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A Review on Lean Construction technique:Last Planner System

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ABSTRACT: Lean construction is a relatively new construction management philosophy which has evolved from Lean manufacturing principles. Lean construction along with its various tools like the Pull Approach, Just in Time, Continuous Improvement, Last Planner System, etc. has gathered a lot of impetus in the developed nations. The challenge now lies in implementing it in the developing countries. The Last Planner System (LPS) is well-documented in the literature, and has sometimes been used to represent lean construction or lean project management. LPS aims to achieve reliable workflow by encouraging foremen to have a sense of ownership of the project programme and to build-in their commitment into it. Lean Construction method is considered the core principle behind the Identification and Elimination of various wastes in construction.

KEYWORDS: Lean construction, Lean Principles, Last Planner, Labour activities, target works

I. INTRODUCTION

As such when we talk of construction, the immediate characteristics that go in our mind are uniqueness, complicacy and end result inclination. In order to execute an activity, the first and foremost step is the thought of answering how, when and most importantly "by whom". Though modern constructions have started to improve the construction practice and procedures by means of mechanization, a large part of any activity is dependent on the construction workers, whom we will here in after refer to as 'Labours' throughout this paper. Lack of skilled labour and low productivity may seem to be the immediate cause of wastage of labour resource. This is significant mainly in the finishing activities of any building project, since the appearance and a feeling of good aesthetic is mind oriented which can be well organized only with the help of labours. As its name indicates, in LPS the decision making is given to the 'last planner' or foreman, so that he can add in details and commit to what can actually be achieved in the coming week (Ballard, 2000). More significantly, a working together environment of planning is nurtured for the exchange of information about the growth being made on site among different works and/or subcontractors during the planning exercise.

NECESSITY OF THE STUDY:

Planning defining criteria for success and producing strategies for achieving objectives. Control causing events to conform to plan and promoting, learning and re-planning. Better planning results from overcoming several obstacles common in the construction industry, including

- Management concentrate on control, which prevents bad changes and neglects gap, which results in good changes.
- One of the best known Lean techniques is the Last Planner System which has been displayed to be a very useful tool for the management of the construction process, and continuous detection of the planning efficiency.
- Planning is not originated as a system, but is rather understood in terms of the skills and talents of the individuals who are in charge of planning.
- The Last Planner components are master plan, phase planning, look- ahead and weekly planning.

II. LAST PLANNER SYSTEM

Last Planner System is a technique that modulates the system workflow of a project and addresses the variance in the construction. As the name suggests, the Last Planner is the person or the group, which is responsible and accountable for the planning operations at the root level through which the production unit is controlled and individual assignments are clearly specified. In the Last Planner System, the work flow of the planning system moves from the bottom level of constraint and variance analysis to the Master Schedule. The middle stages of planning such as the percent plan complete, weekly work plan, reverse phase schedules are altered in accordance with the root level planning. Hence, this system develops and creates an efficient schedule of planning

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framework with a pull technique, which regulates the workflow and sequence of activities and the rate of activity completion. Last planner system also correlates the process flow and capacity. It also creates new methods for execution of activities and sustains communication between trades.

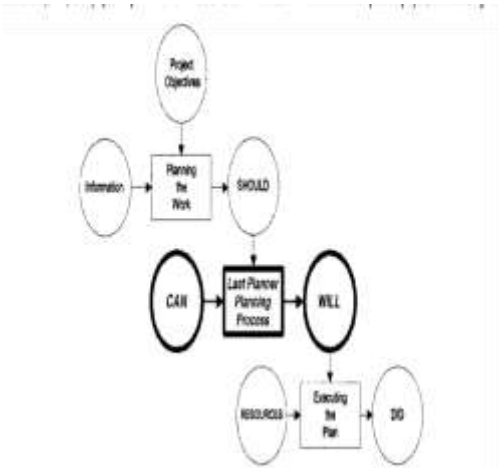
As stated by Ballard in his works on Lean construction, the Last planner system integrates the key words such as "Should" which indicates works to be executed according to the planned schedule, "Can" indicating activities which can be accomplished in spite of various constraints, "Will" indicating a definite commitment of the last planner and "Did" indicates the tasks that have been completed. The main role of the Last Planner tool is to bring about a realistic planning from the optimistic planning approach and this is made by scrutinizing the performance of workers not only based on their productivity but also their ability to achieve their goal in a realistic and a committed manner. The ultimate aim of the Last planner is to pull the activities by reverse phase scheduling method and integrated planning.

• **SHOULD**: tasks that need to be performed in the near future, according to the overall project plan. What should be done actually involves a push mind-set, on the basis of which, project tasks are pushed to execution. The works that should be done to achieve staged milestones are among some of the good examples that fall in this category. These "should-be-done" work items are derived from multiple sources, including the project objective, information, client input, as well as planners' past experiences.

• **CAN**: this process involves adjusting what SHOULD be done to what CAN be done. Efforts need to be made to screen tasks that have all their prerequisites ready—that is, where previous project steps are completed, the necessary materials are at hand, and the workforce is available. Only when all constraints are removed, can the tasks be allowed to proceeded, if the plan's reliability is to be improved.

• **WILL**: the tasks that are commenced before the next planning round.

• **DID**: the tasks that have been completed.



Moreover, LPS employs a four-level hierarchy of schedules and planning tools: the master plan, the phase (pull) plan, the look-ahead plan, and the weekly work plan (Ballard, 2000; Kenley and Seppänen, 2010). The four schedules are as follows:

1. Master and phase plan:

The master schedule is the overall project schedule, which isdeveloped from the design criteria and supports the client's project objectives. It consists of milestones and items with long lead times. Milestone dates are determined by using the "pull" process from successor milestones (Ballard, 2000). The plan is then developed by those responsible for building the phase together with subcontractors, starting backward from the planned phase completion date (Kenley and Seppänen, 2010). The process reveals what must be done to release work for production.

2. Look-ahead plan:

The Look-ahead plan represents an intermediate level of planning. It is a schedule of potential assignments, typically for the next 6 to 8 weeks (Ballard, 2000). The number of weeks over which a look-ahead process extends is determined by project characteristics, the reliability of the planning system, and the lead times for acquiring information, materials, labour, and equipment (Ballard, 2000). Thework is planned on assignment level, which means something that can be communicated to workers (Kenley and Seppänen, 2010). Management continues to break down the activities into more details and screen the resulting smaller activities throughout the look-ahead window, until the activities are essentially assignment-level tasks.

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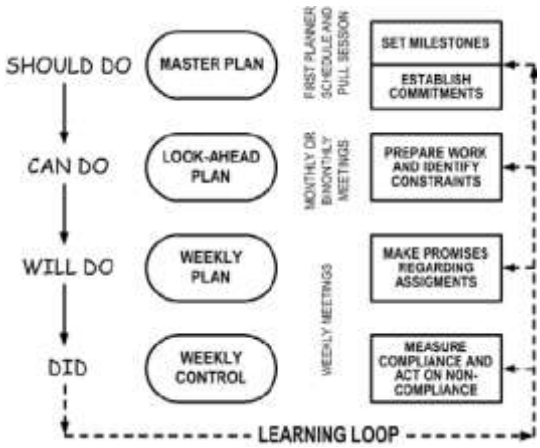
3. Weekly work plan (WWP):

The weekly work plan is an assignment-level schedule. Detailed schedules are derived from the look-ahead plans on a weekly basis. The WWP is formed based on the mechanism of LPS, which aims to transform what SHOULD be done into what CAN be done (see Fig. 2), thus forming an inventory of ready work. In the meanwhile, examination of the prerequisites can take place when this level of detailed schedule can be achieved (Kenley and Seppänen, 2010). A typical weekly work planning procedure proposed by Ballard and Howell (1998) should follow the principles including definition, soundness, sequence, size and learning. In addition, to review the previous weeks' work plan against what they have been promised in one earlier week is another important agenda during weekly meetings. LPS projects would rely on percent plan complete (PPC) to reflect the progress. More importantly, they would record the quantity and reason for any variation of each tasks on the weekly work plan.

4. Percent plan complete (PPC):

This is another key feature of the LPS, which tracks what is known as percent plan complete. It is calculated by dividing the number of completed assignments (what "did" get done) by the total number of assignments each week (what was projected "will" get done) and reasons are identified and acted on for failures to complete assignments. A high PPC means that the LPS allows for reliable forecasting of work, and that tasks made ready are being completed on schedule.



III. IMPLEMENTATION:

From this overall study the main objectives of implementation of LPS can be listed out as,

• Reduction in uncertainty related to projects and executive planning of the construction.

• To ensure the complete control of information and its adequate distribution.

• To create favorable conditions for the person involved in the project so that they are more compromised with goals.

• To allow action of rearranging to be planned and executed by construction personnel.

Production control is grounded on commitments; the quality of the schedule is depending on the quality of the settled commitments (Hussain S. M.). For the effective implementation of LPS it is of utmost importance that the last planner (site manager, construction manager etc.) is well prepared for WWP and has a clear idea about the construction stage and announce its impact on sequencing and the critical path and is capable of drawing lines back to the phase schedule. Even the last planner understand the process very well, he should be open for the challenges and details that he might have overlooked. For the preparation of the improved schedule the commitments have to be settled a mutual agreement with the best possible information in hand. Reliable commitments should be made related to the machinery, material, workers, working conditions on sites, climate, sector requirements on the sites etc.

LPS differs from traditional planning in that it assumes that the uncertainty of making predictions for the point at which all constraints are out of the way so that work can commence can only be removed in the final instance by the team leader responsible for providing the labour needed for any given task(Kalsaas B.) In traditional management system work stresses due to end date scheduling affects learning ability of an individual. Learning appears as a combination of organizations learning environment and individuals learning ability. According to Bo Trje Kalsaas's learning theory LPS can mitigate use of the experiential learning through Collaborative Management as experiential learning that is learning from the experience tends to close the door on experimentation. LPS should find its basis in learning theory as according to this theory LPS relates to an individual's ability of understanding and acquisition.

LPS implementation can be linked with the allocation and reduction of the activity time buffer. Time buffer is an amount of extra time added to the individual task durations to compensate for uncertainty and protect against variation. The time buffer is the difference between the schedule or a planned duration and the minimum duration possible (Russell M.). LPS can be promoted as an effective planning tool which

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directly attacks the source of uncertainty and improve the reliability of the plan through improved performances. More reliable plan will automatically reduce the amount of the variation which in turn will reduce the need for the large time buffers over the course of the construction project. Again the bottom-up planning approach of the LPS where last planners actually helped to create the schedule rather than having it dictated to them helped to reduce a lot more problems and avoid variation and large time buffers.

Implementation of the LPS can be enhanced by use of the social sub contract. It strengthens the social networks within the construction project which by default increases the collaboration among the parties involved. The interdependence between the trades involved in the construction industry is made worse by the traditional separation between the parties that is separation between client and contractor, designer and builder, Contractor and supplier etc. If we highlight this point the contractual relationship between consultant and contractor is more complex than the relationship between Owner and consultant because in consultant contract a relationship there is need to integrate different types of individual work and individual contracts. In the process of social sub contract contractor has given an opportunity to define the conditions they need for efficient workflow in consecutive WWP of LPS. These social sub contract conditions are mutually agreed and then a written agreement is signed by consultant, contractor and site engineer. This social sub contract document develops behaviour criteria to which consultant and contractor should commit. Thus it maintains the commitment because of social Shaming.

Implementation of LPS in conjunction with risk assessment matrix can help in reducing or eliminating the task duration variation. Variation, defined as the difference between what was planned and what actually happened (Wambeke B.). Variation is influenced by amount of uncertainty involved in tasks to be performed and this can affect the labour productivity significantly. Again variation cannot be completely eliminated from construction process hence some flexible provision must be provided for uncertainty involved. Use of risk assessment matrix prioritize causes of variation and determines which are most critical of them and can be removed. For this it tracks magnitude & reason of variation for each task in WWP of LPS. Metrics are provided for evaluation of variation in matrix for example horizontal axis represents frequency means no. of times particular reason has occurred and vertical axis represents severity or magnitude for that reason. It helps project manager to target most critical causes of variation for improved workflow.

BENEFITS:

Most common benefits observed from study are,

- Improved work flow
- Reduction in project delivery time
- Better collaboration and improved communication amongst parties involved in process
- Enhanced quality of work
- Step towards the knowledgeable learning instead of only experiential learning
- Revised supply chain management
- Reduced stress levels & fatigue on construction sites

IV. CONCLUSION

LPS proved to be very effective approach in planning, improving coordination amongst participants, better collaborative management and information flow. Analysis of this literature study shows that training for LPS in essential in order to achieve full implementation as alteration in participants work identity must be feasible with his previous desired work practice. Study reveals that LPS is not expected to have greater impacts when applied for shorter interval; repetition of look-ahead schedules ,WWP and PPC measurements with learning process will improvise work flow in longer periods of implementation as it will produce an experiential learning cycle.

Understanding the causes responsible for variation observed in learning phase of LPS and initiating appropriate action over these causes using applications of risk assessment matrix, excel spreadsheets, time buffers, information flow software's, social subcontracts , action research etc. will enhance effectiveness of LPS.

Top management plays the key role in successful implementation of LPS as adoption of this technique will reduce the power of autonomy by delegating the decisions to the involved participants in process. This study contributes in learning theory behind last planner system, understanding the key implementation factors, barriers to its full implementation and renowned benefits of Last Planner System.

BARRIERS:

Most common barriers observed from study are,

- Stubborn attitude i.e. resistance to change.
- Partial implementation of LPS.
- Faulty presentation of PPC components.

• Inadequacy in reliable commitments during LPS implementation.
• Non supportive top management in fear of delegation of authority.
• Inadequate use of information generated during implementation.
• Short term vision, bad work environment or lack of collaboration.
• Lack of training for LPS implementation or ill-defined understanding of system components.

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