatial element to the concept of learning cycles.

Boundary objects

More recent studies have covered learning at the organizational level across boundaries (Scarborough *et al.*, 2004) and between organizations (Bresnen and Marshall, 2000). This raises the important issue of learning across organizational boundaries both within and between organizations, which was explored in relation to the concept of boundary objects by Star and Griesemer (1989). They suggested that boundary objects provide a means of 'translation' whereby the same knowledge and information is used by different actors who have diverse perspectives and views about the information being generated and how it should be used and interpreted. They concluded from their research that two things were necessary, 'standardized methods' and 'boundary objects'. The latter are objects which are; plastic enough to adapt to local needs and constraints of those using them; robust enough to maintain a common identity across sites; weakly structured in common use; abstract or concrete; have different meanings in different 'worlds'; commonly structured making them recognisable to actors in more than one 'world'; capable of acting as a means of translation (c.f. Star and Griesemer, 1989). More recently in construction management have found that studies into the role of boundary objects they have a key role in the sharing and transformation of knowledge in construction project environments (Bresnen and Harty, 2010).

Knowledge Management

A key element of any learning process is the transformation of tacit knowledge into explicit knowledge and vice-versa. Nonaka and Takeuchi (1995) developed a model of organizational knowledge creation which used the Socialization-Externalization-Combination-Internalization (SECI) concept of knowledge conversion. This concept consists of four modes of knowledge conversion. The first, 'socialization', builds a "field" of interaction where the actors share experiences and mental models. The second mode, 'externalization' is where dialogue and/or collective reflection help the actors to articulate their tacit knowledge which is normally held within the mind and not easy for others to access. The third mode, 'combination', is triggered by networking newly created knowledge with existing knowledge. The final mode, internalization, is enabled through "learning by doing". The concept was further developed by Nonaka *et al* (2000) to include the concept of 'ba' which concerns the 'conditions' under which knowledge conversion takes place. They defined 'ba' as providing the energy, quality and place to perform the individual conversions of knowledge and move along the knowledge spiral. This emphasised the need for the right 'environment' or 'conditions' for learning to be successful.

A more recent review of the theory of organizational knowledge creation by Nonaka *et al.* (2006) found that whilst 'ba' is theoretically relevant there are a lack of empirical studies into the concept. A review of the debates surrounding tacit knowledge and knowledge conversion by Nonaka and von Krogh (2009) called for more theory building and longitudinal studies by researchers to empirically explore

the intersections of social practice and knowledge creation in this area. A further study by von Krogh *et al.* (2012) emphasized the important role that leadership plays and introduced a framework for situational leadership in propagating knowledge creation.

A study by Mohd Zin and Egbu (2010) outlined the need for individually tailored solutions for the implementation of knowledge management in construction organisations and also proposed using it to promote organizational improvement.

Learning in project-based organizations

Project-based organizations have a number of significant differences compared to more functional-based organizations (Wiewiora *et al.*, 2009). In terms of organizational structure they are orientated around the project itself rather than a centralised hierarchical structure. The aspect of time is more emphasis as projects are temporal organizations and only exist for the delivery cycle of a project at a dispersed geographical location. They can also be from different organizations due to the nature of project supply chains which often involve different scale of sub-contractors from SME's to individual contractors. The processes in projects are flexible and phased not fixed and repeatable. People in projects change throughout the life cycle and are re-assigned to other projects rather than allocated to a particular location or process. These all affect the success of knowledge transfer in construction project settings. The role of individuals was explored by Senaratne and Malewana (2011) who concluded that team leaders need to recognize the centrality of individuals to organizational learning in construction project team settings compared to normal team settings.

A review of project learning methods by Schindler and Eppler (2003) identified a number of success factors: regular capture at important milestones; use of a neutral moderator; collective interactive evaluation of lessons; use of graphics with outputs in a poster format; commitment to action with an outline plan; and nomination of a person with responsibility for their implementation. Anbari *et al.* (2008) investigated how knowledge management and learning are linked in the context of project review processes. They concluded that 'regular collection of lessons learnt in projects their careful storage in the organizations historical information data base, and their meaningful utilization in subsequent projects are critical elements of project success and organizational competitiveness'. A study by Julian (2008) looked at the reasons for failure to embed past project learning in new projects leading in the re-solving of the same problems again and again. Recommendations to improve project lesson learnt included; PMO leaders acting as knowledge brokers across multiple communities; equal emphasis on review of good as well as poor projects; the need for reflection on lessons over the whole project lifecycle not just at completion; use of independent facilitator's to create the right conditions for reflective activity by actors.

Barriers to project learning

There are a number of factors which inhibit the capture of lessons and learning from them in project contexts. Some of the major inhibitors are the wide variety of actors involved; the geographically dispersed nature of large scale projects (Sapsed and Salter, 2004); the temporary nature of project teams (Keegan & Turner, 2001); and, the different forms of project-based organizations (Sydow *et al.*, 2004). One of the key enablers for improving project delivery is the ability to learn from existing activities and use this learning to continually improve and innovate whilst delivering a quality service or product to clients (Carlile, 2004). A key factor is the time-critical nature of

projects which makes the creation of the right conditions for learning and the application of the lessons difficult (Keegan & Turner, 2001, Julian, 2008). This is supported by the findings of other researchers involved in construction who have found that there is increasing pressure from clients to complete projects on time, to budget, and to the right quality (Carrillo, 2005; Carrillo *et al.*, 2004; Chinowsky and Carrillo, 2007; Jashapara, 2003).

METHODOLOGY

The research was aimed at the development of a practical approach to improve project-based learning with strong theoretical roots that promoted bringing theory into practice as a form of *praxis* i.e. ‘practice, as distinguished from theory’ (OED, 2005). A single organization case study approach was selected as the main strategy of inquiry. Yin (2003) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The adoption of this strategy also allowed the researcher some flexibility in selection of methods and techniques to use in following a course of inquiry that would be likely to change over time. The main techniques adopted were surveys, semi-structured interviews and direct observation.

The following inter-related research questions were addressed by the research; What are the key learning and knowledge management theories that apply to project-based organizations; How is organizational learning and knowledge management currently applied in practice; What theories and approaches can be used to propagate duetero-learning in project environments; How can an event-based approach with a benefits focus be used to overcome barriers to project-based learning; How can *praxis* aid the development of improved lessons learnt in projects across organizations; How can existing theory be communicated in a more understandable manner.

CASE STUDY OUTLINE

The case study organization was a fast growing knowledge intensive professional services organization operating mainly in a project-based delivery mode. The performance and the quality of the service provided and the sustained competitiveness of the business were largely down to how effectively promises can be delivered and challenges met. The key enablers for this are the ability to learn (both individually and organizationally) from existing activities and apply that learning to continually improve and innovate whilst delivering a quality service to clients. The division being studied was the Highways business which had 3,500 employees delivering roads design, maintenance and technology services for local authority and central government transport departments. A high proportion of staff were in project management and engineering roles. The operations were spread over 80 locations across the UK and Eire with many contracts based at client premises and co-located with their teams. This added to the complexity surrounding creation of an effective project learning process.

The research was conducted in four phases. The first covered the initial review of the literature and related work in the field. The main objectives for this phase were to review existing research to identify potential models that could be used to inform learning practice in the context of project-based organizations and also to identify the existing types of learning processes in the case study organization. The literature identified a lack of studies that sought to unify some of the theories in order to explain the variety of processes involved in project-based learning. The research undertaken set out, in part, to address this important issue. The second phase consisted of initial pilots to investigate learning and measurement concepts and tools in real-world settings. This phase was used to develop a practicable time-efficient approach to capturing lessons learnt and benefits measurement. Various concepts and tools/techniques were investigated and a series of pilots were used to apply the most relevant theories in real world environments. They were designed to allow the issues and barriers to the implementation of learning theories to be examined and remedies proposed. Feedback on the effectiveness of the approach was obtained through electronic surveys to gain feedback from participants. The third phase covered the development of new event-based project learning processes designed to improve the capture, dissemination, implementation of lessons from projects by promoting measurement of benefits. In this phase the approaches developed in the second phase to propagate duetero-learning across the organization were validated. Surveys of participants followed by semi-structured interviews with practitioners were used as a form of triangulation. The final phase was used to propose a new theoretical framework for the application of learning theory in project-based environments

FINDINGS

The research in the first phase identified Organizational Learning, Learning Organizations and Knowledge Management as the key areas to investigate for suitable models/theories. The existing project learning processes within the case study organization were also identified. These were found to be focused on developing competences to create a 'high performance' culture. Several barriers to developing a learning culture were identified i.e. pressures of time, shortage of resources and lack of understanding. The key findings of the second phase were that a pragmatic approach based on knowledge integration that propagates duetero-learning, whilst focusing on benefits realisation, could overcome many of the barriers identified in phase one. In addition, there was a need to improve the operationalization of the theories used. This was achieved through both the focus on benefits and the use of language that actors at all levels could understand. The third phase identified the key concepts that could be mobilised to both improve the understanding and the processes involved in project learning. These were boundary objects, knowledge spirals, 'ba', and action research. The challenges overcome by the approach developed were; obtaining buy-in, understanding complex theories, creation of right conditions, application of learning, benefits measurement and sharing lessons/outcomes. The event-based approach caused the project team members to enact the complex/abstract theories in a form of praxis rather than have detailed explanations of their applicability to project learning. It also spanned both the individual and organizational boundaries enabling the diffusion of the project lessons to a wider audience. The final research phase and the related findings are described in the next section.

MODEL DEVELOPMENT

The research was also aimed at making the theoretical concepts employed more readily understandable. Project-based organizations are reliant on the expertise of their engineers and their ability to cope with a high level of complexity. Their knowledge is built up over a number of years where they learn the lessons from each project and build up an individual tacit knowledge base. The existing approaches for capturing project lessons are hard to apply consistently and it is difficult to make this knowledge more explicit to a wider audience. The research revealed that there are several theoretical models that can be used to better understand the complex and often abstract theories involved in project learning. The model developed combined the key theories and concepts utilized by the process. This provided a more comprehensive understanding of how the approach worked in practice. A number of stages were involved in the development process as shown in Figure 1. The first was the identification of learning concepts/models from the literature review. The next stage was to assess their applicability to project learning in multi-phase project environments based on the researcher's experience. The final stage was to produce an overall model which could act as a visual representation of the learning processes involved i.e. a generative project learning model which is shown in Figure 2.

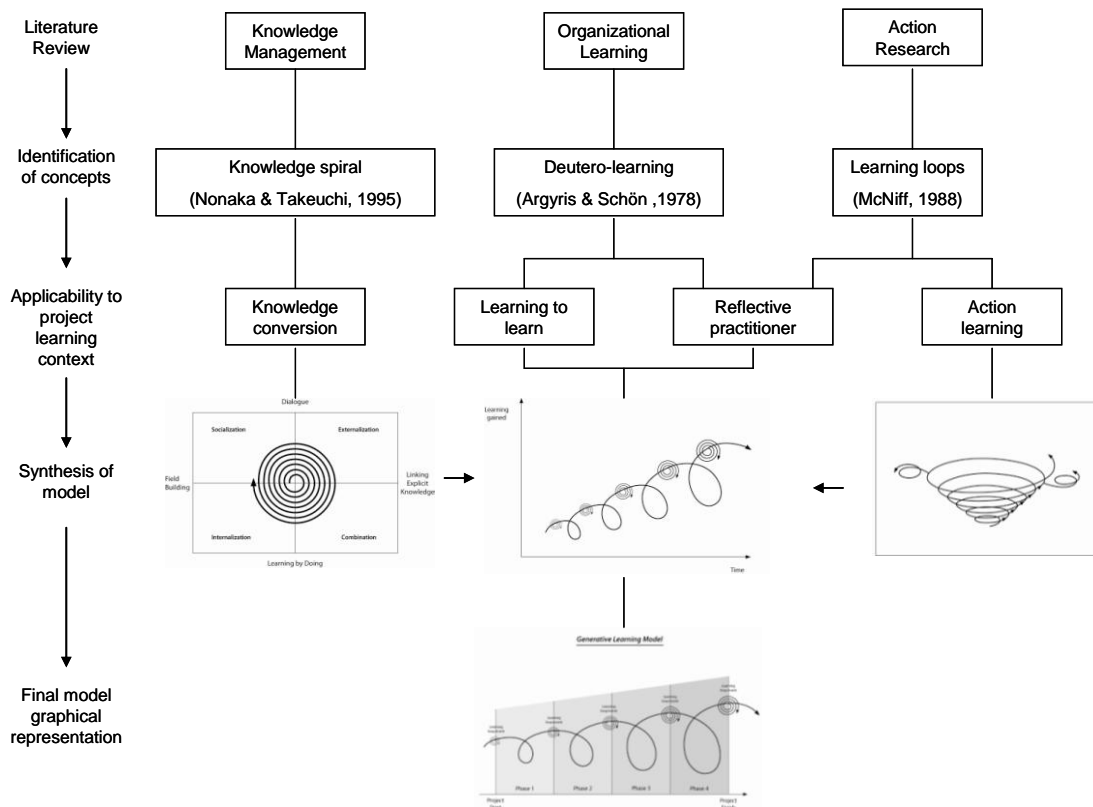


Figure 1: Stages of model development

The approach was designed to create time and space for learning amongst the actors in an ongoing continuum. The aim was to create a number of ‘learning spirals loops’ (McNiff, 1998) over a period of time. These loops were designed to help the actors to learn about learning i.e. duetero-learning (Argyris and Schön, 1978) through personal and collective reflection about their experiences on projects as well as in their general work. In order to explain these concepts and their applicability to project learning in multi-phase projects more clearly a visual representation of the model development stages was devised as shown in Fig.1. The process developed was aimed at improving the capture and implementation of project review generated learning by taking the actors through the four SECI modes. This was achieved through a number of specific events where the actors reflected on their past experiences and then collectively agreed which of the lessons should be implemented. They also took away their own ideas of lessons that they could apply elsewhere. The outcome was that their learning would increase over time and this could be represented by the diagram in Fig. 2 below which shows the ‘spirals’ of knowledge creation (Nonaka and Takeuchi, 1995) combined with the ‘learning loops or spirals’ (McNiff, 1998) which produced a series of learning cycles which generated the project learning. In order to demonstrate how this would apply in a multi-phase project environment a project plan template was superimposed to explain how the process operated as a generative project learning model. The smaller learning loops were combined with the SECI model to represent the learning activity during the lessons learnt workshops conducted at key phases of a project.

Generative Learning Model

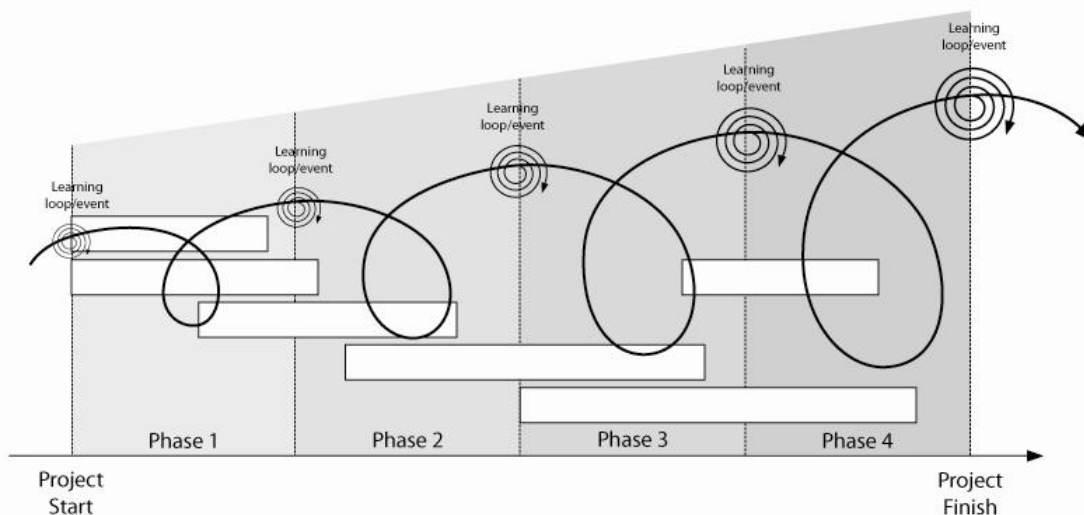


Figure 2: Generative project learning model

The model developed shows, in a simple manner, how the key theories and concepts of the project learning process developed can be applied to create a generative learning cycle. It shows how the events mediate the diffusion of the actor’s tacit knowledge through a combination of boundary objects, successive learning loops and knowledge creation cycles throughout the life of the project. The model can be used as a framework for further investigation into the dynamics of learning in project-based environments. It was designed to aid the understanding of others who might wish to adopt the approach to extend this research in this area or in other contexts.

SUMMARY AND CONCLUSIONS

This study set out to address the problems that organizations face in successfully exploiting lessons learnt in project-based environments. The empirical basis used for the development of the methodology allowed the approach to use a variety of concepts, techniques, tools and theories rather than adopting a narrow approach linked to one particular field of research. This helped to overcome a number of the barriers to project-based learning that exist. It has brought learning theory into practice by incorporating it into project lifecycle processes. By using a unique combination of a number of different theoretical perspectives a practical methodology has been developed which enables *praxis*. It has shown that project learning is a highly complex social process that is dependent on creating the right environments (both project and organizational), processes and tools. These need to be effectively combined to capture, disseminate and successfully implement lessons learnt. An event-based approach has been developed to achieve this and a 'generative learning' model developed to explain how the relevant theories were combined. The model can be used to explain how this improvement in learning occurs over time if a duetero-learning culture has been established. The combined phenomena of knowledge conversion, duetero-learning (learning how to learn) and boundary objects generate outputs that codify the lessons learnt for re-use.

This research has limitations in that it has been carried out within a single organization using a limited number of small scale pilots, surveys and interviews. However the longitudinal approach has allowed the various theories and processes to evolve and be tested over time. The model and the methodology developed need further evaluation in practice to establish more fully the effectiveness of the approach. This will need to take the form of benefits monitoring and analysis of the results to further establish causality. The research will be of interest to any project-based organizations that are interested in improving their project outcomes and developing their organizational learning/knowledge management capabilities.

REFERENCES

- Anbari, F.T., Carayannis, E.G. and Voetsch, R.J. (2008) "Post-project reviews as a key project management competence", *Technovation*, Vol. 28, pp. 633-643.
- Argyris, C. (1992) *On Organizational Learning*, 2nd Ed. Oxford: Blackwell.
- Argyris, C. & Schön, D.A. (1978) *Organizational Learning: A Theory of Action Perspective*, Reading Massachusetts: Addison Wesley.
- Bresnen, M., and Harty (2010) "Editorial: objects, knowledge sharing and knowledge transformation in projects", *Construction Management and Economics*, Vol. 28, No.6, pp. 549-555
- Bresnen, M. and Marshall, N. (2000) "Learning to co-operate and co-operating to learn: Capturing knowledge of partnering in construction", In: Akintoye, A. (Ed.) *Procs 16th Annual ARCOM Conference*, Glasgow, UK, Association of Researchers in Construction Management, Vol. 1, pp. 313-323.
- Carlile, P.R. (2004) "Transferring, Translating, and Transforming: An integrative Framework for Managing Knowledge Across Boundaries", *Organization Science*, Vol. 15, No. 5, pp. 555-568.
- Carrillo, P. (2005) "Lessons learned practices in the engineering, procurement and construction sector", *Engineering, Construction and Architectural Management*, Vol. 12, No. 3, pp. 236-250.
- Carrillo, P., Robinson, H., Al-Ghassani, A. and Anumba, C. (2004) "Knowledge Management in UK Construction: Strategies, Resources and Barriers", *Project Management Journal*, Vol. 35, No.1, pp. 46-56.

- Chinowsky, P.S., and Carrillo, P.M. (2007) "Knowledge Management to Learning Organization Connection", *Journal of Management in Engineering*, Vol. 23, No.3, pp. 122-130.
- Cresswell, J.W. (2009) *Research Design: Qualitative, quantitative, and mixed methods approaches*, California: Sage.
- Gibson, G. E., Caldas, C.H., Yohe, A.M. and Weerasooriya, R. (2007) "An Analysis of Lessons Learned programs in the Construction Industry", 2nd Ed., Construction Industry Institute, Texas.
- Jashapara, A. (2003) "Cognition, culture and competition: an empirical test of the learning organisation", *The Learning Organisation*, Vol. 10, No.1, pp. 31-50.
- Julian, J. (2008) "How Project Management Office Leaders Facilitate Cross-Project Learning and Continuous Improvement", *Project Management Journal*, Vol.39, No.3, pp.43-58.
- Keegan, A. and Turner, J.R. (2001) "Quantity versus Quality in Project-based Learning Practices", *Management Learning*, Vol.32, No.1, pp.77-98.
- McNiff, J. (1998) *Action Research: Principles and practice*, Routledge, London.
- Mohd Zin, I.N., and Egbu, C.O. (2010) "A Review of Knowledge Management Strategies – Issues, Contexts and Benefits for the Construction Industry", In: Peter Barrett, Dilanthi Amaratunga, Richard Haigh, Kaushal Keraminiyage and Chaminda Pathirage (Eds.) *Proceedings of CIB2010: Building a better World*. The Lowry, Salford Quays, UK.
- Newell, S. and Edelman, F.E. (2008) Developing a dynamic project learning and cross-project learning capability: synthesizing two perspectives", *Information Systems*, Vol.18, pp.567-591.
- Nonaka, I. and von Krogh, G. (2009) Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory, *Organization Science*, Vol.20, No.3, pp. 635-652.
- Nonaka, I. and Takeuchi, H. (1995) *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York.
- Nonaka, I., Toyama, R. and Konno, N. (2000) "SECI, Ba and leadership: A Unified Model of Dynamic Knowledge Creation", *Long Range Planning*, Vol. 33, pp. 5-34.
- Nonaka, I., von Krogh, G. and Voelpel, S. (2006) Organizational Knowledge Creation Theory: Evolutionary Paths and Future Advances, *Organization Studies*, Vol.27, No.8, pp. 1179-1208.
- OED. (2005) *Oxford Dictionary of English*, 2nd Ed. (Revised), Oxford University Press, Oxford.
- OGC. (2009) *Managing Successful Projects with PRINCE2*, The Stationery Office, Norwich.
- PMI (2008) *A guide to the project management body of knowledge (PMBOK guide)*, 4th Ed., Project Management Institute, Newton Square, PA.
- Sapsed, J. and Salter, A. (2004) "Postcards from the Edge: Local Communities, Global Programs and Boundary Objects", *Organization Studies*, Vol.25, No.9, pp.1515-1534.
- Scarborough, H., Swan, J., Laurent, S., Bresnen, M., Edelman, L. and Newell, S. (2004) "Project-based Learning and the Role of Learning Boundaries", *Organization Studies*, Vol. 25, No. 9, pp. 1579-1600.
- Schindler, M. and Eppler, M. J. (2003) "Harvesting project knowledge: a review of project learning methods and success factors", *International Journal of Project Management*, Vol.21, pp.219-228.
- Sense, A.J. (2007) "Structuring the project environment for learning", *International Journal of Project Management*, Vol.25, pp.405-412.
- Senaratne, S. and Malewana, C. (2011) Linking Individual, Team and Organizational Learning in Construction Project Team Settings, *Architectural Engineering and Design Management*, 7:1, 50-63
- Star, S. L. and Griesemer, J. R. (1989) "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology", *Social Studies of Science*, Vol. 19, pp. 387-420.
- Sydow, J., Lindkvist, L. and de Fellippi, R. (2004) "Project based organisations, embeddedness and repositories of knowledge: Editorial", *Organization Studies*, Vol. 25, pp.1475-1489.
- von Krogh, G., Nonaka, I. and Rechsteiner, L. (2012) "Leadership in Organizational Knowledge creation: A Review and Framework" *Journal of Management Studies*, Vol. 49, No.1, pp 240-277.
- von Zeditz, M. (2002) "Organizational learning through post-project reviews in R & D", *R & D Management*, Vol. 32, No.3, pp. 255-268.
- Wiewiora, A., Trigunarsyah, B., Murphy, G. D., Gable, G. G., & Liang, C. (2009) The impact of unique characteristics of projects and project-based organisations on knowledge transfer. In: Bolisani, E. and Scarso, E. (Eds.) *Proceedings : 10th European Conference on Knowledge Management*, Vicenza, Italy, pp 888-897.
- Williams, T. (2004) "Identifying the hard lessons from projects – easily", *International Journal of Project Management*, Vol.22, pp.273-279.
- Yin, R. K., (2003) *Case Study Research: Design and Methods*, 3rd Ed., Sage, Thousand Oaks, CA