A CASE STUDY OF LAST PLANNER SYSTEM IMPLEMENTATION IN NIGERIA

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ABSTRACT

The work described in this paper presents preliminary results of an ongoing Research project. It focuses on the implementation of Lean Construction (LC) technique to improve construction management practice in Nigeria. To achieve this, design science research strategy was undertaken with different data collection methods. These methods included direct observations, interviews, questionnaires and documentary analysis.

The research was carried out in a University construction site, where four prototype hostel buildings were being constructed simultaneously by four different contractors. LC technique via the Last Planner Systems™ (LPS) was adopted by one of the contractors in the construction of one of the hostel building.

The results reveal that the LC project made significant improvements in terms of; the timely completion of the project, 30% cost savings as against the others and an average Percentage Plan Completed (PPC) of 80%. These improvements were facilitated by the way the site was planned, managed and controlled using LPS. Last Planner System (LPS) is the most developed LC tool used in improving work plans and control of projects.

The paper concludes by discussing possible barriers hindering the full potential of LPS. These barriers include; lack of commitment to change and innovation, and starting off the implementation half way into start of the project. The critical success factors are also discussed and further research is being proposed.

KEYWORDS

Design Science, Last Planner System (LPS), Lean Construction (LC), management, planning.

INTRODUCTION

Basically, the construction industry in Nigeria has seen a decline in investment over the past 3 decades and the industry accounts for approximately 1.4% of the country's

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GDP (Oluwakiyei, 2011) and it is yet to realize its potential despite the huge deficits of infrastructure the country possess. Different authors have identified and enumerated the problems facing the industry.

Oyewobi *et al* (2011) – observed that the problems associated with the industry are mainly ethical and corruption issues in all stages of any project which is currently resulting in poor quality work, cost and time overruns.

Aibinu and Jagboro (2002); Odeh and Battaineh (2002) – identified the causes of 'delays' and 'wastes' within Nigerian construction processes. These 'delays' were identified to come from suppliers, while the 'waste' as a result of bureaucracy.

Olusegun and Michael (2011) – identified the root causes of abandoned projects which included: inadequate planning; inadequate funds; inflation; bankruptcy of contractor; variation of project scope; political factors; death of client; incompetent project manager; wrong estimate; inadequate cost control; faulty design; delayed payment of contractor and suppliers.

Aina and Wahab (2011), Windapo and Martins (2010), Dlakwa and Culpin (1990); Mansfield *et al* (1994) and Olomolaiye *et al* (1987); all identified different causes of problems ranging from: Inadequate planning; inadequate funds; inflation; bankruptcy of contractor; variation of project scope; political factors; death of client; incompetent project manager; wrong estimate; inadequate cost control; faulty design; delayed payment of contractor and suppliers etc.

These were mostly exploratory in focus and they dwelt only on the problems living out solutions to the problems mentioned. However, Alsehaimi *et al* (2009) identified that problems of this nature within construction are mainly as a result of poor project management theories. However, Howell (1999) had proposed that Lean Construction could be a solution to the limitations of project management theories. Lean Construction (LC) is defined by Howell and Reed (2007) as a way to manage work, reducing waste and adding value.

Thus Lean construction using its related tools and techniques is being proposed as a possible improvement to the problems identified above in the Nigerian construction sector. Although Ahiakwo *et al* (2012a) identified that the level to which clients in Nigeria perceive Lean Construction is very low and most of them are not even aware of the Lean principles or its corresponding tools. Conversely, Ahiakwo *et al* (2012b) reviewed the potential of implementing Lean Construction by practically implementing the Last Planner System within the Nigerian Construction industry. It was identified that there was a huge potential of solving the problems associated with the Nigerian construction sector if the Lean construction tools were practically implemented in construction projects.

It is thus on this basis that the author implemented the Last Planner System which is reported to be the most developed lean construction tool (Thomas *et al* 2003). The results from the implementation in comparison with similar projects also constructed simultaneously showed that the LPS project was completed within recorded time and within project budget.

LEAN CONSTRUCTION AND THE LAST PLANNER SYSTEM

Lean construction sprang up after lean production was applied to the construction industry on the limitations of the traditional project management techniques (Howell 1999). Lean Construction (LC) offered an advantage in the way projects were

planned and controlled, while meeting customer needs using fewer resources. 'Planning' in LC defines the criteria for success and creates strategies to achieve project objectives, while 'control' causes events to conform to plan, enhancing re-planning and learning (Howell 1999).

Planning and control in LC is practically achieved through the implementation of the Last Planner System (LPS). It has been successfully implemented in different developed and emerging countries. LPS offers the promise to make assignments ready while supporting short term planning and minimizing non-value adding work. It makes projects more predictable, minimizes buffers, reduces uncertainties, encourages collaborative planning, creates reliable work plans and decreases workflow variability (Ballard *et al* 2009; Gonzalez *et al* 2010; Mossman 2012).

RESEARCH METHODS

The Design Science Research (DSR) method adopted for this research involves the development of solutions that have practical and theoretical relevance. DSR is a research method for producing innovative constructions, intended to solve problems faced in the real world, thereby making contributions to the theory of the discipline in which it is applied (Lukka, 2003).

Generally, DSR has also been described as a research approach for conducting research in Lean Construction (Formoso *et al* 2012). In addition, Koskela (2008) states that to help solve the problem of relevance affecting construction management as a discipline, other than carrying out explanatory studies in the form of explanatory science, such studies should be positioned as a design science research. Similarly, Alsehaimi *et al* (2012) and Simeon (1996) point out that in order to connect research and practice while producing theoretical knowledge, research should be positioned as design science.

Furthermore, Holmstrom *et al* (2009) and Peffers *et al* (2007) proposed detailed steps for conducting DSR. These steps are:

- Problem identification & motivation
- Understanding the problem and defining the objectives for the solution
- Developing a solution and implementing it
- Assess the usefulness of the solution
- Assess the theoretical contribution of the solution

The basic idea is that DSR is not a linear process but involves two fundamental activities of 'Build' and 'Evaluate' (March and Smith, 1995). This research is being positioned as a design science research based on the argument of Hervner *et al* (2004) that an outcome or contribution of a DSR is 'the use of an existing solution in a new domain'.

Hence in carrying out this research, LPS which is an existing solution is being utilized in a new domain i.e. the Nigerian construction sector; which is fragmented in nature and characterized by poor project definitions, incomplete project designs, uncompleted projects and poorly completed ones.

LPS is implemented in a hostel construction project and the outcome of the implementation was compare with similar prototype projects carried out simultaneously that did not implement LPS.

Data was collected by conducting interviews, undertaking participant and non-participant observations, documentary analysis and finally through survey questionnaires (to assess the benefits recorded in the implementation).

CASE STUDY DESCRIPTION

BACKGROUND

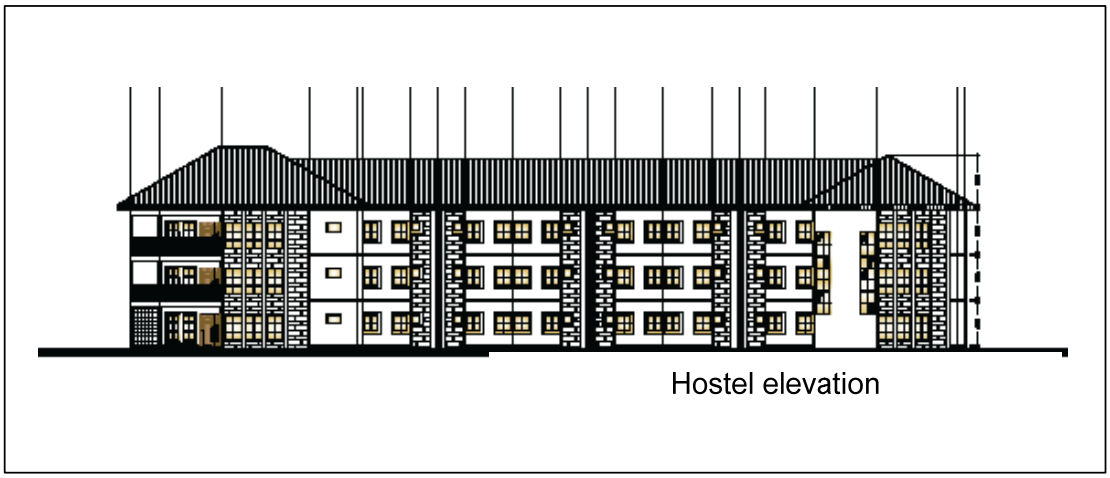

Figure 1: An elevation of the hostel building constructed by each contractor

The case was carried out in a Federal university in the North Central region of Nigeria. It entailed the construction of four prototype hostel buildings by four different contractors. An elevation of one of the project is shown in figure 1, The contact value for each of the contract was approximately N300,000,000.00 which is approximately £1,200,000.00 and with an estimated project duration of 18 months. The details of the four different contractors engaged in the four prototype hostel construction are shown in table 1 below.

Table 1: Characteristics of the four contractors

Code name for each contractor	CRT1	CRT2	CRT3	CRT4
Average no. of employee	80	120	200	85
Area of specialization	Buildings	Infrastructure	Engineering	Buildings
Years of experience	10	20	25	15

The fourth contractor with code name CRT4 agreed to implement the Last Planner System during the process of constructing the project. This implementation was facilitated by the first author and jointly implemented with CRT4 project engineer with a lot of assistance from the project manager.

The implementation commenced with the first author undertaking non participant observations; of the workflow patterns together with how site activities were coordinated. Then interview sessions were undertaken to ascertain the available planning, control and management practice within the organization before the LPS implementation commenced.

However, at the commencement of the implementation, participant observations were undertaken with the first author reviewing planning documents and attending weekly meetings. The focus was on short term planning hence only weekly work plans were executed, with the Percentage of Plans completed calculated at the end of each week.

Phase planning was introduced however only reverse phase scheduling and look ahead planning was undertaken throughout the implementation. This process lasted for 21 weeks and at the end questionnaires were administered to evaluate the LPS implementation.

RESEARCH FINDINGS AND RESULT

PERCENTAGE OF PLANS COMPLETED

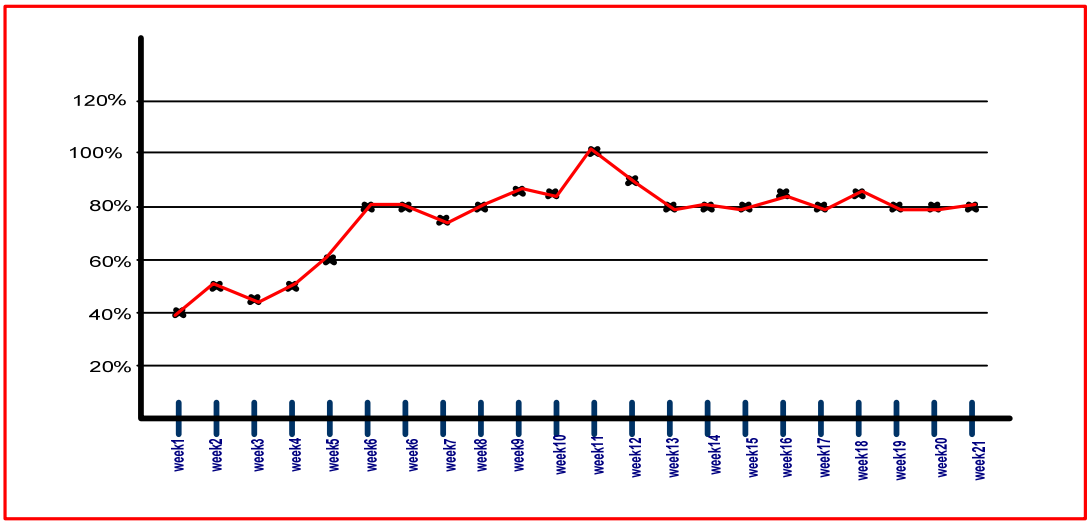

Figure 2: Weekly PPC values for the entire implementation

The Percentage of Plans Completed (PPC) started off low in the first few weeks. This was because most of the project team members were resistant to the LPS implementation. They were skeptical about the benefits the implementation was going to offer. However, this resistance was overcome during the implementation and this was primarily because of the keen interest of the PM. The PPC feedback charts gave him weekly progress of how the project was performing.

The PPC rose and stabilized at about 80%, however it peaked to 100% at the 16th week after the project team understood the need to keep promises and positive impact completed assignments had on the project. This made the project team meet targets; improved proactive site planning, facilitated control and the communication between all project stakeholders were drastically improved.

ANALYSIS OF REASONS FOR INCOMPLETE ASSIGNMENTS

The reasons for the incomplete assignments within the 21 weeks of LPS implementation for the project that adopted the Lean concepts are as shown in figure 3.

For this LPS project, material unavailability was the biggest or main reason for incomplete assignment. This was due to an excessive hike in prices especially that of cement and steel reinforcements. The distance from the project site to the nearest supply location for aggregates and other building materials was also the result for shortages of materials on site. This shortage of materials was however overcome by proper planning and requesting suppliers to deliver well in advance to allow for continuous work.

The second main reason for incomplete assignments was pre-requisite work. This was followed by labour supply for the reason that available workforce could not meet the project needs. Other reasons for incomplete assignments included submittals (late request), poor weather, and defects requiring rework, equipment breakdown and incomplete design information. Although this analysis for incomplete assignments were limited to category presented.

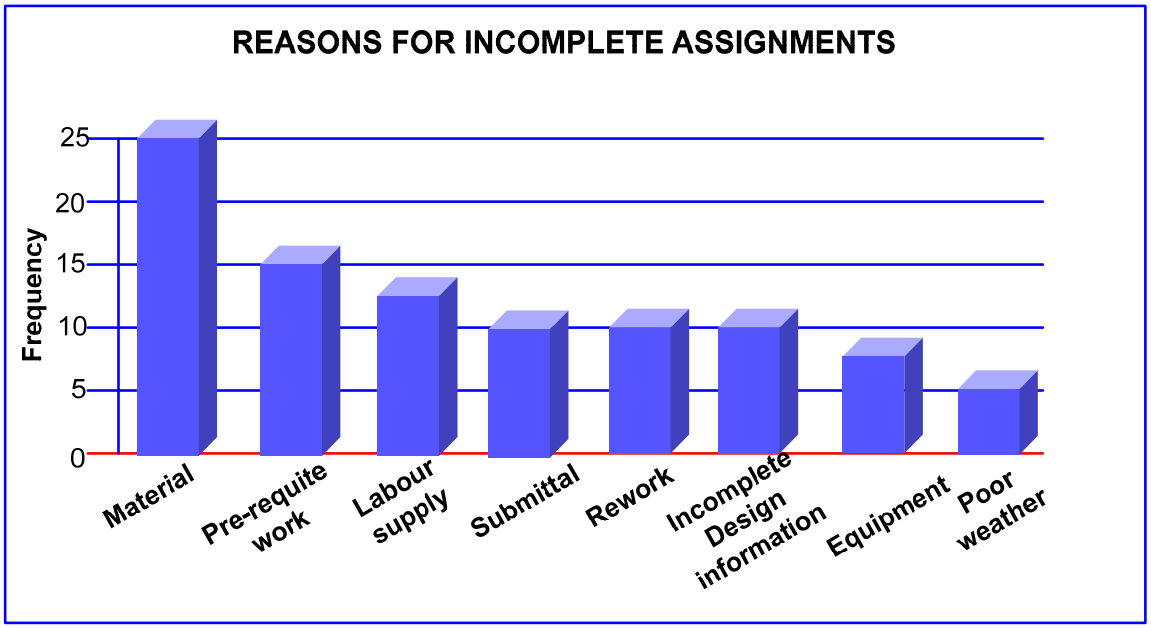

Figure 3: Reasons for incomplete assignments

COMAPARISON OF THE FOUR PROTOTYPE HOSTEL PROJECTS

Comparing the outcomes of the four projects, it was observed that CRT 4 i.e. the fourth contractor, produced substantial results in terms of time cost and quality performances. The contractor finished the project two months earlier than the completion date allocated to the project, though the project kicked off three months late.

In comparison the first contractor CRT1 who completed his project 5 months late and the second contractor CRT2 completed the project 6 months while the third contractor (CRT3) couldn't complete the project but abandoned it due to cost overruns.

On the other hand CRT 4 had a better allocation of resources, an organized flow and access of materials and this reduced interference amongst working teams. Making each team members were aware of what to do and when to do each assignment.

Although the four projects suffered from material shortages, the problem of Material shortage was overcome by the fourth contractor by engaging in short term and Look ahead planning together with regularly doing a constraint analysis to envisage possible constraints to the project before they occur.

Implementing LPS helped the project team to receive information regularly of the project success and failures during weekly meetings.

DISCUSSION

From the LPS implementation, it was observed that LPS promotes collaborative planning and advocates for learning from failures, which is vital for continuous improvement.

The LPS implementation started off after the project had already commenced with different trades already working. This was a major setback for the implementation process because bringing all parties working in the project to embrace a new system after they were already used to the traditional way of working. It was not an easy task, but the first author was appointed as the project coordinator by the client. This made the implementation process a lot easier. Hence there was a smooth transition from inducing the new management practice to adopting it. Obstacles were still encountered during the implementation and these included lack of commitment to change and innovation, unrealistic expectations and lack of top management commitment.

However, at the end of the implementation, everyone that participated enjoyed being part of the planning and decision making process. It was also observed from the interview sessions at the end of the process, training will be a key aspect of any successful implementation of LPS in Nigeria. Other factors include: awareness and enlightenment campaigns, a high level of commitment from the organizations management and formation of polices to suit Lean Construction adoption in Nigeria.

The implications of implementing LPS within the fourth project showed that LPS addresses variability of workflow and reliability of planning.

CONCLUSION

The study reveals the impact of implementing LPS within a construction project in Nigeria. The research took a different form from the conventional exploratory research method. DSR methodology was adopted to compare the impacts of implementing LPS in a project that entailed constructing four prototype hostels. It was revealed that LPS made plans more predictable while utilizing short term and look ahead planning. This was evident when the four projects were compared and it was observed that the three other projects did not anticipate foreseeable constrains (especially material unavailability). However, within the fourth project (CRT4) it was observed that the LPS managed the project by ensuring that possible issues were resolved before they become problems.

From the PPC data it was also revealed that material unavailability, pre-requisite work, labour supply, submittals i.e. issuing in late requests, poor weather, rework, equipment breakdown and incomplete design information were all constrains faced

within the project. However, LPS was able to identify these constrains on time and it minimized the effect on the project compared to the other three projects.

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