CHAPTER II

LEAN APPROACH

2.1 INTRODUCTION

The construction industry is experiencing distinctive issues, for example, low profitability, inadequate quality, lessened safety, time and cost overwhelms limiting the assessment of the product. The usage of lean standards to the development is a creative way to deal with managing and enhancing the construction procedure by diminishing expense and amplifying a value for client needs. Figure 2.1 shows the various problems in the study.

![Figure 2.1: Project Problem](image)

Implementation of lean principles results in minimizing wastes at first stage and leads to better quality and completes the project within the stipulated time and cost. Traditional task controlling methodologies are most appropriate for simple works. These general designs would not be equipped to satisfy with the necessities of the propelled project because of
the different communications between site exercises. While trying to locate an elective way to deal with manage the many-sided quality and issues of the task, (Koskela, 2004), who is a pioneer in presenting the lean construction method. He argued that conventional reasoning of development project administration, for the most part, centers on-site exercises and does not focus on flow and value. He also expressed that wastes related to the development procedure as a waste of materials and non-value-added occasions that may prompt deposits like postponements, transportation of necessities & others. Few types of research were performed in the United States and Europe and reasoned that waste would produce the stream strategy of development. Following are the quantities of consumed cost because of flow lack as per pioneer discoveries;

- Conformance high-quality value consumes 12% of overall project rate
- Poor resources controlling causes 11-13% of overall labor cost
- Period used for non-value addition actions costs to 66% of overall project time
- Look of safety amount to 8% of overall construction cost.

By eliminating cost consuming flow actions, the lean technique presents potential benefits for value discount, while efficiently applied in a construction company and be recognized as cost leadership.

2.2 LEAN DEVELOPING TO LEAN PRODUCTION

Development processes are ending up more basic, and a rational administration approach ought to be produced to take care of the interminable issues and troubles of the development project s. The essential point of a lean creation framework is to build esteem and lessen squander by utilizing lean supporting strategies. Despite the critical projects between the highlights of development and assembling; they nearly share similar objectives and seek after standards, for example, framework enhancement through cooperation, persistent change, enthusiasm on consumer loyalty work process by taking out impediments and non-included qualities and making pull construction.
2.2.1 On-Site Construction

It is the site place development where the manufacturing system is carried out at the site to enhance the value of the project. Likewise, the contractual worker guarantees high quality standards for the raised components on work place which is significantly influenced by site conditions.

2.2.2 One-of-a-Kind Construction

The frequency of modifying items in development is higher than in assembling where the clients assume a critical part in change all through the task. In contrary, a building perceived for specialized tools and plants to systematize the components receiving the low-level of customizations by retailers.

2.2.3 Complexity

The development system is intricate, distinctive and effective where each assignment is a new task followed by different construction resources, opinions and fundamental design with variable requirements. In Lean process, the production makes the best use of specialized modern technology to make sure the reliable progress of the product. These characteristics cause a lot of uncertainties in the production process like weather and site conditions, systematization between various trades and the customer change are few of the obstacles that may practise any project causing the significant effect on the duration and cost of the development project.

2.3 WASTE REDUCTION

Wastes resulting from failing governed systems and operation that produce in excessive duration and value. The level of waste related with the development project has been described to be as much as 60% and is refer to inefficiencies in planning, design, demonstration, maintenance and construction activities.

The primary target of the lean building is waste lessening. The task in waste lessening is defining and identifying the various wastes in construction projects. The different kind of construction wastes are as follows:
Figure 2.2: Production Flow Procedure

Figure 2.2 shows the construction organization, waste production is not just bound to that approached about due to execution, however, stretch out to the stream of information and certification. Its effort to the kinds of waste and its conceivable reasons to the submitted audit process in the construction project. Thus, waste minimizing became a objective by itself more than a tool when fully collaborates with other lean standards.
2.4 LEAN PROJECT DELIVERY ORGANIZATION

The manufacturing process aims to deliver the product while growing the value and minimizing wastes. The Lean Task Convention Framework is another development administration approach promoted by the Toyota Construction Structure (TCS). LPDS has been introduced by LCI (Lean Development Organization), and it is a creative way to outline and build capital offices. LCI explained the Lean Project Convention Framework which applies lean development standards and tools to a more general enterprise; Generate checks, controls, honors and reduces damage through the development process.

The objective of this structure was to increase the contradictory framework and its basic parts to move forward each sub-process independently. According to the system period of the customary process, the LPDS divides the interconnecting steps for configuration and supply collection from project definition into five distinct steps.

Task definition includes planning ideas, framework criteria, cost and time estimation, and mass generation with customers and whole project partners. Lean supply includes the material project on the site and the project configuration taken after the conception. In contrast to this process, there is a need to reduce the site inventions. There should be a complete process for creating customer value. Once the site is delivered to the site, it will be completed in a thorough and stable mode and each job will be completed by giving the job effectively to the customer. Figure 2.3 illustrates the project delivery process.

Figure 2.3: Lean Project Delivery System
2.5 LEAN CONSTRUCTION PRINCIPLES

The main goal of approaching projects as construction systems is to change the entire structure of work in both design and construction to increase the project performance. Lean principles present whole process optimization through coordinated and monitoring effort, no changes in design, and disposal of waste from the site and consumer loyalty by conveying the quality sought by the end client. Lean construction thinking connected to generation frameworks has explained the advantages of balanced performance of force stream of groups and materials to minimize inventories of work in advancement (WIP). Womack and Jones highlighted the five-fundamental standards of lean design shown in Figure 2.4.

![Figure 2.4: The Five Guide Principles of Lean](image)

1. Customer recognizing the importance: It is essential that you reach the necessary conclusions without taking into consideration the value of the entity or administration, and the consumer value of the project relates to the standard consecration.
2. Delete Value Stream (Automatic Creating Activities): The entire procedure to consider when reporting an item or administration and providing a display of client evaluation. It speaks to cryptic technology, which promotes the client by reducing any of the unrelated values.
3. Create a Flow of Products: Waiting is a waste: make the best of jobs, do not take up a job or do not take the appropriate job process, and never end up in the enterprise network.
4. Use a Pull Logistic: It means generating as per the customer requirement to the fulfill the demand of the customer.
5. Look for perfection in all activities: The consumer can always find time by continuous change and integrating the suitable strategic procedures.

2.6 LEAN CONSTRUCTION TOOLS AND METHODS

Many Lean advancement practices and methods can be used to improve project activities in the construction industry and to ensure efficient processes in pre-production and maintenance phases of the project. A detailed description of the following methods are as follows:

2.6.1 Flow Procedure

The lean construction system aimed production as a flow of materials, data, machinery, and workers from raw material to the product. Continuous flow is considered as one of the important principles of lean thinking. Many lean tools are used to increase the flow rate and minimize wastes.

2.6.2 Reduce Process Variability

Methods of production are subject to different stages of functioning and instability which cause all the processes. In lean assemblies, fail-safe operations are used to prevent defects from going to the next process automatically. Since then, in construction, this approach was challenging due to the complexity of finding deficiency before establishment.

2.6.3 Reduce Cycle Time

Reduced variability requirement reduces the length of the job process. The process of development reduces the duration of time and reduces exercise delays so that users can take over and re-examine the process for making it more professional and more extensible and economical.
2.6.4 Reduce Batch Sizes

Reduces the workflow by lowering the batch size, thus reducing the process's duration.

2.6.5 Increase Flexibility

It is easy to change and get multi-scaled groups. Improve efficiency to the next tasks to reduce the time commencing with a movement. Additionally, using different professional groups also limits the process time duration and increases the working process.

2.6.6 Pull Method

A standout amongst the most significant and most imperative highlights of lean approach is utilizing the pull planning is one of the basic lean systems to enhance work process in construction projects.

2.7 LAST PLANNER SYSTEM

The last planner system (LPS) technique is developed by professor Glenn Ballard and Greg A Howell, and the lean construction institute. It is designed to increase the certainty of workflow and improve the productivity in the production unit. The system view plans as commitments between parties, not an order, and the name built on the idea that it is the individual team leaders, the final point of production, which will have the best qualification to do the planning. Figure 2.5 shows the different phases of LPS.

![Figure 2.5: Different Phases of LPS](image-url)
The LPS was developed by Glenn Ballard and Greg Howell as a lean construction tool for production control and planning. The manufacturing industry deals with several variables, including production rates and labor efficiency (Gonzalez et al. 2008) LPS emphasizes minimizing waste and growing successful planning uniformity. Through LPS, industries find their planned percent complete (PPC) along with other metrics to improve their planning. PPC calculated by dividing the number of the completed activities by the total number of planned tasks (Ballard 2000), employing LPS, many associations have stated a development in workflow reliability, improved project delivery time, and labor productivity (Hamzeh et al. 2008; Porwal et al. 2010).

LPS leads to reduction of waste, time and variation, work flexibility and transparency, which in turn increases the value provided to customers and worker involvement in planning. LPS ensures collaboratively produced plans, identification and removal of constraints early on, reliable promising and learning from past failures and successes (Ballard et al. 2009; Hamzeh 2009; Kalsas et al. 2009). The LPS could be the supervisor, foreman, squad boss or any individual or group responsible for work completed in the near term; they oversee that work results in completed task and production (Ballard and Howell 2003).

Figure 2.6 shows the conflicts between traditional development processes and LPS. The specific contradiction can be 'able' and 'choice' in the organizing process of LPS.

![Figure 2.6: Last Planner System](image-url)
Ballard outline ‘should’ tasks are those that must be finished to meet the master schedule of the plan. The approach of ‘can’ and ‘will’ are comparatively new to the development industry as they built up communication between all parties involved and aid in the collaborative agreement of feasible task.

To aid in transforming the ‘should’ task into ‘can’ tasks, Ballard suggested tasks meet the following criteria; interpretation, soundness, sequence, and size. A task is well defined when the amount of men, materials, equipment, resources required, and verification is measured. Sound tasks are those in which of all the required labor, material, resources, etc., are available by the scheduled start of the task. The sequence of a task looks at whether the tasks are in the proper order to meet customer expectations and to minimize possible needs for rework. Tasks are well sized when they are compatible with the designated crew's production capability based on the availability crew size and resources. Each of these items aid in determining if a task ‘can’ be done (Ballard 2000).

The ‘will’ component comes into play when last planners commit to completing a task successfully with an acceptable decision to hand over of that area, material, or item to the next required party.