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LEAN CONSTRUCTION PRACTICE AND THE CHALLENGES IN NIGERIA

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ABSTRACT

The Nigerian Construction Industry is characterized by wastage of construction resources as a result of disruption, thus, the need for a construction delivery system that seeks to coordinate the numerous processes and operations in order to maintain required workflow in a manner that minimizes waste, cut undesirable cost, and adds value. The study aims at evaluating the extent to which limited knowledge impacts on lean construction practice in Nigeria. The method of study involved a critical exposition of related literature and an empirical study employing the t-statistic for data analysis. A structured questionnaire was issued each to a sample size comprising 67 firms drawn from a finite population of 80 medium-large size construction firms operating in South-Eastern Nigeria, using Taro Yamane Formula. The result of the study revealed a low knowledge of lean construction core competences and a scanty application of lean construction in Nigeria. The study concludes that ignorance and a lack of in-depth knowledge of lean construction competencies is largely responsible for the low level of application, hence the wastages that characterize construction industry in Nigeria. The study recommends an improved awareness of lean construction competences through formal education and informal training.

Keywords: Applicability, Construction, Lean, Nigeria, Practice

INTRODUCTION

The construction industry is one of the most people-reliant industrial sectors. A Canadian report states that an average construction worker is occupied productively for only 55% of his workday while the remaining 45% is spent on activities necessary to perform the productive work and on non-productive operations. This constitutes a colossal waste to the industry as workflow is seldom maintained with attendant huge cost consequence arising from idling. The priority of all construction activities is to keep work flowing so that the crews are always productive installing product, reducing inventory of material and tools, and reducing costs (Sowards, 2004). Koskela's research (1992) considered the inadequacies of the time-cost-quality trade-off paradigm that often characterise construction delivery. Also, research by Ballard and Howell (1994a and 1994b), Howell and Ballard (1994a and 1994b) and Howell (1999) variously corroborate project failures of meeting predetermined objectives and pre-planned benchmarks across the globe. Furthermore, Ballard and Howell (2003) state that 'analysis of project plan failures indicate that only about 50% of the tasks on weekly work plans are completed by the end of the plan week and that constructors could mitigate most of the problems through active management of variability, starting with the structuring of the project's temporary production system and continuing through its operation and improvement.

Despite recent advances in technology and production management techniques, human resource competency in construction remains critical assets and major determinants in successful project delivery. The traditional conceptual methods of construction delivery, for example Work Breakdown Structures, Critical Path Method, and Earned Value Management fail to deliver projects 'on-time, at budget, and at desired quality' (Abdelhamid, 2004). Thus, the need to explore the core competences of the Lean construction practice in project delivery. The major objective of this study is to determine the extent to which low knowledge of core lean construction competences is responsible for the low application of lean construction practice, thus, the high incidence of construction wastages in Nigeria.

THEORETICAL FRAMEWORK

The Lean concept is a Western interpretation of the Japanese Production Philosophy in the car manufacturing industry (Bertelsen and Koskela, 2005). It was observed that the mass and craft production of cars often gave room for wastes and defects in the cars produced. The lean manufacturing is based on the philosophy of 'Just-in-Time', in order to eliminate waste and the time lost in waiting for missed or delayed material supplies, by minimising unnecessary storage and reducing the value tied up in large stocks or components waiting for assembly.

The core concept behind LP is to enable the flow of value-creating-work steps while eliminating non-value steps (Dulaimi and Tanamas, 2001). Howell (1999) highlights lean production (LP) concepts as: identify and deliver value to the customer by eliminating anything that does not add value; organize production as a continuous flow; perfect the product and create reliable flow through stopping the line, pulling inventory, distributing information and decision-making; and pursue perfection by delivering on order a product meeting customer requirements with nothing in inventory.

The Toyota Production System was used to develop a production management paradigm for project-based production systems where production is conceptualized as a Transformation (T), as a Flow (F), and as Value generation (V).

Construction Waste, Application and Barriers of lean construction

Construction waste is a global phenomenon but the magnitude among nations varies. Although no standard definition has been adopted, scholars have associated the waste to resources employed in the course of project execution. Construction wastes are excess resources used than required for construction production (Olatunji, 2008). There is high incidence of construction waste in Nigeria with attendant negative impacts on Nigerian construction industry and environment. Olatunji (2008), posits that lean-in-construction offers valuable and important capabilities such as value stream mapping, kaizen, and 5s and so on to enhance workflow and minimize waste generation. There have been limited local research on the application of lean construction in Nigeria, however, lean construction has had significant benefits to other countries of the globe, Chile (Alarcon and Diethelm, 2001), UK (Common et al. 2000), Singapore (Dulaimi and Tanamas, 2001), Brazil (Silva and Cardoso, 1999).

Research conducted by Olatunji (2008), identify the following as major barriers militating against the application of lean construction in Nigeria: -skill and knowledge related, management related, government related, attitude related, resource related, and logistic related. The identified barriers corroborate earlier research findings of Dulaimi and Tanamas (2001), Common et.al. (2000), and Garnet (1999).

Lean Construction Education and Training:

The major barrier to lean construction practice globally is 'awareness through knowledge'. The lean competency is relatively new to most countries of the world, and where they existed, did so with varying degrees of formality and intensity of application. Institutional frameworks and collaborations with government are fundamental for developing the lean competence in nations; especially in the area of solid industrial base, communication technology, and transport system, Education was found to be central in the effective implementation of this contemporary innovation.

RESEARCH METHODS

An empirical research was conducted to evaluate the extent to which knowledge of the core competences of lean construction relate to its application by construction industry stakeholders in Nigeria. The study sought to collect and analyse empirical data obtained from numerous construction industry professionals including architects, quantity surveyors, and engineers in the employ of construction firms operating in South-Eastern Nigeria. The research design adopted represents a realistic and feasible process of investigations aimed at achieving a systematic application of the scientific method of examination of research questions.

Research Question

To what extent do knowledge of core lean construction competences relate to the application of lean construction practice in Nigeria?

Research Hypotheses

The research hypothesis in line with the objectives of study was formulated as follows:

Null Hypothesis (H_0):

There is no significant relationship between knowledge of core lean construction competences and the application of lean construction practice in Nigeria.

Alternate hypothesis (H_a):

There is significant relationship between knowledge of core lean construction competences and the application of lean construction practice in Nigeria.

Population of Study and Sample Size Determination

The study population is 80, and involved all medium-large size contracting companies operating in the six states that make-up the South –Eastern Nigeria geo-political zone, namely- Abia, Anambra, Ebonyi, Enugu, and Imo states. Yamane (1964) formula for selecting sample size from a finite population was applied and this yielded 67. The firms were subsequently issued a questionnaire each, out of which 59 responded, representing a response rate of 88%, and this is considered reasonable for a study of this magnitude.

RESULTS AND DISCUSSIONS

Table 1: Knowledge of Lean Construction Core Competencies

S/No	Enquiry code	Response Status	Value label	Frequency	Percentage
1	A 2.1	Valid	to a great extent	3	5
2	A 2.2	Valid	to a considerable extent	5	8
3	A 2.3	Valid	to a moderate extent	9	15
4	A 2.4	Valid	to a fair extent	17	29
5	A 2.5	Valid	Not at all	25	42
TOTAL				59	100

Source: Field survey (2012)

The results in Table 1 show that only 8% of the respondents have considerable knowledge of the key competencies of lean construction, 15% have a moderate knowledge, while 42% have no knowledge of the core competencies. The results reveals that the level of awareness of lean construction core competencies among construction industry practitioners in Nigeria is low.

Table 2: Extent to which firms apply Lean Construction

S/No	Enquiry code	Response Status	Value label	Frequency	Percentage
1	B2.1	Valid	to a great extent	0	0
2	B2.2	Valid	to a considerable extent	0	0
3	B2.3	Valid	to a moderate extent	5	9
4	B2.4	Valid	to a fair extent	9	15
5	B2.5	Valid	Not at all	45	76
TOTAL				59	100

Source: Field survey, 2012

The result of the study in Table 2 shows that 9% of the respondents employ lean construction to a moderate extent, 15% to a fair extent, while 76% of the respondents do not at all apply lean construction. Thus, a majority of Nigeria contractors do not apply lean construction for reasons that could be connected to large ignorance of lean construction core competences.

Test of Hypothesis:

Null Hypothesis (H₀):

There is no significant relationship between knowledge of core lean construction competences and the application of lean construction practice in Nigeria.

Alternate hypothesis (H_a):

There is significant relationship between knowledge of core lean construction competences and the application of lean construction practice in Nigeria.

The t-test statistic was employed in the analysis of values in tables 3.1 and 3.2.

$t_c = 25.557$ and $t_t = 1.645$ at $\alpha/2$, $\alpha = 0.05$

Since, the result yielded $t_c = 25.557 > t_t = 1.645$ at $\alpha/2$, $\alpha = 0.05$, we reject H_0 , the null hypothesis, and accept H_a , the alternate hypothesis: $p \neq 0$; and conclude that there is a significant relationship between knowledge of core lean construction competences and the extent of application of lean construction practice in Nigeria.

SUMMAARY OF FINDINGS

1. Quality of knowledge of construction industry personnel relates to their ability to plan, monitor, control and deliver projects using Lean Construction competence.
2. Ignorance of core lean construction competencies was found to be high among construction industry professionals in Nigeria.
3. Few construction organizations that practice lean construction do so at low formality an intensity.
4. Earlier researches on factors militating against lean construction practice in Nigeria including skill and knowledge, management, government, attitude, resource, and logistics were corroborated by the study.

CONCLUSION

Construction waste is a global phenomenon that has impacted on the construction industry negatively as the required workflow had remained interrupted and expected value not created. The lean construction practice competency, an intervention measure, was developed to mitigate non-value adding steps in construction operations in order to deliver value to customers. Lean Construction utilizes the Toyota Production System that emphasizes-Transformation, Flow and Value generation. Lean Construction as a contemporary construction practice, is assuming a global dimension especially in the US, UK, Brazil, Chile, Finland, Denmark, Australia, Israel, New Zealand, Thailand, South Korea, Japan, Hong Kong, and the Netherlands, but unfortunately not so for Nigeria, where it is characterized with informality and low

application principally as a result of ignorance and lack of knowledge of its core competencies by construction industry practitioners. The broad factors militating against lean construction practice in Nigeria are - skill and knowledge, management, government, attitude, resource, and logistics as identified in lean construction literature. The study corroborated a lack of 'skill and knowledge' of Lean Construction core competencies as a major deficiency among construction industry professionals, hence, the low application and high waste in Nigeria.

RECOMMENDATIONS

1. The study recommends an improved awareness of lean construction competences by construction industry stakeholders through formal and informal education.
2. The establishment of lean construction institute in each of the six geo-political zones of Nigeria and integration of this competency in the curriculum of construction industry courses at tertiary institutions of learning will go a long way to improve knowledge of this competency by construction practitioners.
3. The Professional institutions in Nigeria Construction Industry should as a critical part of their Continued Professional Development (C.P.D) organize regular workshops and training for their members on this fast emerging competency.
4. Institutional frameworks should be developed by Government to ensuring that Lean Construction Practice is adopted as a deliberate policy on a sustainable basis in most public owned projects.
5. Government support is necessary to create an enabling environment and a robust incentive scheme for building material manufacturers and information technology providers by removing obstacles that fraught performance of the subsectors.

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