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## Investigating Facilitators and Barriers for Adopting Lean Construction Principles in the Nigerian Building Consulting Firms

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### **Abstract:**

*The adoption of lean construction principles within the manufacturing and other industries has led to notable improvement and has resulted in improved time-to-market, reduced production cost, improved quality of the product and active customer involvement. The intent of this study was to investigate and identify facilitators and barriers that construction-related Nigerian consulting firms could use to adopt lean construction principles. The method of study consisted of a critical exposition of related literature and an empirical study employing the mean scores with relative ranking. The results of the study revealed that availability of trained professionals, education, and skills development are the most important facilitators for adopting lean construction principles. In contrast, barriers to adoption of lean construction principles that were ranked most important include: inadequate preplanning, corruption, inadequate exposure to the requirements for lean implementation, inaccurate and incomplete designs, and misconception about lean concepts. These barriers existed in areas such as: management, financial, educational, governmental, technical areas. These barriers also existed within human attitudes and interpersonal interactions. The study recommends that building construction stakeholders in the Nigerian construction industry should provide a more enabling environment that will guide and ease the adoption of lean construction principles.*

**Keywords:** Barriers, Building consulting firms, Facilitators, Lean construction, Nigerian construction industry.

### **1. Introduction**

Construction is a key sector of the national economy of any country. It contributes a large portion to a nation's total employment and revenue generation. However, problems facing construction are well documented as low productivity, poor safety, inferior working conditions, low quality of work done, lack of timely communication and coordination among project stakeholders, and rising litigation (Koskela, 2000 and LePater, 2007). The Nigerian construction industry suffers from all the above mentioned problems. It has been severally characterized as inefficient with low productivity and lack of capacity to deliver and satisfy its clients. Oyewobi *et al.* (2011) attributed the drop in the Nigerian construction industry's contribution to GDP between 1980 and 2007 to poor performance and low productivity. Similarly, Idrus and Sodangi (2007) asserted that the Nigerian construction industry produces nearly 70% of the nation's fixed capital formation, yet its performance within the economy has been, and continues to be, very low. Other criticisms facing the industry are time and cost overruns (Kuroshi and Okoli, 2010; Ameh and Osegbo, 2011; Ogwueleka 2011), inadequate planning and budgetary provisions, contract sums inflation, inefficient and poor service delivery (Kolo and Ibrahim, 2010). Thus, Aibinu and Jagboro (2002) and Olamilokun (2014) emphasized the need for improved performance and efficiency if the industry is to deliver value for money and effectively satisfy the needs of its clients.

Lean construction principles are one of such innovative processes that bring about the much needed continuous improvement and desired change in the construction industry. Koskela (2000) stated that lean construction is a way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible amount of value. Hence, the adoption of lean techniques to construction eliminates non-value steps i.e. waste and it better meets client's demands. It also dramatically improves the Architectural/ Engineering/ Construction (AEC) process and products. It is critical to note that while Lean Construction is identical to Lean Production in spirit, it is different in how it was conceived as well how it is practiced. Adopting Lean construction principles has its benefits reaped by not only contractors, a popular misconception, but the architect and owner as well, who are set to gain a lot by this practice. A case study taken in USA in 1998 shows remarkable benefits of adopting Lean Construction (Garnett *et al.*, 1999): Office construction times reduces by 25% within 18 months; Schematic design reduces from 11 weeks to 2 weeks; Turnover increases of 15-20% (Pacific Contracting); Satisfied clients looking to place repeat orders; Reduction of project costs. However, adoption of innovations such as lean construction principles usually brings about changes in the business processes and operational procedures of an industry or an organization. However, it may also be faced with some risks and challenges that may hinder its successful take-up.

The study is therefore aimed at investigating the factors that will facilitate and those that will hinder the successful adoption of lean construction principles by the stakeholders' organizations and the entire construction industry.

## **2. Factors Affecting the Adoption of Lean Construction Principles**

The introduction and adoption of any new paradigm such as lean construction principles prior to its implementation usually require that the factors that may positively or negatively affect the adoption by the relevant stakeholders be identified and addressed. Numerous potential facilitators and barriers for the adoption of lean construction principles were documented in the literature as can be seen below:

### *2.1. Facilitators to the Adoption of Lean Construction Principles*

According to Salem *et al.* (2006), lean construction principles is seen as drivers/facilitators that can help the building industry to improve its productivity by ensuring effective communication and collaboration among all project stakeholders from inception to completion of building projects. Several lean construction related studies have been reported, especially those that have to do with its success stories and inherent benefits. However, drivers/facilitators identified in several studies and a thorough review of research by Alarcon *et al.* (2002); Castka *et al.* (2004); Olatunji (2008); Alinaitwe (2009) and Mossman (2009) found top management support and commitment, education and skills development, client interest in the use of lean construction in their project, commitment and cooperation of professional bodies, attitudinal change, government policy and availability of trained professionals are among the facilitators to adopting lean construction principles across organizations.

### *2.2. Barriers to the Adoption of Lean Construction Principles*

Several researches have been conducted in various countries to investigate factors that could affect the successful adoption of lean construction principles. Abubakar *et al.* (2010) classified these barriers into six categories such as financial, educational, governmental, attitudinal, managerial and technical issues, which were based on thorough and critical review of international literature relating to its implementation.

#### 2.2.1. Management Issues

The management of every organization has a major role to play in achieving a successful implementation of innovative strategies. The success of lean practice lies in their commitment to implement an effective plan and adequately provide the required resources and support to manage change. A thorough review of research by Alarcon *et al.* (2002); Olatunji (2008) and Alinaitwe (2009) found delay in decision making, lack of top management support and commitment, poor project definition, delay in materials delivery, lack of equipment, materials scarcity, lack of time for innovation, unsuitable organizational structure, weak administration, lack of supply chain integration, poor communication, use of substandard components, lack of steady work engagement, long implementation period, inadequate preplanning, poor procurement selection strategies, poor planning, inadequate resources, lack of client and supplier involvement, lack of customer focus and absence of long term planning are among major barriers to lean practice.

#### 2.2.2. Financial Issues

The implementation of innovative strategies like lean construction requires some funds. Adequate funding is needed to motivate the workers, provide relevant equipments and employ lean specialist to guide both employers and employees in implementing the concept. However, the nature of this barrier varies across countries. An analysis of studies reported by Olatunji (2008) and Mossman (2009) identified some of these barriers to include corruption, inadequate projects funding, inflation, implementation cost, poor professional wages, lack of incentives and motivation and risk aversion.

#### 2.2.3. Educational Issues

There have been several efforts to provide awareness, guidance and knowledge relating to lean construction by academics, researchers, practitioners and bodies such as Lean Construction Institutes, Construction Lean Implementation Program (CLIP), Construction Excellence (CE) and British Research Establishment (BRE). However, these bodies operate in very few countries. Despite the large amount of publications made by researchers, it seems educational issues appear to be the most common barriers to lean practice. Some of these barriers are identified by Alarcon *et al.* (2002); Olatunji (2008); Alinaitwe (2009) and Mossman (2009) to include lack of understanding, lack of technical skills, high-level illiteracy, lack of training, lack of holistic implementation, inadequate knowledge, lack of project team skills, inadequate exposure to requirements for lean implementation, lack of awareness programs, difficulty in understanding concepts and lack of information sharing.

#### 2.2.4. Governmental Issues

Despite the significant economic contribution made by the construction sector in various countries, it faces numerous problems which appear to be related to government policies. Some studies reveal that certain barriers arose due to government attitudes towards the construction industry in some countries. An in-depth analysis of research findings in Olatunji (2008) and Alinaitwe (2009) revealed barriers like government bureaucracy, inconsistency in policies, lack of social amenities and infrastructure, materials unavailability and unsteady price of commodities.

### 2.2.5. Technical Issues

The implementation of lean construction may be affected by barriers which are technical. These barriers are considered technical because they have a direct impact on applying certain lean construction principle and tools such as reliability, simplicity, flexibility and benchmarking. Some of these were identified by Ballard and Howell (1998), Koskela (2000) and Alinaitwe (2009) as lack of buildable designs, incomplete designs, poor performance, measurement strategies, lack of agreed implementation methodology, lack of prefabrication, uncertainty in supply chain, lack of design constructability, inaccurate and incomplete designs.

### 2.2.6. Human Attitudinal Issues

Human attitude is one of the major factors affecting the implementation of lean construction in various construction industries. Based on studies carried out by Alarcon *et al.* (2002); Alinaitwe (2009) and Mossman (2009), some of these factors are lack of transparency, cultural change, lack of team spirit, lack of self-criticism, lack of teamwork, lack of cooperation, poor housekeeping, poor leadership, leadership conflict, poor understanding of client's brief, misconceptions about lean practice, over enthusiasm and fear of unfamiliar practices.

## 3. Research Method

Data for this study were collected with the aid of structured questionnaires which were administered in northern Nigeria. Abuja (FCT), Kaduna and Kano states of Nigeria were chosen because they are developed states with a large concentration of building consulting firms. A total of 360 questionnaires were distributed to respondents in the target population, 130 were returned and found appropriate for the analysis.

The population for the study is the stakeholders majorly responsible for the delivery of building project designs in Nigeria. They include Project Management Firms, Architectural Design Firms, Structural Design Firms, Mechanical and Electrical Services Design Firms, and Quantity Surveying Firms of the Nigerian construction industry. Respondents were asked to indicate their extend of agreement based on a 5-point Likert rating scale with "5" being the highest of the ratings representing "strongly agree" and "1" being the lowest of the ratings representing "strongly disagree".

The study utilized a number of descriptive statistical techniques to facilitate the organization, analysis and interpretation of the data. Mean, standard deviation and relative ranking were used.

## 4. Results

In a study conducted by Kado (2013), the total number of registered design firms with the Corporate Affairs Commission was shown to be 6,990; 34% of which are located in northern part of the country. Out of 360 questionnaires administered, 130 representing 36% of the total were returned and found appropriate for analysis. Using Yamane (1986) formula, the sample size for this study was calculated to be 342. Moser and Kalton (1971) asserted that, result of a survey could be considered significant if the response rate is not lower than 30-40%. In view of this, 36% response was considered adequate for analysis.

Thus, 27% of the respondents was engaged in Architectural consultancy, 29% was engaged in Quantity Surveying consultancy, while 21% and 13% were engaged in structural engineering consultancy and project management consultancy respectively. The remaining 10% of the respondents was engaged in Mechanical & Electrical consultancy. The result expresses a fair representation of the major stakeholders of the Industry. Also, 27% of the respondents belonged to the strategic/senior management level, 60% belonged to the middle management level, while only 8% and 5% belonged to the knowledge/lower management level and operational levels respectively, that 34% of the respondents had 16-20 years of experience, 24% had 11-15 years of experience, 22% had more than 20 years of experience, while 15% and 5% had 6-10 years of experience and less than 5 years of experience respectively.

### 4.1. Facilitators of Adopting of Lean Construction principles in the Nigerian Construction Industry

Facilitators	Respondents' assessments					Mean	SD	Rank
	1	2	3	4	5			
Availability of trained professionals	0	0	5	59	66	4.47	0.57	1
Education and skills development	0	0	2	66	62	4.46	0.53	2
Commitment and cooperation of Professional bodies	0	0	7	71	52	4.35	0.58	3
Client interest in the use of LC in their project.	0	0	19	57	54	4.27	0.70	4
Attitudinal change	0	0	26	48	56	4.23	0.76	5
Top Management support and commitment	0	0	24	63	43	4.15	0.71	6
Government Policy via legislation	2	7	50	45	26	3.66	0.91	7

Table 1: Facilitators of adopting Lean Construction principles

Table 1 shows the extent of agreement of Nigerian building consulting firms with factors which can be termed as facilitators for adopting lean construction in the Nigerian construction industry. Nigerian building consulting firms ranked availability of trained professionals and education and skills development as the two most important facilitators for adopting lean construction principles in the Nigeria construction industry.

## 4.2. Barriers of Adopting of Lean Construction Principles in the Nigerian Construction Industry

Barriers	Respondents' assessments					Mean	SD	Rank
	1	2	3	4	5			
<b>Management related Barriers</b>								
Inadequate preplanning	0	2	14	38	76	4.45	0.75	1
Poor planning	2	2	7	64	55	4.29	0.77	2
Lack of top management support and commitment	0	2	19	57	52	4.22	0.75	3
Poor project definition	0	5	17	52	56	4.22	0.82	4
Poor communication	2	5	7	64	52	4.22	0.84	4
Poor procurement selection strategies	5	0	23	59	43	4.04	0.93	6
Long implementation period	0	10	14	73	33	3.99	0.82	7
Delay in decision making	0	0	26	85	19	3.95	0.59	8
Inadequate resources	5	0	23	78	24	3.89	0.84	9
Unsuitable organisational structure	2	7	26	64	31	3.88	0.89	10
Use of substandard components	2	10	26	61	31	3.84	0.93	11
Absence of long term planning	0	7	38	54	31	3.84	0.85	11
Lack of equipment	2	9	26	71	22	3.78	0.86	13
Lack of client and supplier involvement	2	10	35	57	26	3.73	0.92	14
Lack of steady/work engagement	0	12	33	73	12	3.65	0.77	15
Delay in materials delivery	0	2	54	64	10	3.63	0.65	16
Lack of time for innovation	5	13	28	64	20	3.62	0.99	17
Lack of customer focus	2	9	50	52	17	3.56	0.86	18
Lack of supply chain integration	2	9	48	57	14	3.55	0.84	19
Materials scarcity	4	22	36	55	13	3.39	0.98	20
<b>Financial related Barriers</b>								
Corruption	3	2	19	54	52	4.15	0.89	1
Risk aversion	0	0	19	78	33	4.11	0.63	2
Inflation	2	2	12	88	26	4.03	0.70	3
Inadequate projects' funding	2	3	26	66	33	3.96	0.83	4
Lack of incentives and motivation	0	0	21	97	12	3.93	0.50	5
Implementation cost	0	0	45	69	16	3.78	0.65	6
Poor professional wages	0	5	57	61	7	3.54	0.66	7
<b>Educational related Barriers</b>								
Inadequate exposure to requirements for lean implementation	3	2	5	28	92	4.57	0.83	1
Lack of training	5	0	7	54	64	4.32	0.89	2
Lack of awareness programmes	2	2	7	76	43	4.2	0.74	3
Lack of understanding	5	2	10	61	52	4.18	0.93	4
Lack of information sharing	2	5	17	50	56	4.18	0.91	4
Lack of technical skills	7	0	7	66	50	4.17	0.95	6
Inadequate knowledge	5	0	10	80	35	4.08	0.83	7
Lack project team skills	5	5	10	68	42	4.05	0.95	8
Difficulty in understanding concept	5	7	21	57	40	3.92	1.02	9
High-level illiteracy	10	5	24	63	28	3.72	1.09	10
Lack of holistic implementation	5	0	42	71	12	3.65	0.80	11
<b>Governmental related Barriers</b>								
Corruption practices	2	0	17	64	47	4.18	0.78	1
Inconsistency in policies	2	0	17	71	40	4.13	0.75	2
Government bureaucracy	0	2	21	76	31	4.05	0.68	3
Inflation	5	0	35	57	33	3.87	0.93	4
Unsteady price commodities	0	0	33	87	10	3.82	0.55	5
Professional wages	0	5	50	64	11	3.62	0.70	6
Lack of social amenities and infrastructure	7	2	50	57	14	3.53	0.91	7
Materials unavailability	3	14	54	52	7	3.35	0.83	8

Table 2 Continue...

<b>Technical related Barriers</b>								
Inaccurate and incomplete designs	3	5	14	71	37	4.03	0.87	1
Lack of agreed implementation methodology	0	5	40	73	12	3.71	0.69	2
Poor performance measurement strategies	0	7	40	69	14	3.69	0.74	3
Incomplete designs	2	17	33	64	14	3.55	0.91	4
Lack of prefabrication, uncertainty in supply chain	5	7	50	64	4	3.42	0.81	5
Lack of design constructability	7	31	14	66	12	3.35	1.10	6
Lack of buildable designs	7	31	35	52	5	3.13	1.00	7
<b>Human attitudinal related Barriers</b>								
Misconceptions about lean practice	2	0	10	50	68	4.4	0.76	1
Fear of unfamiliar practices	0	0	12	68	50	4.29	0.63	2
Seen as too complex and alien	0	3	7	73	47	4.26	0.67	3
Lack of cooperation	5	0	12	71	42	4.12	0.87	4
Lack of teamwork	5	0	12	78	35	4.06	0.84	5
Poor leadership	0	3	33	54	40	4.01	0.81	6
Lack of team spirit	2	0	33	69	26	3.9	0.77	7
Leadership conflict	0	5	35	59	31	3.89	0.81	8
Cultural change	2	7	40	50	31	3.78	0.93	9
Poor understanding of client's brief	2	10	40	45	33	3.75	0.97	10
Lack of self-criticism	3	5	47	61	14	3.6	0.82	11
Over enthusiasms	0	5	59	52	14	3.58	0.74	12
Lack of transparency	0	7	54	57	12	3.57	0.74	13
Poor house keeping	5	23	43	45	14	3.31	1.01	14

Table 2: Barriers of adopting Lean Construction principles

Table 2 presents the extent of agreement of Nigerian building consulting firms with barriers which could militate against the adoption lean construction in Nigeria. As shown in the table, the barriers to adopting lean construction in the Nigerian construction industry were considered under five headings as identified by Abubakar *et al.* (2010). The barriers were ranked using their respective mean score under each heading. As shown in the table above, inadequate preplanning, poor planning and lack of top management and support were ranked as the most important management related barriers to the adoption of lean construction in the Nigerian construction industry; corruption, risk aversion and inflation were ranked as the most important financial related barriers to the adoption of lean construction; inadequate exposure to requirements for lean implementation, lack of training and lack of awareness program were ranked as the most important educational related barriers to the adoption of lean construction; corrupt practices, inconsistency in policies and government bureaucracy were ranked as the most important governmental related barriers to the adoption of lean construction; inaccurate and incomplete designs, lack of agreed implementation methodology and poor performance measurement strategies were ranked as the most important technical related barriers to the adoption of lean construction; misconceptions about lean practice, fear of unfamiliar practices and seen as too complex and alien were ranked as the most important human attitudinal related barriers to the adoption of lean construction.

## 5. Discussions and Conclusions

- i. The survey revealed that the Nigeria building consulting firms responded positively to the existence of facilitators of adopting lean construction principles in the Nigerian construction industry. The respondents rated availability of trained professionals and education and skills development as the two most important facilitators for adopting lean construction principles with mean scores of 4.47 and 4.46 respectively.
- ii. The ranking identified barriers also revealed that inadequate preplanning with mean score 4.45, corruption with mean score 4.15, inadequate exposure to requirement for lean implementation with mean score 4.47, corruption practices with mean score 4.18, inaccurate and incomplete designs with mean score 4.03 and misconception about lean concepts with mean score 4.40 are most important for management, financial, educational, governmental, technical and human attitudinal related barriers to adoption of lean construction principles in Nigeria construction industry respectively.
- iii. It can be inferred that for the organizations to fully be ready to adopt the principles, the facilitators of lean construction principles adoption in Nigeria need to be tremendously improved and the barriers to the adoption be eradicated or significantly minimized.

## 6. Recommendations

- i. The study revealed the potential drivers of the Nigerian construction industry to adopt and reap the widely acclaimed benefits of lean construction principles by exploring the key facilitators of its adoption in the industry. It is recommended that these facilitators be tremendously improved by continuously meeting clients' needs and respond to the global, social and environmental challenges.

- ii. The study has established findings on the serious barriers of adoption of lean construction principles in the Nigerian construction industry. This has prepared a ground for organizations to find out ways of reducing these barriers and ensuring a smooth transition from the traditional management approach to lean construction principles based construction project delivery in the Nigerian construction industry.

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