Lean Project Management

In Large Scale Industrial Project via Standardization

Lean project management is the comprehensive adaption of other lean concept like lean construction, lean manufacturing and lean thinking into project management context. Execution of many similar industrial projects creates the idea of lean project management in companies and rapidly growing in industries. This paper offers the standardization method in order to achieve Lean project management in large scale industrial project. Standardization refers to all activity which makes two projects most identical and unify to each other like standardization of design, reducing output variability, value analysis and strategic management. Although standard project may have minor efficiency decrease, compare to custom built project; but great advantage of standard project like cost saving, time reduction and quality improvement justify standardization methodology. This paper based on empirical experience in industrial project and theoretical analysis of benefits of project standardization

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Introduction

Standardization of large scale industrial projects is new idea which emerged in leading companies in last few years and it is under development in companies and wildly spread through industry. Execution of many similar large scale industrial plants generates the idea of lean project management through standardization of large scale project.

Standardization of project refer to all activity to make a large scale project as identical as to other similar project by means of standardization of design, reducing output variability, strategic planning, project orientation strategy instead of product orientation strategy, standardization of procurement, construction and value analysis. Standardization of large scale industrial project is one of the methods of applying lean philosophy to industrial projects and project management aspects of these projects.

The topic of lean thinking has gain credence over the past decade. Also lean construction is based on lean production idea. Lean construction looks into possibility of bringing successful lean production theories and concept into construction industry.

This paper aims to apply the common principals and feature of the lean manufacturing and lean construction to lean project management and provide real industrial case to introduce standardization methodology.

Background

Standardization

Standardization idea is broadly used in computer and electronic industry since 1980 according to Cusumano (1987, 8) and used in car manufacturing from 1960 and greatly adopted and developed by Toyota in 1980 and flow to other mass production factory like machine tool manufacturing, aircraft and agriculture equipment.

In practice there are three forms of standardization as below;

1. Product standardization
2. Process Standardization
3. Project Standardization : which is main discussion of this article

Womac and Jones (1996) suggested that, standardization of processes can be a means of reducing costs and saving time.

As Cusumano (1987) noted if a customer needs a product, whether it is an automobile, a machine tool, a semi conductor chip, or a software program, there are basically three options:

1. Obtain a fully customized product;
2. Obtain a standardized product;
3. Obtain a semi customized product

Above statement present three options for the purchaser or client in order to procure his goods or project. Of course as the product became more customized the price of the good/project will raise. Providing three options or two options to client in

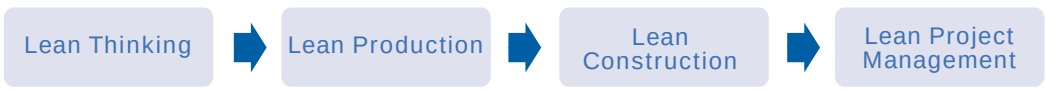


Figure 1. Lean Concept

the large-scale project will give a chance to client with tight budget or time, in order to proceed with his project.

Process standardization is the next step in standardization, which focus on the process and project standardization is the most comprehensive way of standardization, which focus on making overall project more identical and standard.

Design Standardization

Standard design is the first step and also major step of standardization of project, which results in minimizing waste of material, time and maximization of project value.

For example in Iron ore production industry, assume one client decide to construct five plants with 3.5, 2, 5, 3.7 and 1.5 Mtpa in different location. If the designer design the plants with throughput of 2, 4, 6 Mtpa instead of above capacities, that will be standard plant. In this case the client should be convinced to purchase a plant with 4 Mtpa instead of 3.7 Mtpa or 3.5 Mtpa. Also this client will easily select his future projects from existing standard design.

As noted by Thomas, H.R., et al. (2002) variability is common in project and must be managed effectively. By reducing variability we earned better labor and cost performance. **Reducing Variability** of project's output is one of the bases of the standardization theory.

In Iron Ore example, the designer company could limit its plant to three sizes of 2, 4, 6 Mtpa and select all of his new project from these 3 standard plants instead of unlimited number of various throughput like 4.5, 5 and 5.5 Mtpa. After few projects all the design and procurement and construction of these types of Iron Ore projects will be more available in these standard sizes in the market. It should be noted the standard design mainly could be used in companies which have similar project with similar technology. Designing and construction of these standard type projects are much easier than design of unlimited throughput of the plant. By constructing more standard plant, the subsections and equipments of plants is also will be designed and built in standard sizes and after few years the whole project include design and construction and procurement will be available in standard sizes in the market.

Construction Standardization

As mentioned by Polesie and Frodell (2009) construction standardization is considered to be structured planning and operational sequence of activities that have been learnt from experience as being the most effective processes for reducing waste and increasing customer value.

According to Green and May (2005), one the most practical methods of applying standardization in construction are off-site manufacturing, prefabrication and modularization. Off-site manufacturing and modularization is broadly used in building construction industry. In this paper we aim to expand these techniques and especially modularization to large scale industrial project like mining industry. Fewer people with less training and skill require for assembly of prefabricated units as per Green and May (2005).

Project Management Standardization

As defined by Inman and Milosevic (1999) we define Standard Project Management as a process of managing projects composed of standardized practices. The measure of the standardization is the degree of absence of variation in implementing such practices. Hence, the less varied the practices, the more standardized they are.

Standardization of contract documents like technical specification, bidding requirement, condition of contract and drawings are part of standardization of a project and can assist engineer in upgrading the quality of construction.

Standard project management is one part of standard project; however it does not cover all aspect of standardization of a project. Dragan and Peerasit (2004) mentioned companies frequently decide to implement standardize project management, which can be defined as a standardize set of project management practices. These companies expect that such an approach will carry significant potential for improvement project performance.

Project management of a Large Scale Industrial Project: Project management techniques which is used for large scale projects are similar to common project management practice mentioned in related books like PMBOK (Project Management Body of Knowledge), or other available sources in this field. However project management for standard project and similar project use project portfolio management techniques beside other common techniques of project management like PMBOK.

Project portfolio is a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives.

A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. From above text we will understand the project management of standard projects happens in same environment as portfolio of projects. And concepts and techniques related to project portfolio management could be used for standard projects as well.

Strategic Management

'Multi-project management provides a vehicle for considering both internal and external environments and thus integrates projects and **strategic planning**. An empirical study has shown the important role of multi-projects in aligning strategy and projects'. (Aritua et al. 2008)

Strategic planning has very strong application in multi-project environment and therefore in standardization of projects. Standardization is not short term goal for companies and requires enough time for substituting current project with standard project. Thus, companies should consider the standardization as strategic plan and strategically manage multi project to approach standard projects instead of similar project.

Value Analysis

Value Analysis is the system of views, methods and procedures aiming on substantial decrease of expenditure required for carrying out of certain

functions by an object.

An object of VA may be a product, a process and their elements as the carriers of certain functions.

It is estimated that 20-30% of any technical system's cost is related to its main functions, approximately 50% to its auxiliary functions, and 10-20 % to functions that are never used. The challenge is how to cut the cost of a product and improve its quality. Using VA we can meet this challenge. (Kosse 2009)

By constructing the standard plant in most heavy industry the basic functions of plant will be satisfied. This standardization will reduce cost and relax time and effort in all stage of project from contract preparation, preliminary design up to construction and commissioning. Custom design of project assures fulfillment of secondary function of project, on the other hand it is more expensive and more complicated to construct.

Summary of Project Standardization

Standardization of project is a technique which has many building elements, which build project standardization concept. These elements are as below;

Design Standardization- Construction Standardization- Project management standardization – Documents standardization – Strategic management- Value analysis

Lean Concept

Lean Thinking

Lean thinking has come into vocabulary as a title of the book by Womac and Jones, which published in 1996 and attempts to update and expands the concepts developed in the automobile industry.

'The critical starting point for lean thinking is value. Value can only be defined by ultimate customer'.(Womac and Jones 1996)

In this book the lean principles introduce as: Value-The Value stream-Flow-Pull-Perfection.

'The topic Lean Thinking has gained credence over the past decade. During the 1980's, the institute of the Automobile at MIT did a comprehensive study of manufacturing process in automobile industry. One of the major ideas which were developed as part of this work was called Lean Production.'(Halpin and Kueckmann 2002)

Lean Design

According to Koskela and Howell (2002), lean construction starts from **lean design**. Lean design is the first step of lean project management, which results in minimizing waste of material, time and maximization of project value. In this article lean design has the same concept and definition of standard design. Also, lean design is the main ground of lean project management.

Accepting standard project instead of custom build project requires an agreement between all parties involved.

Mainly end user or client of project must agree on standard project instead of custom build project and accept the standard project technical specification in order to benefit from standard project advantages. In this article lean design is substitute by standard design.

As below short definition of similar and standard project which is used in this article are presented.

Similar Project: Refer to projects, performing similar task but the physical characteristic of equipment and sub-systems are not identical. For example Iron ore plant with 4.5 and 3.5 Mtpa iron ore throughout are similar. But the sub system and equipments inside plants are different.

Standard Project: Project with similar performing task with sub system and equipment as much identical as each other. For example in above example iron ore plants with 4 Mtpa are standard

By constructing more standard project the more standard design and equipment will be available in the market and standard project will become more common and available in the market.

Lean Manufacturing

In general lean manufacturing has the capability to produce product using the least amount of non-value adding activities that add time and subsequently cost to the manufacturing process. (Hobbs 2003)

Although lean manufacturing does not specify any specific methodology, it has few main principles like reducing waste and adding value which stay constant in all over lean definition like lean construction and lean thinking. This report extends these principles to lean project management definition and techniques.

As noted by Hobbs (2003) there is no single method of lean manufacturing. According to that, our techniques of standardization include value analysis, strategic management and standardization could be one element of lean project management principles.

Standard project will decrease waste and increase value in all stages of project by decreasing design time and cost in overall of project. Thus, one of the methods of approaching lean project management is using standardization methodology.

Lean Construction

As lean construction is a project based process, it is easier to use lean construction principles for lean project management. Thus, in this section the adoptable practices will be taken from lean construction and apply to lean project management.

As noted by Ballard (2000) lean construction tries to reduce variation in every aspect like product quality, rate of work and manage the remaining variation. According to Ballard reducing variation in every project is one of the methods of applying lean construction. This idea is strongly used in project standardization and lean project management.

'Variability is common on construction projects and must be managed effectively. New management thinking, like that of lean production, has suggested that better labor and cost performance can be achieved by reducing output variability. '(Thomas et al. 2002)

Reducing Variability of project output is one of the bases of the standardization theory. For example reducing the throughput of Iron Ore

plant to 4 Mtpa and accepting tolerance of Iron Ore plant output is an example of reducing output variability of a project.

As mentioned by Green and May (2005), one the most practical methods of applying lean philosophy in construction are off-site manufacturing, prefabrication and modularization. Off-site manufacturing and modularization is broadly used in building construction industry. In this report we aim to expand these techniques and especially modularization to large scale industrial project like power plant and mining.

Lean Project Management

Lean project management is a comprehensive outcome of other lean principles and has many ideas in common with other lean concept. Still the main definition of lean project management is delivering more value with less waste in project context.

As mentioned by Artitua and Smith (2008) the most widely used sources of project management guidance, bodies of Knowledge and the tools / techniques used in projects in construction sector are also generally focused on achieving single project objectives. More detail review of construction activities shows that many projects are increasingly undertaken in a multi-project context now a day. Against this background, the need for new approaches, processes and techniques suitable for multi-project management is therefore obvious.

'Projects are temporary production systems. When those systems are structured to deliver the product while maximizing value and minimizing waste, they are said to be 'lean' projects. Lean project management differs from traditional project management not only in the goals it pursues, but also in the structure of its phases. Construction is among many types of project-based production system'. (Ballard and Howell 2003)

Again there is no unique method to achieve lean project management in projects. This article suggests standardization of project as lean project management approach in a lean project.

Summary of Lean Concept

The following schematic summarize the process of the lean idea and developing this idea from lean thinking to lean project management, according to above literature review. The containing elements of each lean concept are shown in related box.

Result of Standardization of Large Scale Project

In order to find out the result and advantage of standardization of large scale project, one industrial case study in power plant industry in subsection of Heller Cooling System has been studied and following tables and chart are employed. These tables and information based on author work experience in power industry and they are indication for comparison for similar and standard project.

These tables are;

- Identicality percentage comparison table for main equipment in Heller cooling system between standard and similar project
- Identicality percentage comparison table between standard project and similar project with break down to each discipline i.e mechanical, electrical and etc
- Identicality percentage comparison table between standard project and similar project for each sub system and in different stage of project (Design, Procurement, Construction)
- Percentage of identically with breakdown into sub-system during different stage of project

Due to limitation in space these tables are not presented in this article.

In below the definition of standard Heller cooling system and similar Heller cooling system is stated:

Standard Heller Cooling System means two Heller Cooling Systems with identical cooling tower (size & dimension), condenser (size & detail), peak cooler (technical specification) and other main equipment.

Similar Heller Cooling System means two Heller Cooling Systems with different capacity for example 250 MW and 280 MW cooling capacity. In similar cooling system, sub systems have different size and technical specification. But perform same task and have identical features.

Performing above industrial case will find out the exact percentage of unification between standard and similar project in different stage of project. However a preliminary study in the report shows the unification percentage of a standard project will increase from 60 to 90 in design phase, 65 to 90 in procurement and 75 to 90 in construction stage among similar project to standard project.

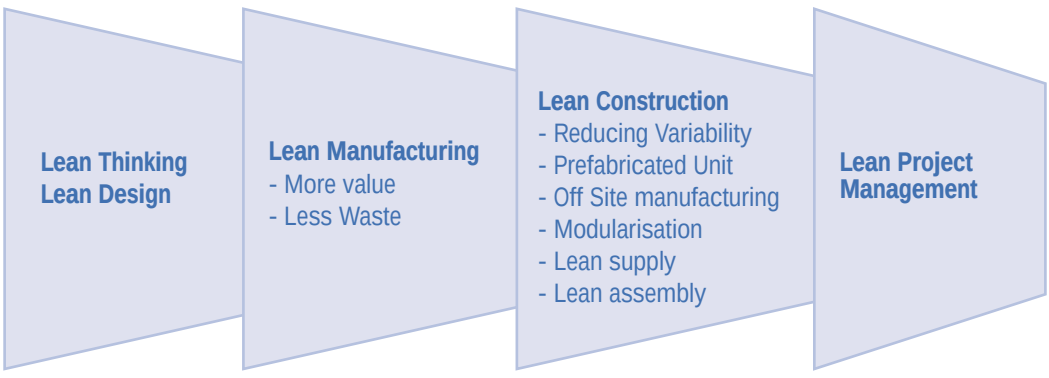
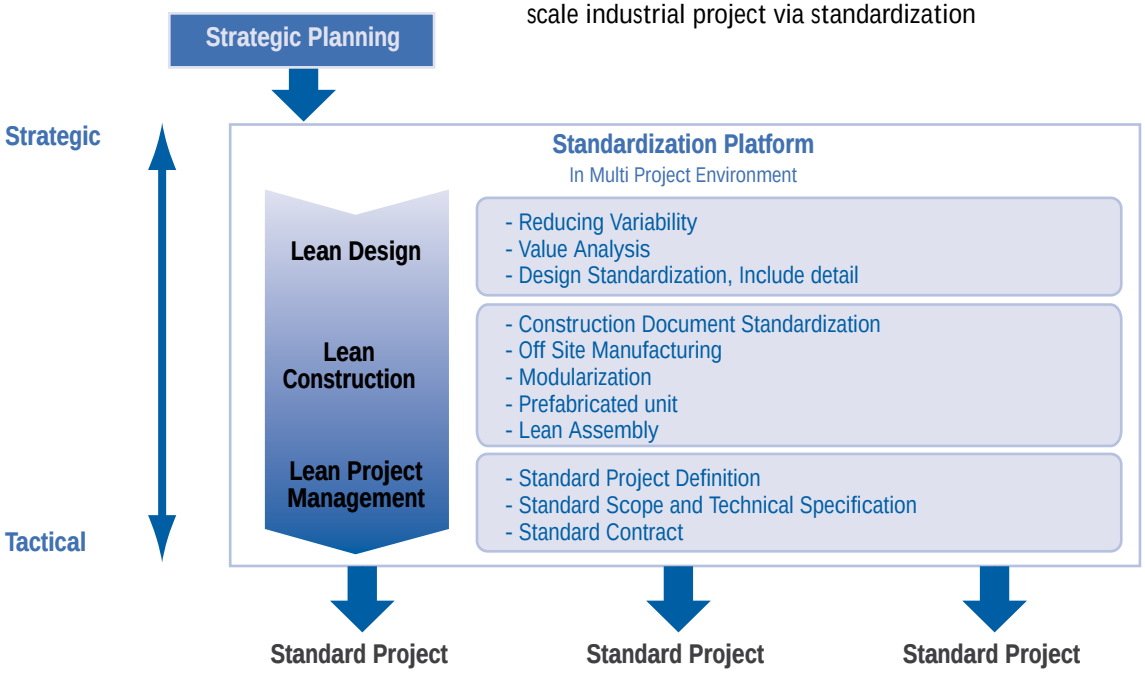


Figure 2. Development of lean concept

Figure 3. Procedure of applying lean project management to large scale industrial project via standardization



Lean Project Management Procedure

Following schematic shows the procedure for applying lean project management and standardization methodology. This schematic summarized all the techniques which highlighted in preceding sections.

This is summary and outcome of this article, which shows the road map of standardizing one large scale project.

Conclusion

Based on case study, **Time and Cost** in standard projects are very high identical. Also, standard project provide easier execution and management compare to similar project. This is a great advantage for companies and clients. Very high unification in standard project assist client to know the cost and time of a project at start of project. This information will be very useful for any potential client.

Another advantage of standard project is using existing as built drawing, which greatly reduce the revision and construction mark up.

Although, standard project has many advantages, but here are some political issues against standardization of project among companies.

For example reluctance to change current methods and fear of losing the market to competitor companies, because of easier access to projects technical information and easier method of project execution. Possible, reduction in efficiency of standard project is another disadvantage of standard projects. These disadvantages will be strongly compensated with reduction in cost and time.

Also, company down-sizing and job loss are other possible disadvantages for companies.

In other hand, easier construction and performing of industrial project means decrease in cost and time of project and happier client, which result in companies to win more projects and have more job security. Also advantage of lean project will increase after constructing more standardize project and as time progress.

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