

CRITICAL REVIEW OF POTENTIAL FOR IMPLEMENTATION OF LEAN IN THE NIGERIAN BUILDING INDUSTRY

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ABSTRACT

The concept of Lean Construction has been observed to improve workflow reliability, planning and control, particularly in developed and emerging countries like USA, UK, Korea and Brazil. It has been a useful means of achieving project duration reduction and improved cost and quality performance.

Predominantly, the Last Planner System, process mapping and other collaborative planning tools of lean construction were utilised in these projects and they accounted for the successes of these projects. However, within under developed and a few developing countries the situation is slightly more at variance. Using Nigeria as a case study for example, the general perception at the moment is that the building industry is mainly characterised by poor project definitions, incomplete project designs and waste generation resulting in uncompleted building projects or poorly completed ones.

This paper commences with a review of how lean was applied and why it was successful in the countries identified by previous studies. It then progresses to further review what is currently obtainable in the Nigerian building industry. This then led to a process of addressing the applicability of lean tools within the Nigerian building industry.

The results from the review reveal the potential for the application of lean tools within the industry. Sequel to this, the author proposes that Last Planner System of lean be implemented via action research within building industry of Nigeria. It is on the basis of this that further research is being proposed to address this concern.

KEYWORDS

lean construction, Last Planner, Nigeria, workflow

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INTRODUCTION

The Nigerian construction industry accounts for approximately 1.4% of the country's GDP and the industry is mainly dominated by small and medium size contractors operating locally and are involved mainly in private residential building projects (Oluwakiyei 2011, Olatunji 2008, Dantata 2008).

Typically, building projects within the country are handled by private clients who engage only hired artisans and labour, with the owner in some cases directly supervising the project. On the other hand, experienced and established contractors also exist within the industry and this group of contractors are legally registered to carry out construction projects and are usually made up of highly skilled workers, both expatriate and local (Dantata 2008).

Over the past decades, the building industry within Nigeria has been characterised by poor quality work, cost and time overruns (Oyewobi et al. 2011), resulting from poor project definition during planning (Olusegun and Michael 2011, Oke and Ogunsemi 2011), incomplete designs during the design stages (Aina and Wahab 2011, Windapo and Martins 2010), unethical behaviours in the form of fraudulent practices and kickbacks (Mansfield et al. 1994, Olomolaiye et al. 1987), waste generation due to bureaucracy, variations, delay from suppliers and poor site management (Oke and Ogunsemi 2011, Dlakwa and Culpin 1990).

Although these problems are peculiar to Nigeria and some other countries (especially within Africa) suffer from similar low productivity in terms of costs, delivery time and quality of buildings produced. However, Ballard and Howell (2003) acknowledged that lean construction have made an immense contribution within the construction industries of developed and emerging economies like UK, US, Australia, Brazil, Finland, Singapore, Peru, Chile, and Denmark. Furthermore, some other developing countries like Singapore, Ecuador, Indonesia and Columbia has also recorded improvements after implementation (ibid).

It was observed that lean construction in recent times has attracted a lot of attention in the building industry as it tends to increase construction's process reliability, reduce total lead times and improve the quality of projects produced (Sacks and Goldin 2007). Researchers (AlSehaimi et al. 2009, Alarcon et al. 2005, Salem et al. 2005, Ballard et al. 2009, Gonzalez et al. 2008, Loong et al. 2010, Yu et al. 2009, etc.) have investigated the implementation of lean tools within developed and emerging countries. The results have been positive and it was observed to improve the performance of projects where they were applied.

This study forms part of an on-going PhD research on Lean construction in Nigeria and it assesses the potential for the implementation of lean tools within the local companies in the building industry. It commences by examining the advances of Lean construction in developed and emerging countries. It then delves into a description of the Last Planner System (LPS) as a Lean tool and reviews the benefits LPS offers with the potential hindrances its application within Nigeria is posed to face. It then proposes an Action research frame work for the implementation of the LPS within local building construction companies in Nigeria.

ADVANCES OF LEAN CONSTRUCTION

Lean construction implementation in developed and emerging countries has been identified by Alarcon et al. (2005) to improve the entire construction process, from

planning to procurement up till the actual construction and hand over. Within the construction industry, building construction (which accounts for majority of projects within the industry) has formed a sub-industry termed building industry primarily characterised by residential and building projects. In view of this, Sacks and Goldin (2007) stated that the building industry has become a prime candidate for lean construction.

Similarly, other studies have shown that the adoption of lean within the building industry of other countries have improved labour flow reliability (Thomas et al. 2003), improved planning reliability and project performance for better productivity (Gonzalez et al. 2010, Ballard 1999) by maximizing value and reducing wastes (Koskela 1992).

Certain benefits and improvements a few countries are currently enjoying by adopting lean construction within building projects are shown in table 1. The table was compiled as a result of the extensive literature review; this was related to part of this work.

Table 1: Benefits of lean construction in building projects

s/n	Benefits Of Lean	Project Type	Country	References
1.	Reduction of expected total construction time and cost	Residential buildings	Brazil	Conte, (2002).
2.	Drastically improve workers safety, customer satisfaction, increased value and lower costs	Housing construction	Demark	Bertelsen (2002)
3.	Reduction of cycle time	Building projects	USA	Walsh et al. (2003)
4.	Improved structure and promoted discipline in planning	Building projects	United Kingdom	Johansen et al. (2003)
5.	Improved reliability of planning and executing projects	39 low rise building, 15 high rise, 11 heavy construction and 12 light industrial projects	Chile	Alarcon et al. (2008)
6.	Improved planning and work flow reliability	Heavy civil construction project	Korea	Kim and Jang (2005)
7.	Increased process reliability, reduced total lead time and improved quality	Residential buildings	Canada	Yu et al. 2009
8.	Improved supply system, flow of construction process, minimising waste	Structural steel industrial houses	USA	Tommelein and Weissenberger (1999)
9.	Reduction in project duration and cost, improved communication flow.	Industrialised houses	USA	Chen et al. (2004)

CRITICISMS TO LEAN

Despite the benefits recorded above, lean construction has been criticised as being immature, basing its concepts on value and being promoted from a one-sided positive view (Green 1999, 2002, Green and May 2005). Stuart D. Green, a major critic of lean, questioned its promotion in a number of his publications by highlighting how the application of lean practices within construction has paid little attention to its

implications to human resources allegations in its application within production (Green 2002, Green and May 2005).

Green's debate is titled *'The Dark Sides of Lean Construction: Exploitation and Ideology'*. There he claims construction researchers are mainly shaped and controlled by the prevailing ideology of neoliberalism and that the lean construction philosophy is based on a selective elucidation of available literature (Green 1999). However, in Howell and Ballard's (1999) paper titled *'Bringing Light to the Dark Side of Lean Construction: A Response to Stuart Green'*, the authors argue that early enthusiastic adapter of lean would have made the mistake of presenting it as an ideology. However, 'lean' aims to control variation of workflow used in delivering custom products. Furthermore, they argue that Green missed the fact about the foundation of lean which they claim sprang from the physics of production and is based on how things are made not how people are treated. It was argued elsewhere (Terry and Smith 2011) that 'the respect of people', was inherent in the 'value' of lean construction as opposed to the claims of Green (1999, 2000). Lean construction was also perceived to build up the skills of workers by encouraging active participation of the work force in understanding how work is configured and organised to yield value (Jorgensen 2006).

Lean champions also argue that the negative impacts created by lean in production do not necessarily transfer to lean in construction (Terry and Smith 2011). It was argued that opposite to lean production, some of the techniques used within construction offer a different solution. An example is Just-in-Time system of production which is supposed to eliminate waste in time and inventory by removing buffers. Whereas, the LPS which is attributed to lean construction uses buffers strategically to reduce workflow variability thereby increasing predictability and plan reliability (Ballard 2000, Ballard et al. 2009, Alarcon et al. 2005).

It was also identified in table 1.1 above, that the LPS was the major lean tool/technique used within the recorded projects that brought about high productivity and benefits recorded. Similarly, Ballard and Howell (1998) stated that the LPS was a valuable lean tool used in improving planning and controlling of construction projects.

LAST PLANNER SYSTEM (LPS)

The main aim of the Last Planner System (LPS) is to improve productivity within systems (Ballard 1994). It was based on lean principles and used as a system for production planning and control to overcome issues usually recorded within projects and also decrease the impacts of workflow variability within projects by creating an improved and reliable work plans (Ballard 2000). It was identified in Gonzalez et al. (2008) that planning reliability is positively related to the performance of any project, whereas, Ballard and Howell (1998) identified that improving planning reliability means improving workflow reliability.

Furthermore, the LPS has been argued to be the most developed practical use of lean construction (Thomas et al. 2003). It addresses variability of workflow and reliability of planning. It operates with buffers in the form of 'workable backlogs' that level the workflow by buffering against unpredicted plan variation. It develops a work plan using 'should-can-will' analysis. The 'should' shows all the work to be carried out, but in most cases restraints arise which limit the work that 'can' be done. Then LPS works in such a way that it makes a commitment to the work that 'will' be

done. The PPC calculates the ratio of tasks ‘did’ to the task that ‘will’ be done. A low PPC shows poor planning and the reasons for poor results are investigated to promote better planning (Ballard 2000, Ballard and Howell 2003, Salem et al. 2005).

The basic function of the LPS thus is to make projects more predictable, minimise buffers, reduce uncertainties, collaborative planning, creating reliable work plans and decreasing workflow variability and maximizing project benefits (Ballard et al. 2009, Gonzalez et al. 2010). The major tools LPS uses the are: Percent Plan Complete (PPC), constrain analysis, reverse phase scheduling, task hierarchy, first run studies, daily huddles, reliable promises and 5 Whys analysis (Ballard et al. 2009).

The full details and workings of the LPS have been described in different perspectives in a number of publications (Ballard 1994, 2000, Ballard and Howell 1998, 2003, Ballard et al. 2009).

LPS has gained considerable popularity in terms of its implementation within building construction projects. It has been successfully implemented in different developed and emerging countries as shown in Table 1. Similarly, Forbes et al. (2002) also reported that the LPS specifically improved quality control of a 2001 housing project in Quito, Ecuador. In another project at Avenida Ayrton Senna in Rio de Janeiro, LPS was utilised during the construction of a Mc Donald’s restaurant and Forbes et al. (2002) also observed that the use of LPS within the project reduced the project’s duration, rework and interference among working teams while improving site organization and resource allocation.

Conversely, within underdeveloped and a few developing countries with exceptions of a few (Brazil, Ecuador, India, Peru, Chile, etc.) this situation is very different, though building construction projects are facing serious challenges in terms of poor quality work, time and cost overruns within these region particularly in Africa. A typical case study is the Nigerian construction industry where different researchers have numerated the different problems currently experienced there. The proceeding section of this study fully discusses this.

NIGERIAN BUILDING INDUSTRY

The building industry in Nigeria (the experienced and established building contractors) predominantly uses the traditional management approach for scheduling work plans. In this approach, activities and tasks are scheduled in terms of what should be done from the master plan without actually considering what personnel or worker would be able to carry out the task (Gonzalez et al. 2010).

This workflow pattern has made the industry record delays in project completion, cost overruns, abandonment, ethical issues and poor quality work (Oyewobi et al. 2011, Olusegun and Michael 2011, Aina and Waha 2011, Windapo and Martins 2010 amongst others). These problems have been grouped mainly into poor planning and workflow variability (Olusegun and Michael 2011). Workflow is said to encompass the entire material, information and equipment resources used within the projects (Thomas et al. 2003). As identified in Aibiun and Odeyinka (2006) variability within workflows in Nigerian projects negatively affect how crews perform causing ineffective work, delays and the project completion time.

Similarly, Thomas et al. (2003) showed that workflow reliability is an important factor to construction performance and that the way labour performs within any project generally affects the cost and schedule performance of the project. This, the

author identified was as a result of the way the contractor manages their workforce, emphasising that labour flow is essential to the performance of the project. Hence it is perceived that the some efforts should also be given to improving the reliability of labour flow while improving workflow and work plans (Thomas et al. 2003).

In recent times, researchers tend to adopt the constructivist approach characterised by participative and collaborative practise for the practical implementation of the LPS since it improves workflow of construction sites (AlSehaimi et al. 2009). However, within the Nigeria, research is yet to show where or how lean construction or LPS has been implemented within construction projects especially in building construction despite the advantages it possesses.

Although Suresh et al. (2012) and Olatunji (2008) recorded the level of clients' awareness about lean construction within Nigeria. It was observed that their level of awareness was very low and clients have been recognised to be the core of construction since they are the driving force for construction improvement (Othman 2011). Hence, if clients undertook adequate project planning and control of their building projects using improved planning tools (like the LPS) that lean offers based on successful experiences in other countries, the issue of abandoned project, quality of the project, cost and time overruns would be minimised if not completely eliminated.

Hence, this research proposes the implementation of the LPS in Nigeria via an action research approach. However, implementing the LPS within Nigeria is feared to be faced with a number of challenges. These challenges are discussed below.

BARRIERS TO THE IMPLEMENTATION OF LPS IN NIGERIA

Limited literature explains the barriers to the implementation of LPS in Nigerian building industry. However, Suresh et al. (2012) identified some barriers to the implementation of lean construction within Nigeria. These barriers include: shortage of technical, skilled and professional workers, pitiable wages and salaries, clients uncertainty and inconsistency, poor organisational structure and management, poor government control and enforcement of regulations. These barriers could be grouped into three major groups similar to the barriers recorded in Othman (2011) which include:

1. Organisational resistance
2. Inadequate executive sponsorship
3. Unrealistic expectations.

To overcome these barriers however, Suresh et al. (2012) identified that a protocol has to be in place which should embrace client's awareness and enlightenment, trainings and practical sessions and tool implementation and monitoring. Similarly, Othman (2011) recognised that to overcome these three barriers:

1. A clear case for LPS has to be developed and people should be adequately trained and involved within the implementation process.
2. The financial benefits of implementing LPS should be clearly stated to the executive.
3. Reasonable time scales and limits should be set for the improvement period.

PROPOSED METHODOLOGY

In view of the benefits of implementing the LPS and with the current level of development within the Nigerian building industry, it is perceived that lean construction tools (e.g., LPS) has a potential for implementation in Nigeria. Therefore the researcher hopes to adopt a constructivist approach (via an action research) to explore the implementation of LPS within the Nigerian building industry.

An action research (AR) is an established qualitative research method used for scholarly enquiry by building and testing theory with a perspective of solving practical problems in a real setting Azhar (2007). Although Rapport (1970) argues that it is usually difficult to strike a balance between the organisations needs and that of the researcher within the AR, Azhar et al. (2010) identified that AR is a problem solving approach that promotes collaboration between practitioners and the academic research.

An AR usually proceeds through five-level circulatory stages: Diagnosing, action planning, action taking, evaluating and specifying learning. These stages are defined below (as sighted in Jang et al. 2010, Azhar et al. 2010, Azhar 2007) and they reflect the specific plans the author proposes to undertake for this study:

1. Diagnosing – this would entail analysing the current situation to identify the primary research problem. This diagnosis would be in the form of a pilot study.
2. Action planning – this involves setting up plans based on the theoretical assumptions identified from the pilot study.
3. Action taking – the planned action is implemented with a collaboration of the researcher and the practitioners.
4. Evaluating – the researcher and practitioners critically evaluates the outcome of implementing the plan.
5. Specifying learning – the knowledge gained from the action research is used for further research and the theoretical frame provides knowledge to the scientific community.

Taking a leap from what Alarcon and Seguel (2002) and Alsehaimi et al. (2010) proposed in their research, an action research framework integrating the implementation of LPS was thus proposed for this research. The five interrelated phases to be imbedded with the LPS are shown in figure 1. It is envisaged that the LPS could be implemented using this AR frame work within local construction companies currently handling mega building projects in Nigeria. Specifically those encountering peculiar labour flows, workflows and planning problems would be targeted to ascertain if the LPS could improve these peculiar problems. The pilot study is expected to underpin the identification of these problems as they relate to the Nigerian building industry.

CONCLUSION

There is a need to improve the Nigerian building industry, especially in view of the current problems associated with it. However, within developed and emerging economies, Lean construction (prominently via the implementation of LPS within projects) has significantly improved productivity within projects where it was applied. This is because the process makes the projects more predictable and minimises uncertainties. This review work thus, discusses the possibilities for implementing lean

in the Nigerian building industry using an action research approach. It reviews how the LPS works in developed and developing countries and the benefits gained from implementing it. Hence, this review work proposes an action research frame work for LPS within local industries in Nigeria. It is envisaged that, if this proposed framework is successful, it would improve on labour flows, workflows and reliability of work within the local industry in Nigeria and demonstrate that LPS could cause significant improvement even in third world economies facing peculiar construction challenges. It is also envisaged that this would significantly enhance further research within this subject area.

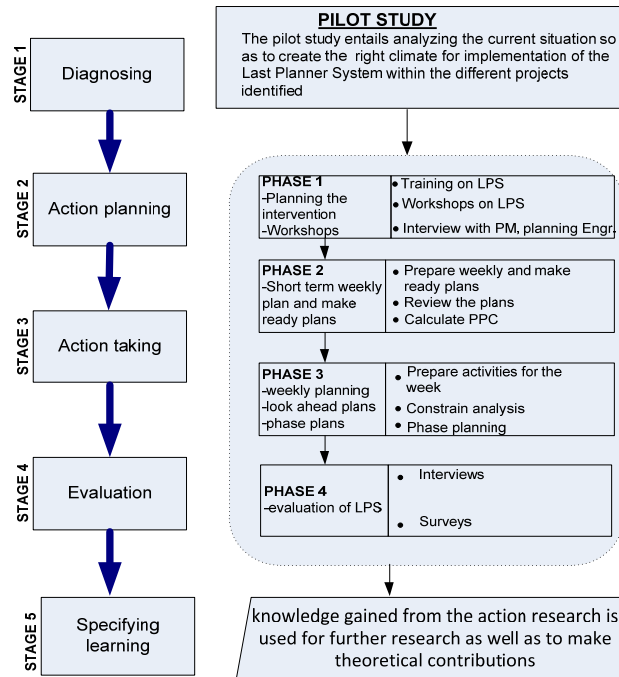


Figure 1: The proposed action research framework (Alsehaimi et al. 2010)

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