

Impact of Knowledge Management of Lessons Learned in a Consulting Engineering Company

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Abstract

For Lessons Learned to generate effective results in organizations, it is essential to establish effective Knowledge Management, capable of converting these lessons into continuous organizational learning. However, although many companies are aware of the importance of Knowledge Management, they limit themselves to recording Lessons Learned without integrating this practice into structured learning processes. The aim of this study is to analyze the impact of Knowledge Management on Lessons Learned in a consulting engineering company. The methodology adopted is a case study, with both qualitative and quantitative analysis. Data collection includes interviews and receiving data from the company with Lessons Learned records from two projects and their impacts. Based on this set of information, an analysis of the impacts observed in the projects is provided, with the aim of highlighting the value of Lessons Learned Knowledge Management and reinforcing its importance for future applications in new projects, which results in gains mainly in the reduction of rework, optimization of working hours, improvement in meeting deadlines and productivity based on the company's ability to maintain Lessons Learned Knowledge Management by

applying them in the projects presented. Therefore, it can be concluded that there is a need for Lessons Learned Knowledge Management in a consulting engineering company so that it can apply the lessons in future projects and show gains.

Keywords

Knowledge Management. Lessons Learned. Learning.

1. Introduction

Nowadays, companies are constantly seeking to improve their performance and expand their operations in the competitive market. In this context, organizations that develop projects with a focus on efficiency and reducing recurring errors have already adopted the recording of Lessons Learned as a strategy to take advantage of the knowledge generated in previous projects and apply it to improving future projects. However, according to Guzzo (2023) the Knowledge Management associated with these lessons is still underdeveloped, making it necessary to implement management that transforms these records into useful and sustainable knowledge for the organization, so that they are not lost over time.

Sharing Lessons Learned promotes the exchange of knowledge internally and allows the organization to confirm the validity of the lessons learned, helping to reduce errors and increase efficiency in future projects (Fernandes et al. 2023). For Balbino et al (2021), recording these lessons highlights failures that caused problems in the past, which reduces the likelihood of these errors being repeated in future activities, as well as consolidating successful practices that can be replicated, benefiting the organization on its path to continuous improvement. In this way, this practice generates a competitive edge, as the market demands that companies improve their performance, and project-based Knowledge Management is a means of doing so. However, as Silva and Santos (2024) state, most companies still face difficulties in implementing this management effectively.

In addition, the literature on the subject tends to focus on studies of project management and Knowledge Management, paying less attention to Lessons Learned and, above all, not widely exploring the relationship between these lessons and Knowledge Management, a fact that is revealed in practice, since according to Balbino and Silva (2021) Lessons Learned work together with Knowledge Management in the organizational environment, however this relationship is not adequately explored due to the lack of knowledge of tools to manage lessons and the practice of not using a single environment to store and share with members of the organization.

Therefore, the focus is only on the lesson recording model, without discussing in detail how lessons are recorded, managed and effectively used to support active and transformative Knowledge Management and its impact on projects. Habib. et al (2023) adds that the organization that is able to maintain this relationship will reach privileged levels in the competitive market.

Therefore, this study seeks to answer the following research problem: how Knowledge Management of Lessons Learned impacts project performance in a consulting engineering company. To this end, the main objective is to analyze the impacts of this Knowledge Management, using a quantitative and qualitative approach, to show how Lessons Learned management influences project management. In addition, the study seeks to make it clear that the continuous improvement of Knowledge Management is essential to ensure maximum use of Lessons Learned and consequently contribute to greater efficiency and a reduction in errors in future projects.

1.1 Objectives

This study seeks to answer the following research problem: how Lessons Learned Knowledge Management impacts project performance in a consulting engineering company. To this end, the main objective is to analyze the impacts of this Knowledge Management, using a quantitative and qualitative approach, to show how Lessons Learned management influences project management. In addition, the study seeks to make it clear that the continuous improvement of Knowledge Management is essential to ensure maximum use of Lessons Learned and consequently contribute to greater efficiency and a reduction in errors in future projects.

2. Literature Review

Every organization, in principle, aims for longevity and, to this end, must constantly seek to improve its development, and continuous learning is a fundamental tool for this purpose, as explained by Silva et al. (2024) it is essential to encourage learning in order to transform knowledge into power and generate organizational growth.

According to Guzzo (2023), the organization that effectively learns is the one that is focused on developing skills to detect, obtain, produce and share knowledge, in order to adopt new practices that aim for continuous learning and its sharing throughout the institution.

Guzzo. (2023) states that Organizational Learning is linked to the activity of identifying and correcting errors, based on reflection on experience, especially on the factors that contributed to failures. This process consists of extracting lessons and knowledge that can be applied to improve future results.

However, for this learning to take place effectively, it is necessary to maintain a posture of openness, dialog and collaboration; defensive attitudes or those based on accusations compromise the environment necessary for the exchange of ideas and the growth of collective learning (Doro 2022).

2.1 Knowledge Management

Knowledge has been valued today and is considered key to the growth of companies and capable of stimulating innovation and leveraging the organization in the competitive market (Habib et al, 2023).

However, according to Silva et al. (2024) for this to be possible, Knowledge Management is necessary, which involves identifying, possessing and sharing this knowledge efficiently.

In other words, Knowledge Management consists of organizing and managing all the knowledge acquired by the organization from the experience of the projects carried out (Lessons Learned).

According to Vicente and Cunha (2021) the 6th edition of the PMBoK [2] states that Knowledge Management in a project using Lessons Learned consists of “ensuring that the skills, experiences and expertise of the project team and other stakeholders are used before, during and after the project”. Therefore, the knowledge acquired through Lessons Learned, if maintained through management, is shared in the organization and drives learning, and can be used for future projects.

For Ziviani et al. (2022), the effectiveness of knowledge transfer and learning promoted by Knowledge Management is directly linked to organizational principles and the actions of the organization's members.

SILVA and SANTOS (2024) states that the principles and habits of the organization must be ordered with the actions of Knowledge Management in order to achieve a conducive culture. In addition, leadership support is essential for the culture to be implemented.

2.2 Lessons Learned

The practice of Lessons Learned is an activity that promotes continuous learning in the organization and is present in Knowledge Management in projects and in the organization. It is ideal for driving innovation and the search for continuous improvement in projects and generates greater knowledge, learning and the ability to adapt to change (Azevedo, 2022).

For Balbino et al (2021, p. 52), “lessons learned can be considered as intellectual assets that create value from the experiences lived”.

Balbino et al (2021) and Guzzo. (2023) define Lessons Learned as the identification of experiences in previous projects in order to replicate them if they have had a positive impact or to avoid them if the result has been negative, thus generating knowledge and learning for application in future projects.

For Lessons Learned to be successful, they need to be identified and validated (through group meetings) before they are recorded, there needs to be a storage environment, Lessons Learned need to be shared and there needs to be a continuous monitoring process to review and identify new activities, because according to Guzzo (2023) the biggest challenge is not in the Lessons Learned recording phase, but in the phases in which these lessons need to be organized, safeguarded and shared.

Therefore, it is important for the corporation to have mechanisms for recording Lessons Learned and to be open and attentive to them, in addition to them being applied effectively by the members of the organization, not being wasted over time and maintained as a power of knowledge of the organization.

Guzzo (2023) states that if they are not effectively applied, Lessons Learned will only be lessons that remain as theoretical records, because a Lesson Learned, in its essence, is defined by the transformation resulting from its practical application. It is a concrete change that promotes significant improvements in the target process, and not merely the archiving of potentially valuable experiences that are still waiting to be put into practice.

It is a question of vision and a proactive collective attitude, which is also linked to the theme of Knowledge Management.

2.2.1 Importance Of Lessons Learned

In order to stand out in today's competitive market, the search for continuous improvement is fundamental, which is closely linked to the practice of Lessons Learned management, because as Balbino et al (2021) states, the management of these Lessons Learned results in a competitive advantage, raising the level of the organization, which when applied collaborate for the growth of the organization and lead to opportunities and cost reduction and the repetition of errors.

Morales and Cândido (2021) illustrates that the practice of Lessons Learned drives learning and produces greater knowledge, continuously generating improvements for the organization.

By implementing a Lessons Learned culture, companies are able to turn every experience, positive or negative, into future improvements, increasing the efficiency of the organization, the quality of the results and contributing to the creation of a sustainable competitive advantage in the market, continuously.

Therefore, as Balbino et al (2021) teaches, the practice of Lessons Learned drives the application of past experiences in future projects, resulting in both success and a reduction in errors and rework, and consequently generating knowledge and continuous learning in the organization.

2.3 Organizational Culture

For Knowledge Management to be successful within the organization and for Lessons Learned to be used, an appropriate Organizational Culture is essential, because as Silva and Santos (2024) explains, it influences the values and attitudes of the organization's members.

Silva and Santos (2024) illustrate that Organizational Culture shapes the character of the organization and relates to its principles, guidelines and habits, acting on the way of thinking, acting and the relationship between members of the organization.

Thus, in order for Lessons Learned to be implemented and for them to contribute to the organization's Knowledge Management, organizational learning must be encouraged, because according to Silva and Santos (2024), in order for efficient Knowledge Management to exist, a culture is needed that drives the act of learning and the sharing of knowledge. Doro (2022) states that the effectiveness of Organizational Learning depends on the implementation of a flexible Organizational Culture, open to collaboration and change, and with effective communication.

3. Methods

This research is based on a case study, with a qualitative and quantitative approach, in a consulting engineering company that uses Lessons Learned in projects. According to GUERRA (2023) a case study is characterized as a study

of a fact and its variables in a well-defined location such as an institution, a local unit or a person and aims to analyze and explore these facts in depth, generating knowledge about them.

The analysis, validation and discussion of the results are made possible by selecting information capable of showing the impact of Lessons Learned on projects, making it possible to compare projects that have applied the lessons with those that have not, and preferably quantitative data, together with qualitative data capable of showing the proposed objective. Thus, all the impacts are discussed and analyzed based on the theoretical framework of the work, but especially those impacts that can be measured are transformed into graphs.

The choice of using both qualitative and quantitative data is justified by the view that, according to SOARES et al (2022), a well-executed study encompasses different forms of methodology that together contribute to a more complete evaluation and discussion of the results, both with opinions and with numerically concrete data.

SOARES et al (2022) states that qualitative data is subjective and subject to interpretation by the data collector, so that an analysis can be made based on the theoretical framework, while quantitative data is objective and subject to objective analysis, based on the presentation of results and direct discussion.

4. Data Collection

Data collection is divided into two parts: initially, data was collected through interviews with project managers from two of the company's projects, resulting in a good understanding of the context of each project. After this, the last stage of data collection refers to receiving information from records provided by the company, which contain the Lessons Learned in two specific projects, as well as the associated qualitative and quantitative impacts. From this database, it is possible to carry out a survey of the impacts resulting from both the application and lack of application of Lessons Learned in the projects of a consulting engineering company. The analysis of the data serves as evidence of the relevance of Knowledge Management in making effective use of Lessons Learned, to guarantee their application in future projects.

5. Results and Discussion

In this section, the main lessons learned are presented, addressing the practices and changes implemented throughout two projects selected by the company, with the aim of analyzing the impact of these lessons on the organization, considering both quantitative and qualitative aspects. The first project, belonging to the mining sector, resulted in a periodic dam safety report, lasting one year and divided into two main phases. The team involved consisted of approximately 15 people. The second project, also in the mining sector, involved a study of alternatives for the location and disposal of tailings, lasting one year and comprising six execution phases. This project involved a team of around 40 people.

Project 1: Anticipating potential structural changes contributed to reducing risks, reviews, and meetings, while strengthening team confidence and collaboration. Replacing Planner with Azure DevOps enhanced agility in SCRUM, improving team integration and time efficiency. Understanding essential data improved risk identification and response, optimizing planning. Identifying critical activities refined the schedule, making it more detailed but also more complex. The clear separation of responsibilities within the schedule improved planning and resource allocation, ensuring greater accuracy in meeting deadlines.

The lack of records on execution times in previous reports highlighted the need for standardization and better knowledge management. The maximum discretization of activities boosted productivity and ensured compliance with deadlines throughout the project. Prioritizing quick, daily meetings reduced delays and rework, fostering a more integrated and productive environment. Closing meetings reinforced continuous improvement, reduced revisions, and increased customer satisfaction. Finally, the immediate alignment of new professionals ensured knowledge standardization, engagement, and rapid adaptation to processes.

Anticipating potential changes in structures sensitive to alterations was identified by the company as a positive action in previous projects. This approach was recorded in the internal project management system as a lesson learned and incorporated into Project 1, enabling the lesson to be preserved and applied to the project. This led to greater predictability and control over the impacts of changes. In Project 1, implementing this action resulted in a significant

50% reduction in hours dedicated to reviews and alignment meetings. This optimization not only reduced the time spent on these activities but also freed up resources to focus on other strategic tasks, contributing to more efficient time and project management.

A good practice from previous projects involved replacing long, infrequent meetings with short, daily ones, leading to a reduction in rework and avoiding delays in meeting deadlines. These results transformed the practice into a lesson learned, recorded in the internal management system and shared, making it a valuable learning experience to integrate into future projects. In the case of Project 1, applying this practice led to a significant reduction of approximately 20% in delays in delivering activities.

Project 2: Several lessons were learned and implemented to enhance processes and ensure greater efficiency and productivity. One of the key improvements was the adoption of the Work Breakdown Structure (WBS) Dictionary, validated with the client. This initiative enabled the project team to gain a clearer understanding of the deliverables, reducing rework and providing a more precise breakdown of the work package. As a result, there was a significant increase in productivity, as evidenced by the relatively low number of hours dedicated to rework compared to the total hours worked.

Furthermore, the implementation of a production line approach for deliverables improved the visibility of workload demands and allowed for more effective prioritization of tasks. The strategic division of teams ensured that each member had a well-defined role, which facilitated more targeted and accurate planning, enhanced risk mapping, and fostered a multidisciplinary perspective within the project.

The adoption of agile methodologies and the Kanban system, combined with a dynamic environment using Microsoft Azure DevOps, resulted in substantial benefits, including improved traceability of project information, enhanced responsiveness to changes, and more effective deadline management. Simultaneously, the implementation of the Agile Engineering Framework strengthened communication within the team, ensuring clarity and direction while fostering active listening and continuous collaboration.

Another crucial aspect was the improvement in deliverable planning, which was restructured with a higher level of detail, significantly reducing the number of adjustment requests from the client throughout the project. The average number of adjustment requests decreased from approximately 15 to around 5 per delivery, demonstrating enhanced predictability and alignment with client expectations. These lessons learned were instrumental in reinforcing the company's organizational culture, fostering a collaborative environment aligned with continuous improvement. The adoption of these measures led to a reduction in rework, increased process efficiency, and ensured a more productive and transparent workflow in Figure 1.

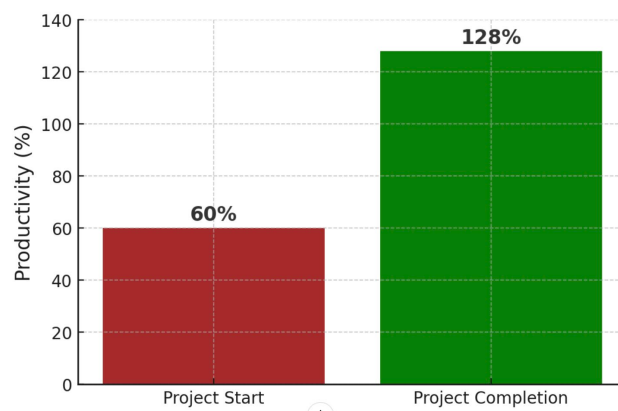


Figure 1. Impact of WBS Dictionary Addition and Client Validation on Project Productivity

Figure 1 illustrates the impact of adding the WBS Dictionary and validating it with the client on project productivity. This lesson learned, identified and applied during the project, demonstrated that using the company's internal registration and management system facilitated access and implementation, resulting in a productivity increase from 60% to 128% throughout project execution.

6. Conclusion

Lessons Learned are records of past experiences, whether positive or negative, which are used to inform future projects or phases within the same project. For these lessons to be effectively applied, the knowledge they generate must be managed. By adopting best practices for documenting lessons and fostering an organizational culture that is collaborative, transparent, and open to sharing both mistakes and successes, the learning process rooted in Knowledge Management and the application of Lessons Learned becomes more effective.

The case study concluded that Knowledge Management of Lessons Learned has a positive impact on a consulting engineering company. The results demonstrate that by maintaining Knowledge Management of Lessons Learned for application in projects, the company achieved significant benefits, particularly in reducing rework, optimizing working hours, improving deadline compliance, and increasing productivity. However, the current method of recording Lessons Learned is neither ideal nor practical, as it lacks standardization. All Lessons Learned should be documented within a context and specified as clearly as possible to facilitate Knowledge Management. The absence of this standardization makes it harder to manage knowledge and causes missed opportunities for applying to new Lessons Learned.

Additionally, the results and discussions reveal that Lessons Learned can foster a culture of Knowledge Management and Organizational Learning. From the moment a Lesson Learned is documented, its knowledge is managed, and as it serves as learning for the company, these stages enter a cycle, each benefiting from the other to drive continuous improvement.

Therefore, it is crucial to make a sustained effort to manage the knowledge generated by Lessons Learned so that companies can continue to pursue continuous improvement, distinguish themselves in the market, and grow sustainably. Finally, we recommend that future research explore ways to implement a practical and functional system for documenting Lessons Learned in the consulting engineering sector. This approach should focus not only on recording but also on maintaining the management of the knowledge generated by Lessons Learned, ensuring they are not just recorded but effectively applied to contribute to the organization's ongoing learning.

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