

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

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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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