

LAST PLANNER SYSTEM: EXPERIENCES FROM PILOT IMPLEMENTATION IN THE MIDDLE EAST

Abdullah AlSehaimi¹, Lauri Koskela²

ABSTRACT

The work described in this paper is devoted to evaluate the effectiveness of implementing Last Planner to improve construction planning practice in Saudi construction industry. Firstly, the primary results of implementing Last Planner System (LPS) in two construction projects in Saudi Arabia are presented. Action research strategy was undertaken with different data collection methods employed included interviews, observation and survey questionnaire. Secondly, benefits gained in terms of improving construction management practice are presented, the critical success factors for LPS implementation are discussed, and potential barriers for implementing LPS revealed from the studies are presented. The results demonstrated numerous benefits were gained in terms of improving construction planning and site management. The fact that the structural work in one of the sites finished two weeks ahead of schedule is a clear evident of this improvement. However, there are some potential barriers reported which hindered the achievement of full potential of LPS. Finally, a comparison between the outcome of this study and some previous studies on Last Planner in other countries is briefly carried out.

KEY WORDS:

Action Research, Construction Industry in Saudi Arabia, Construction Management, Construction Planning, Last Planner System.

INTRODUCTION

Construction management suffer from many problems and the majority are practical which need to be solved or better understood (Love et al., 2002; Wing et al. 1998). However, in this field, typical research tends to be description and explanation driven. It is contended that this type of research is inappropriate for solving the persistent managerial problems. As a result, the construction industry is overwhelmed by delay and often has suffered cost and time overrun. In their critical evaluation of previous studies on construction delay, Alsehaimi and Koskela (2008a) reported that the poor project management was a dominant and common reason for delay in construction projects. They criticised the previous studies as they fell short to provide clear recommendations demonstrating how project management practice could be improved since the majority of recommendations where made are general in nature and do not lead to a focus on a specific area (Alsehaimi and Koskela, 2008a; Alsehaimi and Koskela, 2008b). Consequently, these problems associated with management in particular, should be understood and efforts need to be directed towards developing solutions and more efficient methods of operation (Alsehaimi and Koskela, 2008b). Koskela (2008) reported that the solution of many difficulties in the construction problems seems to require certain research approaches rather than exploratory research. In this context, Alsehaimi and Koskela (2008c), suggested several courses of action for planning practice in construction need to be taken and they proposed that rather than solely explanatory studies, proper management techniques (i.e. Lean Construction techniques) could be practically implemented in non-traditional research approaches such as constructive and action research to tackle some of the persistent managerial difficulties in construction, enhance the performance of the practice, and contribute to knowledge in construction management research.

¹ Civil Engineer, MSc, PhD Candidate, School of the Built Environment, University of Salford, 4th Floor, Maxwell Building, Salford, M5 4WT, UK. A.O.Alsehaimi@pgr.salford.ac.uk

² Professor of Theory Based Lean Project and Production Management, Salford Centre for Research and Innovation (SCRI) in the Built and Human Environment, University of Salford, Salford, M5 4WT, UK, L.J.Koskela@salford.ac.uk

Research on Lean and LPS shows no evidence into its practical application within construction industries in the Middle East and Saudi Arabia. Therefore, to the best knowledge of the authors, the research here reported is the first application of Lean construction aiming to improve the practice and provide a basis for the development of research in the area of Lean construction in Saudi Arabia. This paper seeks to describe the process of implementing LPS via an action research strategy aimed of improving construction planning practice within two construction projects in Saudi construction industry.

This paper is organized as follows. Firstly, literature in Lean and Last Planner is briefly addressed. Secondly, the research method described, the two case study projects introduced, along with descriptions of the ways that the LPS was applied. Thirdly, benefits gained in terms of improving construction management practice are presented, the critical success factors for LPS implementation are examined, and the identified potential barriers for implementing LPS discussed. Finally, a comparison between the outcome of this study and some previous studies on LPS is briefly undertaken.

LITERATURE REVIEW (Lean Construction and Last Planner System)

According to Ballard (1994), one of the most effective ways to increase productivity is to plan more efficiently, improving production by reducing delays, getting the work done in the best constructability sequence, matching manpower to available work, coordinating multiple interdependent activities, etc. Lean Construction considers planning and control to be complementary and dynamic processes maintained during the course of the project. Planning defines the criteria and creates the strategies required to reach the project objectives. At the same time, control makes sure that each event will occur following the planned sequence. Re-planning must be done when the previously established sequences are no longer applicable or convenient. Feedback facilitates learning when the events do not occur as planned (Ballard 2000; Howell 1999). Howell (1999) argued that control is redefined from "monitoring results" to "making things happen". Planning system performance is measured and improved to assure reliable workflow and predictable project outcomes. In Lean Construction as in much of manufacturing, planning and control are two sides of a coin that revolves throughout a project:

- Planning: defining criteria for success and producing strategies for achieving objectives.
- Control: causing events to conform to plan and promoting learning and re-planning.

Ballard and Howell, 1994 states that better planning results from overcoming several obstacles common in the construction industry, including: 1) Management focus is on control, which prevents bad changes; and neglects breakthrough, which causes good changes. 2) Planning is not conceived as a system, but is rather understood in terms of the skills and talents of the individuals who are in charge of planning. 3) Planning is considered to consist of scheduling, not taking crew level planning into equal consideration. 4) Planning system performance is not measured. 5) Planning failures are not analyzed to identify and act on root causes.

One of the best known Lean techniques is the Last Planner System (LPS) which refers to the process of creating a master planning, phase, lookahead, and a weekly work plan through front-end planning, lookahead planning, and commitment planning, respectively, using Lean Construction Planning techniques (Ballard and Howell 1994). The Last Planner integrated components; master plan, phase planning, look ahead planning, weekly planning, PPC and reasons for incomplete, when all systematically implemented can bring many advantageous and add major benefits to construction management practice in general and planning practice in particular.

RESEARCH METHOD

Two case studies on an action research mode were conducted to examine the impact of LPS on improving construction managerial practice in two governmental facilities. An action research project emerges from and has to contribute to the practical concern of people and the solution of existing practical problems (Järvinen, 2007). Dick (2002) argued that action research is a flexible spiral process which allows action (change, improvement and research (understanding, knowledge) to be achieved at the same time.

Data was collected by conducting (a) interviews aimed to evaluate the current management practices, (b) attending the weekly meetings as a facilitator of LPS application over a period of eighteen weeks, (c) interviews with participants during the implementation process, (d) participant and non participant observation and (e) finally

conducting survey questionnaire to assess the stakeholders' perceptions on implementation of LPS. To justify the adoption of action research, the study aimed to contribute to practice, bring improvement to the managerial practice which could not be achieved via other research methods. Further, action research provides a richness of insight which could not be gained in other ways putting academic ideas into practice (Gann, 2001). Moreover, authors believe that organisations should benefit from knowledge and research advancements rather than being an actor in the processes being studied.

LAST PLANNER SYSTEM IMPLEMENTATION

The LPS was only implemented half-way through the projects. The research plan was to undertake the implementation process (facilitated by the researcher) in four phases with an evaluation being made at the end of each phase. This incremental implementation is believed to gradually stabilise the elements of LPS, minimise resistance to change, and have the additional advantage of providing an opportunity to evaluate each phase and take the lessons learned to the next one. In the first phase, workshop on Lean and training participants on the use of LPS were provided to highlight the issues and identify perceived advantages of Lean and LPS, after which there was two-weeks observation period to monitor the current planning practice, interviewed the participants and to make notes.

In the second phase, implementing LPS on site was facilitated by the author and it was agreed that PPC and reasons for tasks incompletion will be traced and recorded on weekly basis for a period of five weeks in an attempt to help the team in driving improvement to see how the LPS improves the planning practice. In this phase, the focus was on short-term planning and make ready only and little attention was directed to Look Ahead planning.

In the third phase, in addition to the weekly planning and make ready, two main components of LPS applied; Look Ahead planning was undertaken, and the phase planning was introduced. Phase planning sessions carried out through the project various phases aiming to provide certain goals in each phase and then work backward from the target completion date to achieve the proposed milestones.

The fourth phase focused on a survey questionnaire administered to evaluate the process of LPS implementation from participants' point of views aimed to allow all participants to self-report the achieved benefits, CSFs, and barriers to LPS implementation in the projects.

KEY FINDINGS

1. Weekly PPC and Reasons for Activities Incomplete

The researcher played the role of facilitator of implementing LPS over the period of approximately eighteen weeks in the two sites. In the first project, PPC rose from 69% in the first week to a level of 86% in the last week, peaked at 100% in the first week after introducing look ahead planning and then stabilised at the level of 86% for the last two weeks of the project as shown in Figure 1. In the second project and over the same period, PPC rose from 56% in the first week to a level of 82% in the last week, it reached the peak (84%) at the middle of the period and then stabilised above 80% for the last five weeks of the project, as indicated in Figure 1. In the figure, the PPC for the two projects combined together to allow for some comparison. Figure 2 presents the various reasons for non completion of planned tasks reported for the two projects. These most repetitive reasons for non completions were prerequisite, labour, approval, material, change priority, late or incomplete information and others with difference in the degree of importance between the two projects (combined in the same figure) as shown in figure 2.

2. Outcome of the Survey Questionnaire

The questionnaire contained ten questions, but due to space limitation only the questions related to the achieved benefits, CSFs and barriers for LPS implementation are covered here. Questions were formulated using a five-point Likert scale that requested opinion about different attributes gathered from the outcome of previous studies in LPS, from the literature in LPS and Lean construction, and from observation and notes taken during the involvement of the researcher in the implementation. In the first project, the sample is 26 respondents; from all parties involved. In the second project, 32 respondents from all involved parties contributed to the questionnaire. A key objective was to allow participants to self-report the achieved benefits, CSFs, and barriers to LPS implementation in the project. This is summarised as follow.

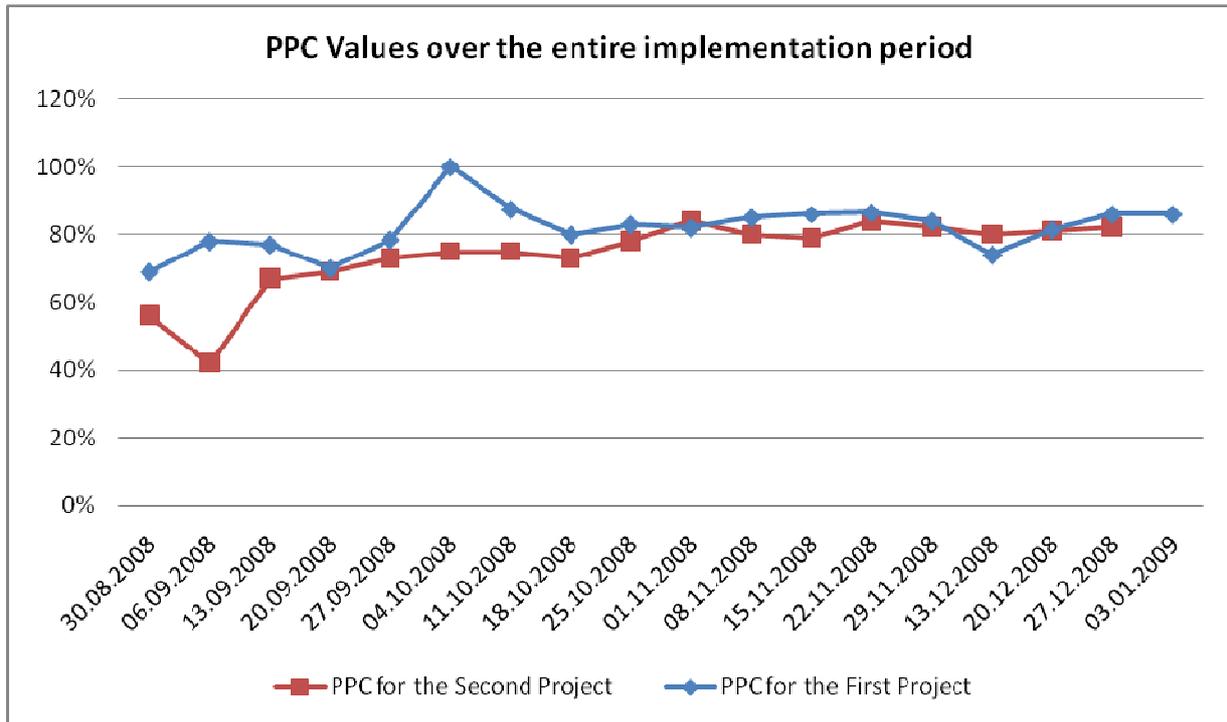


Figure 1: Weekly PPC Values over the Entire Implementation Period for both projects

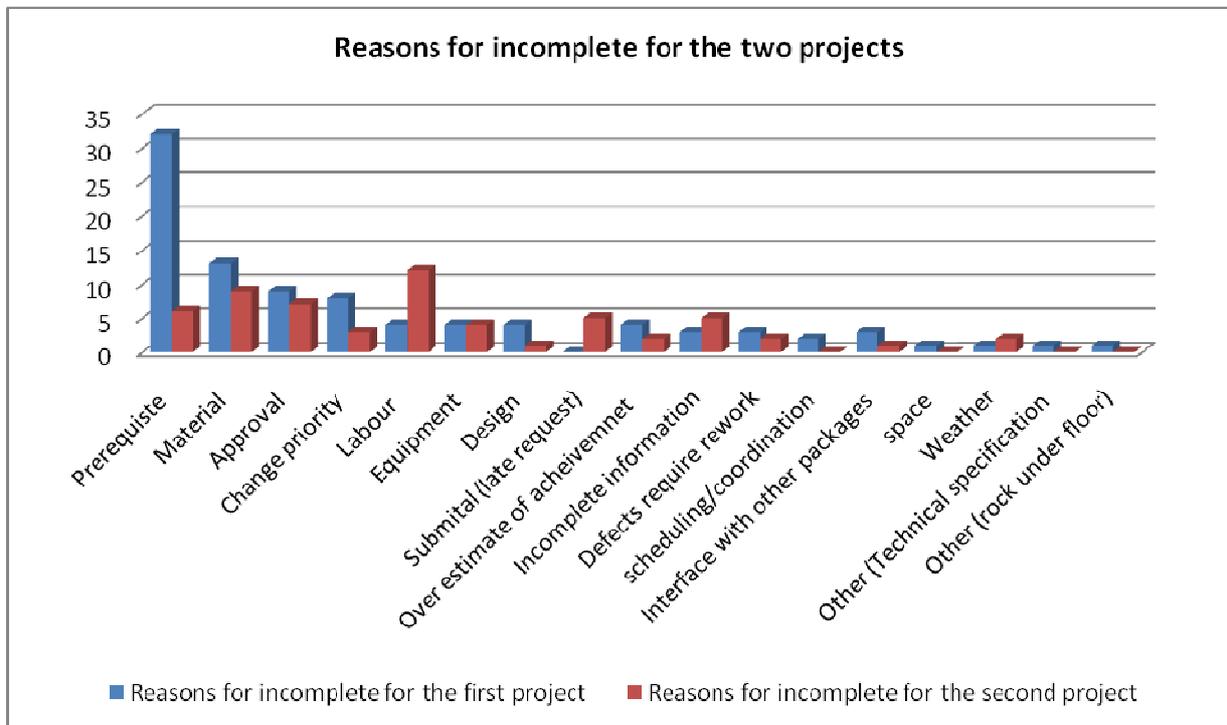


Figure 2: Reasons for Assignments Incomplete over the Whole Period in the Two Projects

3. The Achieved Benefits, Critical Success Factors (CSFs) and Barriers

One of the major conclusions that can be drawn from the findings is that the experience was very successful, had a positive impact on performance as reflected by the main achievements and the outcome of the implementation. Interviews with participants, observation by the researcher and survey questionnaire were all employed to investigate the achieved benefits, CSFs and barriers (table 1). In both cases, the benefits and CSFs are similar to a large extent with differences only in the degree of agreement. Numerous benefits were achieved including: improving planning and controlling practice, improving site management, improving productivity, enabling site supervisors to plan their workload, enabling accurate prediction for resources, improving learning process, preparing team members to be in collaboration, and reducing uncertainty.

The most important identified CSFs are top management support, commitment to promises, involvement of all stakeholders, close relations with suppliers and communication and coordination between parties. Also most of the identified barriers are common with disparities only in the degree of importance from one study to another. These include: the involvement of many subcontractors, lengthy approval process by client due to enormous amount of paperwork routinely involved between employees, cultural issues, commitment and attitude to time. The last two factors are probably what differentiates Arab culture from others, since in Arab societies, one or two hours delay and maybe days in some cases, is usual. It is normal to start meetings an hour late and most people accept this. However, this comes as a surprise for people with no experience in Arab countries. Such attitudes to time can have an impact on the implementation of techniques that are time-dependent and a commitment to this is crucial.

Table 1: The achieved benefits, CSFs and barriers for LPS in the two projects

Project	Benefits of LPS	CSFs of LPS	Barriers of LPS
(1) Faculty of Business and administrative science	<ol style="list-style-type: none"> 1. Enabling site supervisors to plan their workload. 2. Improving learning process 3. Improving planning and controlling practice 4. Enabling accurate prediction of labour 5. Reducing uncertainty 6. Preparing team members to be in collaboration 	<ol style="list-style-type: none"> 1. Top management support. 2. Commitment to promises. 3. Involvement of all stakeholders. 4. Communication between parties to achieve team work 5. Close relationship with suppliers 6. Motivate people to change 	<ol style="list-style-type: none"> 1. Lengthy approval procedure by client 2. Cultural issues 3. Commitment and attitude to time in Arab world 4. Short term vision
(2) Classrooms and laboratories	<ol style="list-style-type: none"> 1. Enabling accurate prediction for resources 2. Improving planning and controlling 3. Enabling site supervisors to plan their workload 4. Improving site management 5. Improving learning process. 6. Reducing uncertainty 7. Improving productivity 	<ol style="list-style-type: none"> 1. Commitment to promises 2. Communication and coordination between parties 3. Involvement of all stakeholders 4. Top management support 5. Close relations with suppliers 6. Manage resistance to change 	<ol style="list-style-type: none"> 1. Involvement of many subcontractors 2. Lengthy approval procedure by client 3. Commitment and attitude to time in the Arab region. 4. Cultural issues 5. Short term vision

Experiences from implementing LPS in the Saudi construction industry are to some extent similar to prior implementations in other countries (Ballard, 2000, Kim and Yang, 2005, Koskenvesa, and Koskela, 2005 and Jounir et al. 1998), but there are some novel emphases. Perhaps the most important reside in the identified potential barriers to the LPS implementation namely; involvement of many subcontractors, lengthy approval procedure from client (government departments), commitment and attitude to time in Arab world, and cultural issues. It was expected that the Multilanguage construction site can be a barrier but surprisingly it was not. The explanation behind this is that it was evident that the majority of engineers and site supervisors speak good English. On labour level, in case of any language-associated difficulties, drawings can be utilized for explanations and senior labour called as interpreters.

CONCLUSION

By means of collaboration between the action researcher and the studied organisations, improvement in quality of work practice, enhancement of managerial practice, knowledge expansion and learning have been achieved via action research process. The LPS technique proved that it could enhance construction management practice in various aspects and bring numerous advantages where the PPC's and the participants, views indicate this improvement. An important event that indicates the success of LPS implementation in the first project was the fact that the team were able to shorten the time of structure activities by about two weeks. Even there are some obstacles prevented the the achievement of full potential of LPS, the implementation process in the two projects was successful as demonstrated by the studies' results and the outcome of the survey questionnaire. Besides its contribution in improving the project management practice in the companies being studied, this study has made a valuable contribution to construction management practice in Saudi Arabia, and added to the theory of Lean construction and LPS, since it has reported the outcomes of implementation of LPS in an environment which differs from places where it has been implemented before. Additionally, the study developed a basis for the development of research in this area in one of the academic establishments in the country. This intended contribution to both theory and practice was the key reason for choosing action research in this study. The study's outcomes suggest the need for improvements in certain areas in the Saudi construction environment. Further, the results can be used as a reference for organisations which look forward to improve their managerial practice and the benefits of this study can be extended from Saudi Arabia to other countries particularly in Arabian Gulf Region and countries in the Middle East in general.

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