APPLYING LAST PLANNER® IN THE NIGERIAN CONSTRUCTION INDUSTRY

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ABSTRACT

The Nigerian construction industry has yet to adapt Lean Construction modern to eliminate or minimize waste and improve value. This makes shelter unaffordable to low-income citizens. This paper reports on and evaluates the effectiveness of implementing the Last Planner® System (LPS) in Nigeria by comparing it with the traditional method on construction of 300 housing units by the Yobe State Government of Nigeria in Damaturu. The effectiveness of LPS was measured in terms of time to complete 50 houses AND performance criteria. LPS proved superior even though most of the party's involve were not familiar with it. Wider interest in applying LPS and Lean Construction in Yobe State has developed in the top management staff of the Ministry of Housing. It was concluded that effective training and implementation in the application of Lean Construction techniques will reduce waste and non-value-adding steps from planning and design through construction. This will increase value and reduce the exorbitant cost and time to deliver structures.

KEYWORDS: Lean Construction, Last Planner System, Traditional method, increasing value, reducing material and time waste, Planning Production, Improvement.

INTRODUCTION

The Nigerian construction industry is facing serious problems. Profit margins are declining as the demand for housing and infrastructure increases. Construction contractors are declining to enter new contracts because of the uncertainty in the price of building materials will reduce further their profits. They are also experiencing increased disputes and claims due to variations.

The Yobe State Government launched a construction project of 500 housing units for low-income citizens. The Executive Governor challenged the Ministry of housing to develop a design and management planning system to deliver houses that were affordable for junior civil servants and other low-income citizens. A round table discussion including a cross-section of construction industry stakeholders explored the application of Lean Construction practices. This initiative drew on the idea of applying lean production to construction that has developed in the International Group for Lean Construction community since the early 1990s (Koskela 1992). This included understanding the difference between manufacturing and construction in terms of the nature of operations, planning and execution (Paez et al, 1995). LPS, the most developed tool of Lean Construction, stresses the relationship scheduling, planning and production control in order to produce predictable workflow was

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introduced in 1992 (Ballard 2000). While both traditional practice and Lean Construction aim to satisfy customers and reduce waste and time required, only Construction is based on production management principles (Howell 1999). Lean Construction gives better results even on projects that are complex, uncertain and quick projects (Salem et al 2005). While lack of knowledge is an obstacle in Nigeria, Lean Construction is well developed and its tool such as LPS are tested in the field and refined over two decades. Other tools such as daily huddle meetings, 5S and visual displays continue to develop.

BACKGROUND OF THE STUDY

The study is based on the on the construction of 500 housing units by Yobe State Government of North Eastern part of Nigeria. The desert encroaches on this state making some parts of it assessable only with strong four-wheel drive lorries and jeeps. The housing project was spread all over the state in 17 local government areas; State capital 300 units, 17 Local Government Areas each with 10 units and 2 Headquarter Zones each with15 units.

The pilot project was initiated by the Yobe State Government to increase the housing available in the state. The project include 200 blocks of two bed room bungalows, 100 blocks of two bedroom duplexes semi-detached, and 100 blocks of three bedroom bungalows, using Hydra Form block making machines to produced clay bricks. The vision of this project was “Building in value”. The professional staffs of Ministry of Housing were to plan the production management of the 300 housing units in the state capital. Six teams were formed, each to construct 50 houses, with responsibility of managing the production and materials schedule. This aimed to achieve maximum value of the end product.

The first author’s team used LPS to manage the production process. This included development of a Master Schedule. Phase Plans, Constraint Removal, Weekly Work Plans (WWP) and measuring PPC for improvement. Yobe State Aluminium Company provided the roofing and window subcontractor. Five teams used traditional methods to construct the remainder of each building. The management staff led the supervision of the project teams and assessed their performance.

LPS was used to plan the construction of 50 houses. The leader monitored the application of LPS implementation and gave feedback. The 50 houses managed with LPS had s significant impact in the project in general. On average, 7-10 people were attached to each stage of a house in order to cut down idleness. The Master Schedule of the 50 units was done in three stages; main structure, roofing, finishing and services. The duration of the project was planned and measured on five working days in a week. The total duration established for the project was 120 days in Master Schedule. The Reverse Phase Schedule (RPS) established a 90 day duration for each unit. All units constructed using LPS of management were completed in 65 to 72 days. None of the houses completed by the other teams using traditional methods of production management were completed in less than 120 days by 15 or more workers on each house. As a result, some of uncompleted blocks were handed over to the Last Planner team for immediate completion. The Last Planner team was lead by project manager on general planning and operational control.

IMPLEMENTATION

Intensive study and training on LPS implementations was conducted. The LPS was selected by the team for implementation in the construction of 50 houses allocated to the team in 300 housing unit projects. A comparative analysis is also made of other teams using traditional method. The data were collected through direct observation and interviews only in the process of operation and labour utilization. The data was compiled directly from schedules and huddle meetings in the construction process. The first author was the head of implementation team. Data was collected starts beginning to the end of the project. The data compiled on the implementation of the two approaches is shown Table 1 below.

LPS	Minutes of meeting, schedules, activity and its duration, completion date as per schedule, date completed, constraints and reason for failure to complete the assignment as planned, labour employed to each activity and result of interview.
Traditional method	Schedules, activity and its duration, completion date as per schedule, date completed, labour employed to each activity and result of interview.

Table 1: Management Practice Comparison

CONSTRAINTS AND THEIR SOLUTION

The project manager, who was the team leader on a 50 house blocks used LPS to reduce the cost and duration of the project. That aim was achieved, but the members of the team were not familiar with LPS. Therefore it was a tedious job for the project manager to monitor all activities. The team members were not happy with the new techniques during the project, but appreciated them at the end. Initially, the project manager had to document everything, including the sub contractor's work, as they did not want to participate in planning the work and recording the results. The team members did not expect that additional management tools would produce the project objective; it made their work more tedious. The project manager proposed an incentive to be given to committed staffs. This improved the participation of the project team in record keeping. Daily meeting were held and causes of failure to meet planned completion were identified. List of constraints were compiled and variance were identified and addressed. The result was generally satisfactory.

MANAGING THE CONSTRUCTION 50 LOW-COST HOUSING UNITS

To achieve the objective of the project, waste and non-value adding activities must be eliminated, a functional two-way communication must also be provided. With regard to this issue, the traditional scheduling method was replaced with LPS based approach technique shown in Figure 1 below.

The process steps are as follows; The Master Schedule was developed by the project manager based on time given to the team and experience on previously executed projects. The schedule, drawings, early warning chart, and construction methodology were all distributed to the team members before the RPS meeting. The LPS concept was linked to the objective of the project, and the procedure was

explained to the team before the RPS meeting. All the team members participated in developing the RPS activity program. The logic of the activities was identified and the sequence adjusted to requirement. Activities that dominate the critical path were identified, and the float provided for activities with uncertainty in the critical path. The Master Schedule is the guide for RPS production. Finally a detailed Six Week Look ahead (SWLA) plan is produced with constraints identified. The process was observed and new detailed schedule is produced as needed.

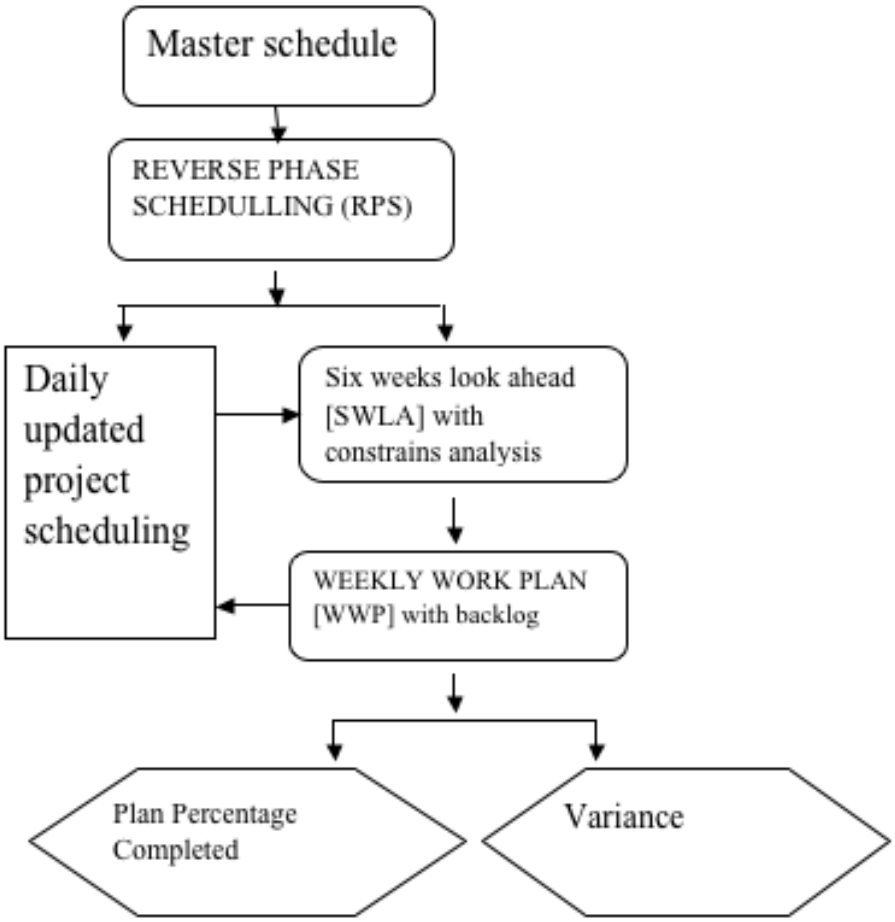

Figure 1: The Sequence of Last Planner (Salem et al. 2005)

The project manager developed the SWLA based on the RPS and Master Schedule. Constraints were recorded and analysed. The SWLA was distributed to WWP meeting members. All members of the team participate in WWP meeting every Monday including the Honourable Commissioner of the ministry of Housing. The WWP is compiled from the submission by different trades before the meeting. The meetings usually addresses the issue of planning process such as schedules, manpower, safety, construction, early warning chart and all other problems. The meetings are open and integrate two-way communications.

The project manager compiled the list of activities completed, updated and analysed the WWP and variance control table. Percentage Program Completed [PPC]

was calculated based on start and finished time of activity and circulated to members for discussion aimed at improving performance. See Figure 2 below.

RESULTS AND DISCUSSION

PERCENTAGE PROGRAM COMPLETED (PPC)

The weekly work program meeting is conducted weekly. The work was completed fifteen days before the RPS and four days before the Master Schedule.

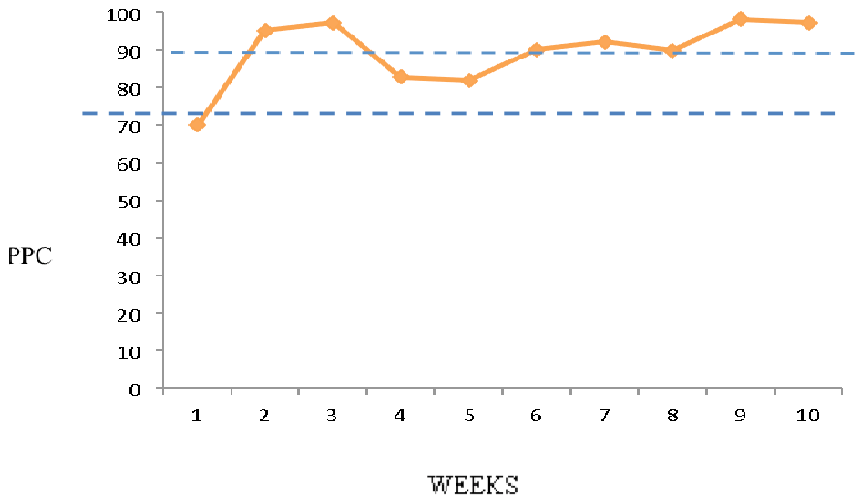

Figure 2: Percentage Program Completed

All values of PPC were above 70% and there were no interruption to disrupt the schedule. (Remember that the estimated schedule was based on knowledge of traditional project management. This was the main reason that activities are completed earlier than shown on the Master Schedule. The results were achieved because of the incentive offered to team members, two-way communications, team-work and common understanding. Problems resolved once in WWP meeting stayed resolved. Training and experience on Lean Construction technique and production management reduced the conservative estimates as the project progressed. The project manager solved higher-level problems and helped manage constraints due human error.

A program wide comparison is offered in Table 2 below.

Table 2: Comparative Results.

Schedules	LPS	Traditional method
Master Schedule	120 days	120days
RPS	79 days	-
Actual completion period	65 to 72 days	Not in less than 120 days
Worker Days to Complete 50 Units	Approx: 560 worker day (8 worker for 70 Days)	Approx: 1200 worker days.

Photo of the project with the first author in Photo 1. Photo 2 shows work not completed in 120 days.

Photo 1 50 blocks fully completed within 65 to 72 days using LPS.

Photo 2: Units not completed after 120 days expired

FINAL ASSESMENT

The Lean Construction technique is new in Nigeria, few professionals in the construction industry know about it. Implementation tends to be difficult and tedious. It involves training in both management and production using new materials. Therefore this assessment of a pilot initiative cannot be compared with and ongoing organized implementation process. The management approach was tested and assessed based on its contribution in achieving the objective of the project. The assessment rated this 50 house block as highly impressive when compared to the traditional method. LPS itself was assessed high due to its impact to the project objective of maintaining the scheduled completion of units.

CONCLUSION AND RECOMMENDATIONS

The paper reported the implementation of LPS as Lean Construction practice in the Nigerian construction industry. The author is the project manager and served as the Last Planner on this project. He was the only one having the knowledge of Lean

Construction techniques, but the support and commitment of management staff and workers demonstrate that this approach will reduce waste and improve profits in the Nigerian construction industry. All stakeholders in the industry should support the training and enlightening of all parties involved about Lean Construction techniques. They are the solution to the main problems faced in the industry. Research on the implementation of lean techniques continues, schedules, estimates and weekly work program are reviewed, and more tools are going to be tested. This year's budget includes plans to construct 1000 houses using these techniques. Some institutions have joined the ministry in its effort to eliminate waste and non-value adding steps in the industry to get low cost houses for its citizens.

REFERENCES

Ballard, G., and Howell, G. (1997). "Implementing Lean Construction: improving downstream performance" Lean Construction, Alarcon, L. (ed), A. A. Balkema, Rotterdam, The Netherlands, 111-125.

Ballard, G. (1999). "Improving work flow reliability" Proc., IGLC-7, 7 Conf. of Int. Group for Lean Construction, Univ. California, Berkeley, CA, 275-286.

Ballard, G., and Howell, G. (2003). "An update on Last Planner" Proc., IGLC-11, 11 Conf. of Int. Group for Lean Construction, Blacksburg, VA <http://strobos.cee.vt.edu/IGLC11> (Mar. 5, 2004)

Blacksburg, VA. 418-426. <http://strobos.cee.vt.edu/IGLC11> (Mar. 5, 2004).

Schwaber, K. (2002). Agile Software Development with Scrum. Prentice Hall. Upper Saddle River, NJ.

Koskela, K. (1992). "Application of the new production philosophy to construction" CIFE Tech. Rep. No.72, Center for Integrated Facility Engineering, Stanford Univ., Stanford, CA, 4-50.

Koskela, L., Howell, G., and Dr. Tech. (2000). "Reforming project management: the role of Lean Construction" Proc., IGLC-8th Conf. of Int. Group for Lean Construction, 8 Brighton, Brazil

Moser, L., and Dos Santos, A. (2003). "Exploring the role of visual controls on mobile cell manufacturing: a case study on drywall technology." Proc., IGLC-11, 11th Conf. of Int. Group for Lean Construction,

O. Salem, J. Solomon, A. Genaidy, and M. Luegring (2005). "Site Implementation and Assessment of Lean Construction Techniques." *Lean Construction Journal* 2(2). 2 October 2005.

Paez, O., Salem, S., Solomon, J., and Genaidy, A. (1995). "Moving from Lean Manufacturing to Lean Construction: Toward a Common Sociotechnological Framework." *Human Factors and Ergonomics in Manufacturing*, 15(2), 233-245.