

Lean Methodology in Reducing Construction Costs

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Abstract: Lean Construction; As a management strategy in construction projects. Slide presentation. Lean is a term that refers to a way of doing business where it focuses on maximizing value for customers by eliminating all losses from activities that do not generate value. To obtain efficiency in the activities, the performance in quality, time, cost of the project is evaluated. The philosophy of Lean Construction is based on the optimization of the productive processes through the identification and elimination of waste, and the analysis of the value chain, to achieve a stable, constant flow of material, in the right quantity, with assured quality and at the time that this philosophy is necessary, that is, to have the flexibility and reliability that the product is manufactured at the time it is needed. requested by the customer, without producing more or less than required. The Lean methodology is highly recognized worldwide, and the momentum it gets is based on the optimization and standardization of processes within construction companies, completely eliminating waste.

Keywords: Construction Costs, Building process, Management strategy.

INTRODUCTION

Building process is designed with this methodology and the project runs jointly thus, all work is organized around the processes, in order to minimize losses during construction. In addition, both the planning and control system are two processes that are measured for improvement [Babalola, O. *et al.*, 2019; Jin, R. *et al.*, 2018].

Lean Construction is not a guide, but a philosophy that must be followed in order to reach our goal of industrializing construction and gaining efficiency and productivity in the sector.” One of its main goals is to make all phases of the project more efficient. This is where the Lean Building Methodology finds an ally in BIM, a business tool that detects problems at the design stage and allows them to be resolved [Erol, H. *et al.*, 2017].

According to information published in Scientific Studies, about 90% of infrastructure projects around the world cost more than initially planned or are delivered with some kind of delay.

This data, which is added to other studies that demonstrate how a lack of communication and definition of activities affect work, reveals a major challenge for the sector: the pursuit of greater productivity and reduction of waste, which in some cases reaches 57%. [Bertelsen, S. *et al.*, 2016; Salem, O. *et al.*, 2006]

Lean Construction, specifically, serves to solve this type of situation. The methodology began to be used in this sector in the 1990s and its goal is to improve business management.

This business approach seeks to reduce business execution time, efficient use of resources and

generate value for the end product [Hussain, K. *et al.*, 2019].

All phases of planning and implementation are designed based on the needs of the consumer so there is a great focus on reducing waste and getting work done within the expected time frame.

Above all, there is a big conceptual difference. Although traditional work seeks to solve problems that arise during construction, and therefore often has a sense of solving problems all the time (the famous “firefighting”), in the Lean approach there are well-planned strategies, including forecasting potential problems.

There is a kind of manual for the management of work, which predicts exactly what materials will be required and what skills will be necessary for the proper implementation of the project, without unnecessary resources or actions [Sarhan, J.G. *et al.*, 2017].

Main Advantages of Lean Construction

Waste reduction

Lean construction is expected to adopt smart methods and modern technologies capable of accurately calculating the amount of materials required in the project.

Therefore, it is possible to properly invest in resources, without wastage or constant demand for new acquisitions, as is common on traditional construction sites [Fauzan, M. *et al.*, 2021].

The methodology also includes the use of automation systems for repetitive tasks, which translates into labor savings, with the correct implementation of activities.

Increase Productivity

Produce more in less time without compromising the quality of the final delivery this is one of Lean's core principles and a competitive advantage in civil construction.

The construction site becomes more productive with lean construction. This is because there have been a number of changes in the implementation of tasks, ranging from the way equipment and materials are allocated in space, to the adoption of new technologies [Kuzucuoglu, D. *et al.*, 2019; Wong, L.S. *et al.*, 2018].

Reduce Costs

Initially, it will be necessary to invest in new equipment, systems and technologies, as well as to train employees to adopt a new methodology.

However, in a short time, this investment will turn into a high rate of savings. After all, the application of more efficient methods of work ensures the proper use of resources, with a high rate of economic profitability.

The Deadlines

One of the biggest problems in civil construction is the delay in the delivery of projects, whether residential or corporate.

Whether it is due to a lack of organization in the acquisition of materials, the slowness of the tasks themselves or even external factors, such as heavy rain days or winds, it is common for work to be delivered after an agreed deadline.

Lean Construction seeks to change this scenario, simplifying a series of activities and ensuring that deadlines are properly met.

Companies are ready to anticipate problems, plan construction steps while minimizing unnecessary

activities and automate a series of actions, which translate into greater flexibility and efficiency [Bajjou, M.S. *et al.*, 2019].

Reduce Volatility

Another big challenge for the sector is ensuring standardization at the construction site. After all, we are talking about teams assigned to the project to avoid this difference, the lean construction provides for the qualification of the workforce and the use of automation technologies In addition, the management of the work is based on strict criteria of demand: a vision of high quality standards in the delivery of products to the customer.

More Quality

The improvement in construction processes is continuous, with a significant increase in the quality of works.

Knowledge and skills multiply with each new project, ensuring better levels. Moreover, focusing on clients' needs ensures that the end result is of a high standard [Fregonara, E. *et al.*, 2017].

For this, it is worth thinking about the business based on the empathy map, a technique that helps to understand what the consumer really needs and how it can help the business.

Satisfied end Customer

With all this, the result could not be different: the customer is more satisfied, in the end he is placed at the center of the development of the project, ensuring that all his needs and desires are met.

Thus, it is possible to do the "perfect", value-added function, enhance the brand image and gain more space in the market, with increasingly satisfactory results.

Table 1: Factors determining the selection of processes

Factors Favoring the Choice of Processes	Factors Making Process Selection Difficult
Availability of resources: the people who carry out this process and are knowledgeable about it.	Data availability: processes completely outside the system where it is difficult to collect measurable data.
Process stability: the process should not change over time.	Existence of the process: the process either does not exist or is so diverse that it is difficult to establish the core of the process and operationalize it.
Awareness of process boundaries: definition of the beginning and end of the process.	Inventory of processes: lack of knowledge about the number of processes or it is impossible to systematically approach their optimization.
Existence of an actual problem: dissatisfied customer or unfavorable internal control.	Stakeholder support: no real management commitment and no one at the top.
Organizational culture: organization's	Strategy: no strategic approach to process selection.

openness to changes, even at the cost of breaking down silos.	
Repeatability of processes: high repeatability of processes can generate the greatest savings potential.	

Only 5% of respondents reported a reduction of operational risk and a decrease in control activities: 4%. It is a significant finding coming from this research, especially for risk management and ESG (Environmental, social, and governance) reporting. Despite the enormous pressure on international organizations, none of the respondents indicated the possibility of reporting lean management effects in ESG reporting.

The last layer of the survey was focused on the organizational structure of the lean team to gain an understanding of potential dependencies and relations with other structures in the organization. Based on respondents' responses, the team responsible for lean management is organized mainly as a separate team (50%), or there is an independent expert in the organization (27%) [Grabovy, P. *et al.*, 2018]. Specifically asking about process risks and mitigating controls discussion when streamlining processes using the Lean Management method, 68% of respondents confirmed that it is taking place, and it is discussed with a representative of the Internal Controls Team (47%) or Risk Management Team (13%). In

almost 40% of responses, no Risk Management/Internal Controls representative is taking part in the discussion, the knowledge of people in the team and their general understanding of risk is used [Khanna, M. *et al.*, 2021]. This initial result is giving new light on the organization of the process itself and how proper cooperation should look like to build proper synergy between lean management and risk management team. In terms of risk assessment during the improvement process using the lean management method, 70% of respondents confirmed that risks and mitigating controls were discussed and 53% of respondents indicated that a representative of the internal control or risk management team participated in the process improvement. After the process transformation, risk analysis was not executed in 55% of responses and the risk matrix was updated less often than once a month for more than 50% of responses. All these conclusions raised additional questions and require more in-depth analysis via additional surveys and case studies from a risk-management perspective [Banawi, A. *et al.*, 2014].

Table 2: Summary of the respondents and the companies characteristics

Component	Respondents' Responses
Employing entity	82% reported they belong to SSC organization.
Location of employing entity	Most of the respondents represent Poznań (38%), Warszawa (33%) and Kraków (10%).
Organizational level of the position in the company	Most of the respondents represent Directorial level (27%), Managerial level (27%) and Leader level (23%).
Size of the company: number of internal units	Analyzed SSCs support 20–50 units—82%, 50–100 units—9%, more than 100 units—9%.
Size of the company: number of employees	Analyzed SSCs employ 100–300 people—55%, 301–1000 people—36%, more than 1000 people 9%
Scope of services (top 10 ranking)	Purchase to Pay (PTP), Order to Cash (OTC), Treasury/Cash and Banking, Taxes, Procurement, Internal Controls, Customer Service, Corporate functions, Application development and maintenance, Internal Audit.

Bad management can lead the company to the non-completion of a project, in addition to carrying million-dollar fines and in the long term even bankruptcy, all this because of not carrying out planning processes. Also of other factors that affect the development of the work such as non-detailed budgets and schedules, lack of clarity in the functions of the personnel, poor management

of human talent, among others. However, the construction sector is highly competitive and in order to participate and compete effectively against other companies (many of them with more experience), it is necessary to have a well-developed work methodology in order to manage, control and determine changes in the processes. and tasks to execute. All this accompanied by a

budget to meet the planned goals, indicating values and financial terms. In this sense, in the business world there are several methodologies that help to give order to the processes executed by an organization, but the one that fits optimally is the LC methodology. With this methodology, a guide is sought that allows clarity in each of the activities to be carried out by the company Constructions S.A.S, since it develops processes without methodology, since managers make decisions based on their experience, appealing to common sense, although on some occasions it works, on others this way of proceeding will only create delays and losses, causing the company's strengths and experience to take a backseat, thus showing that the need to implement a technique through Planning is essential to improve the execution of activities in an effective and well done way[16]. Taking into account the above, the current degree project will focus on the analysis and development of the LC methodology with which the current conditions with which the company works will be diagnosed, giving us the bases to develop a methodology according to the management of the relationship (time-cost-scope).

CONCLUSION

Certain abstinence to change and innovation in construction companies, it is verifiable that the use of this methodology manages to increase the indicators of productivity, quality, safety, times, delivery times and customer satisfaction. The construction union in Colombia contributes in a large percentage to the mobilization and growth of the economy, and being consistent, it has to advance with the needs of the environment and its demands; Then it is a priority that, when carrying out a self-analysis within the organizations, shortcomings are detected in order to correct them and thus optimize the standard of their processes. Within this process of change or implementation of the Lean Methodology, it is necessary that all the participants interact, and that this results in a transparent process where all the information is accessible, and feedback can be generated in each one of the processes [Aslam, M. *et al.*, 2020; Juliani, F. *et al.*, 2020; Orlov, A.K. *et al.*, 2021; Albalkhy, W. *et al.*, 2021].

This is to decentralize decision-making and promote the development of skills within all members of the company. However, it is necessary that this process is accompanied by the delivery of information and manage training processes that allow all employees to add value by eliminating

waste and increasing the profitability of the companies in which they carry out their activities.

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