

Transformational Leadership and its impact on Lean Implementation

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Abstract: *With the multitude of variables that may play a role in a company's Lean journey, it is becoming more understood that leadership plays a significant role in implementing lean principles on construction projects. The goal of this research is to investigate the relationship between leadership and Lean Construction implementation. The research uses a quantitative research in which a survey was conducted, followed by a statistical analysis to test the hypothesis. Through the statistical analysis of survey data, the research finds that there is positive relation between the level of transformational leadership and the effectiveness of lean implementation. When an organization is implementing organizational change like Lean, traits of leaders must not be underestimated. The study findings may contribute to the knowledge of lean construction leadership by bridging the gap between leadership and the effectiveness of lean implementation.*

Keywords: *Lean construction; organizational change; leadership; implementation strategy; transformational leadership*

I. INTRODUCTION

Lean Construction has become a popular method for project delivery and this has led to more organizations experiencing their own implementation journey. As these organizations may experience, successful implementation can be the result of training with Lean tools and also how well the staff is able to change their behaviors to suit this newer style of project delivery [1]. While the necessity of a successful training program has been declared a part of the effort needed for companies to make a Lean transformation, a significant portion needs to be dedicated to the effort of changing the leader's practices, behaviors and mindsets [2].

With the multitude of variables that may play a role in a company's Lean journey, it is becoming more understood that leadership plays a significant role in creating a company's Lean opportunities. Recognized is how the presence of leadership has to be consistent with an ability to change the company culture by changing management practices [3]. With this said, simply viewing leadership as a facilitator of tasks and assignments is short-sided and further examination from this perspective is needed. There is a wealth of knowledge untapped about the relation between lean construction and leadership though many qualitative studies assert that leadership plays a critical role in lean implementation.

The research began with the idea that leadership should be stressed as a key factor in implementing Lean principles [2]. The ability for organizations to navigate the implementation process not only requires the improvement of company's systems and training

programs, but also understanding that a behavioral change must also occur [1]. In this regard, the goal of this research is to investigate the relationship between leadership and Lean Construction implementation. To this end, the research uses a quantitative research approach in which a survey was conducted, followed by a statistical analysis to test the hypothesis.

II. RELEVANT STUDIES

Developing a hypothesis needs to understand the empirical field of knowledge. The literature has been split into two sections. The first section is an overview of the implementation of Lean Construction in terms of organizational change; the second one focuses on leadership and how it could be applied towards overcoming the challenges faced when implementing organizational change.

A. The Implementation of Lean Construction in terms of Organizational Change

Lean transformation requires more than applying tools and techniques. Implementation of Lean Construction has challenges that are inherent to its own specific principles and systems. Yet the challenges can also include what is found typically in any organizational change [4]. Ballard et al. [5] claimed that application of lean principles at all levels, company, project, and process, requires a change in organizational culture. By understanding the challenges commonly created by organizational change, a better understanding of where to focus research can be obtained.

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Liker et. al [6] discussed the transformation of Japanese management systems in North America, that organizational change can be separated into “strategic design, social construct, and political.” Strategic design has more to do with the training and systems required to implement the organizational change[6]. Social construct is more related to the company culture being able to accept the changes and the role of leadership. Political relates to the dynamic of how organizational change affects the power structure of a company[6].

Another way of categorizing the challenges of organizational change is to identify them as hard and soft issues. Further explained, the hard issues relate to technology, structures and systems and the soft issues have to do with values and corporate culture [7]. These are similar to the categories identified in Liker, Fruin and Adler [6] in that systems required for implementation have been separated from the affects due to company culture.

There are suggestions on how to overcome the challenges of organizational change made by Bunker and Alban [8]. Their key points address how to use large group methods in different stages and the use of open communication of stakeholders that has become very popular with today’s large companies[8].Kotter [9] delivers a step-by-step adaption to organizational change with an emphasis ranging from vision to culture and how they are seen as the keys to success. Economic and social forces are also seen as a driver for major change in an organization[10].

While the information is limited on a construction organization, there is research on how an organization could overcome these challenges in lean implementation. Mann [2] addresses how organizations use leadership to implement Lean Manufacturing tools like standardization and value stream mapping but also how the role of culture affects the outcomes. Ballard et al. [5] showed that leadership is the one of primary success factors in lean implementation in construction industry.

B. Transformational Leadership and Organizational Change

Lean implementation at project level requires more than applying lean tools to construction projects. During the implementation of Lean Construction it is recommended that there is a presence of consistent leadership that leads organizational change to effectively implement lean principles [3]. Leadership has been described as a process of social influence in which one person can enlist the aid and support of others in the accomplishment of a common task. [11].

The role of leadership in an organization willing to implement organization change has been documented. As Lester [12] noted, a key to effectively complete organizational change is leadership. Any organization willing to implement change can recognize the value of having leadership at every level [12].The literature embeds key leadership constructs for the improvement of the organizational processes [7]. It is with this leadership infiltrating at every level that company culture can accept

change [12]. Bennis [13] highlighted leaders’ personal style and their effects on organizations.

Bass [14] compares two styles of leadership regarding organizational performance and individual leader’s traits: transactional leadership and transformational leadership. According to Bass, transactional leaders predetermine what their followers should do to realize their personal and organizational aims; they classify these aims and help their followers to become more self-confident in order to achieve their goals with the minimum effort[14, 15]. On the contrary, transformational leaders motivate their followers to do more than they really expect they can do, increasing the sense of importance and value of the tasks, stimulating them to surpass their own interests and direct themselves to the interests of the team, organization or larger community and raising the level of change to a higher level [14]. Transactional leadership is a process in which the relationship of leader - follower is reduced to simple exchange of a certain quantity of work for an adequate price. Contrary to this, transformational leadership is a far more complex process, the realization of which requires more visionary and more inspiring figures [14].

Among the types of leadership, transformational leadership, defined as a set of behaviors that motivates followers to exceed expectations in pursuit of the organization’s vision, sacrifices their self-interests for the collective good[15]. The research finds that the attributes of transformational leadership is in line with the value of lean which emphasizes the sacrifice of self-interests for the organization’s goals living up to long-term philosophy[16].

The most recent model of transformational leadership encompasses the following leadership dimensions as measured by the Multifactor Leadership Questionnaire [15]: idealized attributes, idealized behaviors, inspirational motivation, and intellectual stimulation, each of which is defined [15].

(1) Idealized influence refers to the socialized charisma of the leader, whether the leader is perceived as being confident and powerful, and whether the leader is viewed as focusing on higher-order ideals and ethics; (2) idealized influence refers to charismatic actions of the leader that are centered on values, beliefs, and a sense of mission; (3) inspirational motivation refers to the ways leaders energize their followers by viewing the future with optimism, stressing ambitious goals, projecting an idealized vision, and communicating to followers that the vision is achievable; and (4) intellectual stimulation refers to leader actions that appeal to followers' sense of logic and analysis by challenging followers to think creatively and find solutions to difficult problems.

The linking of organizational culture and the transformational-transactional leadership paradigm was investigated[17]. Hartog et al [17] also discussed the relationship between leadership and organizational culture and how leadership styles should fit with the goals of the organization. Based on transformational leadership theory and organizational change in lean implementation, the researchers developed the following hypothesis:

Attributes of transformational leadership will be positively related to the effectiveness of lean implementation

III. RESEARCH METHOD

A. Procedures, Organizations, and Respondents

Procedures

The participants for this survey were limited to general contractors who are implementing Lean on specific projects on the West Coast of the USA. The general contractors were identified by using references available on the Lean Construction Institute’s website [4]. Emails were sent out to the general contractors who have offices on the West Coast and were asked their willingness to participate in this study. If a company was willing to participate, a point of contact (POC) was established with the company to explain the purpose and process for the study and questionnaire. It was preferred to meet with the POC in person, but given the various locations of the participating companies this may not be plausible and contact via phone or email will have to be used instead.

Instructions for the questionnaire included how it needs to be distributed to a specific project using lean principles and the participants need to be directly involved in the project’s lean effort. The links to the online test was given to the company POC via email for them to distribute to their selected projects. Once the respondent had completed the survey, an email was sent to the researchers indicating it has been completed and compiled for analysis. If the responses in the questionnaire are incomplete or require more information, the researcher will contact the POC in order to request further data.

Participating Organizations

Requests were sent by email to the lean representatives of 16 general contractors located on the West Coast of the USA who were either Lean Construction Institute members or had a Lean program listed on their company’s website. Seven contractors replied back to the email with interest in participating in the survey and of those seven, three agreed to distribute the survey to selected project sites that are implementing Lean that are over 50% complete in the scheduled progress of their project. The first contractor to respond has several offices in the USA and communication with the POC, who is located in the San Francisco Bay Area, was done by phone and email. The other two participants are both from large general contractors with offices located in Seattle, WA. Communication with each POC was done in person, by phone and email. Testing took place from July of 2013 to February of 2014. Descriptions of the general contractors who participated in this study are listed below. The letters, A, B, or C, are used to identify each contractor.

Organization A

Organization A is a general contractor who is an active member in the Lean Construction community who has regional offices around the USA. The company’s core markets includes commercial offices, healthcare, biotech, life sciences and higher education. The POC for this project is located in the San Francisco Bay Area and the study scope and clarifications was made using telephone and email communications. All projects used in this study are located in the state of California.

Organization B

Organization B is a general contractor who is an active member in the Lean Construction community who main office is located in Seattle, WA. The company’s core markets include commercial offices, healthcare, education, life sciences, mixed-use and historical renovations. The POC for this project is located in Seattle, WA and the study scope and clarification was made using a face-to-face meeting and email communications. All projects used in this study are located in the Puget Sound region of the state of Washington.

Organization C

Organization C is a general contractor that has established a Lean Construction program within its organization and has offices located in the Pacific Northwest region of the USA. The company’s core markets include commercial offices, healthcare, higher education, biotech, life sciences, and historical renovations.

Respondents

A total of 78 respondents from three general contractors participated in this study. Forty (50.6%) respondents indicated themselves as followers; thirty-four (43.0 %) respondents indicated themselves as a follower and a leader; and five (6.3%) respondents did not indicate themselves as a leader or follower. The number of respondents per each organization is shown in Table 1.

TABLE I
THE NUMBER OF RESPONDENTS

Organization	The number of Respondents	Percentage
A	53	67.9%
B	15	19.2%
C	10	12.9%
Total	78	100.0%

B. Questionnaire Development

In order to test the proposed hypothesis, questionnaires were designed and refined. The entire

questionnaire is included in Appendix. The questionnaires include two sets: questionnaires to assess a transformational leadership and questionnaires to assess the effectiveness of lean implementation.

Assessing a Transformational Leadership

The direct followers used a five-point scale (0=not at all, 5, frequently, if not always) to rate their leader’s transformational leadership skills using Multifactor Leadership Questionnaire (MLQ) Form [15]. The followers were asked how frequently a list of 18 behaviors characterized their leader that can be categorized as one of the four transformational dimension: idealized influence, idealized behavior, inspirational motivation and intellectual stimulation as defined below [15].

Each factor is considered as an independent variable in multivariate regression analysis while these four factors are summed into one category of transformational leadership values (TLV) in simple regression analysis. The value of TLV is calculated as average of values of four dimensions, which are idealized influence, idealized behavior, inspirational motivation and intellectual stimulation.

Assessing the Effectiveness of Lean Implementation

The project performance itself does not reveal the effectiveness of lean implementation since multiple factors other than lean may impact on the project performance. Instead, the research tried to assess the respondents’ perception on the effectiveness of lean implementation. The questionnaires for assessing the efficiency of lean implementation were designed to assess the survey participants’ perception on how lean implementation impacted on the project performances. Using a five-point scale, all participants rated their agreement with seven statements concerning Lean (1-strongly disagree and 5=strongly agree) such as “Lean could improve the value of the project.”

IV. RESULTS

A. Descriptive Statistics

Table 2 presents the number of samples, means, standard deviations of each variable. The first four variables show each dimension of TLV. Unlike variables one through six, the higher value of “lean construction costs” indicates negative feedback on lean implementation. Variables one through five were used as independent variables while the last two variables (i.e. lean construction effectiveness and lean construction costs) as dependent variables in the analysis.

The initial step to analyzing the responses is to determine the reliability of the responses within a cluster by using Cronbach’s alpha reliability estimates. The Cronbach’s alpha will be used to measure the internal consistency of how closely items in a group are related. If the Cronbach’s alpha of a metric is above 0.9 it can be considered to have an excellent consistency. Above 0.8

will equate to good consistency and above 0.7 will be considered acceptable. The minimum level of acceptance for Cronbach’s alpha will be anything above 0.6. If the Cronbach’s alpha is below 0.6 the metric will not be considered since it will not be considered reliable [18]. The overall results of the Cronbach’s alpha are shown in Table 3 to determine the reliability of the responses. Table 3 suggests that all variables can be considered as a reliable indicator and used in the final analysis.

TABLE II
DESCRIPTIVE STATISTICS

	Min	Max	Mean	Std. Dev.	N
Lean, Effectiveness	2.71	5	4.2122	0.638	78
Idealized Influence	2.33	5	4.0451	0.717	78
Idealized Behavior	2.33	5	4.1305	0.757	78
Inspirational Motivation	2.4	5	4.0131	0.677	78
Intellectual Stimulation	2.57	5	4.0494	0.643	78
Trans. Leadership	2.62	5	4.0601	0.644	78

TABLE III
CRONBACH’S ALPHA RESULTS

Variables	Cronbach’s Alpha	Interpretation
Idealized Influence	0.85	Good
Idealized Behavior	0.83	Good
Inspirational Motivation	0.91	Excellent
Intellectual Stimulation	0.92	Excellent
Lean, Effectiveness	0.87	Good

Table 4 shows the correlations between independent variables and dependent variables. According to Table 3, transformational leadership demonstrated expected positive relationship with the effectiveness of lean construction ($r = 0.644, p < 0.05$). Idealized behavior was most strongly related to the effectiveness of lean implementation ($r = 0.645$), followed by inspirational motivation ($r = 0.640$).

TABLE IV
CORRELATION COEFFICIENT

	Lean, Effectiveness	Idealized Influence	Idealized Behavior	Inspirational Motivation	Intellectual Stimulation
Lean, Effectiveness	1.000				
Transform. Leadership	0.644				
Idealized Influence	0.611	1.000			
Idealized Behavior	0.645	0.606	1.000		
Inspirational Motivation	0.640	0.573	0.589	1.000	
Intellectual Stimulation	0.508	0.552	0.569	0.579	1.000

B. Hypothesis Testing

Although the correlation analyses generally supported the hypothesis, regression analysis was performed to further analyze the relationships between

transformational leadership and the effectiveness of lean construction. First, the research performed simple regression analysis between transformational leadership and lean implementation indexes to understand how transformational leadership impacts on the lean implementation. For that purpose, the research investigated the impact of attributes of transformational leadership (TLV), the average of four factors, on the effectiveness of lean implementation by running the following simple regression equation:

$$\text{Lean Implementation Effectiveness} = \beta_0 + \beta_1 * \text{Idealized Influence}$$

TABLE V

SIMPLE REGRESSION ANALYSIS RESULT

Number of Observations = 78

Dependent Variable = Lean Construction Effectiveness

Adjusted R-Squared = 0.415

	Coefficient	Standard Error	p
Transform. Leadership	0.639	0.087	0.000

The results of regression analysis with “transformational leadership value” as a single independent variable are shown in Table 5. As predicted, transformational leadership was significantly related to the employee's perception on the effectiveness of lean implementation, explaining 41.5 % of the variance when four factors of transformational leadership were averaged as transformational leadership value. This shows that the primary hypothesis of this research holds true. The slope coefficient of 0.639 for “transformational leadership” indicates that one scale level increase of “transformational leadership” would result in a 0.639 increase in “lean construction effectiveness” scale level.

Multivariate regression analysis was also performed to further investigate how each factor is related to the employee's perception on the effectiveness of lean implementation using the following regression equation:

$$\text{Lean Implementation Effectiveness} = \beta_0 + \beta_1 * \text{Idealized Influence} + \beta_2 * \text{Idealized Behavior} + \beta_3 * \text{Inspirational Motivation} + \beta_4 * \text{Intellectual Stimulation}$$

TABLE VI

MULTIVARIATE REGRESSION ANALYSIS RESULT

Number of Observations = 78

Dependent Variable = Lean Construction Effectiveness

Adjusted R-Squared = 0.477

	Coefficient	Standard Error	p
Idealized Influence	0.143	0.087	0.062
Idealized Behavior	0.205	0.054	0.016
Inspirational Motivation	0.237	0.061	0.014
Intellectual Stimulation	0.124	0.153	0.059

As the results indicate in Tables 4 and 6, overall factors of transformational leadership was significantly and positively related to the effects of transformational leadership on “lean construction effectiveness” are

significant. Among the factors in transformational leadership, the effects of “idealized behavior” and “inspirational motivation” on the effectiveness of lean construction are statistically significant ($p < 0.05$). On the other hand, the effects of “idealized behavior” and “intellectual stimulation” are not statistically significant.

V. DISCUSSIONS

With literature review, the research found the transformational leadership relevant and requisite in organizational changes that are needed in implementing lean at project level. Despite the leadership being perceived as a critical success factor in publication on lean construction implementation [3], there are few empirical studies investigating the role of leadership in the domain of lean construction.

In an effort to address the limitations in the lean implementation literature in AEC (architecture, engineering, and construction) industry, the study found strong support for the hypothesized relationship between the level of transformational leadership and the effectiveness of lean implementation perceived by the followers. Among factors in transformational leadership, the research showed that the effects of “idealized behavior” and “inspirational motivation” on the effectiveness of lean construction are statistically significant.

The study results also offer useful implications for construction contractors embarking on their lean journey. When an organization is implementing organizational change like Lean, the leadership must not be underestimated. Contractors may want to conduct assessment of leadership of their project leaders before assigning them to lean projects. While staffing of a project is a dynamic process that involves several factors, the personality of the project leaders could have affect the followers and subsequently the performance of a project. In order to understand the effectiveness of project leadership, organizations can gain insight by interviewing the followers.

While this study has merits in identifying the relationship between transformational leadership and the effectiveness of lean implementation, there are limitations to this study, which include:

1) The sample size (i.e., the number of respondents) is relatively small, not enough to generalize the findings.

2) The opinion of followers was used to measure of lean implementation impacts.

VI. CONCLUSIONS

The purpose of this study was to empirically examine the role of leadership in lean implementation at construction projects. It was also an endeavor that confirms the claims in publication as to leadership being a success factor. Though claimed leadership a success factor in lean implementation, literature has not address the type of leadership needed for lean implementation, nor investigate the relations between leadership and its impact on lean implementation.

Through the statistical analysis of survey data, the research finds that there is positive relation between the level of transformational leadership and the effectiveness of lean implementation. The study findings may contribute to the knowledge of lean construction leadership by bridging the gap between leadership and the effectiveness of lean implementation. They also send a message to the industry, especially the areas in leadership training and the selection of leaders for successful lean implementation.

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Appendix A.

How frequently does the list of behaviors listed below characterize your leader's behavior (1 = not at all, 5 = frequently, if not always).

- Go beyond self-interest for the good of the group.
- Make personal sacrifices for others benefit
- Provide reassurance that obstacles will be overcome

- Consider the moral and ethical consequences of decisions
- Specify the importance of having a strong sense of purpose
- Emphasize the importance of having a collective sense of mission
- Talk optimistically about the future
- Talk enthusiastically about what needs to be accomplished
- Articulate a compelling vision of the future
- Express confidence that goals will be achieved
- Provide an exciting image of organizational change
- Re-examine critical assumptions to question whether they are appropriate
- Seek differing perspectives when solving problems
- Get others to look at problems from many different angles
- Suggest new ways of looking at how to complete assignments
- Encourage non-traditional thinking to deal with traditional problems
- Encourage re-thinking those ideas which had never been questioned before
- Improve decision-making process to increase its effectiveness.

Appendix B.

How do you think the impact of lean implementation? (1 = strongly disagree, 5 = strongly agree, if not always).

- Lean construction practices could help reduce the overall project schedule.
- Lean construction practices could improve the reliability of our subcontractors and suppliers.
- Lean construction could improve the value of the project.
- Lean construction practices reflect the values of my company.
- Lean construction practices could help with my project planning abilities.
- Lean construction practices benefits outweigh any negatives it may create.
- Lean construction practices are worth the work.