Overview of Lean Issues in Managing the Green Construction Project

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Abstract

Lean Management in construction and Green Construction approach seems to be an alternative route towards the sustainable construction. It has been introduced to minimize wastages as the main objective. Recently, a problem such as cost overruns, low productivity and quality occurs frequently in constructions that need to be addressed by the project stakeholders. The management principles and techniques such as Total Quality Management (TQM), Value Stream Mapping (VSM), Critical Path Method (CPM), Building Information Modelling (BIM), Just In Time (JIT) and 5S are some of the lean tools that are implemented to improve the construction process. Hence, through these various lean tools, it is believed that overall construction project performance will improve. This paper evaluates the issues and overview of current lean approaches in green construction agenda. The technical and human issues revealed will then be map to form the framework of implementing a Lean Management in Construction.

Keywords: Lean and Green Construction, TQM, VSM, CPM, BIM, JIT, 5S.

1.0 Introduction

1.1 Issues and Background of the Studies

Nowadays, construction field faces lots of problems such as decreasing profit margins and overloaded waste. These issues affect the performance in construction industry. As mentioned by Raid, A (2011) in his study on 'Applying 5S Lean Technology: An Infrastructure for Continuous Process Improvement', reducing waste process was started by the Japanese industry mainly Toyota, in the 1950 (Ohno, T, .1998). He added Toyota production system focused on pinpointing waste sources and they used tools that prove the effectiveness in reducing waste (Raid, A, 2011). Ritu (2012) conducted a study in lean and green construction. She concluded that, minimal building impact, maximum building system efficiency, energy efficiency, waste reduction, production environment, occupant and healthy environmental are the main elements in this lean and green issue. Therefore, this study focuses on the overview of management principles and techniques in managing lean and green issue in construction industry.

1.2 Objective of study

The study aims to look into:

a) Overview of the management principles and techniques such as Total Quality Management (TQM), Value Stream Mapping (VSM), Critical Path Method (CPM), Building Information Modelling (BIM), Just In Time (JIT) and 5S.
b) Possible barriers in management principles and techniques occurring in construction process.

1.3 Scope of study

The scope of this study focused on literature review of management principles and techniques. It also determines the possible barriers in implementing these management techniques.

2.0 Literature review

2.1 Lean Definition

According to Wilson, L (2009) and Raid, A (2011) lean defines the major types of waste such as overproduction, over processing, defects, inventory, transportation and delay. Salem, O at al (2006) have worked on Lean

Construction: From theory to implementation, lean also comprises a variety of production system including waste minimization, responsiveness to change, just-in-time, continuous improvement and etc (Murman et al, 2002).

According to Lean Enterprise Institute (2000-2015), lean means creating more values for customers with fewer resources. Meanwhile, Lean Construction Institute (2012); Mohd Arif M., et al (2013) define lean as a production management based approach to project delivery-a new way to design and build capital facilities. They also added that Lean construction has caused a revolution in manufacturing design, supply and assembly. Again Mohd Arif M., et al (2013) stated Lean construction is the practical application of lean manufacturing principles, or lean thinking to the building environment (Lukowski, 21010), and also balanced use of people, materials and resources (Lim, 2008).

2.2 Total Quality Management (TQM)

Total Quality Management (TQM) involved in every organization to improve their performance. There are three words in TQM, namely total, quality and management. According to David A., et al (1997), quality can be defined as meeting the legal, aesthetic and fictional requirements of a project. Meanwhile, law defines quality in terms of professional liability, a legal concept that requires all professionals to know their trade and practice it responsibly (David, A., et al 1997). In general, quality is a standard or excellent level as compared to others.

In construction process, quality is involved in three phase such as pre construction (design stage), during construction (construction stage) and post construction (maintenance stage). Figure 1.1 below shows construction process as mentioned by David A., et al 1997.

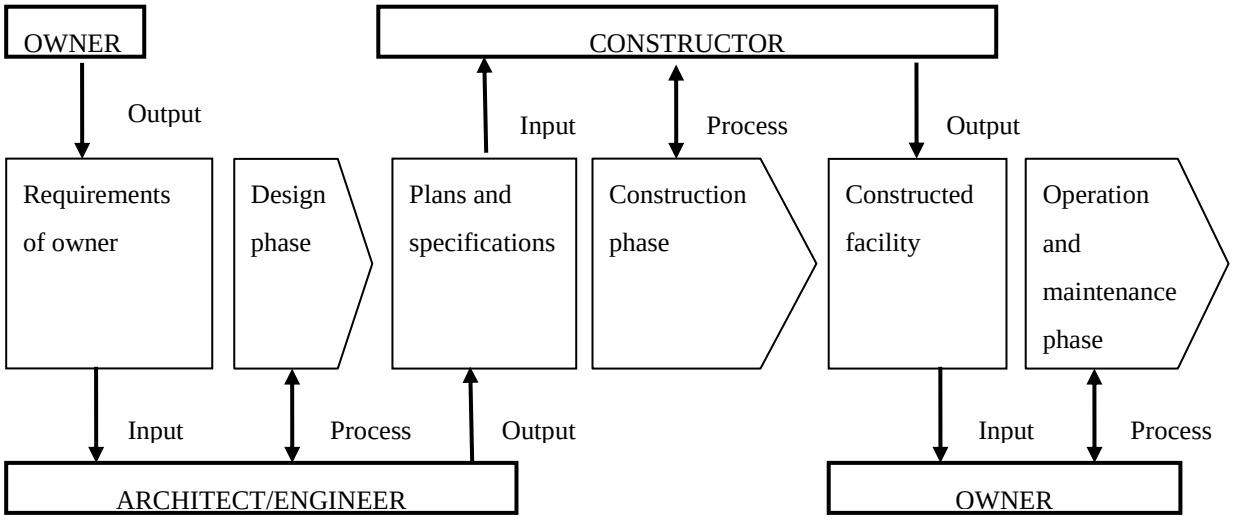

Figure 1.1: Construction process (David A., et al, 1997)

2.3 Value Stream Mapping (VSM)

Value Stream Mapping (VSM) is a lean management where this method shows construction or manufacturing process/ stage form beginning until the end. Bhim, S., et al (2011) as cited in Rother. M et al (1999), mention that value stream as collection of all activities that add values as well as non-value added that are required to bring a product or a group of products that use the same resources through the main flows, from raw material to the end customers. Ritu, A (2012) also agrees that VSM is a tool created by lean production movement for redesigning the productive systems. She also adds that VSM is able to reveal hidden issues such as hidden cost, wastage and etc.

2.4 Critical Path method (CPM)

Critical Path Method (CPM) is a scheduling process for construction project which involve mathematical principles. In CPM, construction teams are able to identify the longest duration period in construction, the earliest and latest period that the construction is able to start or finish, and also time float.

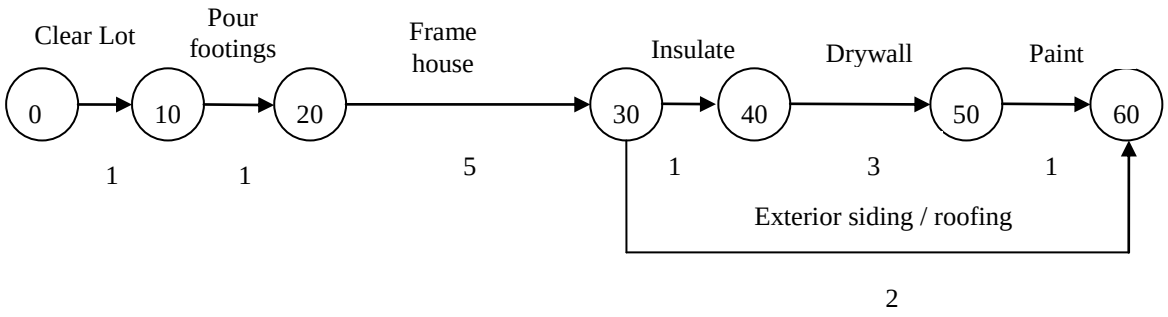

Figure 1.2: Example of a Critical Path Diagram (Institute of Residential Contracting, Home Building Answer, 1989)

2.5 Building Information Modeling (BIM)

According to Ahmad Tarmizi., H et al (2012), BIM is defined as modeling techniques and are associated with a set of processes to produce, communicate and analyze building models. BIM technique requires computers and software to manage database or construction information. BIM offers many benefits such as interference checking and avoidance, clash detection, conflict resolution, less times taken, increase coordination, cost and productivity and energy management (Ahmad Tarmizi, H et al, 2012).

2.6 Just In Time (JIT)

The next management technique is Just in Time (JIT). Through this method, the problems related to material damage, missing or extra inventory and stock are reduced. In construction industry, JIT method is important to save a lot of money. Thus, Industrialised Building System (IBS) is one of the construction technologies in maintaining construction performance.

2.7 5S

The popular definition of 5S by Hirano in 1995 are Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize) and Shitsuke (sustain). In 5S practices, elimination of waste, cleaning, neatness, organize and discipline are the key elements. Therefore, the implementation of 5s is able to manage lean and green construction where 5S is able to reduce waste and optimize productivity and quality. The following are the impact of 5S in construction:

Table 1:1 the impact of 5S in construction process

5S step	Action	Impact
Sort	Eliminate waste, clearing the workplace	Better workplace, more tidy.
Set in order	Labeling process	Shortening of time required for searching necessary things (Harsha et al, 2013)
Shine	Cleaning process	Better condition of workers and prevent from accident. Cost can be reduced.
Standardize	Using the same procedures, instructions, documents or regulations	The standards of the company increase to next level (Harsha et al, 2013) Reduced accident or injuries. Reduced cost and time.
Sustain	Enhance 5S culture in society or company Top management in the company play important roles to support 5S	Increasing the awareness and morale (Michalska et al, 2007) The performance of company improves

3. Possible barriers in implementation management tools

No	Management tools	Possibility of Barriers by previous Literature review
1	Total Quality management (TQM)	a) David A., et al, (1997) stated that TQM success in construction process depends on management, commitment and leadership, teamwork, supplier involvement, cost, training, statistical method, customer service and construction factors. b) Many organizations that have failed with TQM have not had sufficient top management commitment (Ulrika, 2000: Dahlgaard et al, 1994: Oakland, 1993: Tenner and de Toro, 1992). c) According to Masters, R.J (1996), there are 8 possible barriers in TQM such as : (1) lack of management commitment, (2) inability to change organizational culture, (3) improper planning, (4) lack of continuous training and education, (5) incompatible organizational structure and isolated individuals and departments, (6) paying inadequate attention to internal and external customers, (7) inadequate use of empowerment and teamwork, (8) ineffective measurement techniques and lack of access to data and results.
2	Value Stream Mapping (VSM)	a) Ana Julia D.F, (2014) classified seven problems in VSM technique such as : (1) low/lack of integration between process, (2) low/lack of clarify of procedures, (3) low / lack of product modularity, (4) poor/ low skill people, (5) poor/lack process stability, (6) Difficulties in measuring data in processes, (7) lack of documentation, (8) small batches with highly mixed production, (9) production too flexible, (10) process too intuitive, and (11) other problem such as lack of support from management etc.
3	Critical Path Method (CPM)	a) Braimah, N, (2014) listed the problems in CPM, there are : (1) most contractors prefer to use conventional method, (2) there are some difficulties occurred since this method uses software package, and (3) lack of support from management.
4	Building Information Modeling (BIM)	a) Limited data, expensive, lack of experiences, lack of support from senior leaders of the company (conservative approach, lack of information about the strict BIM implementation standards and rules for certain project participants, contract obligations in certain countries and unified documentation for region (such as European Union, Americas, Asia and other) Darius Migilinskas et al (2013) are the problems in BIM implementation. b) As supported by Salman A, (2011), there are several risks in BIM such as lack of determination of ownership of the BIM data and the need to protect it through copyright laws and other legal channels. Other than that, as mentioned by Thompson, D. B et al (2007) BIM involves high responsibility in

		updating building information model data and costly.
5	Just In time (JIT)	a) Harber, D et al (1989), said the considerations in JIT technique are top management support, education and training, quality control and relationship with the suppliers. b) Larry C,Giunepero (1990), quoted that lack of commitment from management, lack of functional support such as engineering, financial and marketing are the biggest issue in JIT implementation.
6	5S	a) Communications failure, provide gap between top management and staff (Khamis et al, 2009); Yusof , J (2014) b) Arash G et al (2012) said the problems in 5S are poor communication, space between management and employees, poor training and awareness of 5S. c) Noni Hartika et al (2011) also agreed that communication, training, reward and recognition and top management support are the key elements in implementation of this tool.

4.0 Conclusion

This research covers the literature review of management tools. It also found that the biggest problem in management tools is low/lack of management support. From the literature review, most of employers are still using the traditional method in their construction process. Another major problem is lack of effective communication. In construction industry, good communication is the key element of success, as it can avoid time, money and energy waste. There are several suggestions to improve these management tools:

a) A good training for management team, employers and staff regarding these management tools and how they influence the project's success. BIM, and CPM techniques need more explanation and training because both methods involve software and programming.
b) The layout of the construction site also can be improved to simplify the work flow (Peng, W et al, 2011). Good site layout is important in order to implement JIT, 5S, VSM and of course TQM techniques.
c) Proper discussions or meetings between the top management and staff need more improvement.
d) Construction flow/ activities are needed to be explained in details to the staff to minimize problems.
e) Seminar, talk or any workshop regarding these management tools and how these tools contribute to green construction are to be organized.
f) Using effective promotions such as presenting web banner, banners, posters, brochures, pamphlet and etc.

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