AN EXPLORATORY STUDY OF THE MAIN BARRIERS TO LEAN CONSTRUCTION IMPLEMENTATION IN PERU

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AGENDA

1. Background and motivation
2. Literature Review: Barriers of lean implementation
3. Survey: Ranking of barriers
4. Conclusions and outlook
BACKGROUND AND MOTIVATION

High share of non-value adding activities in the construction industry requires strategies to minimize waste

(Productive time vs. Non-value adding activities in manufacturing and construction)

Manufacturing Global:
- Productive Time: 87%
- Waste: 13%

Construction Global:
- Productive Time: 43%
- Waste: 57%

Construction Peru:
- Productive Time: 28%
- Waste: 72%

(Aziz and Hafez, 2013; Lean Construction Institute, 2004; Ghio, 2001)
**BACKGROUND AND MOTIVATION**

To get the most out of lean construction: you need to overcome barriers

<table>
<thead>
<tr>
<th><strong>BARRIERS</strong></th>
<th><strong>BENEFITS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of government polices to encourage the use of Lean</td>
<td>• Safety improvement</td>
</tr>
<tr>
<td>• High cost of implementation</td>
<td>• Productivity improvement</td>
</tr>
<tr>
<td>• Resistance to change</td>
<td>• Improve site planning</td>
</tr>
<tr>
<td>• Local and not global flow optimization</td>
<td>• Reduce construction time</td>
</tr>
<tr>
<td>• Long duration of the Lean learning curve</td>
<td>• Avoid rework</td>
</tr>
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<td></td>
<td>• Higher transparently</td>
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(Almanei et al. 2017; Murguia 2019; Bashir et al. 2015)
Research methods to identify barriers of lean implementation

**Research Tools**
- Literature review

**Activities**
- Identification of Lean barriers
- Define categories of Lean barriers
- Identification of implementation models

**Deliverables**
- List of Lean Barriers
- List of Lean Barrier Categories
- List of Lean implementation models

**Validation of Lean barriers: 06 expert judgments**
- Compilation of barriers identified by experts
- Expert barrier list analysis
- Validation of Lean barriers with experts

**Deliverables**
- List of expert barriers
- Preliminary survey
- Final survey

**Professional survey**
- 124 responses from Peruvian engineers

**Deliverables**
- List of expert barriers

**Statistical Analysis - Cronbach’s Alpha**
- Validate features
- Rank main Lean barriers

**Deliverables**
- List of main barriers
LITERATURE REVIEW (1/3)

**Literature review**
- Keywords: “barriers, challenges, factor influencing, lean construction implementation”.
- Databases such as: Google Scholar, IGLC papers, Sciencedirect, Asce library, Lean Construction Journal, Peruvian Institutional Research Repository.
- 93 papers review
- 68 lean barriers identified

**Discussion with experts**
- Semi-structured zoom interviews
- Experts with more than 12 years of experience in implementing Lean
- 01 expert per industry
- 05 barriers identified with experts

32 barriers prioritized with the experts for the study
Barriers associated with the Lean philosophy

- Lack of understanding of the fundamental purpose and rationale for Lean implementation.
- Lack of transparent information between team members and management, reducing reliability in Lean.
- Local and not global flow optimization
- Lack of information exchange between teams, suppliers, subcontractors, etc.
- Lack of long-term thinking in the organization for Lean implementation
- Lack of clear definition of scope, identifying value and definition from the customer's point of view.
- Long duration of the Lean learning curve
- Lack of leadership and empowerment of people in the project.

(Salvatierra et. al 2015, triangle GEPUC)
<table>
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<th>Philosophy associated with the lean culture</th>
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<tr>
<td>Lack of centralized, stored, and shared information to generate a continuous improvement cycle.</td>
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<tr>
<td>Incorrect selection of Lean tools</td>
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<td>Ease of communication from top management with improvement initiatives.</td>
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<td>Resistance to change of people in the organization</td>
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<td>Lack of self-criticism to learn from mistakes and identify problems</td>
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<tr>
<td>Lack of improvement culture throughout the organization</td>
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<td>Inability to measure team performance and progress</td>
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<td>Lack of advance work planning and realistic scheduling using Lean tools</td>
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<tr>
<td>Lack of time to implement Lean in ongoing projects</td>
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<tr>
<td>Lack of collaboration of all project stakeholders at all levels and early stages of design and production (suppliers, subcontractors, etc.).</td>
</tr>
<tr>
<td>People use tools without supporting them with culture and philosophy.</td>
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<th>Other barriers related to lean implementation.</th>
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<td>Replicating the Lean strategy of another organization</td>
</tr>
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<td>Lack of top management commitment to the implementation</td>
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<td>Lack of knowledge and experience of</td>
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<td>Lack of collaborative work between academia and the construction industry</td>
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<td>High cost of implementation</td>
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(Salvatierra et. Al 2015, triangle GEPUC)
SURVEY: RANKING OF BARRIERS

Profile survey

Method of evaluation 1–5 point Likert scale

Rate the frequency with which you experience the practices mentioned above …

1. Never
2. Rarely
3. Occasionally
4. Frequently
5. Very frequently

124 lean Peruvian practicing engineers responded to the survey

Questions with positive or neutral syntaxes so as not to influence or sympathize with answers.
SURVEY: RANKING OF BARRIERS

Highest rated group

Philosophy

Culture

Technology

Ranking results – Top 5 barriers of lean implementation

<table>
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<th>Variable</th>
<th>Rank</th>
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<tbody>
<tr>
<td>Lack of government policies to encourage the use of Lean.</td>
<td>1</td>
</tr>
<tr>
<td>Lack of collaborative work between academia and the construction industry.</td>
<td>2</td>
</tr>
<tr>
<td>High cost of implementation</td>
<td>3</td>
</tr>
<tr>
<td>Low empowered capacity of people in the organization delays decision making.</td>
<td>4</td>
</tr>
<tr>
<td>Low knowledge of Lean among university graduates.</td>
<td>5</td>
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CONCLUSIONS AND OUTLOOK

Lessons learned

• The Peruvian State must adapt the contracting laws to allow flexibility to lean projects.
• Understanding the Lean philosophy by workers is still complex in Peruvian industry.
• Collaboration between academia and companies can reduce many barriers.
• The implementation of lean is possible if we all contribute, know each other, inform ourselves and work as a team.

Outlook

• Generate and propose a roadmap.
• Study of the level of Lean maturity in university students.
• Lean perception study on suppliers, customers, subcontractors, etc.
• Generate and propose a roadmap for implementing Lean in the public sector.

This study is part of a macro study to propose a roadmap for Peru. Identifying the root causes of barriers is fundamental to improve construction in general and to execute projects more successfully.

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REFERENCES

THANK YOU!

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