

MESSAGES IN BOTTLES: THE FALLACY OF TRANSFERRING KNOWLEDGE BETWEEN CONSTRUCTION PROJECTS

Andreas Hartmann¹ and André Dorée²

Department of Construction Management and Engineering, University of Twente, The Netherlands

Although learning from projects in construction has gained much importance in research and practice, progress in understanding and improving inter-project learning appears to be slight. We argue that the adoption of a sender/receiver approach limits the learning effectiveness in construction. Drawing upon the notion of learning as social activity embedded in organisational context, we develop the argument that learning from projects takes place within projects rooted in the historical, organisational and cultural context of previous and current projects. We underpin our argument with results from a multiple-case study on learning in construction organisations.

Keywords: case study, construction project, knowledge transfer, learning.

INTRODUCTION

Since more than a decade, learning from projects in construction has received much attention in practice and research. Driven by the intention to improve the performance of an industry that has continuously been blamed for its poor performance – and thus learning culture – numerous studies have been conducted to identify barriers and enablers for learning from construction projects (e.g. Kumaraswamy and Thorpe, 1996; Paranagamage et al., 2012). Yet despite the efforts made, progress in improving the learning from projects appears to be slight. As a project-based industry, construction seems to be caught in the learning paradox of projects (cf. Bakker et al., 2011). Due to their fluid, temporary and interdisciplinary nature, projects are seen as suitable organisational units for stimulating learning and creating knowledge (Schindler and Epler, 2003). However, it is also argued that the ephemerality and discontinuities of projects restrict the assimilation of the created knowledge by other organisational units and its enhancement over time (Bresnen et al. 2003).

Besides identifying problems and difficulties in cross-project learning in construction, previous studies investigated a number of tools for extracting and disseminating lessons learned such as post-project reviews, company intranet or face-to-face meetings (e.g. Paranagamage et al., 2012). The majority of these studies, often implicitly, adopt a sender/receiver perspective on learning which assumes the possibility of engineering communication channels for transferring knowledge between projects and "lubricating their operation with the proper tools and motivated

¹ a.hartmann@utwente.nl

context" (Kasper et al., 2013, p.334). We argue that particularly this core assumption accounts for the little observable progress in understanding and enhancing learning practices in construction. To be clear, we do not reject the sender/receiver approach, but we argue that within the contextual boundaries of construction with its prevalent business paradigm, production structure and management style, the sender/receiver conceptualisation of learning has its limitation and calls for alternative approaches.

Drawing upon the notion of learning as a contextually embedded social activity, we propose such an alternative approach. Although the social and situated nature of learning has received much attention in research on knowledge creation in organisations and projects, its role for the learning between construction projects is less understood. Clearly, many previous studies revealed the importance of social practices and processes for the knowledge transfer in project environments (e.g. Paranagamage et al., 2012). However, from the perspective of these studies, social practices are still channels or tools for the transmission of knowledge between one project (sender) and another project (receiver) (Noorderhaven and Harzing, 2009). Unlike the sender/receiver perspective, we regard social interactions as contextually embedded and collaborative efforts in projects from which learning occurs. From our point of view, learning from projects takes place within projects as a social activity rooted in the historical, organisational and cultural context of previous and current projects (the imperative of continuity). We specifically argue that strategic objectives of construction organisations can and should serve as contextual binders between projects giving the social interaction within projects focus and orientation for the learning from projects.

In the following we develop our argument based on the project-based and situated learning literature. By referring to the results of five case studies on learning from projects in construction organisations, we then intend to show the limitations of the sender/receiver approach and the potential of the social learning approach for understanding and enhancing learning from and between projects. Based on that, practical implications and further directions for research are discussed.

CONCEPTUAL BACKGROUND

The limitation of the sender-receiver approach

The sender-receiver approach is based on communication and information theories that suggest the existence of source, channel, message, recipient and context (Noorderhaven and Harzing, 2013). It is much connected with the concept of knowledge transfer that depends on the characteristic of the sender unit, receiving unit, relationship between sender and receiver, and the knowledge transferred. The approach implies that under certain conditions, knowledge will flow from one unit (project) to another unit (project). These conditions are: (1) the sender unit is knowledgeable and willing to share its knowledge, (2) the receiving unit possesses the capacity to absorb the knowledge, and (3) the appropriate transmission channels between sender and receiver for the flow of explicit knowledge and tacit knowledge (which can be converted to explicit knowledge) exist. Transmission channels are appropriate if they allow the development of a common lexicon between sender and receiver that "sufficiently specifies the differences and dependencies of consequences at the boundaries" (Carlile, 2004, p.558). The sender/receiver approach relies to a great extent on the storage and retrieval of explicit knowledge and reverts to transmission channels such as electronic and document-based knowledge repositories. It also makes use of social interaction (e.g. meetings, face-to-face conversation) as

channels for the externalisation of tacit knowledge and the transfer of this knowledge from an organisational unit that has the knowledge to another unit that does not have it (Kasper et al., 2013).

The notion of transferring knowledge appears to be appealing, since many studies on learning from construction projects adopted the sender/receiver approach and investigated the effectiveness of channels for the management of knowledge and the transfer of lessons learned between projects. At the same time barriers of knowledge transfer are well documented. Reported problems include lack of time to capture lessons learned (Paranagamage et al., 2012), lack of usefulness of captured knowledge (Newell et al., 2006), focus on failures (Carrillo, 2004), lack of purpose (Ruikar et al., 2007), and commitment of staff and management to knowledge sharing initiatives (Bishop et al., 2008). We argue that these barriers represent major limitations rather than unresolved problems for the learning from projects. The prevalent production structure, business paradigm and management style in construction evoke these limitations. For example, lack of time can be traced back to the very limited ability of construction firms to balance demand fluctuations (through e.g. stock-keeping of creating markets for their services). Since it is the demand that directly determines the utilisation of resources, people are often involved in several projects and face time pressure. As a response to a changing demand rate, construction services, technologies and equipment are often outsourced and subcontracted per project. Many construction firms follow a business paradigm of trade rather than production and are technology-wise empty firms, which makes it difficult for them to define a clear purpose for learning from projects. In addition, many construction projects not only entail a variety of components and equipment, but also have to process a wide range of technical, legal, environmental and organisational information that, to some extent, varies within and between projects. This makes it questionable whether a sender project is able to articulate the knowledge that might be of value to a future, but yet unknown receiving project and to generalise lessons learned to an extent that makes them digestible but still useful for several receiving projects (Bresnen et al. 2003).

The potential of the social learning approach

The social learning approach recognises the social nature of learning and has its origin in social learning theory. Social learning theory claims that learning is not something that solely takes place in the human mind but occurs through the interaction of people (Easterby-Smith et al., 2000). Knowledge emerges from collective actions. It is enacted through the participation of individuals in social processes. It is socially constructed and becomes the active process of knowing rather than being an object that can be transferred between organisational units (Plaskoff, 2003). Consequently, learning is regarded as a situated process in which "a situation posits certain possibilities for some action and not for others depending on individuals' former experiences and power in a specific context. Individuals are at one and the same time to be regarded as 'products' of their social and cultural history and 'producing' situations mirroring that. The individuals interact with selves, others, artefacts and contexts as just that, 'products' and 'producers' of situations" (Elkjaer, 2003, p.43).

We argue that the social learning approach has certain potential for enhancing our understanding of learning from construction projects. Our argument seems to be supported insofar as previous studies emphasise the important role of social practices and processes for learning within and from projects (e.g. Bakker et al., 2011). However, in many studies, social interaction remains a channel in the tradition of the

sender/receiver approach that accommodates the flow of knowledge "produced at one location and consumed at another" (Noorderhaven and Harzing, 2009, p.720). From the social learning point of view social interaction is learning, i.e. the application and, thereby, creation of knowledge in context. In construction the learning context is mainly related to projects which cannot be seen as "islands" (Engwall, 2003). They are history-dependent and organisationally-embedded and, as such, are constituted in and through the context they are producing. In other words, learning from projects takes place within projects through organising the project context which includes organisational procedures and tools, symbolic artefacts, organisational rules and norms, experience and competence of individuals. If projects are perceived as sender/receiver islands, then lessons learned remain "messages in bottles" - freely afloat on the ocean of knowledge, arriving at new shores by chance.

RESEARCH METHOD

Over the years we have been approached by a number of construction organisations with requests to analyse and improve their intra and inter-project learning. That included contractors, engineering firms and public agencies, and we were asked to study the learning between project phases and projects and the effectiveness of project evaluations (Table 1). Since we followed a qualitative approach to better understand the specific circumstances of the learning within the different organisations, the series of studies merged into multiple cases which, in line with Yin (2003), replicated previous results but also provided contrasting findings. The five cases presented here allow us to underpin our argument that the sender/receiver approach is limited and may be fruitfully extended by the social learning approach. Thus, the focus of our analysis was on identifying the channels used in the organisations for (a) the transfer of knowledge and (b) the extent to which construction-specific conditions were limiting the knowledge flow. We characterised tools, measures or organisational structures as channels to determine if they connected organisational units to support the transfer of knowledge between these units. We also explored the case material to determine indicators for social learning and conditions conducive to it. Here, we focused on interactive and social mechanisms through which knowledge was enacted and thus exchanged. The materials that were analysed included transcripts of semi-structured interviews held with employees from the different organisations, project documents and evaluations, and summaries of group discussions which were used to discuss research results and develop improvement measures (Table 1).

FINDINGS

The findings of the five case studies are summarised in Table 2. We elaborate more on them in the next sections.

Case I

Observable limitations from the sender/receiver perspective

Within the contractor organisation a number of channels were established to support the exchange of knowledge and lessons learned between employees and projects. One is the organisation's intranet which provides access to standardised work procedures, and general documents about procurement and quality management. Another channel is ERP software which stores all project documents such as procurement and planning documents. In addition, it includes checklists for purchasing, work preparation and execution and enables employees to make recommendations and give tips related to checklist items.

Table 1: Investigated cases

	Case I	Case II	Case III	Case IV	Case V
Type of organisation	Contractor	Contractor	Engineering Corps	Contractor	Public Agency
Organisational unit	Regional business unit	Regional business unit	Support unit	Functional business unit	Regional business unit
Number of employees - total (business unit)	280 (120)	2200(120)	800(70)	2800 (200)	9000(250)
Research focus	Learning from project	Knowledge sharing between project phases	Learning from out-of-area projects	Effectiveness of project evaluations	Effectiveness of project evaluations
Data collection	Document analysis 15 interviews Tool evaluation	Document analysis 12 interviews Questionnaire 1 group discussion	Document analysis 19 interviews	14 project evaluations 12 interviews 1 group discussion	4 project evaluations 11 interviews 1 group discussion

Table 2: Case findings

	Case I	Case II	Case III	Case IV	Case V	
Sender/receiver approach	Channels used Intranet ERP software	Project documents Transfer meetings	Evaluation documents Evaluation presentations	Evaluation documents Evaluation workshops	Team building sessions Evaluation Project documents	
	Inhibiting conditions Time Relevance	Time Location	Time Relevance Accessibility	Time Relevance Accountability	Time Relevance	
Social learning approach	Project learning context Enabling conditions	Project meetings Pull planning meetings Planning orientation	Estimator/planner interaction Location Planning orientation	Project meetings Tender manager interaction Specialisation orientation	Project start-ups Evaluator involvement Problem orientation	Team interaction Transfer meetings Change of personal Location

The information is accessible for all employees. The employees also have the possibility to make improvement suggestions via a central e-mail address. Despite the existence of these channels for the dissemination of lessons learned, the exchange of knowledge remains limited. The EPR software is rarely used for suggestions or tips, evaluation of projects are incomplete or not stored. One reason for the ineffectiveness is time pressure due to project-based work, which often causes resource allocation problems. Any activity such as evaluations and improvement suggestions that does not contribute to the immediate success of the current projects is given less priority. Moreover, employees perceive knowledge obtained in projects as not relevant for their colleagues and thus do not share it. They either believe that their colleagues already possess the knowledge or they think project peculiarities make the knowledge less relevant for other projects.

Observable potentials from the social learning perspective

In this case study meetings on different levels and with different communities are arenas for social interaction of people active in different projects and organisations. This includes weekly meetings of construction foremen and pull-planning meetings of the contractor with its subcontractors. Through the discussion of cross-project related issues and problems such as resource allocation and planning bottlenecks, these meetings become integral parts of the working process. The clear focus of the meetings on planning coordination between projects stimulates the integration of knowledge from different employees and projects for the progress of the specific project. The willingness to engage stems from the immediate benefit of the discussions for the projects.

Case II

Observable limitations from the sender/receiver perspective

From the sender/receiver perspective the case study revealed two channels for the transfer of knowledge between project phases: project documents and transfer meetings. Project documents include tender documents, calculations, work preparation, drawings and project evaluations which are built up during a project and handed over to the next project phase. The documents are standardised and maintained through the quality management system. The transfer meetings are especially established for the time after winning a tender when the entire project team is expected to meet and transfer the knowledge from the tender and calculation phase to the work preparation and execution phase. However, the transfer meetings appear to be ineffective. Employees do not participate, meetings are cursory affairs or are completely cancelled. Likewise, project documents are incomplete, not up to date, or not even used (e.g. project evaluation). The case revealed that project-based working leads to time pressure, which decreases the use of project documents and transfer meetings for knowledge transfer. Unlike the meetings in case 1, the transfer meetings are regarded as extra workload with little added value for the on-going work. In addition, the geographical separation of project team members and projects inhibits the knowledge flow within and between projects.

Observable potentials from the social learning perspective

An indication for the ineffectiveness of the transfer meetings, as well as for the potential of social learning is the estimator/planner interaction during the work preparation phase. For the planners, assumptions made during the tender and calculation phase are not always comprehensible. From tender and calculation documents alone the chain of thought is not visible to them. It only becomes clear

through discussion with the estimator, preferably supported by the close proximity of the estimator and planning engineer. This again indicates that the ineffectiveness of the transfer meetings, although meant to support the transfer of knowledge from tender to work preparation phase, is related to their decoupling from the immediate working process.

Case III

Observable limitations from the sender/receiver perspective

There are several channels in place to support the knowledge transfer between employees and projects such as team building sessions, project evaluations and project documents. Team building sessions are annual meetings at which specific engineering topics and new developments are discussed. These sessions are regarded as beneficial, since they stimulate social interaction. However, they are seen as insufficient to regularly update the knowledge base. Project evaluations are done on an irregular basis. Their outcomes are centrally stored, but although employees know that evaluation results are available, they have difficulties finding them and rarely make use of them. Reasons that are mentioned include the outdated knowledge of evaluations, their unstructured storage, and the difficulty of extracting and transferring the knowledge in a new project context. Another channel are project documents which capture design knowledge from previous projects and are used as basis for the design in new projects.

Observable potentials from the social learning perspective

Social learning is much connected with team interaction due to changes in team composition. On the one hand, for every project a new team is constituted. On the other hand, project team members change every few years. Despite the risk of losing knowledge, this is also perceived as chance of new perspectives and different experiences which are unfolded in project work. This is additionally supported by the close proximity of team members over longer periods during base design and construction. The regular change of personnel in out-of-area projects becomes part of the working process and the needed transfer meetings are regarded conducive for the exchange of knowledge around the specific circumstances of the out-of-area project.

Case IV

Observable limitations from the sender/receiver perspective

This case organisation follows a very structured and standardised evaluation process of tenders and projects that makes use of evaluation documents and workshops as channels for knowledge exchange. Steps are described, responsibilities are appointed and topics to be evaluated are mentioned. An evaluation form is provided, but its use is not mandatory. Despite the existence of a detailed evaluation procedure with a number of guiding protocols and forms, evaluation reports of only a third of the annual projects could be found in the central quality management system. Reasons behind this include insufficient time for conducting and accessing evaluations, low relevance of generally described knowledge for future projects, and difficulties in accessing very detailed knowledge about previous projects.

Observable potentials from the social learning perspective

The case study showed that social learning in project evaluations is connected to the application of evaluation results which are not stored in reports but which are made available during regular project meetings. Discussions of current project issues are supported with results from evaluations of previous projects. The benefit and thus willingness to use evaluations emerged in the direct working process through their

confrontation with context specific problems and challenges. Here, it was mentioned that in order to be beneficial, evaluations should focus on specific disciplines.

Case V

Observable limitations from the sender/receiver perspective

Project evaluations are very prominent within the agency which can be traced back to the accountability as public organisation. They are regarded as tools to check the efficiency of the agency's work processes and the effectiveness of change programmes. Evaluations of regular infrastructure projects particularly aim at improving work processes. Although many project are evaluated, there is no clear evaluation procedure, evaluation goals are rather general or cloudy, and concrete outcomes are often missing. Evaluations become goals of their own and thus less relevant. Not surprisingly, there is the perception within the agency that results of evaluations rarely find their way into new projects. Yet, evaluation results are disseminated first of all within the own business unit and channels used to transfer these results are reports, workshops and meetings. Employees find it difficult and time-consuming to search for evaluation results from other agency units, but also to make their results available to these units.

Observable potentials from the social learning perspective

An indicator for the existence of social learning can again be found in the application of evaluation results. Evaluations become relevant at the start-up of new projects or if problems are encountered during projects. Employees then revert to evaluations of previous projects to make lessons learned available for the new project or the solution of the problems through the discussion with colleagues. What this distinguishes from the sender/receiver approach is the point that these employees were often involved in the project evaluations which are referred to. Learning does not occur through the extraction of knowledge from an evaluation report but rather through socially unfolding experiences from an evaluated project in the context of a goal-oriented activity.

DISCUSSION AND CONCLUSION

The fallacy of transferring lessons learned

The five cases are very much in line with previous studies in terms of problems related to the sender/receiver approach. It became apparent that the transfer of knowledge from one project to another project via several channels is impeded by characteristics that seem inherent to the contextual nature of construction. Two of these characteristics are particularly prevalent and appear to be interlinked: time constraints and obscured relevance or unclear purpose. In all cases employees lacked time to either adequately capture and store lessons learned or search and extract useful lessons from evaluation documents. Even channels like project transfer meetings are vulnerable to time constraints, as the second case revealed. At the same time the relevance and purpose of particular knowledge for subsequent projects is difficult to determine for the sender as well the receiver. That is, the sender needs time to capture and store lessons learned in a way that they can become relevant for the receiver who needs time to determine whether the provided knowledge is relevant for his/her project. From our perspective the limitations of the sender/receiver approach emerge from the attempt to remove or at least to reduce constraints. The fallacy of the approach lies in the assumption that the transfer of knowledge can be easily improved by making more time available and providing adequate tools for collecting and

disseminating lessons learned. We suggest that time constraints and unclear relevance will remain typical characteristics of a project-based industry limited in its ability to balance changing demand rates. Of course, approaches to enhance the learning between projects in construction need to address these characteristics, but they should be careful in trying to overcome and deny an industry's production structure and conceptually and practically separating the learning from its context. Rather, they should consider learning as an evolving process embedded in context and facilitated through the organising context.

Goal-oriented learning from projects in projects

The social learning approach regards learning as a contextual emerging practice, and the five case studies could provide indicators for its theoretical and practical potential. In all five cases the ineffectiveness of learning from projects can be related to the separation of the learning from the immediate project work. Capturing, disseminating and determining lessons learned were not part of the working process. In the light of time pressure and obscured relevance, these activities were perceived as extra workload and their contribution to the direct project was hardly recognised. As a consequence, the willingness to conduct them was very low; they received low priority or were completely dismissed. However, the five cases also showed that learning occurred when employees were engaged in project work. From the social learning perspective that is not surprising, since learning is seen as something that is "ubiquitous and part of human activity as such" (Elkjaer, 2003, p.43). It was the project context that triggered this learning through posing problems and questions, and offering opportunities and challenges. Particularly the orientation towards the goals of a project or single project activities enabled learning which then also made use of knowledge generated in previous projects. Instead of purely transferring this knowledge, it was unfolded through the interaction of employees directed by goals of the specific project. The transfer meetings used in case II and V point to this learning mechanism. In case II the transfer meetings were organisationally separated from the work process by transferring the outcomes of one project phase to the next phases. In case V the transfer meetings were organised as part of the regular change of staff in projects where in bilateral discussions about project issues the handing over is facilitated. Based on these findings, we see our initial argument supported that learning from construction projects is taking place within projects and that, given the contextual nature of learning, it seems essential to give the learning in projects more focus and orientation so that the learning between projects is further facilitated. A main implication for construction organisations is that they can support inter-project learning by linking projects through strategic objectives which are then translated to the specific project. That such deliberate coupling of sequential projects may improve the learning between projects is indicated by Dorée and Holmen (2004). In their study on technology innovation they could show that a contractor followed a path-dependent process for developing a bridge technology through a number of sequential projects, but without having an explicit technology development strategy. They suggest a more proactive stance of contractors to become aware of their project-crossing trajectories. A possible avenue for future research is to investigate the formulation and translation of cross-project trajectories and how these can impact the inter-project learning. Further areas for research are other contextual aspects of construction projects and their interrelatedness with learning.

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