

# **NORWEGIAN PROJECT MANAGERS AND FOREMEN'S EXPERIENCES OF COLLABORATIVE PLANNING**

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## **ABSTRACT**

Many reports within in the Lean Construction literature have described positive effects of implementing the Last Planner system (LPS), such as increased reliability in planning, improved workflow reliability, and reduced time and waste. LPS has also affected human aspects as work has become more satisfying and challenging, and participants have become more enthusiastic in progression planning meetings. Reports show an increased use of each other's expertise, increased respect and collaboration both between trades and within hierarchical structures. Further positive effects are reportedly improved information sharing and communication, and improvements concerning tidying and cleaning which in turn increases efficiency.

This paper reports from a research project based on implementing LPS in a Norwegian construction company. The Last Planner system was first implemented in 2008, in two pilot projects, and was subsequently implemented in a number of construction projects within the company. The aim of the study was to review the experiences of project managers and foremen, with the implementation LPS. Group interviews were conducted with 34 informants around questions concerning information and support, elements of LPS employed, effects and outcomes, challenges and drivers for future use of LPS.

The findings noted above are largely supported in this paper. However, this paper offers a systematic review of recent practices and experiences within the context of a construction company in Norway. The informants were challenged to reflect upon the reasons for achieving effects and outcomes. These reflections shed light upon processes taking place.

## **KEYWORDS**

Effects and outcomes, Lean construction, Last Planner system, Collaborative Planning.

## **INTRODUCTION**

A number of publications exist which point to positive effects of implementing the Last Planner system (LPS) (Ballard 2000). This paper reports from a research project based on implementing LPS in the context of a Norwegian construction company. Based on structured group interviews, issues regarding the following five questions were explored:

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- What kind of information and support have you received concerning Lean Construction and Last Planner system?
- What elements of Lean Construction/LPS have been employed in your project?
- Which effects and outcomes have you experienced?
- What was particularly challenging?
- What do you need to use the LPS methodology in future projects?

Besides reporting on effects and outcomes, this paper offers an explorative approach to understanding the contextual issues concerning the experiences of project managers and foremen, by addressing the issues noted above.

Reliability is an important factor in all construction projects. Kim and Jang (2005) reported that the Last Planner system improved workflow reliability. According to Ballard (2000), the Last Planner system increases reliability in three ways: first, through the lookahead planning and preparation process; second, by filtering weekly activities to ensure that the previously planned work is completed; and third, by involving and committing managers and employees. Fiallo and Revelo (2002), found that the Last Planner system enabled activities in the coming weeks to be coupled to the master plan of the project.

According to Slivon et al. (2010) “planning can be understood as a conversation in which the interests and concerns of all parties are articulated, discussed, and aligned and commitments to action are made”. The Last Planner system provides a structure for conversations, clarity regarding assignments, elicits task commitment, declaration of completion and pinpoints any breakdowns (Vrijhoef, Koskela et al. 2001).

Elsborg et al. (2004) found that employees and managers were particularly positive to the increased use of each other's expertise, increased respect and cooperation between trades and improved information sharing and communication. Increased job satisfaction were related to participants' immediate experiences in the process and motivated a more committed form of collaboration in the implementation process (Elsborg, Bertelsen et al. 2004; Skinnarland and Yndesdal 2010; Skinnarland 2011).

Other effects of the Last Planner methodology are reportedly improved execution time (Garcia, Romero et al. 2006) and flatter project organizations with a greater commitment by all participants to planning processes (Alarcón, Diethelm et al. 2002). Auada et al. (1998) describe positive effects such as reduced time, reduced waste, little rework and reduced waiting.

## **ABOUT THE PROJECTS AND INFORMANTS**

The construction company in the current DBA research is based in the south-west part of Norway. The company is organised in two regions and within one of the regions, operations are further organised within districts. In addition, the company runs a separate unit of large plants construction. The company undertakes new construction and rehabilitation projects. In 2008, LPS was first implemented in two pilot projects (Skinnarland and Moen 2010; Skinnarland 2011). Subsequently, top management has decided that LPS is to be used in all projects within the

company. Three and a half year after the first initiatives, top management were curious to find out whether or not LPS is beneficial to the company. The perspective taken was to address the experiences made so far by project managers and foremen, in order to learn more about the use of LPS by company projects and the eventual benefits of its use.

The paper is based on data from 26 unique projects in this study. Thirteen respondents reported from only one project, 7 respondents reported from 2 project experiences, 5 respondents reported from 3 project experiences and 1 respondent has reported from 4 project experiences. In all, 46 single project experiences are thus captured in the data. Of the 46 projects reported from, 48 percent are new commercial construction projects. New apartment constructions account for 28 percent, plant constructions for 11 percent, whereas 13 percent are rehabilitation projects or other types. The main type of contract is turnkey contracts, counting for more than 85 percent of the construction projects.

The participants in this research project are project managers and foremen, 54 percent foremen and 46 percent managers, totalling 33 informants, of whom more than 90 percent are men. Nearly half of the informants are 46 years or older. 60 percent have been employed by the company for more than 11 years, and nearly 30 percent have been with the company for 2-5 years. 67 percent of the informants reported from their first project, whereas 30 percent have already completed 1-2 projects with LPS.

## **METHODOLOGY**

Structured group interviews with project managers and foremen were conducted in October and November 2011. The interviews lasted from 90 minutes up to a maximum of two hours. The informants were mainly organised in groups of project managers and foremen respectively. Group interview as a research method has been in use since the 1940s. Group discussions may reflect internal group processes and can be used to generate information on collective views (Bloor 2001). An argument that is made for non-mixed groups contends that informants may feel inhibited to speak freely if higher management is present. A second argument contends that informants who share the same role in construction projects may be able to produce information spin-offs through the sharing similar experiences (Kitzinger 1994). One interview was conducted one-on-one. Three interviews were conducted with 2 informants present, whereas the remaining interviews were conducted in groups of 3 to 6 informants. All in all, 11 interviews were conducted.

Interviews were structured as the main aim was to collect a richness of experiences in terms of a number of preset dimensions, as opposed to in-depth knowledge of a limited number of experiences. During the interviews, the informants were asked to answer a small survey questionnaire, mainly by ticking preset optional answers. The objective was to produce an overview of characteristics of projects and informants. The small survey also asked the informants to respond to 17 statements that reflected their experiences in the projects. The choices of statements were based on previous research by the current author and a literature review. The statements were addressed by ticking 1) no change from previous projects, 2) worse, 3) slightly better, or 4) much better. The

interviews revolved around these and other questions, giving both snap-shot answers, and an opportunity to explore issues further.

## **FINDINGS AND RESULTS**

In this part of the paper the five main questions are attended to in separate sections.

### **Information and support**

Most respondents have received some information in terms of brief, theoretically-oriented information leaflets about the LPS methodology, or orally in meetings, either regional or in projects. The information provided has been directed towards adaptation to each unique project and often included initial meetings with subcontractors. Project management and foremen received more or less the same amount of information.

In addition to theoretical information about Lean Construction and LPS, two lean experts within the company supported project implementation and adaptation to lean methodology. Both assisted projects in the start-up phase of implementing lean methodology. Project support varied, from assisting in kick-off meetings by providing general information, and in phase schedule planning sessions, to supporting projects over time by observing various progression planning meetings, and offering feedback and evaluations. The experts also acted as discussion partners for project managers and foremen. The informants largely agreed on the high value of information and support. Information specifically directed towards individual projects was perceived by the informants to contribute more to the understanding of the methodology than the general theoretical information provided.

### **Use of LPS and Lean Construction principles in projects**

In the construction company, nearly all projects have adopted collaborative phase schedule planning, inviting foremen and team-supervisors and subcontractors to participate in the planning sessions. Progression planning meetings such as team supervisor meetings and lookahead (Ballard 1997) meetings were common practices in the projects. Although not required or even suggested by the LPS, several projects offered shared office facilities to team supervisors, similar to a Big Room (Khanzode, Fisher et al. 2007). Team supervisors from the main company and from subcontractors engaged in informal conversations about ongoing daily operations, and could study and clarify design issues, as well as general interaction. The access to such facilities was given as explanation for improvements experienced in the projects. Clarifications among team supervisors saved time that foremen and project managers used to focus on facilitation of operations in coming weeks.

### **Effects and outcomes of LPS practices**

The projects did not track any hard numbers related to LPS, such as PPC (Ballard, 2000). The following findings reflect project managers and foremen responses to a set of statements concerning potential effects and outcomes of the implementation of lean practices in construction projects, together with data from group interview discussions. Overall, there were few differences between project managers and

foremen in terms of the effects and outcomes experienced from implementing lean. Regarding a few topics, however, such as arenas for collaboration, mutual responsibility, well-being on site, meeting-structure, right information and delivery with few errors, some divergence exists, although the data is too limited to establish this at any level of significance. The finding corresponds with interview data which suggest a similar level of involvement by foremen and project managers in implementing LPS. The level of received information and support also supports this.

Seventy-five percent of respondents feel that control of progress has been slightly or much better. Another effect is increased mutual responsibility among project participants. Foremen seem to have more positive experiences in this respect than project management. Suggested structures for planning meetings have been implemented which accommodate specific planning levels. Both project management and foremen have had positive experiences in this respect. Several respondents were unfamiliar with the term “seven preconditions” (Ballard 2000; Koskela 2000; Bertelsen, Henrich et al. 2007).

One of the most convincing outcomes from the implementation of LPS is the establishment of an arena for collaboration. This is related to the improvement experienced in meeting structures and linking to specific planning levels. In practice, this involved bringing the right people together, on a frequent basis, to discuss and plan for the correct time perspective, and to the appropriate level of detail. Collaboration, as such, was established in-house among main and subcontractor management.

Meeting structures systematized communication between trades and thus established an important arena for dialogue concerning daily production as well as long-term planning of execution of tasks. Dialogue and joint problem solving created a greater degree of commitment and responsibility, which in turn affected the well-being and satisfaction on the site. By involving employees and subcontractors in phase schedule planning, and later in regular planning meetings, a structure was created, which provided arenas for dialogue to obtain correct order and sequences of activities.

It is challenging to establish a structure that allows for necessary information about processes and production to flow between participants, between project phases and between various planning levels. By establishing a meeting structure where specific planning levels (time horizons) were systematically addressed, and by involving even subcontractors in these meetings, 75% of the respondents found that a greater degree of necessary information was distributed within the project. Many informants were concerned with the learning aspect of using lean methodologies. This demonstrates that, beyond being a useful tool in daily operations, LPS contributes to process awareness about dependencies, and the overall construction process and relationships in this type of production. Project participants learned much from interdisciplinary conversations, which provided more information to coordinate activities from.

Twenty-five percent of the respondents did not find any change from previous projects regarding meeting deadlines. Fifty percent found that meeting deadlines had improved slightly and 25% believed meeting deadlines improved much. A large proportion of the respondents thus experienced an improvement with regard

to meeting deadlines. This is important because compliance with deadlines is often synonymous with economic outcomes. Milestones reflect deadlines in the course of the project, and increased attention to meeting intermittent deadlines/milestones in the project increases the likelihood that the handover deadline will also be met. Some project managers experienced less need to use overtime work or delivered the final project earlier than planned.

Although a third of the respondents experienced no changes in the level of stress, the majority of project managers and foremen perceived the methodology to help them implement projects more efficiently and with less stress. (Stress here has negative connotations). Some informants described improved collaborative relationships characterized by the absence of stress and a sense of having calm and predictable working conditions. Their own explanation for this was the presence and involvement of all project participants, both subcontractor workers and manager, throughout the construction process. Involvement increased contact with others working on the project.

Two-thirds of the respondents find that time spent waiting, mostly for other trades to finish their jobs, has improved.

When asked about possible improvements of deliveries within budget, nearly 4 in 10 responded that they did not experience any change from earlier, while just over half believed that projects delivered within budget had improved slightly. However, many responded on the basis of their first and ongoing project. Thus their response to this statement was an expression of what they believed might happen, rather than absolute figures. Further, some of the informants chose not to take a position on this question.

Four out of ten respondents experienced no change from previous projects in terms of delivery to correct quality. Nearly 50% reported an improvement. Interview data suggest that improvements were caused by project participants showing more respect for other trades' finished products, and an increased awareness of dependencies and optimal order of activities, all of which lead to less rework.

In terms of human injuries on the construction site, nearly 6 of 10 experienced no change from previous projects. This may be explained by an already strong focus on HSE issues, i.e., that best practices to avoid injuries were already established. However, at the same time close to 40% did report an improvement, which may indicate a positive effect of safety issues being included in the agenda in planning meetings, as part of preparation for the execution of activities.

Approximately two-thirds of the respondents did not experience any change concerning damage to equipment and materials, whereas a third reported a slight improvement. Some respondents pointed out that organizing work in zones (Skinnarland and Moen 2010; Skinnarland 2011), resulted in trades to a large extent being able to work uninterrupted. This helped reduce the amount of such damages. A key principle in the Last Planner system is to organize work such that each trade can work in separate zones. Having sufficient place to work is one of seven conditions Bertelsen et al. (2007) refer to as a premise for optimal production flow. One way of achieving this is by organizing/planning work according to zones. In this way, work can be carried out with less interruption, and more efficiently. Other positive effects are an increased sense of clarity concerning

responsibility for clearing and preparation of work zones, which in turn may positively influence safety, efficiency, satisfaction, and more (Skinnarland and Moen 2010; Skinnarland 2011). The intention is to improve production since it is more effective to work alone in a cleared zone. Tidy work zones clearly define products which are taken over by the following trade.

More than three out of four respondents feel that there has been an improvement in terms of job satisfaction. This result is consistent with qualitative statements in the interviews. Several informants claim that work has become more rewarding and interesting. LPS is claimed to have resulted in a more open environment, which is partly explained by an overall increase in participants' mutual interest in process knowledge.

More than half of the respondents experienced slight improvements in terms of less execution of activities as fire-fighting activities. Lean methodology is a desired collaborative practice since it is perceived as a tool to bring problems to the table, enable discussions and conversations, and find mutual solutions. Lean practices demand that both main contractor and subcontractors commit to the construction process already from the outset of the project.

### **Challenges to implementation**

Some informants experienced challenges in implementing LPS in their projects. These were challenges in terms of planning horizons in planning meetings, subcontractors being self-protective and thus not willing to become really involved, difficulty in motivating conversations, lack of preparation leading to poor communication and dialogue in meetings. Further, challenges were experienced concerning traditional and new structures and routines, involvement in ongoing and new construction projects simultaneously. Other challenges to involvement concerned form and scope of involvement, and the process of involving late entrants. These challenges and obstacles are further discussed in a separate paper (work in progress).

### **Drivers for future use of the LPS methodology**

Virtually all respondents expressed a wish to implement Lean Construction in future projects. Reasons given were increased commitment, an ability to coordinate trade activities, and the ability to highlight problem areas and to discuss and find common solutions. Lean requires commitment from both main contractor and subcontractors, and facilitates early involvement in the building process. This allows project participants to reflect and act in terms of progression and thus avoid stress and fire-fighting activities. According to the respondents there are several drivers for future use of LPS. One driver is dedicated lean enthusiasts; employees both on organizational and project levels who can direct the processes of implementation and development in lean practices. Another crucial driver is that top management must communicate an expectation that lean practices, as a collaborative practice, are to be implemented in all construction projects. Knowledge about the methodology is also an important driver of future projects. Practical and theoretical information and support increases understanding, not only of what to do, but also why.

A few informants found it difficult to accept the idea of on-site changes to projects practices, and pointed out that support from lean experts within the

company had been helpful. Since many project managers were still in the early phases of adapting to lean principles, such support may be a key driver also in future projects. Another important driver is that costs are in fact reduced, and errors limited. Ultimately, project managers need to experience pay-offs from lean practices.

## **DISCUSSIONS AND LESSONS LEARNED**

Many of the findings noted in this paper support research by authors who reported from previous Lean Construction implementation. Effects and outcomes related to production, such as increased reliability, reduced waste, time, rework and waiting are evident in current research. So are effects and outcomes in terms of collaboration, in that meeting structures are improved with defined purposes and technical equipment to support and motivate constructive conversations. Meetings and other arenas, such as the team supervisor shared offices, have provided opportunities for interaction and collaboration, resulting in increased respect and levels of trust between participants. Project participants are reportedly more satisfied and motivated to contribute with their expertise and to commit to overall project goals. Outcomes and effects may be categorised in terms of production, collaboration and the behaviour and attitudes of project participants. However, all three sets of outcomes and effects are intertwined parts in a series of causal relationships. Positive experiences in one area lead to positive experiences in other areas. This may occur as a result of direct impact on production, e.g. future planning enabling improved material and equipment handling. However, this paper argues that change in behaviour and attitude is an intermediate variable in most causal relationships. Production outcomes and effects were experienced because of an increased will to commit to plan agreements, a will to take on increased mutual responsibility to bring the project forward, and the ability of project management to communicate expectations and to practice what they preached. At the same time, outcomes and effects in terms of participant behaviour and attitudes occurred because the participants experienced positive effects and outcomes in production. This is where the money is, and the experience of the win-win situations in which LPS results, provides motivation to strengthen positive behaviour and attitudes. Individual positive experiences thus motivate collaborative behaviour, such as increased willingness to share information, show interest in others' work and needs, make use of each others' expertise and in general improve collaboration (Skinnarland and Yndesdal 2010). This in turn is the basis for further improvements in aspects of production. The paper proposes that closer attention is given to the relationship between the different aspects of construction projects, since desired effects and outcome on one account is dependent on, or has as a premise, that improvements on other accounts are facilitated and motivated. A key driver in this respect is project management and leadership. Although leadership is outside the scope of this paper, it is important to point out that for some project managers, managing people comes naturally, while others may need extensive training and support to develop necessary leadership skills to lead people. The paper addresses other important premises for future use of LPS. One is that construction projects should establish LPS structures and routines from the outset. The change process (from traditional to lean) should be supported according to the

needs of the project manager, both in terms of scope and length of support. Some may need extensive support, while others need none. The project manager has a crucial role throughout the construction project, to facilitate and motivate collaboration.

Even project managers and foremen, who did not experience the positive effects referred to by their colleagues, responded positively to the idea of implementing LPS in future projects. In instances of not achieving positive effects, rather than giving up the idea of LPS altogether, positive attitudes were expressed for future implementation. This suggests that LPS is perceived to be intuitively right, if implemented correctly and with the proper support. Changes may be necessary in terms of, e.g., involving more subcontractors in the use of a LPS structure from the outset, and finding ways to secure involvement of trades who enter the project in later phases.

## CONCLUSIONS

In general, findings reported in this paper support findings made by other researchers. This may indicate that when implementing lean practices and LPS projects, independent of geographical location and access to stories of obstacles to implementation faced in earlier projects elsewhere, construction companies are likely to experience and work to overcome the same obstacles in their own projects, as part of a natural learning period and transition from traditional to lean practices. At the same time, it seems that similar effects and outcomes are experienced independent of geographical location. While this is an assertion which cannot be determined on the basis of this paper, future research may show whether national differences regarding labour traditions and culture may affect implementation of LPS.

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