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РАЗРАБОТКА ПОДХОДЯЩЕЙ МЕТОДОЛОГИИ УПРАВЛЕНИЯ СТРОИТЕЛЬНЫМИ ПРОЕКТАМИ

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Основным важным вопросом в управлении строительными проектами является выбор правильной модели строительства. Успешное завершение строительства часто зависит от возможностей управления проектом и его методологий. Есть много методологий на выбор, каждая со своим собственным набором правил, принципов, процессов и практик. Методология, которую следует внедрить, полностью зависит от типа проекта, который вы собираетесь предпринять. Целью выбора методологии управления проектами является максимальное использование ресурсов и времени.

В этой статье делается попытка представить 3 основные методологии, состоящие из: методологии водопада, бережливого производства и критического пути, а также проанализировать их пригодность для строительной отрасли и предложить хороший способ найти подходящую методологию управления строительством.

Ключевые слова: строительство, наклонять, водопад и методология критического пути, методологии управления проектами.

DEVELOPMENT OF SUITABLE CONSTRUCTION PROJECT MANAGEMENT METHODOLOGY

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The main important subject in construction project management is to choose the right construction model. Successful completion of construction often depends on project management capacity and its methodologies. There are many methodologies to choose from, each with its own set of rules, principles, processes, and practices. The methodology that should implement entirely depends on the type of project undertake. The goal of choosing a project management methodology is to maximize the use of resources and time.

This article tries to introduce 3 main methodologies consists of: waterfall, lean and critical path methodology and analyze their suitability for the construction industry and suggested a good way to find a suitable construction management methodology.

Keywords: construction, lean, waterfall and critical path methodology, project management methodologies.

INTRODUCTION

Project management is the foundation upon which every construction project is built. A construction project manager must have a variety of skills and competencies in order to move through the project and establish functional contact with the many teams. Construction projects have a constant need for modifications and in this sense project management is key to the stability of the entire procedure. The main 3 used project management methodology for construction is: waterfall, lean and critical path methodology.

✓ *The waterfall methodology* is a project management approach that emphasizes a linear progression from beginning to end of a project. This methodology, often used by engineers, is front-loaded to rely on careful planning, detailed documentation, and consecutive execution. The waterfall methodology has a big challenge because it requires significant upfront project planning before any value-creating work is completed. Planning is necessary because clients need to agree on cost, schedule and scope [1,2].

The waterfall methodology is one of the "traditional" project management frameworks. It has been used for several decades, especially in the construction industry. Waterfall model is based on three main principles: low customer involvement, strong documentation, and sequential structure.

✓ *lean methodology:* Lean project management is the application of lean manufacturing principles to the practice of project management. The goal of lean project management is to maximize value while minimizing waste. Lean manufacturing principles were developed by Toyota in the 1950s and applied in the 1970s to combat the energy crisis. The term “lean” was coined in the late 1980s. The Project Management Institute sums it up: “To be Lean is to provide what is needed, when it is needed, with the minimum amount of materials, equipment, labor, and space.”

Lean manufacturing identifies three types of waste: muda, muri, and mura (known collectively as the 3M).

- Muda refers to activities that consume resources without providing additional value
- Muri refers to the overuse of equipment or employees
- Mura is operational “unevenness,” which decreases efficiency and productivity in the long term

Lean project management aims to reduce the 3M within the project process [3,4].

The Lean methodology is suitable for construction on the one hand for costly waste in the construction industry, especially for large projects. There are also many moving parts in people and processes, and the lean framework is well suited to facilitate collaboration and efficiency.

First published in 1996, the book Lean Thinking by James P. Womack and Daniel T. Jones introduced five key principles that can be used to apply the lean concept to project management.

1. Specify value: What is the project’s value in the mind of the customer?
2. Map the value stream: A “value stream” map shows the entire process for creating the product or project. Once this process is mapped, it can be analyzed for waste, such as unnecessary steps that tax resources or compromise quality.
3. Make value flow by eliminating waste: Creating an improvement plan will eliminate the waste identified in the value stream. This plan represents a “future state” for the project’s process.
4. Make value flow at the customer’s demand: The ideal scenario is to move the project forward or create the product when requested by the customer. Get as close to this as possible to reduce inventory and save resources.
5. Embrace continuous improvement in pursuit of perfection: Regularly reassess the project process to eliminate waste and maximizing productivity and efficiency.

✓ *critical path methodology:* The critical path method in construction is a method of project scheduling that breaks down required activities using a diagram to calculate the duration required to complete each activity. The critical path method, or CPM for short, is sometimes referred to as critical path scheduling. It’s commonly used by project managers to accurately plan construction projects.

The critical path is identified by a detailed network diagram that takes into account each activity, its duration, predecessors, and lag. The critical path is the sequence of activities that are necessary (critical) to complete the project.

A critical path diagram is a visual planning tool that represents all of the construction activities required to complete a project. The diagram takes into consideration each activity's duration, preceding activity (how each activity related to another), and lag. The diagram allows for a project to visually be broken down into activities, which are often depicted in boxes [6,7].

The basic assumptions behind critical path management are efficiency and cost control. Project managers create scheduling efficiencies by determining which specific tasks have the greatest effect on the timeline of a project.

As for the critical path methodology, we should find the right set of steps that must be taken to complete the project successfully. To find this "critical path", the project is first broken down into its component tasks. Then, each task is evaluated in relation to its resource needs, prerequisites, schedules, and personnel needs. Finally, any dependencies and relationships between tasks must also be established.

RESULTS AND DISCUSSION

There are many methodologies to choose from, each with its own set of rules, principles, processes, and practices. The methodology that should implement entirely depends on the type of project are going to undertake. The goal of choosing a project management methodology is to maximize the use of resources and time [8,9].

In order to choose a proper methodology, we need to know what we want and our main principles for construction as like as advantages and disadvantages of every methodology.

✓ *Advantages of the waterfall methodology*

- Since technical documentation is a necessary part of the initial requirements development phase, this means that all team members clearly understand the objectives of the project. New developers can quickly discover the coding rules and get into the workflow without too many problems. If a waterfall model is used for the life cycle of an information system or project, gradual breakdown ensures discipline;
- Each step has a well-defined starting point and conclusion, making it easy to monitor progress;
- It uses a clear structure;
- The progression of the waterfall model is intuitive;
- The waterfall model determines the end goal early;
- It transfers information in superior ways when compared to other methodologies;
- The waterfall model keeps a project to a specific timescale;
- There are fewer financial surprises with the waterfall method;
- It reinforces good testing habits;
- The phases of the waterfall model are predictable and don’t overlap.

✓ *Disadvantages of the waterfall methodology:*

- The waterfall model doesn’t support making changes;
- It can invalidate the work you’ve previously accomplished;
- This method excludes end-users and clients;
- It delays testing until after the completion of the project;
- The waterfall model can promote longer delivery times;
- It typically works better for small projects;
- Working models aren’t available until the latter stages of a project;
- It is often compared to a well-known project lifecycle methodology;
- This methodology is still used today in the public sector.

✓ *Advantages of the lean methodology*: Construction organizations that use lean project management can expect [10, 11]:

- Efficiency: By defining processes, developing management and implementing strategies such as the 5 S's (Sort, Streamline, Shine, Standardise and Sustain), companies can therefore improve productivity.
- Speed: With improved efficiency comes increased speed. The more efficient the project, the faster it is completed. And the quicker one project is completed, the quicker companies can move on to the next, which could mean more clients!
- Less Wastage: This does not only refer to product wastage, but to time, energy, and money as well. Lean construction aims to decrease waste from all aspects of the project.
- Safety: Thanks to better organisation and standardised strategies put in place via Lean Construction, many companies have seen a signification decrease in workplace injuries.

✓ *Disadvantages of the lean methodology:*

- Commitment: For Lean Construction to be successful, commitment and focus are need by all involved. Team unity and sometimes additionally training are required.
- Other projects: Current/unfinished projects may take a hit whilst a company is trying to incorporate Lean Construction and is something that needs to be considered before taking on a new strategy.
- Time: Adopting anything into a company can be tricky but more significantly, it can be time consuming. Instant results are not guaranteed as it takes time to implement new techniques. Results are more gradual.
- Cut corners: Some argue against Lean Construction as they believe in order to build so quickly and efficiently, corners are being cut. For example, less than appropriate materials are being used and won't last as long as traditional materials, meaning the project itself won't hold the same longevity.

✓ *Advantages of critical path methodology:* It is considered the best method for

- It figures out the activities which can run parallel to each other.
- It helps the project manager in identifying the most critical elements of the project.
- It gives a practical and disciplined base which helps in determining how to reach the objectives.
- CPM is effective in new project management.
- CPM can strengthen a team perception if it is applied properly.
- CPM provides demonstration of dependencies which helps in the scheduling of individual activities.
- It shows the activities and their outcomes as a network diagram.
- It gives a fair and concise procedure of documenting of project.
- It helps in determining the slack time.
- An explicit and clear approach of communicating project plans, schedules, time and cost performance is developed.
- It is extensively used in industry.
- It helps in optimization by determining the project duration [12].

✓ *Disadvantages* of Critical Path Method (CPM):

- The scheduling of personnel is not handled by the CPM.
- In CPM, it is difficult to estimate the completion time of an activity.
- The critical path is not always clear in CPM.
- For bigger projects, CPM networks can be complicated too.
- It also does not handle the scheduling of the resource allocation.
- In CPM, critical path needs to be calculated precisely.

CONCLUSION

The world has changed. As with all management methodologies though, there are pros and cons — but being aware of the potential pitfalls is your best line of defense. According to the Project Management Institute (PMI), a methodology is defined as 'a system of practices, techniques, procedures,

and rules used by those who work in a discipline. Therefore, any methodology needs to accommodate multiple complex tasks, many of which occur concurrently. The Waterfall Methodology is well-suited because it was designed for the industry. The Lean Methodology is perfect for cutting down on wastage, and the Critical Path Framework is designed for construction companies that handle multiple concurrent projects. Here are three things to keep in mind:

1. Understand the potential problems, and take steps towards mitigating these.
2. Always keep your overarching company goal in mind.
3. Track and monitor progress as you go, both through project management software and daily team standups.

If you use these three points as your guiding star, you'll be able to build an efficient project that evolves and improves each day.

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