

A METHODOLOGY TO EVALUATE CONSTRUCTION PROJECT USING THE CONCEPT OF LEAN CONSTRUCTION

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ABSTRACT

Construction projects in Indonesia are currently experiencing inefficiency problems in implementation. This is caused by the presence of waste consisting of technical constraints (factors of labor, materials, and equipment) and non-technical constraints (poor planning and structured). Waste must be identified and then reduced to improve the performance of construction project implementation. This requires a methodology that can be used to identify waste and propose improvements to the construction project. Lean Construction is a concept that is often used to eliminate waste in construction projects, so this concept can be used as the primary basis for the proposed methodology. The proposed methodology consists of six stages: (1) identification of waste that could potentially lead to delays in the project, (2) the classification of waste according to the five principles of lean thinking, (3) evaluation of waste using lean construction techniques, (4) the proposed improvement of project implementation; (5) future state mapping, and (6) analysis of the proposed repair.

KEY WORDS: construction project, waste, lean thinking, lean construction

1. INTRODUCTION

Nowadays, Indonesian construction has experienced various problems regarding the inefficiencies during the implementation of construction. This inefficiency is caused by the bad performances, non-value-added resources usage during the construction. Based on the records announced by the Lean Construction Institute (LCI), the rate of waste on construction industry about 57% and about 10% of value-added activity (Abduh, 2007). Implementation cost increasing, delays, and dispute was the impact of the inefficiencies of construction industry.

A construction project can be delayed due to technical constraints, such as the factors of labor, material factors and equipment factor. As well as non-technical obstacles, such as lack of good planning and structured. Delays in the construction process can result lack of trust in the owner of the service provider's performance construction.

The delay is due to the waste in the implementation of the project, it is necessary for the evaluation of the system of construction project implementation. For this evaluation have proposed methodology first used as a reference framework. For those on the methodology developed in this paper using the concept of Lean Construction as a reference. The concept of lean construction has been widely applied in the implementation of construction projects (Howell, 1999; Ballard, 2004; Abduh, 2005; Johansen and Walter, 2007; Hook and Stehn, 2008).

2. LITERATURE REVIEW

Construction is an activity of infrastructure development such as, building construction, construction of civil infrastructure (civil engineering), and mechanical and electrical installations. Waste is a problem or an activity that should be minimized because it has no added value.

This paper uses the concept of lean construction for the proposed improvement of the implementation of construction projects with five stages: identifying waste; identify the factors that cause delays; perform classification of waste using lean construction principles proposed by Womack and Jones (1996), namely, value, value stream, flow, pull, and perfection; evaluate projects using lean construction techniques and proposes improvements for the construction project, and analyze the application of the proposed improvements.

2.1 Lean Thinking

Lean thinking is a new way to manage a construction. The goal of Lean thinking to redefine the performance against three-dimensional perfection, namely: different special products, fast shipping, and not sold in any store. This is an ideal way that can maximize value and minimize waste. Lean is a process of finding value and continuously making changes in order to create perfection. To move toward perfection it would be required many forms and procedural changes and change our way about thinking and doing construction.

2.2 Lean Construction

Lean construction is a method used to minimize waste on materials, time, and efforts to maximize the value generated in production system design (Abdelhamid, 2005). Lean construction can change the location of the construction site to assembly line of a factory.

2.2.1 Principles of Lean Construction

There are five principles contained in lean construction concepts that have been proposed by Womack and Jones (1996), namely: value, value stream, flow, pull, and perfection.

Value

Value is defined by the authors as the capabilities provided to customers at the right time and at appropriate prices (Womack and Jones, 2000). There are three main causes that make an activity is not providing value, they are, design, ignorance, and the nature of construction (Lim, 2008).

Value Stream

Value stream in lean thinking is defined as a set of specific activities required to design, order and provide a specific product, from concept, ordered to be sent, and the raw material reach consumer.

Flow

Lean principles to flow is defined as "the progress of achieving the value stream so that the product, from design to order to be sent, and the raw materials reach the customer with no stop or flow back.

Pull

Lean principles to pull is defined as "a flowing production system and instruct delivery from downstream to upstream where none of them is produced by the upstream supplier until the downstream customer signals required". Pull identify a real need to immediately deliver the product to customers when the customer needs it.

Perfection

Lean principles to perfection is defined as "the elimination of all kinds of muda so that all activities along the value stream create a value." Perfection means always improving and changing the skills and knowledge of all parties involved, consider what is being done, and how to settle and exploit it (Lim, 2008).

2.2.2 The techniques used in Lean Construction

Here are a few techniques that have been developed to support the implementation of lean construction concepts (Yapri and Setijo, 2010):

1. Supply chain management (SCM)
2. Just in time (JIT)
3. Huddle meetings
4. Value stream mapping (VSM)

Table 1. The relationship between lean construction techniques on the five principles of Womack and Jones

	5 Lean Construction Principle				
	Value	Value Stream	Flow	Pull	Perfection
1 Supply chain management (SCM)	√		√		
2 Just in time (JIT)				√	
3 Huddle meetings					√
4 Value stream mapping (VSM)		√			

3. PROPOSED METHODOLOGY

3.1. Methodology

The proposed methodology for evaluating the implementation of construction projects using Lean concepts of construction can be seen in Figure 1.

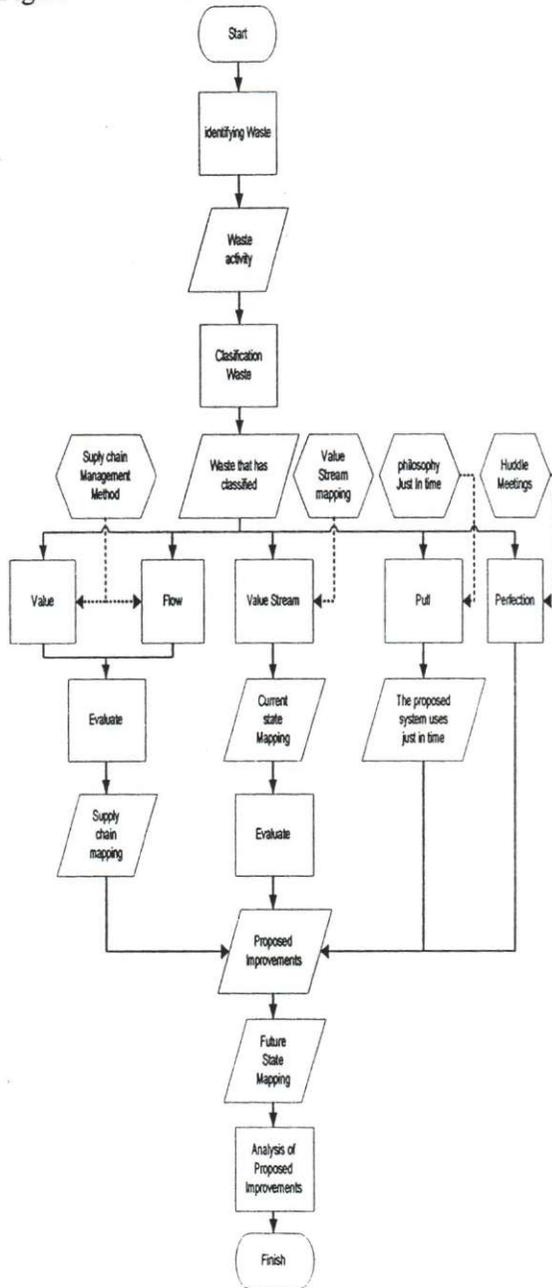


Figure 1. The methodology for evaluating the implementation of the system of construction project

Evaluation of the implementation of the construction project on the proposed methodology in this paper consists of six stages:

1. Identify waste that has been arising from construction, the output is waste activity. Identification of waste is done by in-depth interviews and observation conditions of the current project, the condition described by the current state mapping.
2. Classification of activities that lead to waste in lean construction principles proposed by Womack and Jones (1996), namely: value, value stream, flow, pull, and perfection.
3. Evaluation of construction projects using lean techniques and provide improvement proposals for construction projects. The concept of lean construction proposed by Womack and Jones (1996), namely value, value stream, flow, pull, and perfection.
 - a. Value dan flow evaluated using supply chain management method
 - b. Value stream evaluated using value stream mapping. For current conditions using current state mapping, while the future conditions after repairs using state mapping.
 - c. Pull evaluated using just in time philosophy
 - d. Perfection evaluated using huddle meetings concept
4. Analysis of the application of the proposed improvements in order to know whether the proposed improvements can be implemented or not.

3.2 Data Requirements

The data required in the evaluation using the proposed methodology is the general data of the project, such as an overview of the overall project, a list of project activities, and organizational structure; s curve; main material usage report data, and the data project progress and setbacks.

4. CONCLUSION

This paper has proposed a methodology that can be used to evaluate the implementation of the system of construction project, this methodology can lead evaluator to study and propose improvement system implementation of construction projects. The implementation of this methodology is being performed on one

construction project in Padang City, West Sumatra - Indonesia.

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