# 1 Individual learning in construction projects: professions and their approaches

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## ABSTRACT

New materials, use of sophisticated technologies and increased customer demands, in combination with growing competition among construction companies, have led to a high degree of specialization. For successful integration of the different professional specialists, there is a need for shared learning between project co-workers. Based on twenty eight interviews in six different Swedish construction projects, this paper illustrates strategies for individual and shared learning, among different actors and across various organizational boundaries. The results indicate that personal networks are the most common source of learning for all professions. While clients, architects, and designers also engage in reading and attending courses, site managers and workers are less engaged in these activities. Experimenting and organizing for learning appear to be underutilized strategies by all professions. This leads to the conclusion that attempts to increase learning have to address the differences in learning behaviours of the various groups. Further, focus on experimenting and organizing for learning is a possibility to change the learning behaviour from learning as a consequence of problems to learning for future improvement.

Key words: Construction projects, individual learning, networks, experimenting, reading, organizing

## INTRODUCTION

The increasing complexity of individual work tasks creates either a need for a higher degree of standardization and industrialized building methods or a need for increased organizational learning that enables the individual to deal with this complexity. The first alternative, standardization and industrialization, decreases the complexity of individual work tasks even when the variety of architectural or technical solutions are limited, and work tasks tend to become monotonous. This paper focuses on the second alternative, increased learning, which can enrich work tasks and increase people's ability to handle challenges, such as new customer demands, high-tech materials, or advanced technological solutions. Seen in this light, the demand for organization learning is contingent on the complexity of the tasks; in highly complex construction projects, when standard operation procedures are complicated to apply, there is a more substantial need for organization learning that would help the actors handle the situation. For handling already standardized and well-known procedures, the importance of organization learning is less accentuated.

Since the complexity in construction projects is increasing, both in terms of technologies and materials used, and in terms of the need for coordination and collaboration between actors and occupational and professional groups, organization learning is becoming an important feature of construction companies. Chinowsky (2001) argued that enhanced organizational learning is becoming a necessity to stay

competitive in the construction industry. Holt *et al.* (2000) concluded that organizational learning is a necessity for construction firms to survive and meet customer demands. Appelbaum and Gallagher (2000) put it even more succinctly, arguing that survival depends on the ability to learn in an organization.

Previous research on learning in projects has mainly focused on theoretical discussions of the possibilities of enhancing learning (e.g. Argyris and Schön, 1996; Senge, 1990; Tell and Söderlund, 2001). The focus of the few empirical studies conducted has been mostly on one company or one single profession (see e.g. Gheradi, 2000; Chinowsky and Meredith, 2000; Bang and Clausen, 2001) or one single factor influencing learning (e.g. Rameezdeen, 2003). However, construction projects are normally carried out by a single company. Instead, the project organization involves numerous individuals from different companies, with different professions and hierarchical layers. This fragmentation raises the need for synchronic learning between project co-workers and diachronic learning between project organizations. To date, only a small number of studies have addressed organizational learning in project organizations e.g., Bresnen *et al*., 2004; Scarbrough *et al*., 2004).

Based on a study of construction projects in Sweden, this paper examines how project co-workers (e.g. client representatives, project managers, designers, site managers, workers and sub-contractors) learn in construction projects. Differences and similarities in actors' learning behavior are discussed. The paper closes with a discussion of possibilities to support learning within and among the different project-co-workers.

## INDIVIDUAL LEARNING - A PREREQUISITE FOR ORGANIZATIONAL LEARNING

Since the 1990s the literature about organizational learning has grown rapidly and numerous concepts and theories have evolved. Some examples are the theoretical, non-prescriptive, and value neutral literature about organizational learning and the practical and action oriented stream about the learning organization (Argyris and Schön, 1996). Yeung *et al*. (1999, p. 28) considered "learning to be organizational when ideas and knowledge generated by individuals within the organization are shared across organizational boundaries of space, time and hierarchy". Similarly, Cook and Yanow (1993) related organizational learning to learning that is achieved by the collective instead of the individual. However, an organization itself is not able to learn; it is dependent on the learning of its members. The interrelation between organizational and individual learning is of importance since organizations store their knowledge in e.g. routines or histories, while individuals may enter and leave the organization at certain times (Fiol and Lyles, 1985; Argyris and Schön, 1996; Hong, 1999). "All learning takes place inside individual human heads; an organization learns only in two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have" (Simon, 1996, p. 176). Huber (1996) described organizational learning as a process of knowledge acquisition, information distribution, interpretation and organizational memory. Commonly, individual learning is the main means of expanding or changing the knowledge base of an organization, which makes learning on an individual level necessary for any organizational learning.

## INDIVIDUAL LEARNING

Definitions of learning vary, but have in common that learning is a different behavior or response based on experience and/or new information to the same stimuli (e.g. Weick, 1995). Fiol and Lyles (1985, p. 811) defined learning as: "The development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and further actions." In this context it is important to distinguish between information and knowledge. "Information is a flow of messages, while knowledge is created by that very flow of information and is anchored in the beliefs and commitment of its holder" (Nonaka *et al.* 2001, p. 13). Further, Pawlowsky *et al*. (2001, p. 783) argue that the diffusion of knowledge is dependent on the willingness to share knowledge, which in turn is dependent on a climate of mutual trust and a culture of sharing. Tools for distributing knowledge are of no use as long as the organization's culture and incentive systems do not promote the sharing of relevant information.

In terms of practical work it is useful to separate learning occurring when co-workers in an organization handle emerging practical problems and learning that derives from a comprehensive reflection on how day-to-day work is accomplished. Following Argyris and Schön's (1996) distinction between single and double-loop learning, the former type of learning is attending to practical concerns while the latter form includes abstract and self-reflective thinking. In day-to-day work in construction projects, it is single-loop learning that is the predominant form of learning.

## LEARNING IN THE CONSTRUCTION INDUSTRY

Several companies work together in construction projects towards producing one product while considering their own goals. Therefore, project organizations involve numerous individuals and groups of individuals that have rarely or never worked together. Additionally, high personal turnover characterizes construction-project organizations. All project co-workers are regularly exchanged after the design phase and many are exchanged when a new project phase begins. Hansen *et al*. (2005) argued that focusing on shared learning between phases, as well as within the team and among teams is necessary to increase the level of knowledge. Further, most co-workers are involved in the project only over a short period of time. The high personnel turnover causes loss of information, knowledge, and skills (Spatz, 2000). Project organizations often face difficulties to establish long-term learning. Instead learning is most often individual, unstructured and short-term (Kasvi *et al*., 2003; Schindler and Eppler, 2003). Similarly, Scott and Harris (1998) argued that learning within the construction industry is unstructured. What they mean is that information is gathered, but rarely used for future learning. Similarly, Huemer and Ö stergren (2000) found few systematic approaches for learning within construction companies and even those were rarely used. Anheim (2003) argued that learning mainly takes place at an individual level while learning within the construction project team is limited and mainly occurs among project co-workers belonging to the same profession. Bryans and Smith (2000) stated that long-term oriented learning outperforms the more common short-term oriented training. Still, it might be questionable that learning always creates positive effects. Gheradi (2000), for example, argued that organizational learning may strengthen wrong or inefficient routines.

In summary, the general literature on organizational learning, as well as the literature on learning in the construction industry focuses on the individual as the main source of organizational learning. Most studies considered learning behavior in a single company (e.g. Huemer and Ö stergren, 2000) or for a single profession (e.g. Agyris and Schön, 1996; Yeung *et al.*, 1999; Gheradi, 2000; Sverlinger, 2000; Anheim, 2003). Little has been written about project organization learning involving multiple companies and professions with widely differing learning behaviors. Achieving organizational learning in such project organizations is dependent on the co-operation of project co-workers and a learning structure that is able to incorporate different ways of learning.

## METHOD

*This study is based on a multiple case-study approach, which is useful in explorative studies (Yin, 1994). It includes six construction projects conducted by different contractors. Each project is regarded as one case since construction projects represent isolated units with clear boundaries.*

The construction companies in this study suggested the projects which they thought were suitable for the study. The authors then selected projects that would cover a range of variables in the construction projects, such as new construction of service and industrial projects, construction and reconstruction of infrastructure project, and renovation and reconstruction of housing projects. Further, the kind of client is different in the projects: a company owned by the local government, a large private company, a local government, an internal client, and two private companies. The selected projects included small, medium, and large sized products. Five projects were carried out as a design-build contract and one project was carried out on a yearly contract. The projects were either of low or medium complexity. Table 1 provides an overview of the project characteristics.

Interviews, both individual and in groups, were carried out with 41 individuals from the six selected construction projects. The interviewees represented the main actors in construction projects (see Table 2 for more details). Individual interviews lasted about one hour while the group interviews lasted approximately two hours. As far as possible, the interviews were held at the construction sites. Some of the interviews with clients and designers were held at their offices.

The interviews held in the first two projects (A and B) were general and explorative, concerning the interviewees' organizational learning possibilities. An interview guide drew on the literature on organizational learning and the main questions were based on Yeung *et al.*'s (1999) study of organizational learning capability, especially on their architecture for learning. These covered the six building blocks: culture, leadership, competence, consequence, governance and capacity for change. The interviews in the other four projects (C, D, E and F) aimed at identifying specific situations where learning takes place in construction projects. The interviewees were asked to describe a novel work situation that they had encountered in the project. The interview then developed around this learning situation and explored the building blocks based on the practical example. Based on the interviews we could identify five main learning approaches: learning through individual networking; learning through organizing; learning through experimenting; learning through reading; and learning through attending courses and seminars.Individual interviews

Table 1 Project settings

| ` | ***Project A*** | ***Project B*** | ***Project C*** | ***Project D*** | ***Project E*** | ***Project F*** |
|---|---|---|---|---|---|---|
| Product type | New-construction service building | New-con-struction industrial building | Re-construction infra-structure | Infra-structure building | Reno-vation | Re-construction |
| Client | Company owned by local government | Large private company | Local government | Internal client | Private company | Private company |
| Contract form | Design-build contract | Design-build contract | Yearly contract | Design-build contract | Design-build contract | Design-build contract |
| Size | Small | Large | Small | Medium | Small | Medium |
| Complexit y | Medium | Low | Low | Low/Medium | Low | Medium |

Table 2 Interview settings

| **Individual interviews** | | | | | |
|---|---|---|---|---|---|
| Client | Project manager | **Client** | **Client** | **Client** | **Project manager** |
| Project manager | Site manager building | **Project manager** | **Construction engineer** | **Architect** | **HVAC designer** |
| Architect | Site manager heavy construction | | **Contracting engineer** | **HVAC designer** | **Foreman** |
| Site manager | | | | **Work foreman** | **Work foreman** |
| HVAC designer | | | | | |
| **Group interviews** | | | | | |
| Four workers (HVAC, electrical installation, carpenter, student) and foreman | Sub-contract or steel con-struction and foreman steel construction Architect, structural engineer, and HVAC designer | Site manager, foreman, and worker | Site manager and site manager from a parallel project | Foreman heavy construction, foreman building, and painter | Architect and site manager |

In the next step, the separate results were compared and discussed until agreement was reached on a final category. Several sets of categories were used, for example reasons for learning (problem solving, or active improving) or learning styles (networking, organizing, experimenting, reading, and attending courses).The findings were compared with the existing literature on organizational learning.

## INDIVIDUAL LEARNING IN CONSTRUCTION PROJECTS

Even though the interviewees argued that they learned new things in their day-to-day work, many project co-workers had problems identifying specific situations in their daily work where learning occurred. Construction workers and site-managers had difficulties identifying learning moments, but architects, structural engineers and HVAC designers could identify lessons learned from the projects in question.

### • Learning through individual networks

Learning through networking is perceived to be most common approach to individual learning in the construction projects we studied. Although different professions approach learning differently, there are few differences between the various companies.

Learning was often associated with problems occurring in a work situation. In general, project co-workers tried to solve these problems on their own. If this was not possible, the most common way to solve them was through using their individual networks. One reason was that asking somebody for advice was generally seen as a weakness, especially for older site managers. Younger site managers were more likely to ask for advice when a problem arose. The site managers appreciated being asked and were as helpful as they could be. Many designers believed that the best way to learn is by doing the task and correcting emerging errors on their own. One HVAC designer said:

> *You have to know the building sector. There are so many things that you can only learn by direct experience. Unfortunately, that involves repeating mistakes (HVAC designer).*

The clients and architects also thought that they learnt by making mistakes and correcting them on their own, although many mistakes could have been avoided by collecting information from other project co-workers involved in the project, or from people involved in a similar project. However, many of the older project co-workers thought that it was embarrassing for them to admit not being in control. This tendency was firmly engraved in site managers, but even project managers and clients exhibited similar traits. Younger project co-workers faced fewer difficulties of this kind and thus did hesitate admit their lack of knowledge. Moreover, they could blame their lack of knowledge on their limited experience. One sub-contractor expressed his reluctance in asking for advice in the following way:

*I think it is embarrassing to talk about what I did wrong. I think we could win a lot if we would talk about the mistakes we make (sub-contractor).*

Learning with a goal to improve is of little importance to most project co-workers. Many co-workers were skeptical about new materials or methods; they preferred to work with well-known materials and methods. Still, there were some differences between the professions: the higher qualified project co-workers were more likely to

ask for advice to improve their work performance than the less qualified project co-workers. A project manager stated:

*How often do I get a call? Generally, people who are good at their job call often, while those that perform poorly do not call at all (project manager).*

Individual networks were commonly used by all project co-workers to solve problems as well as to improve project performance. For site managers and workers, activating individual networks was the usual learning approach, using face to face communication and the telephone. Designers used the telephone and email to learn from their personal network. Common for all personal networks was that they are homogenous, meaning that only persons with similar background (e.g. profession) were included. These persons did not necessarily belong to the same company.

**Learning through organizing**

Besides solving problems with the help of individual networks, many problems were solved during scheduled project meetings. These project meetings were seen as opportunities to become familiar with other project co-workers, providing numerous possibilities to discuss problems within the project network. However, many meetings were unproductive due to several reasons. First, everybody took care to not criticize a project member, resulting in problems not being addressed with due diligence. An architect explained the purpose of follow-up meetings in the following way*:*

*In the best case, follow-up meetings for the exchange of experiences are held during the project. While drinking coffee and eating cake, we talk about the current phase of the project. Under pleasant conditions we discuss difficulties and the time schedule. The purpose with these meetings is to avoid repeating mistakes (architect).*

Secondly, many project co-workers felt uncomfortable to reveal their mistakes in front of potential clients or partners. This was especially true when project co-workers were competitors in other projects. Finally, workers did not normally attend meetings with project co-workers, even though most workers thought that they might have gained valuable information and a deeper understanding for the whole project if they had had the possibility to attend meetings.

Most project co-workers agreed that learning from colleagues is important for them to improve their performance. For example, project co-workers located at the main offices, i.e. not at the construction site, saw possibilities to enhance their performance through interaction. Designers saw spontaneous interaction as a valuable resource to learn from each other in projects. Developing a holistic understanding was an important reason for designers to interact with other professions. Furthermore, they saw it as a possibility to further develop their own capabilities. An engineer articulated her view on interaction in this way:

*Well, you learn new things all the time. In the end you become a theoretician when you only sit and deal with cost, and lose connection with reality. That is a big risk, but if you have the possibility to take part in the production you understand the link between theory and practice better (engineer).*

Clients saw interaction with other project co-workers during the construction process as an opportunity to further develop the product as well as their own competence. One client described his benefits from interacting with others:

*Every two weeks I attend the general meeting at the construction site. It is a good possibility to learn. It is a really good way to keep up to date (client).*

Informal interaction is generally preferred. However, organizing construction projects in a way that creates space for formal exchanges of ideas among project co-workers can increase understanding of others' situations and opens up for discussion of problems and possible solutions. Regular meetings are a means of enhancing learning. Another way of organizing for learning is to enable project co-workers to engage in different work tasks to broaden their insight in the construction project.

- **Learning through experimenting**

Experimenting was not a preferred method for learning in the six construction projects. The high costs for potential failures and the difficulties to predict the long-term quality of new materials were often mentioned as reasons. Consequently, most project co-workers preferred well-tested materials and existing routines. One HVAC worker explained his preferences:

*I would like to use something that has been widely used over several years. Somebody else can make the mistakes of using the wrong materials or techniques first. I have no wish to use a new material if it is only an improvement of a product that was good enough already. I am a bit sceptical of using brand new products (HVAC worker*).

Project co-workers perceived that they had a lot of freedom in designing work tasks or choosing certain materials. Still, the majority preferred to stick to what they knew, avoiding the risk of failure due to insufficient experience. As another HVAC worker expressed it:

*Yes, there are possibilities of using new materials and work methods, but our industry is very conservative. Unfortunately, nobody likes to experiment and everybody avoids being the first to make a mistake (HVAC worker).*

Most project co-workers saw experimenting according to customer demands as a possibility to test and verify different opportunities. This possibility was also seen as a challenge to improve technical solutions and test unknown materials. Nevertheless, worries about quality and their reputation limited experimentation. This means that only products that were new to an actor, but well established in the market, were likely to be tested. A client expressed his view on experimenting in the following way:

*A building exhibition is a good opportunity to try new boundaries and experiment, but I think that buildings designed to be used for 50 years or more cannot only be a playground for experimentation (client).*

In general, it seemed that larger projects increased the likelihood to experiment with new materials. The main reason for this was that the potential increase of benefits in

quality as well as profit was significant, while the financial risk in smaller projects was often too risky for clients and project managers.

**Learning through reading**

There are a variety of trade journals related to construction. Some of these are general while others focus on a specific technological area. Most interviewees perceived trade journals as a good source to follow-up on the developments in materials, tools, methods, and trends in the construction industry. However, the large number of journals made it difficult to find timely information. Moreover, this overload of input resulted in actors skimming rather than reading articles. Especially clients that needed a comprehensive view felt themselves at a loss at the vast amount of information:

*I read trade journals. Last week I got ten different journals. I was nearly drowning. I do not read especially much, but I try to go through them. At least I read "Byggindustrin" [a weekly construction magazine] (client).*

Architects used trade journals extensively to follow new trends and novelties, both domestic and international. To deal with the vast number of publications several architects organized relevant articles in ways that made them more accessible for solving specific problems during projects. Designers mainly used journals to follow new technical developments, and also to follow legal discussions. They also used magazines primarily as input to solve crises or incidents that occurred:

*Sometimes, the job means a lot of research and searching for information. Well, there was a lot of research in this case. I was talking to people who published some literature about this specific problem. Then I went to "Byggcentrum" (a information center concerning construction) and searched for literature there. That's basically what I could do (HVAC designer).*

Project co-workers situated in the main offices said that they were overwhelmed by trade magazines. Workers and site managers, on the other hand, reported that their access to literature was limited. Site managers mainly perceived trade magazines as an easy way to follow and discuss developments in the construction industry although they faced difficulties in applying the information to their work. One site manager expplained:

*Sometimes, we get trade journals on site. Not very often though. If I read anything interesting, we discuss it during the coffee break (site manager).*

Construction workers had little access to magazines at their workplace; therefore they hardly used journals as a source of information.

**Learning through attending courses and seminars**

All the interviewees associated learning with attending courses and industry seminars, independent of the interviewees' professions. Courses and seminars were seen as the main source for up-to-date information about new materials, tools and methods. However, the number of courses offered seemed to vary in different professions. The courses offered to clients, architects and technical consultants were apparently satisfactory regarding quality and quantity:

*Sometimes seminars are arranged where I can get some information about new things. That is what I am basically interested in (client).*

The courses offered to workers and site managers, on the other hand, were perceived as too few. In addition, most courses for workers and site managers were held by the unions, which limited the choices of topics to union related issues:

*There are hardly any courses provided if I do not count the courses arranged by the union. They arrange many. But, courses arranged by the company are few. They are only for those responsible for safety, who do not have the appropriate education yet (worker).*

Therefore, workers considered most of the courses of limited value to themselves since they rarely covered areas of technical interest. In addition, the teaching methods were perceived as too theoretical, and therefore workers had problems seeing the practical applications. Some workers saw courses as an escape from everyday routines:

*Some people would like to attend courses because it is a break from everyday work life. I prefer to work. Well, that might depend on the course. There are many interesting courses. For example, we had a course about the construction process from initiation to completion, which was really interesting (foreman).*

The skeptical attitudes to courses may have been strengthened by the lack of encouragement from higher management, mainly because courses entail extra costs and absence from work. A worker expressed it like this:

*There is never time to attend courses and such. Everything has to be done fast nowadays (worker).*

To sum up, most interviewees from all professions agreed that they would be interested in attending courses if the contents would be more interesting and relevant. Further, courses could serve as platforms for meeting other people with similar interests and problems, and to create personal networks that might be helpful in practice.

## DISCUSSION

During the interviews, we observed that many project co-workers had difficulties talking about knowledge and learning issues. They mainly associated learning with attending courses whereas everyday work was not regarded as an arena for learning. During the interviews, we could overcome these difficulties by asking them to refer to practical work examples e.g. through describing problems that occurred during the construction project and how they got solved, or discussing ideas for improvement that were generated and applied during the project.

Some of the literature on organizational learning discusses the learning behaviour of certain actor groups (e.g. Senge, 1990; Gheradi, 2000). However, research concerning multi-disciplinary groups with different learning behaviours are rare. Clients, architects and other designers, on one hand, and site managers, construction workers and sub-contractors on the other hand, approach learning differently.

Clients, architects and technical consultants were generally positive towards learning and could easily recognize the benefits of deeper understanding. Generally, this group of actors appeared to have few difficulties to interact with each other. However there were also differences between these sub groups of actors. These differences seemed to have less influence on their ability to interact. For example architects showed interest in following new developments and trends, which they recognized as an extension of their work tasks. Their willingness to combine explicit knowledge from different kinds of sources such as trade jounals, exhibitions, or the work of others was more developed than that of any other actor. Designers in general were more interested in following development in new materials, technology and tools to stay competitive and to meet customer demands. They readily interacted with other designers, regardless of their professions because of a common understanding of technical issues. Nevertheless, technical consultans had difficulties in applying the experiences they were informed about from architects, site managers and workers.

The clients were the most diverse group. Many had been former contractors, but showed similar understanding and learning behaviour as the designers and architects. Others were one-off clients who needed to understand the basics. Their interest in learning varied since one-off clients were already challenged to follow the main events and were in need of explicit knowledge. Professional clients were interested in following trends and developments and were able to enhance their knowledge based on mutual understanding regarding architects and designers. However, there seemed to be less interaction with other actors than designers and architects. In general, this group showed a good ability to share explicit knowledge. However, underlying tacit knowledge seems to be much more difficult to share.

Site managers and workers showed difficulties associating learning with anything other than courses, and were rather critical of learning. They seemed to be sceptical about any new development, materials, tools, or methods. Other sources than personal networks were little used for gathering information. It is possible to distinguish further between workers and site managers. Site managers were in a position that demanded, on the one hand understanding for designers and, on the other hand, they had to transfer information to the workers. This situation entitled behaviour of responsibility and independent decision-making, without involving others. Site managers had difficulties admitting that they had problems. This was especially true for older site managers participating in the study while younger ones had less difficulties asking for advice. Often, site managers showed difficulties converting explicit knowledge to make it available in their daily work since they were prone to depend on their routines. Workers mainly exchanged knowledge among themselves, even across company boundaries, since their interaction with other actors was limited. Learning occurred mainly in working situations, where tacit knowledge was transferred between project co-workers. For this reason it seemed difficult for them to identify learning situations or what they had learnt. Site managers and workers shared a great deal of tacit knowledge through socialisation (e.g. working together, showing each other how to do something). However, they failed to express this knowledge explicitly..

Theories about organisational learning are based on homogenous groups. Examples are actors at one hierarchical layer (Yeung *et al*. 1999) or groups of actors with similar educational background, such as consultants (Sverlinger, 1999), or senior managers (e.g. Yeung *et al*. 1999). Projects involve several hierarchical layers and

numerous actors with different professions and educations. Therefore, it is difficult to talk only about one, single, integrated learning organisation. It would be more appropriate to talk about several communities of learning characterized by different learning styles and prejudices towards other groups in the same organisation. Furthermore, it is difficult to describe the construction project as one learning culture. There are at least two cultures that share many characteristics: the culture of clients, architects and designers and that of site managers, construction workers and sub-contractors. Moreover, each profession appears to nurture its own idiosyncratic learning behaviour and style. This creates difficulties in forming one project culture, which is probably the reason for the lack of interaction between different actor groups. Taking into account that a learning culture and learning approach differed among the actors highlights the necessity to integrate different ways of organisational learning into one concept. Achieving joint learning among professions in construction projects could be a possibility to enhance the project's learning and thereby improve performance (e.g. Kasvi *et al.*, 2003; Schindler and Eppler, 2003).

This study points at two implications. One practical implication is that the construction industry needs to develop capabilities and mechanisms for coping with diverse learning cultures and fragmented project organizations. Today, each project co-worker is individually responsible for his or her learning outcome. Following this, we could argue that this learning situation rather enforces existing ways of working than develops new creative processes. The theoretical implication is that, although, Scarbrough *et al*. (2004) and Bresnen *et al.* (2004) have pointed the way, there is a need for research on project management and organizational learning. Projects are examined from a range of perspectives, but the ability to learn between and within projects is still little explored.

## CONCLUSION

In this paper we have identified five learning styles in construction projects: learning through personal networks; learning through organizing; learning through experimenting; learning through reading; and learning through attending courses and industry seminars. These approaches were of different importance for the various project co-workers. By structuring the two main styles: networks and organizing, so that that are seen as learning possibilities and by giving them higher priority are two ways to increase construction project learning possibilities. An option is to include site managers and workers more often in meetings with other groups of actors and thus strengthening their feelings of belonging to the construction project organization. This would also create a possibility to exchange theoretical and practical knowledge, which would enhance learning. For example, site managers or workers could provide valuable insights on practical implications already during the design phase of a construction project. To cope with customer demands and to improve quality, all project co-workers need to be encouraged to experiment. Lessons learned from experimentation were strongly related to individuals; however to limit financial risks it is necessary to make them accessible to a broader audience. Reading and attending courses have to be structured and built into the project organization's structure in a way that allows project co-workers to benefit from each other's learning. Especially, there has to be more focus on the site managers' and workers' learning since these are less involved in learning activities than other actor groups. Speaking in theoretical terms, the study of the six construction projects contributes to the situated learning perspective advanced by Lave and Wenger (1991). Organizational learning is in this

perspective contingent and context-bound and anchored in everyday standard operation procedures: organizational learning is what takes place amidst everyday work and in the handling of emerging problems and challenges.

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