TESTING A PROPOSITION FOR A KNOWLEDGE MANAGEMENT METHOD FOR REFURBISHMENT

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The ongoing research reported here is testing a proposition for a knowledge management method for managing knowledge during and between refurbishment projects. Data has been collected by a researcher acting as an observer at meetings associated with five refurbishment projects, two in Denmark and three in Sweden, where knowledge and experiences gained were discussed. The observations were structured into three themes; planning, logistics and handling of tenants, coded and then analysed against the proposition. The results confirm the importance of awareness that the construction industry is several communities of practices and that the project teams' network and relationships, i.e. the organizational context, provide foundations for learning when developing strategies to manage knowledge in the industry, both in new builds and refurbishment programmes. Additionally, many of the practices on construction sites are based on tacit knowledge that is deeply rooted within individuals. Thus, harnessing such knowledge, by involving individuals in learning through communication and discussion having a knowing in practice perspective and including a coordinating function within a platform are key elements of a knowledge management method.

Keywords: experience, platform, million homes programme, tenants, learning

INTRODUCTION

In many of Europe´s big cities, uniform apartment blocks were built in large-scale areas during the 1960s and 1970s in programmes, including the Million Homes Programme in Sweden, intended to improve the housing stock. Now, some 40 years later, many of those buildings have deteriorated and are of low quality (Hall and Vidén 2005). Despite large variations in the building technology used during the Million Homes Programme (Formas, 2012), many of the housing complexes consist of numerous similar apartments that will be refurbished in the same manner, which enables systemic use of repetitive elements and a more effective refurbishment. In such cases, a method for managing relevant knowledge to increase learning within and between different refurbishment projects by incorporating mechanisms to reuse information and integrate experiences, i.e. experience feedback, is highly useful and reduces the risk for wasting a great deal of time and effort in the projects.

A major Swedish contractor has identified refurbishment as an emerging market and decided to collect experiences from the execution of refurbishment projects within their organization. Each project is different in terms of building technology and scope, so the contractor will obtain no direct technology-related benefit from systematizing experiences. However, the firm believes that benefits can be obtained by systematizing experiences regarding processes including planning, logistics and

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handling of tenants. One means of systemizing experiences is to use a platform concept which in this paper is regarded as a knowledge management method with the purpose to increase learning within and between different refurbishment projects. The theoretical foundations underlying this assumption are scrutinized and a proposition is put forward based on theory about platforms, knowledge, knowledge management, and organizational learning. These theories are then viewed in the context of the construction industry.

CONCEPTUAL FRAMEWORK

Platform

Various authors have addressed the management of knowledge in new-build projects in companies using a platform concept (Dave and Koskela, 2009, Meiling, 2010, Styhre and Gluch, 2010, Thuesen and Hvam, 2011, Jansson et al., 2014, and Lessing et al., 2015). These authors have highlighted, inter alia, the importance of integrating experiences gained from earlier projects into such platforms, which can be regarded as vehicles for conveying information between projects (Jansson et al., 2014). The management of knowledge during and between refurbishment projects, the focus of this study, has received little research attention. 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. In slight contrast, platforms for the refurbishment of buildings would largely consist of processes, knowledge, and relationships. Platform organization was developed in industries where competitiveness depends on offering several defined variants to the customer (Meyer and Utterback 1992). Building new variants from scratch is costly, so companies started identifying, improving and standardizing commonalities, i.e. parts that were common to all variants (ibid.). In a platform for house refurbishment the corresponding commonalities are processes that will always be present in a project.

Knowledge and knowing in practice

As noted by Alvesson and Kärreman (2001), "There are many, highly diverse understandings of knowledge" (ibid. 997). Nonaka and Takeuchi (1995) argue that knowledge takes various forms. One form they recognise is explicit knowledge, which can be expressed in words and numbers and thus can be transmitted between individuals formally and systematically. Hislop (2009) refers to such knowledge as "know-what". A contrasting form recognized by Nonaka and Takeuchi (1995) 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, and Hislop (2009) refers to such knowledge as "know-how". Nonaka and Takeuchi (1995) further hold that interaction between tacit and explicit knowledge is vital for the creation of new knowledge, that tacit knowledge can be converted to explicit knowledge, and explicit knowledge can be absorbed by individuals and converted to tacit knowledge.

Polanyi (1983) argues that explicit and tacit knowledge are different dimensions of the same knowledge and they are complementary, a view supported by Tsoukas (2003). According to Jonsson (2012), tacit knowledge is sometimes regarded as knowing and argues that knowledge is a process; the use of knowledge is expressed as an individual's ability to mobilize it in action. Similarly, 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. This may be a complicating factor for the construction of a platform for refurbishment, particularly according to the knowing in practice perspective, which holds that not all knowledge can be objectified, and "focuses on experiences and knowing how to do something, or how to perform a task, rather than on how to store and transform information and knowledge" (Jonsson, 2015, 49).

Knowledge and its management

Knowledge management has been addressed and advocated by both practitioners and scholars in a broad range of disciplines (Alvesson, 2004). "Knowledge management can be seen as an umbrella term for a wide spectrum of academic orientations. These include information systems and organizational learning but also strategic management and innovation" (Alvesson and Kärreman, 2001, 996). Since the 1990s, when the knowledge-based view of the firm emerged, many organizations have invested in various solutions for managing knowledge, but there are not many success stories (Huysman and Wulf, 2005). Jonsson (2015) argues that most organizations seem to be obsessed with solutions intended simply to improve the accessibility of information by using information technology. 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) adds to the critique by stating that knowledge management scholars have mostly 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. Cyert and March (1963), who were among the first to connect research on economics and organizations, argue that an organization can be viewed as a coalition of individuals with their own histories and goals. Therefore in knowledge management, it is crucial to involve the individuals who will provide and use the knowledge.

Two main approaches to knowledge management can be discerned: one focus on technical elements and the other on human factors, i.e. social processes. 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 Newell (2015). However, according to Easterby-Smith and Lyles (2011, p.106), "Effective knowledge management in organizations involves a combination of technological and social elements".

Organizational learning and learning organizations

As argued by Cyert and March (1963) organizations learn through the same processes as individual human beings and exhibit adaptive behaviour over time. Organizations could be seen as consisting of collections of individuals involved in continuous bargaining processes trying to reach decisions regarding their respective organizations´ pressing problems (ibid.). Argyris (1995) suggests that the individual is the key to organizational learning because it is individuals´ thinking and acting that result in learning. Further, actions that individuals have found to be useful and are accepted by the rest of the organization are key elements of organizational learning, thus there is a high degree of casual interdependency between the individual and the

organization (ibid.). An organization is viewed as a learning organization insofar the organizational context contributes to increased learning and knowledge sharing Jonsson (2015).

Senge (1997) supports Cyert and March (1963) and Argyris (1995) arguing that "human perception conforms to `mental models´ that govern the way we think the world works…they shape the way people, and therefore organizations, act." Senge (1997) further suggests that traditional organization structures restrict communications between departments and make sharing experience difficult. In order to learn how to learn an organization should be viewed as a fluid system with complex interrelationships and in addition, a culture that rewards investigation and enquiry, which empowers people to experiment must be established (ibid.).

Managing knowledge and learning in the construction industry

Styhre, Josephson and Knauseder (2004) argue that know-how is primarily shared in construction projects 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 beneficial joint learning throughout projects. Dubois and Gadde (2002) identified patterns in the construction industry as tight couplings in individual projects and loose couplings in the permanent networks. Further, to handle the complexity within the industry, certain collective adaptions occur, where by collective knowledge is created and forms a shared understanding regarding what is done and how it is done. The nature of the construction industry can be regarded as several communities of practices depending on the roles the participants have in the projects (ibid.). These descriptions are consistent with conclusions drawn, for example, by Argyris (1995) regarding key elements for learning, Jonsson (2015) regarding influences of the organizational context on learning and Senge (1997) regarding the importance of interrelationships. To facilitate the sharing of knowledge and information in communities in order to promote joint learning one must consider both technological and social elements Huysman and Wulf (2005).

Proposition

Based on previous findings summarized above, the following proposition has been formulated. An appropriate knowledge management platform is a system that could tighten couplings between construction projects. For refurbishment projects, such a platform would include strong assets in processes, relationships and repetition of know-how. In addition, the effectiveness of a knowledge management system in project-oriented settings depends on individuals´ involvement in communication and discussion to foster learning during day-to-day work having a knowing in practice perspective.

METHOD

The Swedish contractor mentioned in the Introduction faces a qualitative problem, as the firm has an identified need for a method for managing knowledge regarding refurbishment of buildings that incorporates mechanisms to integrate experiences and reuse information. Merriam (2009) describes different views on qualitative research; the concerns about reliability, validity and generalizability and not least the subjectivity of the researcher and others involved in the study. However, both of the researchers have a background in construction and a pre understanding of the context, which increases the reliability and validity in the research. The research is performed

in the context of the construction industry and refurbishment. Further, by being open with both researchers´ backgrounds in construction, readers of the research can critically judge the result. Jansson, Johnsson and Engström (2014) regard platforms, in the construction context, as vehicles that can convey information between projects. At this stage in the research a platform is used as a pragmatic conceptual model that is treated, for the time being, as synonymous with a knowledge management system. The parent organization in a major Scandinavian construction company wants to collect experiences from temporary refurbishment projects undertaken by the organization regarding planning, logistics and handling of tenants. A manager from the parent organization, herein referred to as M, is responsible for collection of these experiences. M selected five ongoing temporary refurbishment projects to focus on in areas where there is continuity and an established operation: two in Denmark and three in Sweden. The projects are briefly described in Table 1.

M visited sites and attended meetings associated with these five projects. To obtain information and understand how knowledge is shared in practice one of the authors of this paper, hereafter the researcher, also attended the meetings, as an observer, and took notes covering 65 A4 pages in total. Observations as a research method is far from passive and ways in which perception of the same scene can vary from observer to observer depend on the observers´ background, culture and expectations Chalmers (1999). Also, the presence of the researcher does affect the meetings. Marvasti (2014) discuss different roles of an observer; peripheral membership, active membership and complete participant and state that "those roles are difficult to distinguish from one another" p.356. We argue that peripheral membership with marginal involvement in what is being observed is applicable in this study. Personnel present at each meeting included the manager from the parent organization, M, the site manager and the researcher.

Table 1: Brief description of the projects

Project	Number of apartments	Type of contracting	Scope
A	190	partnering	extensive refurbishment, from the original building only the concrete load bearing structure is left
B	838	main contractor	new façade with insulation, new windows, new ventilation, new roof with solar cells
C	160	mutual trust contract	new ventilation, new bathroom, new kitchen, new electricity, new water and sewage
D	1391	turnkey contractor	new bathroom, new window, new kitchen
E	436	turnkey contractor	new bathroom , new water and sewage

The researcher had meetings with M both before and after each meeting with the refurbishment projects´ site managers. This was done to obtain an understanding of the purpose of the visit and subsequently record M´s reflections to validate the empirical material.

Further reflections from M were also obtained 10 weeks after the fifth visit. The empirical materials from the project meetings and meetings with M have been separately processed and are separately reported here. Adopting an interpretivist approach, the researcher coded and categorized observations regarding three themes;

planning, logistics and handling of tenants. Findings from the coding were then analysed against the proposition.

FINDINGS

Findings related to planning, logistics and handling of tenants are presented below. The observations also yielded other interesting findings related to the conceptual framework in the context of refurbishment which are to be found under Additional findings.

Planning

A common feature of all five temporary refurbishment projects is that the site manager has a weekly meeting with the foremen, both company personnel and subcontractors, to monitor progress of the work and reconcile conflicts. Workshops were held at the launch of the two projects in Denmark, projects A and B, to harmonise expectations, establish rules, and delegate responsibility. Time schedules were also developed, together with subcontractors, during workshops. Project B´s site manager emphasised the importance of those who will actually do the work suggesting solutions. Similarly project A´s site manager said that working in this manner, e.g. with workshops, provides a helpful climate that promotes cooperation and reduces conflicts, making everything smoother and more efficient. In both projects C and E there is a main time schedule, and more detailed schedules are produced showing work planned 2 to 4 weeks ahead. The site managers in projects A, C, and E expressed the importance of including time buffers in the schedules to allow later adjustments. Project D´s site manager described his view on planning; "I walk around the site every day and directly address problems as they arise. Just sitting in the office working with time schedules increases the risk of losing awareness about what is happening at the construction site, which results in losses in production time". The site managers for projects D and E said they often use the same subcontractors in different projects. According to the former; "this is a very special job and we cannot bring in just anyone, we are a closely-knit gang". In projects C and D the renovation work is planned to allow the tenants to stay in their apartments during Christmas and summer holidays, and the site manager of project C argues that this prolongs the renovation work, but the tenants' wellbeing is more important.

Logistics

In project A there are weekly meetings to provide information about incoming deliveries. The site manager of project B mentioned the importance of disseminating such information. Participants in project A have invented a crane solution so they do not need to rent a crane. To avoid exposing tenants to risks when walking back and forth to their apartments, the site managers of projects B and C say that fences have been erected to keep the tenants away from the renovation area. The site managers in projects B and C emphasize the importance of planning the scaffolding to facilitate transportation of material and ensure the working height is appropriate. In projects C, D and E demolition-materials are often brought out through windows. Generally, there are storage limitations, because of lack of space or restrictions imposed by the landlord.

Handling of tenants

In project A, there are no tenants left in the building complex during the renovation. In each of the projects B, C, D, and E the landlord has appointed someone to have responsibility for contact with the tenants. The site manager in project C said that

having a designated person at the construction site with the main task of taking care of everything related to the tenants has been one of the project´s successes. The site managers in projects B, C and E also emphasise the need for workers with renovation experience, where there is daily contact with tenants. Further, project C´s site manager argues that ideally the same workers should be involved throughout the renovation process, as it makes the tenants more comfortable. Safe management of keys is also important. In project B the person responsible for the tenants also takes care of the keys and they are handed over to workers who need them on the days they will be used, while in projects C and D the person responsible for the tenants takes care of the keys and the contractor changes key cylinders. Also, the doors must be locked all the time. Finally, in project E a digital key management system is used.

M´s reflections

According to M much of the work carried out on refurbishment projects is strongly linked to people. In the future, people with more than 30 years of experience will not be available in the organization, because every building is different so systematization of experiences will provide no direct technology-related benefit for the parent organization. However, it may provide benefits regarding processes like planning, logistics and handling of tenants. M argues that managers need to take the time to visit each other´s construction sites, as it provides a relatively cheap and easy way to exchange experiences. In the future M thinks that developing a training package incorporating practices for handling processes for logistics and planning would be highly valuable, and that several actors should be involved in planning systems.

Additional findings

The site manager in project B emphasizes; "the workers are doing most of the detailed planning work, e.g. during lunch breaks, cooperation takes place and the whole project benefits". Also, the workers are in the same stairwell when carrying out their respective tasks which mean they are constantly updated on the work progress and can plan when next task can start. The site manager in project B further argues; "technically refurbishment is uncomplicated, and the key for success is to have a well-functioning logistics". In addition, information to tenants is essential, both before and during the refurbishment, a fact which also is underlined by the site managers in projects A, C and E. The site manager at project C emphasizes; "firstly, since the tenants stay in their apartments during refurbishment and move around near the refurbishment area it is very important to keep schedules and use transport routes where we interfere the least possible.

Secondly, if we are to be skilled at refurbishment, mistakes must be accepted especially in the beginning, we will gain experience and the outcome from coming refurbishment projects will get better". The site manager from project E argues; "I have conducted a number of refurbishment projects and it is important that I am involved early in the tendering process to avoid unnecessary mistakes, we also have a person, i.e. a project manager, responsible for all projects in the region and once a week the project manager visits every construction site and coordinates the work". M comments; "what you are doing here, i.e. in project E, is not done easily and managers from other regions need to come and visit". Finally according to the site manager at project C; "it is the site manager who creates the atmosphere at the construction site". Also, the site manager at projects D argues; "it is difficult to get good workers who contribute to the team spirit" and M fills in; "they want to work on a construction site only a few years and then they want to advance their carriers".

DISCUSSION AND CONCLUSION

According to the formulated proposition, processes, relationships and know-how are important elements of a knowledge management platform for refurbishment. The findings presented here regarding the benefits of weekly meetings with the contractor´s own personnel and subcontractors to reconcile work progression confirm the importance of focusing on processes and relationships and individuals´ involvement. This is underlined by Jawernick- Will (2012) who states that processes of locating, providing and reusing knowledge largely occur on the micro, individual level. That know-how mainly is shared through informal, personal contacts Styhre, Josephson and Knauseder (2004) is highlighted by the practitioners´ expressed approval of workshops with subcontractors to develop time schedules and establish expectations, safe management of keys, and appointing someone to have responsibility for contact with tenants. Additionally, the statement by the site manager B that the workers are doing much of the detailed planning and when working in the same stairwell are constantly updated are other examples of how know-how is shared informally. Further, the expressed need for workers with experience of refurbishment, especially experience of daily contacts with tenants, confirms the importance of individual involvement and knowing in practice as described by Jonsson (2012). Also, findings regarding the meetings associated with project A and B, workshops with subcontractors, and M´s comment that managers should visit each other´s construction sites to exchange experiences, confirm that key elements of a knowledge management platform for refurbishment are communications and discussions about learning and having a knowing in practice perspective.

Finally, the importance of a coordinating function in refurbishment projects has been disclosed and is exemplified by; "the key for success is to have well-functioning logistics" (site manager B), "it is very important to keep schedules and use transport routes where we interfere the least possible" (site manager C) and "a person responsible for all projects in the region visits every site once a week and coordinates the work" (site manager E).

There are clear indications that a platform can provide a useful vehicle for conveying information between refurbishment projects, but the optimal ways to handle tacit knowledge are still unclear. A working method for communicating and collecting tacit knowledge must be developed and a coordinating function must be included within a platform as it is crucial for successful knowledge management. The presented results indicate that applying a knowing in practice perspective and developing a working method may be more fruitful than developing an information technology system.

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REFERENCES

Alvesson, M (2004) *Knowledge Work and Knowledge-Intensive Firms*. New York: Oxford University Press Inc.

Alvesson, M and Kärreman, D (2001) Odd Couple: Making sense of the curious concept of knowledge management. *Journal of Management Studies*, **38**(7), 995-1018.

Argyris, C (1995) Action science and organizational learning. *Journal of Managerial Psychology*, **10**(6), 20-26.

Chalmers, A F (1999). *What Is This Thing Called Science? 3rd Edition*. Buckingham: Open University Press.

Cyert, R M and March, J G (1963) *A Behavioral Theory of the Firm*. New Jersey: Prentice-Hall, Englewood Cliffs.

Dave, B and Koskela, L (2009) Collaborative knowledge management: A construction case study. *Automation in Construction*, **18**(7), 894-902.

Dubois, A and Gadde, L E (2002) The construction industry as a loosely coupled system: Implications for productivity and innovation. *Construction Management and Economics*, **20**(7), 621-631.

Easterby-Smith, M and Lyles, M L (Eds.) (2011) *Handbook of Organizational Learning and Knowledge Management 2nd edition*. Oxford: Blackwell Publishing.

Formas (2012) Miljonprogrammet:utveckla eller avveckla? Stockholm: Edita AB (Swedish).

Hall, T and Vidén, S (2005) The Million Homes Programme: a review of the great Swedish planning project. *Planning Perspectives*, **20**(3), 301-328.

Hislop, D (2009) *Knowledge Management in Organizations: A Critical Introduction 2nd Edition*. Oxford: Oxford University Press.

Huysman, M and Wulf, V (2005) The role of Information Technology in building and sustaining the relational base of communities. *The Information Society: An International Journal*, **21**(2), 81-89.

Jansson, G, Johnsson, H, and Engström D (2014) Platform use in systems building. *Construction Management and Economics*, **32**(1-2), 70-82.

Jawernick-Will, A (2012) Motivating knowledge sharing in engineering and construction organizations: Power of social motivations. *Journal of Management in Engineering*, **28**(2), 193-202.

Jonsson, A (2012) *Kunskapsöverföring Och Knowledge Management*. Malmö: Liber AB (Swedish).

Jonsson, A (2015) Beyond knowledge management: understanding how to share knowledge through logic and practice. *Knowledge Management Research & Practise*, **13**(1), 45-58.

Lam, A (2000) Tacit knowledge, organizational learning and societal institutions: An integrated framework. *Organization Studies*, **21**(3), 487-513.

Lessing, J, Stehn, L and Ekholm, A (2015) Industrialised house building- development and conceptual orientation of the field. *Construction Innovation*, **15**(3), 378-399.

Marvasti, A.B. (2014). The Sage handbook of qualitative analysis. *In*: U Flick (Ed.) *Analysing Observations*. London: Sage Publications Ltd, 354-367.

Meiling, J (2010) *Continuous Improvement and Experience Feedback in Off-Site Construction: Timber-Framed Module Prefabrication*. PhD thesis, Department of Civil, Environmental and Natural Resources Engineering, Luleå University of Technology.

Merriam, S B (2009). *Qualitative research: A Guide to Design and Implementation*. San Francisco: Jossey-Bass.

Meyer, M H and Utterback, J M (1993) The product family and the dynamics of core capability. *Sloan Management Review*, **34**(3), 29-47.

Newell, S (2015) Managing knowledge and managing knowledge work: What we know and what the future holds. *Journal of Information Technology*, **30**(1), 1-17.

Nonaka, I and Takeuchi, H (1995). *The Knowledge-Creating Company: How Japanese Companies Foster Creativity and Innovation for Competitive Advantage*. New York: Oxford University Press.

Polanyi, M (1983). *The tacit dimension*. Gloucester: Peter Smith.

Robertson, D and Ulrich, K (1998) Platform product development. *Sloan Management Review*, **39**(4), 19-31.

Senge, PM (1997) The fifth discipline. *Measuring Business Excellence*, **1**(3), 46-51.

Styhre, A and Gluch, P (2010) Managing knowledge in platforms: Boundary objects and stocks and flows of knowledge. *Construction Management and Economics*, **28**(6), 589-599.

Styhre A, Josephson P E and Knauseder I (2004) Learning capabilities in organizational networks: Case studies of six construction projects. *Construction Management and Economics*, **22**(9), 957-966.

Thuesen, C and Hvam L (2011) Efficient on-site construction: Learning points from a German platform for housing. *Construction Innovation*, **11**(3), 338-355.

Tsoukas, H (2003) Do we really understand tacit knowledge? *In*: M Easterby-Smith and M A Lyles (Eds.) *The Blackwell Handbook of Organizational Learning and Knowledge Management*, Oxford: Blackwell Publishing.