A SYSTEMATIC APPROACH OF CONSTRUCTION MANAGEMENT BASED ON LAST PLANNER SYSTEM AND ITS IMPLEMENTION IN THE CONSTRUCTION INDUSTRY

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Abstract

Lean Construction Management is a Continous Improvement System that has been around in the construction business since 1993 (Koskela, Theory-based 33), but initial resistance seems to have prevented companies from introducing the system. This research was performed so that Lean or other Continous Improvement Systems can be implemented in a more effective and smooth way so that future implementing companies and people can learn from past mistakes and successes.The Last Planner System is a product planning system with the purpose to produce a better flow of planning, production, and continuous improvement. Existing resistance of Lean Construction Management mainly originated from subcontractors and foremen who did the actual field work. Therefore, the greatest challenge to overcome is to understand their needs and wants. Consistent themes to overcome resistance were; having a worker in a leader position that knows the system well and is passionate about the implementation of it, using the Last Planner System as a first gradual step into becoming Lean mostly because of its benefits in improved collaboration, investing in conceptual training for foremen, and hiring people who know and care about what they are doing. The conclusion is that the implementation of Lean will create resistance, but by simply engaging foremen in the field the implementation will be successful.

Keywords—*Continous Improvement System, Construction Management, Last Planner System, Master schedule, Look-ahead schedule,Percent planned complete, Make work ready planning.*

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1. INTRODUCTION

The aim of the present study is to analyze the Last Planner System in reducing the construction complexities involved in the project and to analyze the last planner system to complete the project within the stipulated time and cost. The Last Planner workshops and seminars are designed to introduce participants to the five elements of the Last Planner are as follows:

- Master Scheduling (setting milestones and strategy; identification of long lead items);
- Phase "Pull" planning (specify handoffs; identify operational conflicts);
- Make Work Ready Planning (look ahead planning to ensure that work is made ready for installation; re-planning as necessary);
- Weekly Work Planning (commitments to perform work in a certain manner and a certain sequence); and
- Learning (measuring percent of plan complete (PPC), deep dive into reasons for failure, developing and implementing lessons learned).

2. LAST PLANNER SYSTEM

Last Planner Lean creates endless opportunities and this exploration is only able to cover a portion of the full complexity that CIS are (Mossman 19). The four principles that encapsulate LCM are all incorporated in LPS and is therefore a crucial concept incorporated in LCM implementations. The construction companies interviewed rarely pursued LCM in its full entirety, but LPS was consistently mentioned as the most helpful concept.

Koskenvesa and Koskela explain the potential impact of LPS: The Last Planner System endeavors to recreate the neat rectangular form of a task output, starting sharply, reaching the sustainable and stable output level immediately, maintaining it to the end, and thus finishing the task as planned, without any tail end.

Fig.1 Last Planner system

2.1 Methodology of LPS

LCI summarizes the LPS and its contribution in these five bullet points:

- Master Scheduling
- Phase "Pull" planning
- Make Work Ready Planning
- Weekly Work Planning
- Learning

2.1.1 Master Scheduling

As for any company, Lean or not Lean, the master schedule is first decided. Milestones are set and strategy chosen (Koskenvesa and Koskela 104) with the help some key trades.

2.1.2 Phase Pull Planning

Pull Planning is a phase "carried out in collaboration between different teams and subcontractors" and it "ensures that the best order of tasks is determined, and thus the risk of unforeseen interference between tasks is diminished" (Koskenvesa and Koskela 104). Practically this means that a company brings their subcontractors and foremen (those who are directly responsible for supervising work at the project site) all in one room to "pull" a schedule backwards and identify any constraints.

2.1.3 Make Work Ready

Planning This part of LPS is commonly known as "look-ahead planning" and exists to make sure that you can start critical activities on time or "that only tasks with all prerequisites available are actually started" (Koskenvesa and Koskela 104). This lookahead plan is recommended to be a minimum of six weeks (Barhsan 8).

2.1.4 Weekly Work Planning

These meetings are a common feature in any construction company, but in the LPS the weekly work plan meeting serves as a time to create work performance commitments ("The last planner", par. 1). This is the phase where the trades will be held accountable for their shared durations during Pull Planning (Barshan 8)

2.1.5 Learning

Lastly, LPS encourages monitoring and measuring. Percent of Plan Complete (PPC) is used in LPS implementing companies as a simple way to measure what percentage of

daily or weekly tasks trades have completed (Barshan 22). The learning phase is the phase where continuous improvements actually contribute to "the reduction of starting problems on longer term" (Koskenvesa and Koskela 104)

3. REVIEW OF LITERATURE

1.S M Abdul Mannan Hussain et.al (2014)(1), has implemented Analysis of lean construction by using Last Planner System in his case study and with the last planner tool project was completed within stipulated time and cost.

2. S M Abdul Mannan Hussain et..al (2014)(2), worked out on "Collaborative implementation of Last Planner System in construction industry and with this technique the resources were well utilized in the construction industry.

3.V. Gonzalez, L.F. Alarcon, F. Mundaca (2008)(3), has done the Investigating the relationship between planning reliability and improved the project performance without any delays as a result planning was very efficient in his case study.

4.L. Koskela(2000)(4), has done a research in exploration towarsd a production theory and its application to construction.

5.G. Ballard, G. Howell (1994)(5),Implemented stabilizing work flow in Lean Construction and with this technique he eliminated the wastes and this approach improves construction process with minimum cost and maximum value by considering customer needs.

6.Diekmann and Thrush, 1986(6), stated in their work that the project costs and schedule was'"under control"because of their planning and controlling techniques which results in saving the project cost.

4. COMMITMENT PLANS

Production control is grounded on commitments; the quality of the schedule is depending on the quality of the settled commitments (Lindhard and Wandahl 2013b). At the point when an activity enters the Commitment Plan a binding commitment is made. "It is crucially important that the sitemanager is prepared to the meeting and knows the construction stage and the impact on sequencing, critical path, and the other selection characteristics and is capable of drawing lines back to the previous plans. If these lines are not drawn there is actually no reason for conducting Phase Scheduling. If the sequence is changed the site-manager has to ask the critical questions to why these changes and adjustments are made. To do so, you will need to be prepared" and continuous "Even though you are prepared and know the process you want on beforehand, you still have to be open for changes and for details you might have overlooked. You need to allow the craftsmen to influence the process to ensure ownership to the schedule".

In the search for improved schedule quality the commitments have to be settled in mutual agreement and with the best possible information on hand (Lindhard and Wandahl 2013b). To procure the information the schedule has to be updated to reflect the construction site's current situation. Based on the completion stage of the individual activity adjustments in the schedule has to be made to avoid any upcoming conflicts in handoffs. Moreover, since the fulfillment of a precondition can change, a health check of the buffer should be implemented (Lindhard and Wandahl 2011).

4.1 Machinery

"Update and link shared equipment and machinery to each activity to ensure availability. Group the activities, in relation to machinery usage, to improve utilization rates. Evaluate the maintenance and consider the effect of the emergency plan and continuously seek for improvements."

4..2 Material

"Update needed material to each work activity and check for material availability. Consider site logistics and continuously seek for improvements."

4.3 Workers

"Make the final decision regarding the needed workforce to each activity and calculate next week's manning. Aim towards a steady manning throughout the entire construction project. Consider the effect of initiatives implemented, to improve the comfort of the individual craftsman, and continuously seek for new ways to improve them. "

4.4 Working conditions

"Update working areas and space requirements to each activity. Ensure that space is available by linking usage to the schedule. Consider the effect, of the initiatives implemented to improve the working comfort, and continuously seek for new ways to improve them."

4.5 Climate

"Consider the implemented climate precautions and scenario plans and update if relevant. When scheduling next week's work, use weather forecast to keep track of the short-term effect of the climate parameters. Constantly follow the weather and act if critical changes occur."

4.6 Safety

"Consider the selected safety precautions to the individual activity, and follow-up by site monitoring during the completion phase. Act immediately if anything critical is detected to hinder accidents in developing." By systematically integrating the procured information into the schedule, relevant changes are made and the quality of the commitments is increased as is the quality of the Commitment Plans which is the output of the process.

5. MODEL DEVELOPMENT

The Flow chart of Last planner system is shown in the figure.

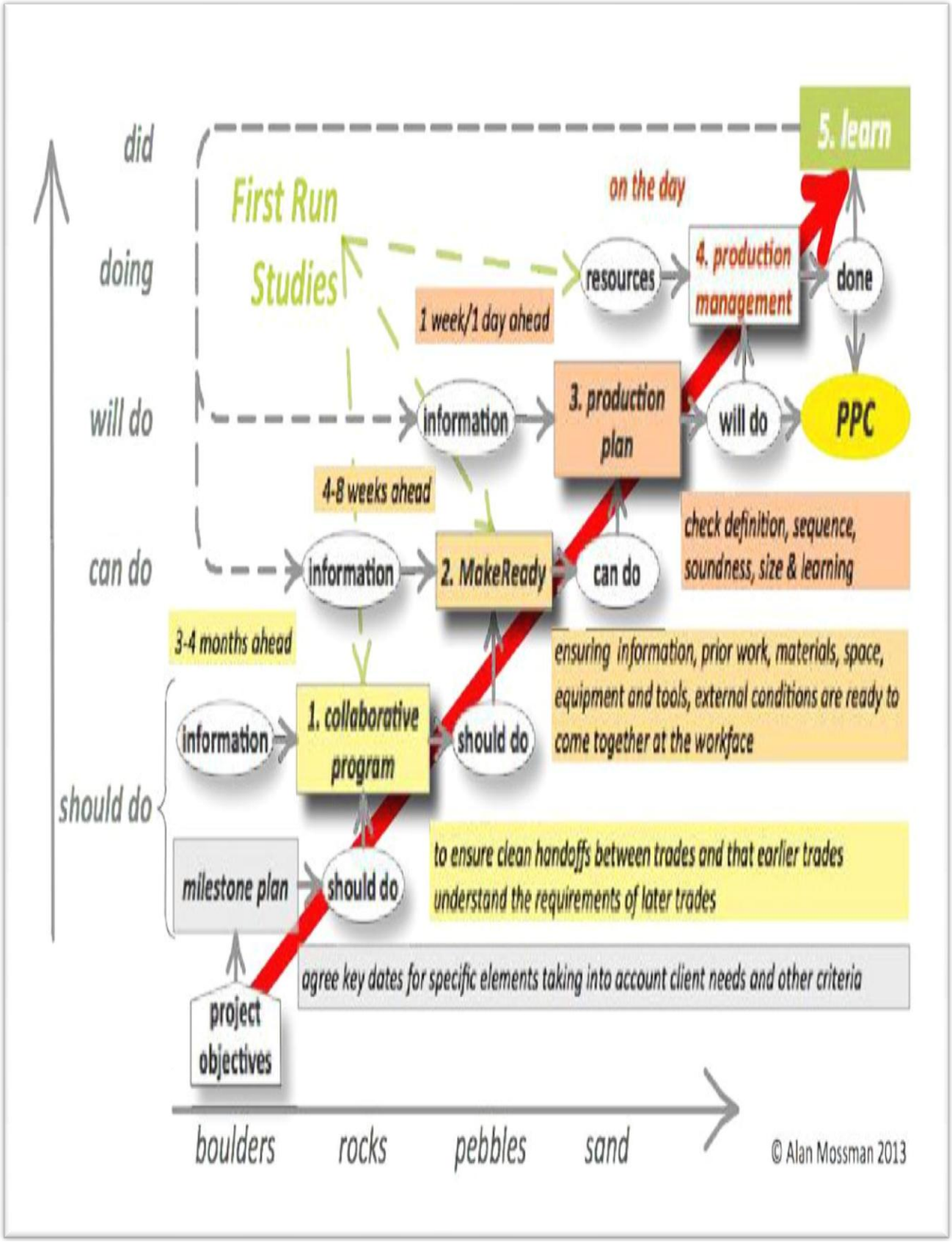

Fig.2 Model development of LPS

6. CONCLUSION

Due to the complex and unpredictable nature of the on-site construction process, production control is the art of the impossible. Multiple approaches have tried to control the process to eliminate the risk of time and cost overruns, but still none succeeded. A resent approach is the lean based production control tool LPS. Researchers within the field have since the late nineties published positive test result of the LPS approach. Despite the positive test results LPS does still not handle the construction process perfectly. Thus, construction projects are still facing perceptible problems such as: cost and time overruns, inadequate communication and collaboration, errors, defects and rework and low productivity. Even though improvement is needed, only little critique of LPS exists. Critique is necessary for improvement to occur. Therefore, in the search of excellence the following research hypothesis was raised: Production control in on-site construction can be improved; this can be achieved by improving the efficiency and effectiveness of LPS.

By looking into the current situation at on-site construction it was verified that production control in on-site construction can be improved. Errors were found to be significant. Moreover a lot of concomitant problems were registered: waiting, motion, cleaning, rectifying etc. which resulted in time- and cost overruns and chaos (Love 2002). Thus, errors induced negative variation in the execution process, and were subsequently registered as leading to low quality and rework resulting in an even more unpredictable, complex and chaotic construction process. Today's production control systems are neither able to reduce or handle errors nor able to reduce the concomitant problems to avoid the associated time- and cost overruns

7. SCOPE OF FUTURE WORK

An accurate planning can increase the productivity of construction activities, improve the utilization of resources. A comprehensive prediction of costs, planning are the main important factors for successful construction management. The Last planner system can be successively use by planning engineers to make the project schedules more predictable and increases the chances that work will flow and projects will be completed on time.

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