



## The Barriers for the Adoption of Lean Construction Principles in Nigerian Construction Firms

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### ABSTRACT

*Lean construction principles are method of minimize wastage of materials, time and effort during the course of construction projects in order to accomplish the client satisfaction. But most of the Nigerian Construction Firms are yet to fully adopt the lean construction principles due to certain barriers. Therefore, the aim of this paper is to identify the barriers for the adoption of lean construction principles in Nigerian construction firms. A detailed review of relevant literature was conducted with the view of collecting relevant data necessary for this paper. A total of 120 numbers of questionnaires was distributed to Engineers, Quantity surveyors, Builders and Architects in construction firms at Abuja. The descriptive method of analysis was used to analyse the data obtained from the survey. The result obtained shows the followings as top ranked barriers for the adoption of lean construction principles. These are (1) corruption, (2) poor planning, (3) poor communication, (4) lack of training, (5) lack of top management support & commitment and (6) lack of team work. These aforementioned are the main barriers for the adoption of lean construction principles in Nigeria construction firms. Therefore, the paper recommended that the top management of construction firms should be committed to the adoption of lean construction principles by ensuring teamwork among the staff, avoidance of corruption, effective communication and planning to achieve the client's satisfaction.*

**Keywords:** Construction Firms, Lean Construction, Lean Principles, and Project Performance

### INTRODUCTION

The construction industry is a critical sector in the world's economy because it builds and maintains infrastructures on which all other industries depend upon. However, the construction industry is also one of the most inefficient due to its lack of use of design, product delivery and information technology. Due to the enormous size of the construction industry, small productivity changes can have a significant and direct effect on national productivity and economic wellbeing. The declining trend in productivity is a huge problem that causes billions of unnecessary waste to society. In the United States alone, construction is a \$1 trillion/year dollar industry with 30% of waste in the form of time, material, rework, inventory, and over production, amounting to an average of \$300 billion per year of construction waste (Abdelraziq, 2015). Reducing the wastes in process, time, costs and other integrated entities and maximizing the value added is considered a crucial strategy to be implemented in construction projects (Radhika and Sukumar, 2019). This practice is applicable throughout the lean construction principles. During the life cycle of construction projects, most of contractors are striving to reduce their losses and maximize their profits overall stages in the project life cycle. Such attitude is traced strongly with the lean construction philosophy. The real challenge that faces the clients and contractors is how to measure and quantify their achievements of lean construction principle. The factors that contribute to strength the adoption of lean construction concept were in a critical position being highlighted for all project stockholders. Besides, the challenges that face the adoption of lean construction was also in the important track that clarified with the suggested proposals to overcome it. Moreover, the proper tools/techniques that is effective



to be used in construction projects and empower the lean ideology were also add value in this research. The research will provide a strong value for the decision makers i.e. clients and contractors to appraise and adopt the lean construction principles in their projects. This study will also give valuable contribution towards the continuous improvement strategy for construction industry environment, stakeholders, local community and global community as well. The above mentions are the gap for this research to identify the barriers for the adoption of lean construction principles in Nigerian construction firms, with a view to improving project performance towards satisfaction of client's needs.

### Concept of Lean Construction

The concept of lean principle is to generally make the construction process leaner removal of wastes regarded as non- value generating activities (Koskela, 2000). Lean construction has the potential of bringing innovative changes in the construction industry. Dulaimi and Tanamas (2001) pointed out that the adoption of lean techniques to construction eliminates non-value steps i.e. waste of resource and effort to satisfy client's objectives. Howell (1999) explained that the lean production's concept to identify and deliver value to the client and eliminate anything that does not add value. It also perfects the products and create reliable flow through stopping the line, pulling and distributing information and decision making. Aigbavboa, Oke & Momoti, (2016) provided a conceptual framework of lean construction as shown in Figure 1.

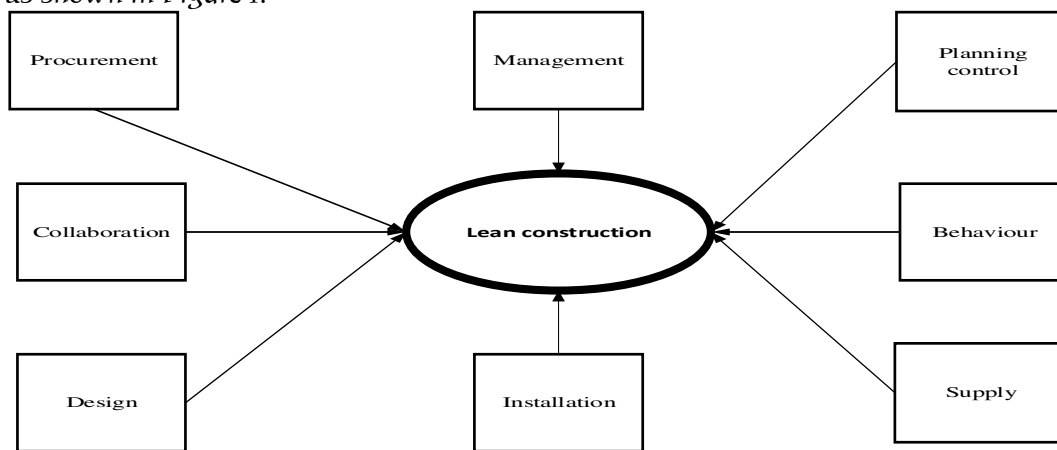


Figure 1: The conceptual frame work of lean construction, (Aigbavboa *et al.*,2016)

### Lean Construction Tools and Techniques

Lean construction has several tools and techniques that have evolved since the beginning of it is application in the construction industry (Abdelrazig, 2015). These tools and techniques continue to develop as more understanding and experience develops. Lean construction has been identified as ways of develop a list of the most prominent and exhaustive tools and techniques that are being implemented in today's construction industry and that might also impact performance practices (Forbes and Ahmed, 2011). Howell, (1999) highlighted some of the tools related to the topic of study are: [Constraint analysis, look-ahead planning, the Percent Plan Complete (PPC) measurement, concurrent engineering, just-in-time, resources managing, immediate problem detection,

standardization, detection of incompatibility and discrepancy, process evaluation, team integration, use of visual indicators and continuous improvement]. The implementation of such lean tools and techniques had significantly reduced waste and improved performance in construction projects (Abdelrazig, 2015).

### Barriers for the adoption of Lean Construction Principles

According to Gao and Lawsuit (2014) that lean construction practices and associated barriers in implementing lean factors in China construction industry were identified. The factors identified are absence of lean culture, use of multi-layer subcontracting, people and partner issues, and also issues related to managerial and organizational, lack of support, culture and philosophy, Government and procurement. Forbes and Ahmed (2011) asserted that the main obstacle to implementation of lean construction principles is that the construction firms do not focus on productivity and quality. Alinaite (2009) further highlighted barriers as technical aspects. According to him, the barriers can be divided into two groups; viz barriers those influence the worker productivity and those barriers which are easier to overcome. Olatunji (2008) classified the barriers of implementing lean into seven groups which are skills and knowledge related, management related, Government related, attitude related, resource related and logistics related. Abdullah, Abdul-Razak, Abubakar, and Mohammed, (2009) added that lack of top management commitment was one of the main barriers in lean construction implementation. He also added that, lack of communication among the labours and top management may also cause barriers in lean construction adoption. Howell (1999) with contrary opinion that human attitude slows down the application of lean construction principles in the industry, lack of discussions and meetings also leads to the decrease in lean construction adoption. Olatunji (2008) described the barriers on the basis of financial aspects. Such as poor management of time, lack of incentives, low wages etc are some of the examples of the barriers to lean construction application.

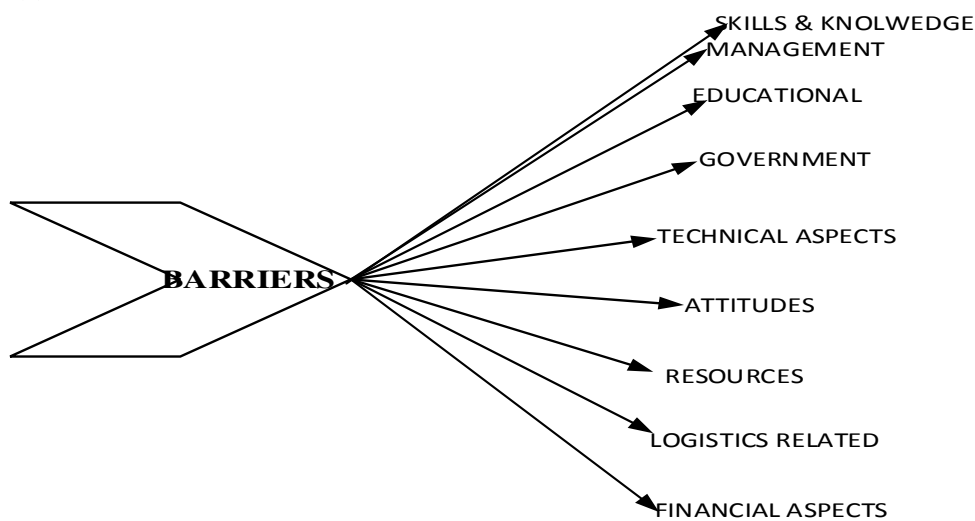


Figure 2: Different aspects of lean barriers (Radhika & Sukumar, 2017)



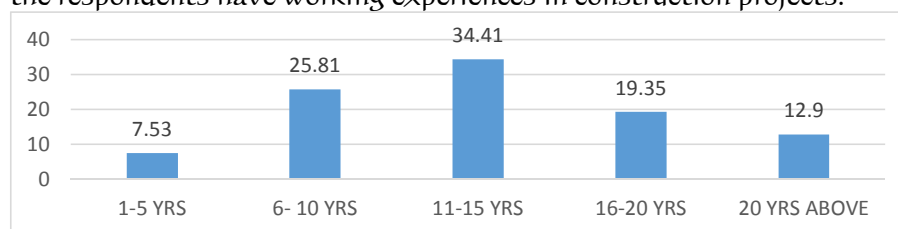
## Research Method

This study adopted quantitative research approach via survey questionnaire to sample individuals from a population with a view towards making statistical inference about the population using the sample (Creswell, 2003). And also to pull out public opinion, such as beliefs, perception, ideas, views and thought about the barriers for the adoption of lean construction principles in Nigerian Construction Firms. In order to obtain the require population for this study, the stratified random sampling technique was adopted for the selection of the construction firms that participated in this study. This selection was in line with concept of Creswell and Tashakkori (2007) that respondents are arranged in strata for the convinienency in questionnaire distribution and assessment. In addition, the simple random sampling was adopted in each of the construction firms for the selection of construction professionals from the strata. The questionnaire that was used to record the responses of each respondent contained mainly closed ended questions using a five- point Likert scale ranged from strongly not agree, not agree, slightly agree, agree and strongly agree. The scores of the respondents were computed based on the variables used in the questionnaire. As earlier explained that simple random sampling techniques was adopted in each of the construction firms for the selection of construction professionals. 120 numbers of professionals in the Construction Firms were selected. These professionals are: Quantity Surveyors fourth numbers (40), Architects thirty numbers (30), Builders thirty numbers (30) and Civil Engineers twenty numbers (20). However, only ninety-six (96) numbers of those selected professionals were able to return the questionnaire, while three (3) of the ninety-six (96) were ignored for incorrect entry. The inference statistic was adopted to summarise the sample, rather than use the data to learn about the population and sample. In this paper, inference statistic was used to present means score, standard deviation and frequency counts. The mean score was used to rank the respondents' opinions or responses obtained.

## Findings and Discussion of Results

The results of the demographic profile of the respondents were presented in section 4.1 to respectively. Years of Experiences of Respondents in Construction Firms

Figure 3 shows years of experiences of respondents, thus with 11-15 years of working experience represent 34.41%. While 6-10 years of working experiences represent 25.81%. In addition, respondents with 16-20 years of working experiences constitute 19.35%. Furthermore, thus with 20 years of working experiences constitute 12.9%. And respondents with 1-5 years of working experiences which represent 7.53%. This indicate that majority of the respondents have working experiences in construction projects.

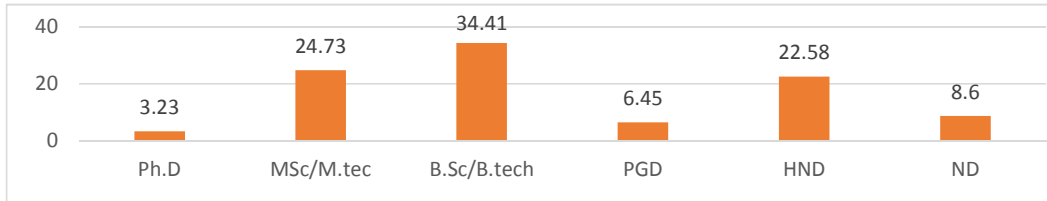


**Figure 3. Years of working experience in construction projects (Field Work, 2019)**

4.2 Qualification of the respondents

Figure 4 shows that 34.41% have B.Sc/B.Tech degree, 24.73% have MSc/M.Tech degree

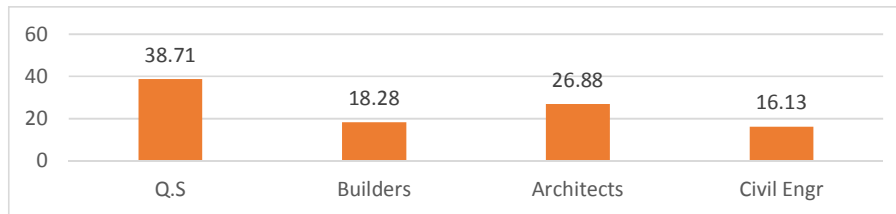
In addition, 22.58% have HND and 6.45% have PGD. This signify that the respondents have required qualification in different background of knowledge of construction projects.



**Figure 4: Qualification of Respondent (Field Work, 2019)**

4.3 Profession of Respondents

Figure 5 shows 38.71% of respondents are Quantity Surveyors, 26.88% are Architect; 18.28% are Builders and 16.13% are Civil Engineers. This reflect that the professions of the respondents are relevant to construction projects.



**Figure 5: Profession of respondent in construction projects (Field Work, 2019)**

The barriers for the adoption of LC principles in construction firms in Abuja were presented in Table 1.

**Table 1. The Barriers for the adoption LC.**

Barriers	Mean	Standard Deviation	Ranked
Corruption	4.82	1.170	1
Poor planning	4.76	0.862	2
Poor communication	4.73	0.531	3
Lack of training	4.66	1.076	4
Lack of top management support and commitment	4.51	1.041	5
Lack of team work	3.92	0.892	6
Risk aversion	3.91	0.721	7
Inadequate projects funding	3.88	1.304	8
Lack of incentives and motivation	3.61	0.431	9



Lack of awareness of lean application	3.58	0.425	10
Implementation cost	3.53	0.521	11
Inadequate exposure to requirement for lean implementation	3.51	0.732	12
Poor procurement selection strategies	3.49	0.441	13
Long implementation period	3.47	0.645	14
Delay in decision making	3.45	0.981	15
Misconception about lean practices	3.33	1.027	16
Inadequate resource	3.31	0.980	17
Unsuitable organizational culture	3.28	1.431	18
Use of substandard components	3.25	1.023	19
Absence of long term planning	3.22	0.541	20
Lack of equipment	3.18	0.782	21
Delay in materials delivery	3.17	1.041	22
Lack of time for innovation	3.17	1.340	23
Lack of supply chain integration	3.08	1.410	24
Inflation	2.94	0.141	25
Lack of understanding	2.87	0.622	26
Lack of information and knowledge sharing	2.77	0.543	27
Lack of technical skills	2.64	0.231	28
Inconsistency in policies	2.62	1.011	29
Government bureaucracy	2.58	0.921	30
Poor performance measurement strategies	2.53	0.874	31
Lack details working design	2.51	0.691	32
Fear of unfamiliar practice	2.46	1.123	33
Lack of customer focus	2.44	1.042	34
Poor leadership	2.42	0.897	35
Lack of self-criticism	2.38	0.423	36
Lack of transparency	2.09	0.251	37
Poor understanding of clients brief	1.85	1.032	38

Source: Field Work, (2019)

Table 1 shows that corruption, poor planning, poor communication, lack of training, lack of top management support and commitment were ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> with mean scores of 4.82, 4.76, 4.73, 4.66 & 4.51 respectively and standard deviation values of 1.170, 0.862, 0.531, 1.076 & 1.041 respectively. This reflects that corruption, poor planning, poor communication, lack training, and lack of top management support & commitment are the main barriers for the adoption of lean construction principles in Nigerian construction firms. The study conducted by the Aigbavboa *et al.*, (2016) in South Africa agreed with the findings that the followings are barriers to lean construction principles: (1) Inadequate pre-planning (2) extensive use of unskilled labour (3) poor communication (4) human attitude towards change (5) fragmentation nature of the industry (6) lack of interest from client and supplier

involvement (7) change in materials prices or prices escalation (8) lack of management support & commitment (8) lack of training and (9) lack of technical skills. Alinaitwe (2009) further supported the result by highlighted the followings as barrier associated with the lean construction, lack of communication, lack of projects team skills and lack of defined focus for the team, human attitude towards change. In addition, the result shows that lack of team work, risk aversion, inadequate project funding, lack of incentives & motivation, lack of awareness of lean construction, implementation cost and inadequate exposure to requirement for the adoption of lean construction principles were ranked 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup>, & 12<sup>th</sup> with mean scores of 3.92, 3.91, 3.88, 3.61, 3.58, 3.53 & 3.51 respectively and standard deviation values of 0.892, 0.721, 1.304, 0.431, 0.425, 0.521 & 0.732 respectively. This signifies that the aforementioned are the leading barriers for the adoption of lean construction principles in Nigerian construction firms. Olatunji (2008) and Mossman (2009) agreed with the result that barriers to lean construction include corruption, inadequate projects funding, inflation, implementation cost, and poor professional wages, lack of incentives and motivation, and risk aversion. Unless adequate efforts are made to overcome these barriers, several companies could be discouraged from adopting lean in their organisations. The result further shows that fear of unfamiliar practice, lack of customer focus, poor leadership, lack of self-criticism, lack of transparency and poor understanding of client brief were ranked 33<sup>rd</sup>, 34<sup>th</sup>, 35<sup>th</sup>, 36<sup>th</sup>, 37<sup>th</sup> & 38<sup>th</sup> with mean scores of 2.46, 2.44, 2.42, 2.38, 2.09 & 1.85 respectively, and standard deviation values of 1.123, 1.042, 0.897, 0.423, 0.251 & 1.032 respectively. This indicates that fear of unfamiliar, lack of customer focus, poor leadership, lack of self-criticism, lack of transparency and poor understanding of client brief are the least barriers for the adoption of lean construction principles in Nigerian construction firms. Aigbavboa *et al.* (2016) argued that the barriers to lean construction are administration viewpoint, budgetary angle, instructive perspective, legislative perspective, specialized perspective, specialized angle and attitudinal perspective.

### Critical Success factors (CSF) for the adoption of LC

The critical success factors for the adoption of LC in Abuja were presented in Table 2.

**Table 2: CSF for the adoption of LC**

Critical Success Factors	Mean	Standard Deviation	Ranked
Team work	3.89	1.175	1
Quality leadership	3.87	0.723	2
Continuous improvement	3.61	1.104	3
Commitment of the top management	3.58	0.584	4
The presence of the scheduling and planning	3.53	0.321	5
Adequate knowledge to begin the project	3.51	1.210	6
Workers within the company with multiple tasks and experiences	3.49	0.982	7
Desire to learn the company and their crews	3.47	0.905	8



An integrated characterization of the work on the project	3.45	1.207	9
Business combinations and make a unified system	3.33	1.188	10
Periodic maintenance of the company's equipment	3.31	0.647	11
Decentralization and motivation	3.21	0.502	12
Multiplicity of tools used in project applications	3.18	1.117	13
Show the required information visually	2.89	0.498	14
Involving company employees in business activities plans	2.81	0.417	15
Begin as soon as possible with an important and visible activity	2.74	0.456	16
Good network of contracts in the company	2.49	0.512	17
A mandatory clauses in the contract	2.45	0.932	18
Necessary changes in the organizational culture	2.31	1.132	19

Source: field Work, (2019)

Table 2 shows that team work, quality of leadership, continuous improvement, commitment of the top management and the presence of the begin the project were ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> with mean scores of 3.89, 3.87, 3.61, 3.58, 3.53 & 3.51 respectively, and standard deviation values of 1.175, 0.723, 1.104, 0.584, 0.321 & 1.210 respectively. This indicates that the aforementioned factors are the main CSF for the adoption of lean construction principles in Nigerian construction firms. In addition, the result also shows that good network of contract in the company, a mandatory clause in the contract and necessary changes in the organizational culture were ranked 17<sup>th</sup>, 18<sup>th</sup>, & 19<sup>th</sup> with mean scores of 2.49, 2.45 & 2.31 respectively, and standard deviation values of 0.512, 0.932 & 1.132 respectively. This implies that good network of contract in the company, a mandatory clause in the contract and necessary changes in the organizational culture are the least CSF for the adoption of lean construction principles in Nigerian construction firms. Dulaimi and Tanamas (2001) agreed that adoption of lean construction enable to eliminate non-value steps such as waste and better meet client demands and dramatically improves the construction process and products with significant benefits.

## CONCLUSION

The paper draw conclusion from the findings by identifies the followings as main barriers for the adoption of lean construction principles in Nigerian construction firms. These are: corruption, poor planning, poor communication, lack of training and lack of top management support. Likewise, the followings are critical success factors to be considered for effective adoption of lean construction principles in Nigerian construction firms. These are: teamwork, quality of leadership, commitment of top management and continuous improvement. The paper therefore recommended that the top management of construction firms should be committed and support the adoption of the lean construction principles by ensuring teamwork among the staff, avoidance of corruption and adopt the habit of changes from the traditional method of doing things. The Government should encourage





construction firms to adopt the lean construction principles since it's reduces wastages and delay, through the introduction of incentives and motivation to thus that committed to its practice. This paper contributed to the knowledge by highlighted the barriers and critical success factors for the adoption of lean construction in Nigerian construction firms.

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