Managing non-value adding activities in a project: A small building construction project in Thailand

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Abstract
Severe competition in today’s business demands every organization to adapt and create new strategies to compete. Among those strategies, cost reduction is one popular strategy that is usually used in the competition. Normally, several activities must be performed to complete a project in a certain timeframe. These activities also generate costs to the project by consuming materials, using labour, and utilizing equipments and utilities. However, some activities do not create value to the project which is referred as non-value adding activities. A non-value adding activity relates to the activity that generates extra costs to the project but no extra value is generated to the total project values. Examples of non-value adding activities in a construction project include material handling, inspection, storage, rework, etc. Since a construction project is a fixed position layout, hence, materials, resources, equipments must be transported to the working area to perform an activity. However, the transport activity contributes extra costs to project but it does not generate much value to the project. Thus, these non-value activities must be effectively managed. Generally, non-value adding activities can be managed by reducing non-value adding activities or cutting off the cost of non-value adding activities. For instance, an activity may be redesigned to use less transportation activity or more effective material handling equipments are employed. Finally, the methodology is implemented and tested in an actual building construction project in Thailand. Objectives of this research are (i) to determine non-value adding activities in the construction project, (ii) to establish effective methods to remove non-value adding activities from the project, and (iii) to successfully implement these methods to the actual construction project.

Keyword: Project Management, Non-value adding activities, Project costs, Material handling.

1. Introduction

Basically, a construction project consists of value adding and non-value adding activities. A value adding activity is the activity that generates extra values to the project when it is performed. Normally, a value adding activity involves a transformation process or innovation [1]. Materials physically change their structures or appearances. Examples of value adding activities are foundation, wall installation, pipe installation, etc. A non-value adding activity refers to an activity that generates extra costs to the project but do not contribute value to the total project [2]. Examples of non-value adding activities are material handling, set up, reworks, storage, inspection, or design changes after contract is awarded [3], etc.

Unfortunately, a project manager may not realize the direct impact of several non-value adding activities in the project since a project manager prefers to make sure that the project can be delivered in time and a project manager normally prepares to pay more to shorten the project duration. However, the project completion time and cost can easily be shortened if non-value adding activities are removed. Hence, non-value adding activities in a building construction project must be determined and removed to reduce their inefficiency [1,4].

Non-value adding activities can be handled in several ways e.g. redesigning non-value adding activities or reducing non-value adding activity costs [4]. In material handling activity, materials are transported from one place to the other place in the project site. This handling activity can be organized by designing of new material handling method or using of new handling equipments. Furthermore, redesign of the building is able to cut off material handling activity as well.

In this research, non-value adding activities in a small building construction project in Thailand are determined. Consequently, solutions to reduce non-value adding activities are implemented and evaluate to see how effectively these solutions are performed.
2. Research objectives

Objectives of this research are (i) to determine non-value adding activities in the construction project, (ii) to establish effective methods to remove non-value adding activities from the project, and (iii) validate these methods to the actual construction project.

3. Non-value adding activities in a building construction project

Generally, a building construction project consists of both value adding and non-value adding activities. Both activities also consume several resources e.g. labors, materials, equipments, utilities, etc, thus, generate costs to the project. Hence, the utilization of these resources must be measured to see how effectively these resources are allocated. In many cases, resources consumed in the project do not add value to the project since they are used in non-value adding activities. For example, wastes or scraps must be moved from the working area in the project site as illustrated in Figure 1. If these scraps are moved to another place in the project site, this activity only generates costs from double handlings since these materials will definitely be removed from the new area again.

Many activities that are performed in the building construction project are non-value adding activities. In this research, non-value adding activities are summarized into 6 categories - transportation, storage, inspection, rework, delay, and set up.

3.1 Transportation

A building construction project is a fixed position layout. Thus, materials, equipments, or resources are transported to the working area. A transportation activity refers to an activity that moves resources, materials, equipments, and scraps from one place to another place. It includes loading, unloading, handling, and so on. Obviously, movement of resources or materials does not create extra value to the project [2]. Frequently, material handling equipment is involved in the transportation that also incurs extra expenses. Costs of handling activities contribute 30-40% of the production costs [5,6]. Moreover, materials can be damaged during transportation, especially, unloading activities.

Major determinants in the transportation activity are distance [7], handling frequency, unnecessary handling, and handling costs. If materials are transported frequently or materials are unnecessarily transported or handling equipments are costly, it is more likely that transportation activities contribute high costs to the project.
3.2 Storage

Materials or equipments are stored in the project site for a certain time before they are actually consumed later in the project [2]. Storage is useful when a material price is discounted for a large quantity or a material price is fluctuated [4,8]. Additionally, when a local supplier is unreliable, a material storage is able to ease up a material shortage situation. A project can be continued its construction smoothly.

On the other hand, storage normally requires space to store materials or equipments [8]. However, space is commonly limited in a construction project and it is not always convenient to allocate partial spaces in the construction site for equipments or materials storage. Moreover, labors and equipments are required to load and unload materials. Also, periodic counting is needed to check the actual quantity and status. Inevitably, extra costs are added to the project.

Additionally, materials or equipments in storage may encounter damages or losses if they are not properly stored. Figure 2 depicts broken materials in storage. Also, several equipments may be rusty if they are stored in humid environment. Expensive materials or equipments can also be stolen. Thus, a safe storage space is required.

![Figure 2 Damages of material during storage](image)

3.3 Inspection

Sometimes, activities must be inspected by a supervisor, an owner, or a local government agency to see whether the activity outcome is achieved according to the approval design or not. Inspection is needed since it is able to monitor the activity progress and measure activity performance. If things go wrong, corrective actions must be taken place. For example, installation of water drainage, a test must be taken to see how effectively water can be drained and whether a water pipe is leaked or not. However, inspection normally takes time and requires skilled labor as well as special equipment in performing the test [9]. Hence, additional costs are incurred.

3.4 Rework

In construction project, rework is taken place when the activity performance is underachieved or specification requirement is changed [3]. Hence, corrective action is carried out to repair the work done previously. For example, electric welding is carried out to repair the joint that is not properly fixed. Tiles are extracted from the wall or floor, if they are not set correctly.

Rework activity does not add value to the project. Rather, rework is the result from poor performance or failure. Moreover, rework is time consuming and difficult to perform. Consequently, rework consumes materials, labors, equipments, etc and generates extra costs to the project [1,9].
3.5 Delay

Delay can be encountered in the project. A particular task may be waiting for available materials, equipments, and resources due to delayed delivery from suppliers, unavailable resources occupied by other tasks, or other uncontrolled events [7,10]. In the case that precedent tasks are not complete as planned, subsequent tasks must wait for the completion of precedent tasks. Consequently, subsequent tasks in the projects might be delayed.

Normally, a delayed project has negative impacts to the project. For example, all subsequent tasks must modify their schedules to match the new completion time or penalty costs are charged when a project delays. Penalty costs increase the burden to the project and must be eliminated. Other negative impacts are loss opportunity to generate return to the project, loss of reputation, loss of potential customers, etc.

3.6 Set up

In some case, a set up activity in the project is required before proceeding subsequent tasks. For example, racks must be set before workers can go to work at high level. Setting up rack does not add values to the project but it eases up handlings of materials, equipments, and labors. Also, it is time consuming to assemble and dismantle racks since several workers and materials are required to build the racks.

One kind of set up activities is measurement. Measurement activities are frequently performed in the construction site. For example, measuring lengths, widths and heights of steels, pipes, tiles, doors, and so on. Workers take times to measure a dimension of a task performed. Moreover, errors from measurement can be taken place as well.

4. Solutions for handling non-value adding activities

Non-value adding activities can be tackled using several methods. In this section, four different approaches for handling non-value activities are proposed. These four approaches are reductions of the need, frequency, costs, and time of non-value adding activities.

4.1 Reduce the need of non-value adding activities

The need of non-value adding activities can be removed by redesigning the project or activities. For example, implementing an investment plan by concerning truck access or material handling access to the construction site. Buildings that are easily constructed in the early phase may result in difficult material handling access in constructing buildings next phase. Hence, the owner must construct buildings in the early phase by considering the ease of material handling access in a subsequent construction. Thus, decision of what buildings should be constructed first is able to eliminate unnecessary material handling.

Selecting proper materials can also eliminate the need of non-value adding activities [4]. The use of ready-mix concrete or prefabrication concrete is able to reduce the need of storage of materials such as cement, sand, stones, etc.

4.2 Reduce the frequency of non-value adding activities

The non-value adding activities can be limited by reducing their frequencies. Tasks with similar set up must be performed continuously to reduce frequent sets up. For example, racks should not be only used for laying roof tiles, but painting or light installing should be performed using the same rack as well. Moreover, the same rack can be used for unloading scraps from top floor too.
4.3 Reduce the costs of non-value adding activities

Obviously, project costs can be decreased if costs of non-value adding activities are lower. Hence, reduction in costs of transportation, storage, inspection, rework costs, delay, and set up are able to reduce negative impacts to the project. For example, using local suppliers can shorten traveling distance and result in less transportation costs. Ordering materials at the right amount and the right time can reduce the storage costs [4]. Also, using high quality materials or skilled labor is able to reduce the chance of reworks. Moreover, early negotiation must be taken place regarding the costs of delay if the project encounters uncontrollable events.

4.4 Shorten the time used in non-value adding activities

Using work and time study principles can shorten non-value adding activity time. For example, using a predetermined or standard length is able to ease up measurement activities and result in shorter measuring time. Redesign of the job or tasks to eliminate unnecessary movement is able to shorten activity time [4]. Additionally, using proper equipment helps workers to finish their tasks faster and more comfortable. Effective handling equipment is able to shorten handling time [6]. Human resource training is also important. Skilled workers are more correctly and more quickly in performing rework activities.

From four approaches, the key success factors in improving non-value adding activities are effective design [4] and skilled workers [2]. In the next section, these four approaches are implemented in the actual building construction project in Thailand.

5. Case study

Figure 3 illustrates a building construction project in Thailand. In this project, four buildings are constructed within a year. Each building has four floors and twenty workers involve in the project. Materials, equipments, resources must be handled to the construction site. The project team carries out most activities in the project. However, some activities are outsourced from local suppliers e.g. windows, ready mix concretes, building paintings, water systems, and electrical systems.

During the construction, prices of several materials are fluctuated. For example, steel and oil prices. Hence, a project manager is required to effectively manage the construction project. The project manager’s objective is to eliminate non-value adding activities as many as possible. Later, a building is redesigned and investment plan is revised to allow easier material handling access to the overall project site, especially, construction of the building in the subsequent phase.
6. Results

Building is redesigned to remove non-value adding activities by eliminating a building “rib”. In Figure 4, each building on the left has double ribs. The new design on the right has only single rib. Since the rib does not add value to the project, eliminate it could result in reduction in materials, labor, and handling activities required to build it or save 50% of rib costs.

![Figure 4 Two building designs with single and double “ribs”](image-url)

Redesign of the construction method is able to eliminate rework. In Figure 5, water pipes are installed before concrete setting. It is better than installing water pipes after concrete setting. In the latter case, rework activity is performed. Labors, materials, and equipment are required to drill down the concrete floor to install water pipes. It is more difficult and time consuming.

![Figure 5 Pipes installation before concrete setting](image-url)

7. Conclusions and discussions

Several activities performed in the construction project generate extra costs but do not add values to the project. These activities are defined as non-value adding activities and must be eliminated from the project. Non-value adding activities in the building construction project can be categorized into six different activities – transportation, storage, inspection, rework, delay, and set up. Four solution approaches are introduced to tackle non-value adding activities by reducing demand, frequency, costs, and time of non-value adding activities. These four approaches could be implemented by modifying the building design or changing construction method. In the actual construction project, the building is redesigned and results in fewer quantities of materials, equipments, and labors used.
References


