

# **METHODS USED FOR KNOWLEDGE MANAGEMENT AND ORGANIZATIONAL LEARNING IN THE PRACTICE OF CONSTRUCTION PROJECTS: A SYSTEMATIC LITERATURE REVIEW**

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There is a need to refurbish many of the apartment blocks that were built in Europe's big cities during the 1960s and 1970s, the same applies to the Million Homes programme in Sweden. Many of the housing complexes consist of a numerous similar apartments that will be refurbished in the same manner. To learn from previous refurbishment projects, a method for knowledge management to facilitate organizational learning would be useful. In new build, one method for managing knowledge is to use a platform concept. Drawing on this, applying a knowing in practice perspective and adopting methods for the sharing, codifying and transfer of tacit knowledge is recognized being crucial for successful knowledge management when using a platform concept. The aim of this research is to identify methods used in the everyday practice in construction projects for the sharing and transfer of tacit knowledge and to address this; a systematic literature review has been conducted. Findings indicate, e.g. different kinds of mentoring, especially in the form of learning by doing or working side by side with more senior colleagues are recognized as being used as a method for the sharing and transfer of tacit knowledge. Further, the adopted methods for managing knowledge, e.g. by the use of a platform concept, should involve both technological and social elements. Hence, involving different actors, and methods including social elements such as different kinds of face-to-face meetings, mentorships, i.e. learning by doing under supervision, and site visits are recognized as being especially useful for knowledge sharing and knowledge transfer per se.

Keywords: refurbishment, knowledge sharing, knowledge transfer, platform, knowing in practice

## **INTRODUCTION**

The rapid urbanization in Sweden during the 1950s in combination with growing demands on housing standards and state regulations resulted in housing queues of ten years or more (Hall & Vidén 2005). To solve the problem of the housing shortage, the Swedish parliament adopted the target of completing a million new homes in ten years, between the years of 1965-1975, The Million Homes Programme. The Million Homes programme was carried out and now more than 40 years later the buildings from the Million Homes programme are in need to be refurbished. The technical

quality of those buildings is often low, and in many cases the external environment is poor (Hall & Vidén, 2005). There are large variations in the building technology that was used in the Million Homes programme (Formas, 2012). Despite this fact per se, many of the housing complexes consist of numerous similar apartments that will be refurbished in the same manner. A major Swedish contractor has identified refurbishment as an emerging market and has decided to collect knowledge and experiences from the execution of refurbishment projects within their organization. The contractor want to obtain benefits, hence reducing the risk of wasting time and efforts in new refurbishment projects, when learning from previous refurbishment projects by systemizing the knowledge and experiences obtained from previous refurbishment projects. With this scope, a method for managing relevant knowledge to facilitate learning between refurbishment projects and the permanent organization is highly useful, i.e. increase organizational learning. In new build, a platform concept is recognized as one method for managing knowledge. However, in their study about testing a platform concept as a knowledge management method for refurbishment Lundberg & Lidelöv (2016) indicate that applying a knowing in practice perspective and adopting methods for the sharing, codifying and transfer of tacit knowledge are crucial for successful knowledge management. Additionally, that the tenants have a prominent role during refurbishment is also recognized by Lundberg & Lidelöv (2016) which is also supported by Lind et al. (2016). The aim of this research is to identify methods used in the everyday practice in construction projects for the sharing and transfer of tacit knowledge.

Knowledge takes various forms, as argued by Nonaka & Takeuchi (1995): one form of knowledge is explicit knowledge, which can be expressed in words and numbers and thus can be transferred as information between individuals formally and systematically. Another form of knowledge is tacit knowledge, which is highly personal and deeply rooted in individual's actions, experiences, ideas, values and emotions. Hence, tacit knowledge is often difficult to verbalize and communicate to others (ibid). Lam (2000) holds that large parts of human knowledge are tacit, particularly operational skills and know-how acquired through practical experience. Thus, as large proportions of the work carried out on a construction site is inherently action-oriented, practical, experience-based and performed according to rules of thumb, much of it is arguably rooted in tacit knowledge. Further, the view of knowledge as a dynamic and ongoing social accomplishment, referred to as knowing in practice by Orlikowski (2006), is adopted. Jonsson (2012) supports this view and argues that knowledge is a process and further emphasize that the use of knowledge is expressed as an individual's ability to mobilize it in action.

Since the 1990s, when the knowledge-based view of the firm emerged, many organizations have invested in various solutions for managing knowledge (Easterby-Smith & Lyles, 2011). Most organizations seem to be stuck with solutions intended to improve the accessibility of information by using information technology (Jonsson, 2015). However, a key step towards effective knowledge management and ultimately experience feedback is to understand how knowledge is shared in practice, in the day-to-day work (ibid.). Javernick-Will (2012) further argue that knowledge management scholars mostly have focused on macro-level constructs and relationships, i.e. at the organizational level. Thus, they have recognized the importance of technology, communication strategies and resources for sharing knowledge. Nevertheless, processes of locating, providing and reusing knowledge within an organization largely occur on the micro, individual employee level. Similarly, the individual is the key to

organizational learning because it is individuals' thinking and acting that result in learning (Argyris, 1995). Two main approaches to knowledge management can be discerned: one focus on technological elements and the other on social elements (Newell, 2015). Some authors treat knowledge as a resource that can be managed like any other (tangible) resource, while others focus on managing knowledge work rather than knowledge itself (ibid.). However, "Effective knowledge management in organizations involves a combination of technological and social elements" (Easterby-Smith & Lyles, 2011, p.106). The view of the connection between information, knowledge and learning when managing knowledge as described by Winch (2010) is adopted: information is knowledge in use by a resource mobilized to create new values, and the learning generated during this mobilization has the potential to enhance the existing stock of knowledge and it is this process of organizational learning by the resource bases that has become known as knowledge management.

Dubois & Gadde (2002) argue that in a construction project collective knowledge is created and forms a shared understanding regarding what is done and how it is done. They further identified patterns in the construction industry as tight couplings in individual projects and loose couplings in the permanent networks, i.e. learning both between different projects and learning from projects to the permanent organization in a construction company is a challenge. Additionally, Styhre, Josephson & Knauseder (2004) empathize that in construction projects know-how is primarily shared through informal and personal contacts, and new arenas are needed where various professional groups can share knowledge and information, i.e. experience feedback can occur, for the beneficial joint learning.

In the process of implementing industrialised house building, contractors have recognized the use of the platform concept as one method to become more efficient and reduce costs. For instance, Thuesen and Hvam (2011) presented quality and lead time improvement as well as a reduction of project cost by 30% in a study of a German Housing platform. Also, Bonev et al. (2015) have studied the precast sector and the findings suggest that utilising platforms involves the creation of an optimum cost – value relation for the target market segment. Further, in contemporary studies on platform concepts various authors have highlighted the importance of integrating experiences gained from earlier projects into the platform, i.e. to increase organizational learning (Dave and Koskela, 2009, Meiling, 2010, Styhre and Gluch, 2010, Thuesen and Hvam, 2011, Jansson et al., 2014, and Lessing et al., 2015). Drawing on these studies a platform concept is regarded as a vehicle for transfer of information from construction projects. Additionally, contemporary studies on platform concepts in the construction industry mainly concerns new build. According to Robertson and Ulrich (1998), a platform is the collection of assets that are shared by a set of products. These assets are components, processes, knowledge, and relationships. Platforms for the refurbishment of buildings would largely consist of processes, knowledge, and relationships.

## **METHOD AND STRUCTURE ADOPTED FOR THE SYSTEMATIC LITERATURE REVIEW**

To identify methods used in the everyday practice in construction projects for the sharing and transfer of tacit knowledge, a systematic literature review was performed. A systematic literature review is a question-driven methodology, and involves identifying and sifting through relevant literature and evaluating each according to predefined criteria. Further, a systematic literature review must be transparent and use

a standardized, structured and protocol driven methodology (Jesson, Matheson & Lacey, 2011). The systematic literature review was conducted between February and June 2016 and covered the databases of Web of Science and Scopus, and included publications from the year of 2005 to the year of 2016, because from the year of 2005 the publications increased considerably. As described by Walker (2016), well - publicised reports from Latham (1994) and later Egan (1998, 2002) prompted serious rethinking of how construction management practice could be improved leading to much of the substance in the rethinking debates has been focussed on enacting effective innovation through improved knowledge management and organizational learning practices. Additionally, a whole new subset of knowledge management and organizational learning has risen out of understanding learning through practice (ibid.).

The research question underlying the search was:

RQ: What are the methods for organizational learning in terms of knowledge sharing and knowledge transfer in the everyday practice of construction projects on site level in a western world context?

The following search string and combination of keywords were used: ("construction industry" OR "building industry") AND ("organizational learning" OR "knowledge sharing" OR "knowledge transfer"). The rationale for using the chosen keywords are, firstly, it is in the context of the construction industry (or building industry) the refurbishment of the Million Homes Programme will be carried out. Secondly, organizational learning has the potential to be the outcome of knowledge management and for a knowledge management initiative to succeed; both sharing and transfer of knowledge must take place. Inclusion criteria for further analysis were; peer-reviewed journal papers written in English describing methods for organizational learning/ knowledge sharing/ knowledge transfer, encompassing empirical data from practice, site level in construction projects and western world context. As argued by Jonsson (2015), to better manage knowledge within an organization we need to develop our understanding how knowledge is used and shared in practice, i.e. having a knowing in practice perspective. Further, since much of the work in construction projects are carried out on construction sites, analysing the site level is appropriate. Additionally, Kurth's (2004) definition of "the West" was adopted, i.e. the West includes the United States, Europe, Canada, Australia and New Zealand. The search from using the search string identified 99 papers in Scopus and 32 papers in Web of Science. Duplicates of the papers were deleted. Each title and abstract was screened using the inclusion criteria leaving 53 potential papers. The remaining potential papers were read more closely for information about methods for organizational learning, knowledge sharing and knowledge transfer in the everyday practice of construction projects at a site level in a western world context. The final number of papers which met the inclusion criteria was 11. See Table 1 for the search report. The fact that only 11 articles qualified for the final analysis was slight surprising. However, it seems to indicate that despite calls for more emphasis on more empirical foundation especially in terms of viewing from an organizational learning perspective at a construction project level, i.e. site level, (Chan et al., 2005), methods used for the sharing and transfer of knowledge at a construction site level has been embraced somewhat sparsely in the empirical construction project literature to date.

Table 1 Search report

Scopus	99 papers
Web of Science	32 papers
Potential in scope and interesting	53 papers
In scope after reading	11 papers

To analyse the 11 included papers and by adopting an interpretivist approach, the researcher ordered, systematized and grouped the included papers in ten themes. The themes recognized as technological elements are ICT, platforms, formal processes, formal documentation and different kinds of revisions, and the themes recognized as social elements are workshops, different kinds of face-to-face meetings, use of moderators, use of mentors and visits.

## **RESULT FROM THE SYSTEMATIC LITERATURE REVIEW**

The result of the systematic literature review, which also is an answer on the research question underlying the search for literature, is presented in condensed form in Table 2. The first page of Table 2 address technological elements and the second page of Table 2 address social elements.

Regarding technological elements, in 9 out of the 11 papers, ICTs such as intranets and e-rooms are used with the purpose to facilitate communication. Intranets are primarily used for transfer of general company information. Further, in 6 papers prescribed formal processes for live capture and reuse of project knowledge are described. The objective is to capture and systemize knowledge and experiences to facilitate knowledge transfer and learning. Also, in 5 papers formal documentation are described as being important for systemizing and transfer of knowledge. Revisions are recognized in 4 papers and are supposed to function as a process for learning from mistakes by the capture and systemizing of knowledge. Then, as described in 3 papers, there is an indication that a platform, functions mainly as a technical platform prescribing technical solutions, i.e. functioning as a tool for information and knowledge transfer for new housing, and further, coordinates the work within a project.

Regarding social elements, in 9 out of the 11 papers, face-to-face meetings, often involving different actors in a construction project are commonly used for knowledge sharing and knowledge transfer. Also, mentoring, as recognized in 5 papers and site visits, 4 papers, are described as being important for knowledge sharing and knowledge transfer. Especially, mentoring in the form of learning-by-doing or working side by side with senior colleagues are described as working well for the sharing and transfer of practical knowledge, i.e. tacit knowledge. Site visits are carried out, e.g. to study and evaluate different issues in practice. The use of a moderator, 4 papers, are mainly functioning as a facilitator for coding and transfer of knowledge with the purpose to increase learning in the company. Finally, workshops are less used as a knowledge sharing and knowledge transfer activity, 2 papers.

To increase the use of a technological element such as an intranet Styhre & Gluch (2010) argue that it must be more user- friendly. Further, Ingirige & Sexton (2007) mean that intranet use of site staff is low because of the lack of information regarding task specific issues and conclude there is still much to be done for intranets and their

role as a functioning knowledge sharing and knowledge capturing tool. Regarding e-rooms the risk of information overload has been identified, this issue is handled by having a designated person, e.g. a moderator which in this study is regarded a social element, to administrate the flow of information, acting as a kind of filter (Bigliardi, Dormio & Galati, 2010, Tan, Carrillo & Anumba, 2012).

Out of the 11 papers included for in- depth analysis only the paper written by Haapalainen (2008) concerns refurbishment. The importance of involving the end-users, i.e. the tenants, early in the planning is emphasized (ibid.).

During the systematization process it became clear that a majority of the papers involve a combination of technological and social elements for knowledge management. Whether they are effective regarding knowledge management, i.e. leading to organizational learning is not studied though. Nevertheless, in some papers there is a predominance of one of the two. Hence, papers identified as studying cases with a predominance of technological elements for knowledge management, i.e. ICT, platforms, formal processes, formal documentation and different kinds of revisions, had a more intra organizational focus regarding learning, i.e. a focus on learning within the organization. Whereas papers identified as studying cases with a predominance of social elements for knowledge management, i.e. workshops, different kinds of meetings, moderator, mentoring and visits, had a more inter organizational focus regarding learning, i.e. a focus on learning across organizations.

Table 2, first part address tech. elements &amp; the second part address social elements

	Intra	Inter	ICT	Platforms	Formal processes	Formal documentation	Revisions
Ingirige & Sexton (2007)	X	-	Intranet for static company communication				
Haapalainen (2008)	-	X					
Styhre (2008)	-	X				Paper books at an individual level	
Bigliardi, Dormio & Galati (2010)	X	X	Integrated information system, database, e-mail discussion groups		Method including six phases	Paper-based system	
Bresnen (2010)	-	X	ICT, e-mail for general communication			Booklets to workforce informing about the importance of collaboration	
						Paper-based system	
Styhre & Gluch (2010)	X	-	Internet based media	Technical platform			
Hallowell (2012)	X	-	Intranet showing safety records, rec. for prevention and planning from workers		Analyzing accidents		Performing self-inspections
Tan, Carrillo & Anumba (2012)	X	-	Web-based knowledge base allowing individual submission Staff profile, e-forum		Prescribed methodology for capture and reuse of project knowledge		Project reviews
Håkansson & Ingemansson (2013)	-	X	ICT tools for planning	Technical platform	Routines, partnering		Exchanging experience from finished projects
Jansson, Lundkvist & Olofsson (2015)	X	-	Feedback systems logging individual reflections	Technical platform	Design optimization twice/project A formal process how to handle routines	Routines and documents to facilitate knowledge transfer	Internal reviews
Peters, Pressey & Johnston (2016)	-	X	e-mails	-	Sign-off system after each stage	Technical drawings and diagrams	

	Intra	Inter	Workshops	Meetings	Moderator	Mentoring	Visits
Ingirige & Sexton (2007)	X	-	Internal workshops				
Haapalainen (2008)	-	X		Both informal and formal meetings	Mock up room		Site visits to evaluate in practice
Styhre (2008)	-	X		Informal, (coffee breaks) Verbal comm. important		Learning-by-doing	
Bigliardi, Dormio & Galati (2010)	X	X		Regular interorg meeting (customers, suppl. & own staff)	A person responsible for handling & storing information	Junior managers working side by side with senior managers	
Bresnen (2010)	-	X	High level works. (senior staff from client, consultant & contractor) Project specific workshop (site personnel incl. subcontractors)	Face-to-face meetings			Weekly design meetings on site
Styhre & Gluch (2010)	X	-			Knowledge centres		
Hallowell (2012)	X	-		Safety related discussions among workers		Safety mentorships	
Tan, Carrillo & Anumba (2012)	X	-		Project meetings	Person responsible		
Håkansson & Ingemansson (2013)	-	X		Internal & external courses		Learning by doing through mentoring/coaching	Study visits at clients place
Jansson, Lundkvist & Olofsson (2015)	X	-		Improvement meetings once per month. Client feedback meetings			
Peters, Pressey & Johnston (2016)	-	X		Monthly face-to-face meetings		Senior champions	Informal site visit

## DISCUSSION AND CONCLUSIONS

In their study about testing a platform concept as a knowledge management method for refurbishment Lundberg & Lidelöw (2016) indicate that applying a knowing in practice perspective and adopting methods for the sharing and transfer of tacit knowledge are crucial for successful knowledge management. Therefore, the aim of this study was to identify methods used in the everyday practice in construction projects for the sharing and transfer of tacit knowledge.

A question-driven systematic literature review has been performed and the result indicate that different kinds of mentoring, especially in the form of learning by doing or working side by side with more senior colleagues are recognized as being used as a method for the sharing and transfer of tacit knowledge. Also site visits, in particular when used for evaluate and study some issues in practice, have a potential as a method for sharing and transfer of tacit knowledge.

Winch (2010) means that organizational learning has the potential to be the outcome of knowledge management. Further, the research question underlying the literature review was: what are the methods for organizational learning in terms of knowledge sharing and knowledge transfer in the everyday practice of construction projects on site level in a western world context? The results indicate that in a majority of the cases, a combination of technological and social elements (methods) for managing knowledge are used, this is in line with the reasoning by Newell (2015) and Easterby-Smith & Lyles (2011). It is also recognized that only 11 articles qualified for the final analysis. This indicates that from an organizational learning perspective, methods used for the sharing and transfer of knowledge at a construction site level has been embraced somewhat sparsely in the empirical construction project literature to date. Moreover, if these methods lead to organizational learning which has the potential to be the outcome of successful knowledge management as argued by Winch (2010) is not made clear. The results indicate that ICTs are widely spread throughout construction companies. Further, intranets transfer primarily general company information and it is further recognized that there is much to be done for intranets and their roles as a functioning knowledge sharing and knowledge capturing tool (Ingirige & Sexton (2007), Styhre & Gluch (2010)). Also, various forms of e-rooms are implemented with the expectation to facilitate communication, i.e. facilitate knowledge sharing and knowledge transfer. However, with the use of e-rooms the risk of information overload has been recognized. To overcome this, a designated person, i.e. a moderator is used acting as kind of a filter deciding what knowledge and information to store in intranets and formal company documents. Moreover, formal processes, often in combination with formal meetings, are frequently used to capture and systemize knowledge with the purpose to facilitate knowledge transfer and learning. Various forms of revisions have a similar function, and the focus is to learn from mistakes. In construction companies there is an indication that a platform concept function mainly as a tool for prescribing technical solutions, e.g. transfer of knowledge and information. The results further show that social elements such as different kinds of face- to-face meetings, mentorships, i.e. learning by doing under supervision and site visits, often involving different actors, are commonly used for knowledge sharing and knowledge transfer. Papers recognized as studying cases with a predominance of technological elements for knowledge management, i.e. ICT, platforms, formal processes, formal documentation and different kinds of revisions, had a more intra organizational focus regarding learning, i.e. a focus on learning within the organization. Whereas papers identified as studying cases with a

predominance of social elements for knowledge management, i.e. workshops, different kinds of meetings, moderator, mentoring and visits, had a more inter organizational focus regarding learning, i.e. a focus on learning across organizations. This observation is interesting given the Million Homes Programme and using a platform concept for refurbishment as a tool for managing knowledge and learning, especially since it is recognized that it is important to involve the tenants in the refurbishment process (Haapalainen (2007), Lundberg & Lidelöw (2016)). With regard to refurbishment Lind et al. (2016) further empathize that both municipal housing companies and some long-term private owners are looking for a more sustainable refurbishment policy, taking into account environmental, social and economic sustainability. Hence, making a more holistic evaluation of various refurbishment options and involving the tenants in the decision and implementation refurbishment process (ibid.). Thus, this is an indication of that a contractor should consider an inter organizational focus regarding learning, i.e. focus on learning across organizations, when refurbishing The Million Homes programme. Further, the adopted methods for managing knowledge, e.g. the use of a platform concept, should involve both technological and social and elements. Hence, involving different actors, and methods such as different kinds of face- to-face meetings, mentorships, i.e. learning by doing under supervision, and site visits are recognized as being especially useful for knowledge sharing and knowledge transfer per se. Finally, despite calls for more emphasis on more empirical foundation especially in terms of viewing from an organizational learning perspective at a construction project level, i.e. site level, (Chan et al., 2005), there are only a limited number of studies investigating methods used in the everyday practice in construction projects for the sharing and transfer of knowledge. Also, what these methods actually mean for organizational learning benefiting a construction company need to be further investigated.

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