

# 1 Challenges to the Implementation of Lean Construction 2 Practices in the South African Construction Industry

3 Ayodeji Oke<sup>1</sup>, Opeoluwa Akinradewo<sup>1</sup>, Clinton Aigbavboa<sup>1</sup> and Mulongo Ndalamba<sup>1</sup>

4 <sup>1</sup> SARChI in Sustainable Construction Management and Leadership in the Built Environment,  
5 Faculty of Engineering and the Built Environment, University of Johannesburg  
6 corresponding-author-opeakinradewo@gmail.com

7 **Abstract.** Lean Construction (LC) aims at concentrating on improvement,  
8 reduction of waste, money value, focus of user, project quality management,  
9 supply management, and improved communications. LC helps in reducing waste  
10 of materials, effort and time which therefore generates maximum possible value  
11 and provides a cohesive supply chain that reduces lead time. The Construction  
12 Industry performance is affected by waste. Such wastes are measured in  
13 materials, resources, time, movement, production and creativity. Hence this study  
14 identifies the challenges of implementing LC practices in the South African  
15 construction industry (SACI). Data used for this paper were collected using well-  
16 structured questionnaire distributed to professionals within the SACI ranging  
17 from Quantity Surveyors, Architects, Civil Engineers, Project Manager,  
18 Construction Manager, and Construction Project Manager. Findings emanating  
19 from the study revealed that poor work culture among project partners ranked  
20 highest followed by lack of good policies, complexity of lean construction  
21 process, poor organization knowledge among others as the challenges facing the  
22 implementation of lean management in the SACI. It was concluded that the main  
23 significant aspect that lean construction evolves around is attitude, this, therefore,  
24 requires construction industry participants to have a complete attitude shift and  
25 practice lean construction on their every-day tasks.

26 **Keywords:** Construction Industry, Lean Construction, Project delivery,  
27 Construction waste.

## 28 1 Introduction

29 The word lean is a term adopted from the manufacturing industry, which was later  
30 introduced for use in the construction industry. In the 1950s, the promotor of the Toyota  
31 Production System Taiichi Ohno, concentrated his efforts on finding ways of  
32 converting waste into value developed the Lean production management principles [1]  
33 and [2]. Koskela [3] and [4] also affirmed that lean construction is an idea formed from  
34 the concepts of lean manufacturing. The term lean construction (LC) was pioneered by  
35 [3] who introduced the idea of understanding production as0020construction and  
36 establish the lean concept in construction [4]. The [5] defined LC as a dominant  
37 technique that delivers improvement efficiently, reduce waste, and improve quality.

38 Construction Industry Institute [6], LC is described as a continuous method which helps  
39 to reduce waste, meet client's requirements, concentrate on the maximum amount, and  
40 pursue excellence in the realisation of projects. Based on the definition of [7] and [8]  
41 "LC is a business system that encompasses culture, planning, concepts, and tools to  
42 maximize value while minimizing all forms of waste". LC aimed at concentrating on  
43 improvement, reduction of waste, money value, focus of user, project quality  
44 management and supply management, and improved communications. LC helps in  
45 reducing waste of materials, effort and time which therefore generates maximum  
46 possible value and provides a cohesive supply chain that reduces lead time. Such wastes  
47 are measured in materials, resources, time, movement, production and creativity [8–  
48 11]. By eliminating waste, LC practices enhanced the performance of the C.I using a  
49 minimum amount of resources.

50 Common et al. [16, 17] explained that the lean concept exists since the beginning of  
51 1900's. It is Henry Ford who presented the philosophy of the assembly line that  
52 revolutionised car production. The adoption of lean concept in production as  
53 established by Toyota Motor company in Japan brought about the principles of lean  
54 construction. Engineer Taiichi Ohno, the company head of production engineering,  
55 devoted his time into discovering how to convert waste in the industry into value [1, 2,  
56 18]. With the adoption of lean concepts in the construction industry, benefits have been  
57 recorded in reducing construction waste during the execution of projects on site. LC  
58 helps to eradicate time and materials waste as a means to generate value in more  
59 possible ways [3]. According to [19] time is reduced by the cohesive supply chain of  
60 LC. By clearing project objectives, LC shows the difference in it compared to project  
61 management method [18], and the function of LC is highlighted in maximising the  
62 performance of projects by eliminating waste throughout the design to delivery  
63 lifecycle of the project. Improvement in the construction process came as a result of  
64 these principles of waste reduction. Conclusively, the adoption of LC helps to meet the  
65 requirement of clients, reduce the value stream and it also pursuit perfection in  
66 construction projects. Its application spans across construction project design through  
67 delivery and use.

68 In the last decade, several research efforts have been geared towards the  
69 classification of construction waste. these relate to various characteristics such as type,  
70 magnitude, etc [12]. Waste can also arise from procedures of work, resources, time,  
71 operations and equipment [13, 14]. Waste in construction could be because of design  
72 errors, redoing work, defects, modifications and using more materials [14]. However,  
73 waste in construction and manufacturing industry comprises of waiting times, excess  
74 inventory, rework, lack of safety, quality costs, unnecessary transportation trips, set up,  
75 motion, handling, expedition, prioritizing, inspections, improper choice or management  
76 method or requirement and lack of constructability [15].

## 77 **2 Methodology**

78 This survey adopted a quantitative approach to achieving the objective. Quantitative  
79 research is a numerical representation and manipulation of observations which

80 examines and gives an understanding of the phenomena that those observations reflect  
81 [20]. The research method helped to determine the challenges that the SA construction  
82 is facing in the implementation of LC practices. With the use of a questionnaire survey,  
83 the primary data were obtained. Respondents for this study are Architects, Quantity  
84 Surveyors, Project Managers, Construction Project Managers and Civil Engineers who  
85 have been involved in construction projects. Data collection was done by using a  
86 structured questionnaire which was designed based on information from the literature  
87 review. Descriptive statistics, Mean Item Score (MIS) and Standard Deviation (SD)  
88 were used in analysing data for this study through the use of SPSS.

### 89 **3 Results**

#### 90 **3.1 Respondent's Demographic Information**

91 The research result shows the professional qualification of the sampled respondents and  
92 it reveals that 35.0% are Quantity surveyors, 18.3% construction managers, 12.2%  
93 Project managers, 23.1% civil engineers, and 9.2% Architects. Result also showed  
94 62.2% had experience that ranged from 1-5 years, 20.0% 6-10 years, 11.1% 11-15  
95 years, 4.4% 16-20 years while 2.2% had more than 20 years of experience in the  
96 construction industry. Further result showed 16.5% of the respondents work for private  
97 clients, 39.9% consultants, 36.4% contractors, and 7.2% works for public  
98 client/government. The result revealed that 17.8% of the respondents have been  
99 involved in 1-2 projects, 26.7% in 3-4 projects, 37.8% in 5-6 projects, 8.9% in 7-8  
100 projects and 8.9% of the respondents were involved in more than 8 projects. The  
101 research result shows that 20.0 % of the respondents weren't involved in projects in  
102 which Lean Construction was practiced, 51.1% of the respondents were involved in 1-  
103 2 projects, 22.2% in 3-4 projects, 6.7% in 5-6 projects, and none of the respondents  
104 have been involved in more than 6 projects that LC was practiced on. It was also  
105 gathered from the result that out of the projects in which Lean Construction was  
106 practised, 23.6% are school projects, 21.3% are hospital projects, 15.6% are housing  
107 estates projects, 8.2% are road construction projects, 4.6% are other civil works (dams  
108 etc.) projects, 14.5% are government offices projects and 12.2% are renovation projects  
109 (residential, civil, etc). With this demographic information of the respondents, it can be  
110 concluded that the respondents possess enough experience in Lean Construction  
111 Practices in the South African construction industry and therefore their opinion can be  
112 relied upon for this study.

#### 113 **3.2 Challenges to the Implementation of Lean Construction Practices**

114 The ranking of the challenges in table 1 was done using the combined opinion of the  
115 respondents for an overall interpretation. Findings on the challenges of implementing  
116 Lean Construction practices in the South African construction industry as shown in  
117 table 1 from contractor respondents' point of view, shows the top five most dominant  
118 challenges are poor culture among project partners, lack of good policies, lack of

119 understanding of lean construction, lack of skills on lean construction process and  
 120 complexity of lean construction process.

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122 **Table 1.** Challenges to lean construction practices implementation (Contractor's view)

| Challenges of implementing Lean Construction | Contractors |       |    |
|--|-------------|-------|----|
|  | MIS         | SD    | R  |
| Poor culture among project partners          | 4.97        | 7.228 | 1  |
| Lack of Good policies                        | 4.10        | 0.712 | 2  |
| Lack of understanding of lean construction   | 3.93        | 0.980 | 3  |
| Lack of skills on lean construction process  | 3.93        | 0.583 | 3  |
| Complexity of lean construction process      | 3.90        | 0.923 | 5  |
| Takes time to adopt                          | 3.87        | 1.137 | 6  |
| Poor organisational knowledge                | 3.83        | 0.874 | 7  |
| Human Attitude                               | 3.80        | 0.714 | 7  |
| Ineffective management                       | 3.83        | 0.874 | 7  |
| Inherently knowledge-intensive               | 3.70        | 0.651 | 9  |
| Financial boundaries                         | 3.67        | 1.061 | 11 |
| Poor time management                         | 3.67        | 0.884 | 11 |
| Creates stress on contractors                | 3.60        | 0.932 | 13 |
| Lack of resources                            | 3.57        | 0.935 | 14 |
| Reduction of inventory                       | 3.47        | 1.042 | 15 |

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124 Table 2 indicates client and consultant respondents' point of view and the top five  
 125 most dominant challenges are inherently knowledge-intensive, poor organisational  
 126 knowledge, lack of resources, poor culture among project partners, and complexity of  
 127 lean construction process.

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129 **Table 2.** Challenges to lean construction practices implementation (Clients and  
 130 Consultants' view)

| Challenges of implementing Lean Construction | Client and Consultants |      |    |
|--|------------------------|------|----|
|  | MIS                    | SD   | R  |
| Inherently knowledge-intensive               | 4.20                   | 0.56 | 1  |
| Poor organisational knowledge                | 4.07                   | 0.80 | 2  |
| Lack of resources                            | 4.07                   | 0.88 | 2  |
| Poor culture among project partners          | 3.93                   | 1.10 | 4  |
| Complexity of lean construction process      | 3.93                   | 0.80 | 4  |
| Takes time to adopt                          | 3.87                   | 0.92 | 6  |
| Financial boundaries                         | 3.87                   | 0.99 | 6  |
| Lack of understanding of lean construction   | 3.80                   | 1.21 | 8  |
| Human Attitude                               | 3.73                   | 0.96 | 9  |
| Poor time management                         | 3.73                   | 0.70 | 9  |
| Reduction of inventory                       | 3.67                   | 0.72 | 11 |
| Lack of Good policies                        | 3.60                   | 0.99 | 12 |
| Lack of skills on lean construction process  | 3.60                   | 0.99 | 12 |
| Creates stress on contractors                | 3.47                   | 0.64 | 14 |
| Ineffective management                       | 3.33                   | 1.23 | 15 |

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132 Table 3 shows combined respondents' view with the top five most dominant  
 133 challenges being poor culture among project partners, lack of good policies, complexity

134 of lean construction process, poor organizational knowledge and lack of understanding  
 135 of lean construction.

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**Table 3.** Challenges to lean construction practices implementation (Combined Opinion)

| Challenges of implementing Lean Construction | Combined View |       |    |
|--|---------------|-------|----|
|  | MIS           | SD    | R  |
| Poor culture among project partners          | 4.41          | 0.712 | 1  |
| Lack of Good policies                        | 4.08          | 0.968 | 2  |
| Complexity of lean construction process      | 3.89          | 0.748 | 3  |
| Poor organisational knowledge                | 3.87          | 0.888 | 4  |
| Lack of understanding of lean construction   | 3.85          | 0.419 | 5  |
| Takes time to adopt                          | 3.79          | 0.571 | 6  |
| Inherently knowledge-intensive               | 3.74          | 0.865 | 7  |
| Lack of skills on lean construction process  | 3.70          | 0.663 | 8  |
| Human Attitude                               | 3.69          | 0.795 | 9  |
| Financial boundaries                         | 3.67          | 1.004 | 10 |
| Lack of resources                            | 3.65          | 0.591 | 11 |
| Poor time management                         | 3.61          | 0.621 | 12 |
| Ineffective management                       | 3.55          | 0.902 | 13 |
| Creates stress on contractors                | 3.54          | 0.801 | 14 |
| Reduction of inventory                       | 3.49          | 0.826 | 15 |

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#### 4 Discussion

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This survey agrees with the study carried out by [21] who identified the human attitudinal issues of implementing lean construction; Absence of a lean culture in the company; cultural change; poor team spirit; misconceptions about lean practice - seen as too complex; and fear of unfamiliar practices as the major challenges facing the implementation of Lean Construction practices. On the other hand, client and consultant respondents viewed inherently knowledge-intensive, Poor organisation knowledge, Lack of resources, Poor culture among project partners and Complexity of lean construction process as the top five most common challenges of implementing lean construction. These findings agree with the survey of [22, 23] which identified inherently knowledge-intensive as the most common challenge during the implementation of LC practices. As a result of this, the combined opinion (Contractor respondents and Client/Consultant respondents) using calculated MIS and SD showed that the most significant challenge is Poor culture among project partners. However, they both agreed there are common challenges such as complexity of lean construction process with a mean gap of 0.03 and that lean concept takes time to adopt with a mean gap of 0.00. The findings also agree with similar research carried out by [24] which focused on Gauteng province of South Africa. From this research, it is evident that the South African Construction industry professionals are faced with some challenges in implementing LC practices with Poor culture among project partners playing a major role together with Complexity of LC process and the long time it takes to adopt LC concept.

## 161 **5 Conclusions and Recommendations**

162 From the research work carried out, it can be concluded that the main significant aspect  
 163 that lean construction evolves around is attitude, this, therefore, requires construction  
 164 industry participants to have a complete attitude shift and practice lean construction on  
 165 their every-day tasks. This will consequently reduce human error which the  
 166 construction professionals are prone to making in carrying out their professional  
 167 services to an extent. It is therefore recommended that there should be initiation of  
 168 stakeholders with positive culture and behaviour because they are the ones who can  
 169 sustain the changes over time in the industry while Clients are encouraged to employ  
 170 lean expert managers because lean management plays a vital role in the successful  
 171 delivery of projects. This study was carried out in Western Cape province of South  
 172 Africa only which is a major limitation, it is therefore advised that it should be carried  
 173 out in other areas of the country to compare opinions of construction professionals.  
 174 Further studies can also be carried out on the determination of the relationship between  
 175 lean management and traditional management within the South African Construction  
 176 Industry.

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