

Addressing Bureaucratic Inefficiencies: A Case Study on Adaptation of Waterfall Methodology for Improved Project Management

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Abstract

This paper aims to explore the bottlenecks in the project management processes of a large profit driven Oil & Gas downstream sector organization which has adopted traditional predictive methodology. Annually, the company elaborates and refines a portfolio of programs and projects for execution, but the performance of its Project Management Office (PMO) has been on the decline, resulting in a failure to utilize the budget that gets allocated each year. The author conducts this research to discover if bureaucratic inefficiencies and lack of process adaptations are among the real causes of the problem. This research employs qualitative research methodology and an inductive research approach. The primary data collection method includes semi-structured, face-to-face interviews of the PMO employees to gain an in-depth understanding of their experiences and to determine the challenges and inefficiencies they encounter in project management. Moreover, a thorough case study analysis and review of literature on project management frameworks, methodologies, and best practices from other industries was also conducted. The focus was given to predictive project management methodologies (e.g. Waterfall, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT)) to see how these approaches can be used to fight the bureaucratic inefficiencies that are typical for them. The examples of literature review show how the customization of these methodologies can reduce administrative burden while maintaining project control. The outcomes of this research can be useful for the top management of the organization under this study and other O&G downstream companies that encounter similar project management issues. As a result, the study tries to enhance the efficiency and effectiveness of project management practices in such organizations through revealing existing problems and discussing potential solutions to those deficiencies of the predictive project management

methodology.

Keywords

Project Management, Waterfall Methodology, CPM, PERT, Tailoring Processes

1. Introduction

Project management has become a vital aspect in the running of businesses across all industries today. More organizations are now realizing the benefits of dividing up various efforts to specific projects to enhance the general results (Hodgson, 2002). At present, the application of project management approaches is expanding to different areas of life, including construction, information technology, and many others (Kerzner, 2015).

Previously, project management was used mainly for the execution of distinct non-operational activities in particular industries. Recent studies, however, reveal that project management approaches can be implemented in connection with a variety of actions and organizational processes (Thomas, 2009).

Classical project management models such as Waterfall, CPM and PERT have been conventional ways of managing projects for many years. These approaches are based on the notion of a clear structure of phases where one phase is completed before the beginning of the next one. This approach has its advantages but the rigidity of the system, and the emphasis on documentation, result in delays in the decision-making process and poor flexibility to change in the dynamic environment of a project (Boehm & Turner, 2003; Kerzner, 2015). Nevertheless, these methods can be useful and may require some modification for proper implementation in certain conditions (Shenhar & Dvir, 2007; Wysocki, 2007). By adopting these frameworks organizations can avoid unnecessary documentation, which is common in traditional approaches, while still ensuring that projects are on track (Sommerville, 2011).

2. Literature Review

2.1. The Role of Project Management in Organizations

Project Management has been successfully evolved and employed in such efforts as development of new products and services, process reengineering, etc. (Pellegrinelli & Bowman, 1994). Furthermore, project management assists with continuous improvement by providing frameworks for quality control, resource management, and risk avoidance (Bryde & Brown, 2020). For organizations that are stochastic in their innovation, project management ensures that strategic projects are executed efficiently and effectively, and in harmony with the company's long-term goals (Kwak & Stoddard, 2021).

2.2. Predictive Methodologies: Waterfall, CPM, and PERT

Predictive project management methods like Waterfall, CPM and PERT have been widely used for managing projects in structured project execution. However, each of these approaches has its benefits that come with criticism for being too rigid, especially in fast-paced environments where change is frequent. Below is a summary of the main predictive methods and challenges associated with them, from real case projects, based on existing academic research.

2.2.1. Waterfall

According to (Boehm & Turner, 2003), Waterfall is most suitable for projects with well-defined boundaries and low project changes throughout the life cycle, thus being most appropriate in construction or manufacturing industries which are characterized by the necessity of clear and specific processes. Bertschek et al. (2020) state that due to the simplicity and clarity of the Waterfall approach, it is rather easy to manage and control, particularly in projects with clear requirements and products.

However, if such consequences as unanticipated problems and new project specifications are likely to occur during the project, then the rigidity of Waterfall may become a problem. Furthermore, (Kerzner, 2015) notes that large amount of documentation and signature collection at various stages of the project increases the time and effort which are usually not productive in dynamic environments that require quick actions.

NASA's Mars Rover Mission project is an ideal example of the Waterfall approach that has faced the above-mentioned drawbacks, especially the time lag issues in communication between the rover and the mission control. Thus, the more Agile approach keeping the Waterfall approach for major decision making and using the iterative approach for the product testing product was implemented. Subsequently, it reduced bureaucracy in some parts, increased responsiveness to the unforeseen issues and accomplished the project goals (Harris & Harper, 2018).

2.2.2. Critical Path Method

CPM is a very useful scheduling tool that determines the total number of dependencies, shows the sequence of tasks and identifies critical activities that directly affect the overall project timeline. Project managers can, therefore, improve on the allocation of resources, prevent delays and ensure that critical tasks are completed on time. Lock (2017) points out that this effective scheduling approach minimizes risks in a project since it ensures that timelines are met while at the same time ensuring that dependencies are well managed. Kloppenborg et al. (2021) stress that CPM is crucial in large and complex projects where scheduling, resources and coordination are crucial.

However, one of the main drawbacks of using CPM, is an assumption that the task durations are given, which is often not the case in dynamic and unpredictable environments. Changes in resource availability or the presence of obstacles can

lead to the CPM schedule being inaccurate (Shenhar & Dvir, 2007). Additionally, CPM can further complicate projects when many interdependent tasks take place, as scheduling becomes more daunting while identifying relationships between tasks and resources.

Boeing 787 Dreamliner project is a great illustration of the above-mentioned CPM limitations. The project experienced considerable delays and cost overruns, which were mainly attributed to overly bureaucratic processes with involvement of more than 300 subcontractors. To combat this, Boeing adopted a streamlined CPM approach that enabled the subcontractors to make decisions on the non-critical tasks without referring to their higher authorities. That move to optimize CPM enabled Boeing to improve the coordination and decrease the bureaucratic delays in the production process (Thomas & Fernandez, 2015).

2.2.3. Project Evaluation and Review Technique

PERT is a more detailed tool for project management mainly used to identify and depict tasks with a high level of uncertainty and unwell defined durations. As stated by (PMI, 2017), this approach is most useful in projects where time is the critical factor and can be used to identify and manage risks that are associated with time. Morris (2018) notes that the effectiveness of the PERT system cannot be questioned because it allows project managers to include provisions for the uncertain factors during a project, which is crucial in complex and dynamic projects.

However, there is a major drawback of the PERT and that is a time-consuming nature of defining the three-point estimates for each task. As pointed out by (Boehm & Turner, 2003), this step usually involves a lot of work and data collection, especially in large projects with many tasks. The need for frequent revisions and changes to the estimates also increases the administrative burden. As argued by (Bertschek et al., 2020), if there are projects where task durations are known and stable, using probabilistic approach may be unnecessary and could even be counterproductive.

Nevertheless, one of the most complex transport projects in Europe, the London Underground project, employed a traditional PERT approach and managed to tackle the estimation and scheduling issues. To streamline the process, the project managers introduced a customized PERT methodology, where they reduced the frequency of updates for tasks that were on the critical path and allowed for more autonomy at lower levels. This reduction in bureaucracy, in turn, cut decision-making time and led to faster project delivery (Egan, 2016).

2.3. Bureaucracy in Predictive Project Management

Bureaucracy is a widespread issue in predictive project management, which is due to the necessity of a high level of formal documentation, approval, and decision making in most organizations. Lock (2017) states that the main disadvantage of these methodologies is the bureaucratic paradigm that hampers flexibility and

ability to address unforeseen issues or challenges in a project. This focus on detailed reports, formal project plans, and frequent stakeholder reviews results in overregulation, which may be unnecessary for many smaller, more straightforward projects but is still often demanded because of the traditional rigidities of project management frameworks (Kerzner, 2015).

Bertschek et al. (2020) point out that although documentation and structure are necessary for large and complex projects, overregulation can slow down the achievement of project goals. Project management tools like status meetings and reports, if they take over the workflow, can prevent the project teams from focusing on the real activities that create value. Jabnoun and Al-Khalifa (2020) also explain how these bureaucratic procedures impact project timelines, stating that the numerous approval delays and administrative procedures slow down the decision-making process and thus the project implementation. Therefore, the bureaucratic tendency in predictive project management can become a significant problem, especially in fast-growing industries that need flexibility.

2.4. Tailoring Predictive Methodologies

To address the limitations of over-bureaucratization in predictive project management, scholars and practitioners have recommended traditional methodologies optimization to fit specific project context. Tailoring is defined as the customization of existing project management practices to make them more appropriate for a given project considering its size, complexity and stakeholder needs.

From Morris's (2018) view, it is possible to cut down on the bureaucratic controls through adjusting the review frequency, changing the level of documentation or changing the approval procedures to fit the current situation and still be able to maintain acceptable levels of control for project success. This way, project managers can concentrate on the most critical processes for the success of the project as opposed to implementing generic processes that may not be important in every project.

PMI® (2017) in its guide, also advises to consider specific needs of each project. Thus, in response to the specificities of a particular project, some tasks can be avoided, for instance, the development of extensive documentation or the holding of unnecessary approval meetings. Thus, by recognizing the differences in the project contexts and applying a more fluid approach, organizations can enhance the efficiency and effectiveness of their project management practices and hence, develop projects on time, to the specified budget, and to the required scope.

3. Methodology

This research uses a qualitative approach to explore the effects of bureaucracy on predictive project management methodologies, with a particular focus on the Waterfall methodology. The study involved five face-to-face, semi-structured interviews, each approximately 30 minutes in length, with experienced project managers (PMs) who have worked in the organization for more than 10 years. These

PMs were chosen for the study because of their vast experience in project management of different complexity and scale within a traditional framework. The data collected from each interview was transcribed and coded to help identify patterns and themes related to the key codes.

3.1. Coding Process

An inductive coding approach was used to generate initial codes from recurring themes identified in the responses. This approach gave full perspective on the PMs' experiences and perceptions of the challenges and inefficiencies of predictive methodologies. The systematic review of the interview transcriptions was performed to identify meaningful segments that provided insight into the research questions. The initial codes were attached to these segments, enabling the data to be categorized by issues and concepts reported by the participants (**Table 1**).

Table 1. Examples of initial codes from interview data.

Code	Description	Example Quotes
Bureaucracy	Excessive approvals, documentation, and hierarchical decision-making	"The approvals take too long, slowing us down."
Tailoring	Modifying the methodology to meet project-specific needs	"We streamlined the documentation to keep it relevant."
Decision Delays	Delays in decision-making caused by formal processes	"Approval meetings delay critical decisions."
Agile Practices	Integration of Agile methodologies to overcome Waterfall limitations	"I would add short sprints to adapt to changing requirements."
Improvement Suggestions	Suggestions for reducing bureaucracy and increasing flexibility	"Fewer layers in approval would speed things up."

3.2. Thematic Analysis

Following the coding process, thematic analysis was applied to identify the overarching themes and patterns within the data. Thematic analysis allowed for a deeper understanding of how the issues of themes emerged from the interview responses. The three main themes that emerged from the data were:

Bureaucratic Inefficiencies: Participants equally emphasized the negative impact of bureaucratic processes in the Waterfall methodology, namely, excessive documentation, many approval layers, and delayed decision making. Most of the interviewees stressed how these bureaucratic barriers slowed down the completion of projects. A major problem expressed by several PMs was the significant time consumed in reporting and obtaining approval. As PM B noted, "Approval meetings delay critical decisions which negatively impacted the ability to make quick changes to the plan". This finding is in line with literature by (Bertschek et al., 2020; Jabnoun & Al-Khalifa, 2020) where bureaucratic inefficiencies were seen as a major drawback of traditional project management methodologies.

Methodology Adaptations: Some of the interviewees explained the importance

of adapting the conventional Waterfall approach to suit the particular aspects of the company’s projects. They stated that although waterfall is a structured approach, it is too inflexible to fit the dynamics of large industrial projects that can experience sudden changes during execution due to such issues as equipment failure, weather conditions or supply chain problems. PM C also stressed the need to simplify documentation and to change the project phases as the project progresses. PM D added, “We reduced the documentation to keep the relevance” with the aim of making project management more agile without jeopardizing the critical management controls. This theme is in line with the work of (Morris, 2018) and (Shenhar & Dvir, 2007) who recommend customizing the methodologies to the project context, especially in complex settings such as industrial organizations.

Improvement Suggestions: A recurring suggestion across interviews was the use of hybrid methodologies to combine the best of both predictive and agile frameworks. Several managers pointed out that incorporating agile principles like short sprints and iterative feedback loops could help to reduce the bureaucratic overhead. PM E highlighted, “I would also introduce short sprints to address changing requirements,” indicating that agile techniques might provide a more adaptable, real-time way of handling project management without compromising the formality of predictive planning. Moreover, the participants stressed the need for real-time tracking systems and digital tools to enhance decision making and improve coordination. The desire to enhance the current project tracking systems was in line with literature (Kwak & Anbari, 2009), in which the integration of predictive and adaptive approaches was proposed as a way to address the inflexibility of conventional project management techniques.

4. Results and Discussion

The three primary themes: Bureaucratic Inefficiencies, Methodology Adaptations, and Improvement Suggestions were explored in depth, and the results are summarized below in the following charts:

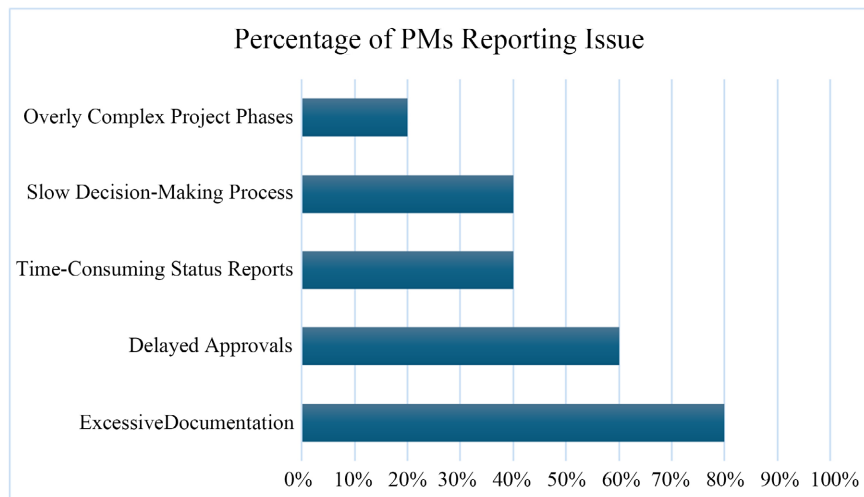


Figure 1. Percentage of PMs reporting each bureaucratic issue.

As depicted in **Figure 1**, key bureaucratic inefficiencies reported by PMs while using the Waterfall methodology include *Excessive documentation* (80%) and *Delayed approvals* (60%). Both inefficiencies slow down the project by creating unnecessary administrative work and delaying the project timelines. The PMs expressed frustration at the time that was taken in reporting and the approval processes which often slowed down the decision-making process and halted project momentum. *Time consuming status reports* and *Slow decision-making processes* were each cited as significant issues by 40% of the PMs. All these activities are essential but were seen as complex and time consuming. Last, 20% of the PMs raised *Overly complex project phases* as a problem, arguing that the rigid structure of the Waterfall methodology was incapable of capturing the dynamics of large-scale projects.

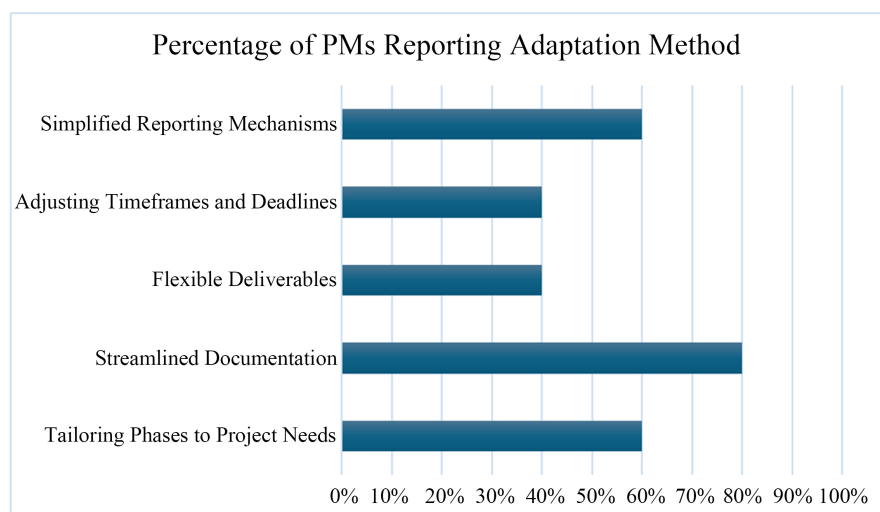


Figure 2. Percentage of PMs reporting adaptation methods.

The results in **Figure 2** show the adaptation methods that PMs employed to overcome bureaucratic problems in the Waterfall model. It was stated that *Streamlined documentation* was the most frequently used adaptation by 80% of the PMs, who argued that reducing the documentation set and its complexity was necessary to enhance the efficiency of the project. Another important adaptation reported by 60% of the PMs was *Tailoring phases to project needs*. This approach provided a way of using the Waterfall phases more flexibly, so that the project structure could be better aligned with the changing needs of the project. *Simplified reporting mechanisms*, which were also used by 60% of the PMs, were very effective in decreasing the burden of frequent reporting. These PMs were able to minimize delays in communication through status updates by focusing on critical information and eliminating redundant reports.

Adjusting timeframes and deadlines and *Flexible deliverables*, both mentioned by 40% of the PMs, were also employed. These methods helped teams to address shifting project circumstances and deliverables, which are typical of large projects.

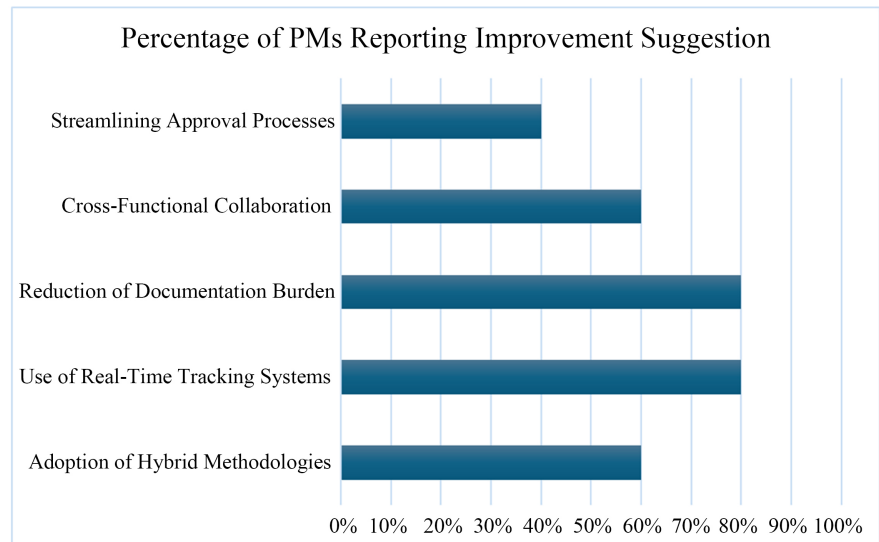


Figure 3. Percentage of PMs reporting improvement suggestion.

Figure 3 displays information which shows various improvements that PMs feel could be made to decrease bureaucracy and increase project flexibility. The most frequent recommendations were the *Reduction of documentation burden* and the *Use of real-time tracking systems* (80%). Both are critical in minimizing delays and enhancing decision-making. Reducing unnecessary documentation helps to eliminate bureaucratic inefficiencies, while real-time tracking ensures project status is visible at all times, enabling timely interventions and more dynamic responses to challenges.

Additionally, the *Cross-functional collaboration* and *Adoption of hybrid methodologies* were seen as important in enhancing flexibility (60%). Therefore, from the PMs' point of view, a hybrid approach that combines Waterfall and Agile practices provides more adaptable planning, while the inclusion of feedback from all teams in the decision-making process helps to reduce delays and enhance project responsiveness.

Finally, the *Streamlining of approval processes* (40%) was also noted as an important area that needs to be addressed. Thus, PMs believe that by reducing the number of approval stages it will be possible to unload the process, maintain the pace and respond more quickly to unforeseen problems or changes in the project scope.

5. Research Limitations

Since this study focuses on a single organization, there is a limitation on the generalizability of findings to other industries or organizational contexts. Additionally, at this stage, the research analyzes only qualitative data from the conducted interviews that's limiting the measurement of the impact from bureaucratic inefficiencies. Moreover, subjectivity associated with the PM's personal experiences and opinions further affects the accuracy and objectivity of the findings.

6. Conclusion

The study thus confirms that while traditional Waterfall methodology is still the most popular approach in complex, large-scale industrial projects, it has inherent bureaucratic inefficiencies—such as overdocumentation, slow decision making, and rigid project phases—that pose significant challenges that can lead to missed opportunities in industries that require rapid responsiveness. The real case study examples from other industries in the literature review section of the article also revealed the challenges of predictive methodologies. The cases demonstrate how the large-scale organizations addressed limitations of the methodology and what tools and advancements have been successfully implemented.

Through thematic analysis and study results, the research has revealed the real constraints in project management of the organization, mainly associated with the bureaucratic inefficiencies and lack of process adaptations. Several key strategies for overcoming these challenges have been collected from the PMs responses. Thus, it can be stated that the aim of the current study has been reached, and further implementation of the proposed strategies will be recommended to the organization management. In case of a successful implementation of the recommendations the obtained results can be further analyzed through more objective quantitative research methodology, to clarify how exactly the adaptation of the Waterfall methodology was/was not beneficial in improving flexibility and reducing bureaucracy. More specific recommendations of the participants on integrating hybrid approach principles, such as short sprints and real-time feedback loops, deserve special attention and can undergo in-depth study in separate research.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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