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## PMO Conceptualization for Engineering and Construction Businesses

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### Abstract

Over the last decade many organizations began to recognize that the implementation of Project Management (PM) practices was a necessity rather than an option. In order to improve the success of projects, organizations have been adopting specialized structures (normally called PM Offices or PMOs) that carry out the management of projects in a coordinated and centralized way. In recent years, several PMO models and functions have been proposed by many authors. The major challenge for most organizations is to decide which specific functions in a particular context should be implemented. In fact, PMO's roles and functions, though standardized and clearly defined in literature, vary in practice. The main goal of this research was to propose a set of functions for a supportive PMO in an engineering and construction company. For example, develop and implement a PM methodology, provide a set of tools to support PM, and develop PM competences.

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## Introduction

The growing competitiveness and globalization of markets, embodied in major technological advances and unstable economic environment, represent big challenges for organizations. Organizations have to survive and thrive in an environment of accelerated and continuous change. Construction projects are increasingly complex and difficult to manage<sup>1</sup>. Complexity is added by the reciprocal interdependencies between different stakeholders, resulting in the need to improve integration, cooperation, communication and coordination<sup>2</sup>. This requires intra- and inter-organizational processes that support communication<sup>3</sup> and build trust between stakeholders<sup>4</sup>. This environment has led to the emergence of Project Management (PM) as a subject of growing importance over the years, helping organizations to fulfil their strategic objectives by implementing good practices that are documented in various standards and methodologies<sup>5</sup>.

PM functions are increasingly being studied in PM and construction management<sup>6</sup>. In fact, the construction industry has a reputation of poor quality, adverse relationships, low productivity and a reluctance to change<sup>7,8</sup>. As a traditional practice, construction projects are based on rigid and impermeable boundaries between processes and stakeholders, which make communication, cooperation and integration of PM practices difficult<sup>2</sup>. The resulting need for a new approach has led to the growth in the last decades of PM as a well-established formal discipline in various industries, including in construction. In order to introduce these new processes and management methods, organizations often undergo an organizational restructuring of business models to improve their performance, for example, through the implementation of PM Office (PMO) structures. According to the PM Institute (PMI)<sup>9</sup>, *“a PM office (PMO) is a management structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques. The responsibilities of a PMO can range from providing PM support functions to actually being responsible for the direct management of one or more projects.”*. According to Kerzner<sup>10</sup>, the PMO may be the decade’s most important initiative for improving PM in organizations. To achieve this goal, the PMO must follow some organizational practices defined by the application of knowledge, skills, tools and techniques to meet the projects’ requirements and objectives, through the implementation of appropriate processes and methodologies, as part of its strategy and as a critical factor in the development of competitive advantages<sup>11</sup>.

Due to the diversity of PMO structures and the need to adapt their functions to a specific organizational context, there are no studies about the typology of a PMO suited for an engineering and construction company. This paper aims to propose a set of functions for a PMO in an engineering and construction company, taking into account its context and specificity. Therefore, this study contributes to support future research, developing implementation guidelines for organizations in the same sector, with similar contexts.

The paper follows an ordinary common structure. After this introduction, the second section discusses the relation of this research with existing theories and previous work. The third section describes the case study used in this study. The fourth section specifies and discusses the results obtained. Finally, section 5 presents the conclusions and the limitations and suggestions for future work.

## 2. Relation to existing theories and previous work

### 2.1 PM offices (PMOs)

The PMO associated with engineering, aerospace and defense projects emerged in the 1950s, due to the increased scale and complexity of projects<sup>12</sup>. However, it was in the 1990s that this concept truly expanded into the forms we see today<sup>13</sup>. The growth in the implementation of these structures seems to have been driven by the companies’ need to gain better control over project risks, standardize the use of PM methodologies, tools, and techniques, improve project performance monitoring, and manage and disseminate knowledge of solid PM practices<sup>12</sup>. Due to the unique nature of projects and the need to adapt a PMO to the organization, Hobbs and Aubry<sup>14</sup> found out that there is a significant variation in the structure, assumed roles, and perceived value of a PMO. The complexity of the phenomenon gives rise to difficulties when it comes to establishing a standard way to typify PMOs. Mintzberg<sup>15</sup> was the pioneer in the creation of typologies of organizational structures. Like Mintzberg, different authors proposed models to classify the main services offered by the PMO. These typologies supported by models are necessarily a simplification and an attempt to reduce the complexity of the organizational reality. When it comes to conceptualizing a PMO, experts agree that *“there is no one-size-fits all”* approach<sup>16</sup>. According to the PMBok Guide<sup>9</sup>, there are several

types of PMO structures in organizations, each varying in the degree of control and influence they have on projects within the organization, such as: (1) Supportive PMOs, that provide a consultative role to projects managers by supplying templates, best practices, training, access to information and lessons learned from other projects. This type of PMO serves as a project repository. The degree of control provided by this PMO is low; (2) Controlling PMOs, that provide support and require compliance through various means. Compliance may involve adopting PM frameworks or methodologies, using specific templates, forms and tools, or conformance to governance. The degree of control provided by the PMO is moderate; and (3) Directive PMOs, which take control of the projects by directly managing them. The degree of control provided by the PMO is high.

## 2.2 PMO functions

When a PMO is implemented, it is essential to adapt its functions to the organizational and strategic context, in order to increase project performance and meet different expectations<sup>17</sup>. In the last decade, there was a wide variety of functions attributed to PMOs, from operational and tactical to strategic functions<sup>18</sup>. At the operational level, a PMO provides basic support to individual projects and ensures professionalism and excellence in applying widely accepted principles and preferred PM practices to each project<sup>19</sup>. At a tactical level, the PMO provides adds value through multi-project coordination and the management of cross-project dependencies, including the integration of resources between projects and ensuring the adoption of PM practices. Finally, the strategic PMO involves all aspects of an operational and tactical PMO and also has the authority to prioritize projects, taking into account their corporate objectives and strategies, and advise senior management on the viability of investing in certain projects<sup>19</sup>. Hobbs and Aubry<sup>14</sup> identified five groups of functions that are typically performed by PMOs, based on a descriptive survey of 500 PMOs, presented in Table 1.

Hobbs and Aubry<sup>14</sup> identified Group 1 as the most important set of functions; it provides the information needed for project decision-making and control. Group 2 consists of functions that are based on the development and ongoing training of project managers, as well as on the definition of methodologies. Group 3 includes the tasks related to the direct management of projects, programs and portfolios, as well as the allocation of resources and coordination between the ongoing projects in the organization. The coordination of interdependencies between programs and portfolios is a central aspect of multi-PM, as can be seen from the functions identified in this group. Group 4 involves the functions in which the PMO relates to the top management, allowing the PMO to be more involved in the strategic alignment of the organization, including benchmarking analysis, strategic planning and top management advice. The functions associated with Group 5 focus on the transfer of information from the project to the organization, in order to benefit future projects. This group includes tasks associated with conducting audits, evaluations, and lessons learned, often neglected by project teams at project closure. Project file archiving and PMO performance evaluation are also included in this group. The authors also identified other activities considered important, but were not grouped for reasons of conceptual coherence. Among them are: to execute specialized tasks for project managers; to manage interfaces with clients; and to recruit, select, evaluate and determine salaries of project managers.

## 3. Case Study

The results presented in this paper are based on a case study – the Bysteel, S.A. company. The case study is assumed as one of the most used research methodologies by researchers following a qualitative approach<sup>20</sup>. When using case studies, the researchers can focus on a particular phenomenon and discover crucial knowledge<sup>21</sup>, within a real-life context using multiple sources of evidence<sup>22</sup>.

Table 1. PMO functions identified by Hobbs and Aubry<sup>14</sup>

PMO Groups	Functions
Group 1. Monitoring and controlling project performance	<ul style="list-style-type: none"> <li>• Report project status to upper management</li> <li>• Monitor and control project performance</li> <li>• Implement and operate a project information system</li> <li>• Develop and maintain a project scoreboard</li> </ul>
	<ul style="list-style-type: none"> <li>• Develop and implement a standard methodology</li> </ul>

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Group 2. Development of PM competencies and methodologies	<ul style="list-style-type: none"> <li>• Promote PM within the organization</li> <li>• Develop competency of personnel, including training</li> <li>• Provide mentoring for project managers</li> <li>• Provide a set of PM tools</li> </ul>
Group 3. Multi-PM	<ul style="list-style-type: none"> <li>• Coordinate between projects</li> <li>• Identify, select, and prioritize new projects</li> <li>• Manage one or more portfolios</li> <li>• Manage one or more programs</li> <li>• Allocate resources between projects</li> </ul>
Group 4. Strategic management	<ul style="list-style-type: none"> <li>• Provide advice to upper management</li> <li>• Participate in strategic planning</li> <li>• Benefits management</li> <li>• Network and provide environmental scanning</li> </ul>
Group 5. Organizational learning	<ul style="list-style-type: none"> <li>• Monitor and control the performance of the PMO</li> <li>• Manage archives of project documentation</li> <li>• Conduct post-project reviews</li> <li>• Conduct project audits</li> <li>• Implement and manage a database of lessons learned</li> <li>• Implement and manage a risk database</li> </ul>

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Bysteel, S.A, founded in 2008, is a steel constructor company that belongs to the dst group, a reference player in Portugal, in five sectors of activity: Engineering & Construction, Water & Environment, Renewable Energies, Telecommunications and Ventures. Bysteel is responsible for the engineering design for the manufacture and assembly of steel structures, but what characterizes and differentiates the company is the integral structural conception and development of construction solutions. Nowadays, Bysteel operates in the national and international market; the company has 228 employees and in 2016 had a turnover of 25M€. The adoption of the case study research strategy is of particular interest in this research work as it has been possible to explore existing theory by adapting it to the real context of engineering and construction businesses. The main goal of this research was to identify and analyze the specific functions of a PMO for engineering and construction businesses, based on the Bysteel SA case study. The first step of this research project aimed to identify the problems associated with the management of projects in order to find out how the PMO could support the company. The second step was the definition of the PMO's set of functions. Due to the nature of this research, this process included techniques such as participatory observation, unstructured interviews and analysis of company documentation, to better understand the problems shared by employees and to realize the dynamics of organizational processes. The research was supported by the literature review. The third and last step was the promotion of a focus group meeting for the validation of the PMO's functions. A focus group meeting is characterized by the intervention of a heterogeneous group of participants, for example, people with different functions, inherent in different hierarchical levels within the company. However, in the focus group meeting conducted during this investigation, this was not possible, due to incompatibilities of the employees' agendas. It was concluded that the directors of each department would be the most relevant stakeholders, even because they are the ones that have the most power to validate the functions of the PMO. The participants in this focus group meeting are characterized in Table 2.

Table 2. Characterization of focus group participants.

<i>Function</i>	<i>Age</i>	<i>Gender</i>
Project Director	45	M
Procurement Director	38	M
Commercial Director	33	F
Industrial Production Director	39	M
Director of Planning and Control of Construction Work	37	F

Financial Director	45	M
Preparation Director	39	M
Quality Director	39	F

## 4. Results and discussion

### 4.1 PMO functions

The role of the PMO will be different in each organization. It was important to consult stakeholders to understand their problems, needs and ideas to determine how and where the PMO would fit into the organization. Several specific problems in PM were identified, in which the PMO functions aimed to solve:

- Decentralized information
- Lack of standardized PM processes
- Disregard for cost management
- Difficulties in internal planning management
- Difficulty in managing projects to face the turnover growth
- Inefficiencies in communication management
- Difficulty in perceiving responsibilities

The Bysteel's PM maturity is still in a rather embryonic stage. For this reason, it was proposed that a supportive PMO should be implemented. It was intended that, in an initial stage, the proposed PMO had a relatively low level of influence and control with the perspective that the management processes can be continuously improved and, therefore, the PMO can subsequently reach a higher level of maturity in PM, and only then a more controlling role would be on the cards. Considering Bysteel's primary needs, we proposed a list of functions for the PMO, supported by Hobbs and Aubry<sup>14</sup> (Table 3). The implementation of a PMO is a vehicle not only to improve the PM practices in the organization, but also to facilitate the transformation and evolution of the company<sup>23</sup>. Thus, the following table shows the specific functions aimed to solve the detected problems. These proposed functions are arranged in a logical order, from the most basic, such as training for project managers, to the most advanced ones, such as to participate in strategic planning, which requires a lot of process systematization.

It is necessary for the business community to understand the PM language. Thus, it is relevant to analyze the PM skills and knowledge available in the organization and thus detect possible shortcomings, in order to create training programs and dissemination of knowledge in PM. The proposed PMO will also be responsible for collecting and analyzing project performance information, seeking solutions to potential problems, and disseminating best practices that project managers should adopt. The PMO should assume a mentor role, through which project managers can seek advice and guidance according to their needs. The use of maturity models as benchmarking will enable the measurement of the company's level of maturity in PM, leading to an understanding of the strengths and weaknesses of their processes and the structuring of action plans for continuous improvement. By applying maturity models, it will be possible to compare the company's maturity level against the best practices of similar organizations. Ibbs and Kwak<sup>24</sup> state that maturity models in PM serve as a framework for comparing current practices carried out by an organization and what are considered to be best practices in PM by the market.

It is assumed that the PMO will be responsible for centralizing all the information of the company's projects. To this end, the information must be properly organized, allowing project teams its easy access and sharing. The PMO should ensure clear and interference-free communication, by sharing data and information, so that it is possible for project managers to carry out their activities as expected. In this sense, the PMO will contribute to standardize communication and establish open channels, facilitating and accelerating decision making (F.2, F.5 in table 3).

Table 3. PMO functions.

ID	PMO function
F.1	Develop PM competences
F.2	Manage and disseminate knowledge and solid PM practices
F.3	Ensure mentoring and coaching to project managers in the use of good PM practices

F.4	Perform benchmarking through the use of PM maturity models
F.5	Manage archives of project documentation
F.6	Provide a set of tools to support PM
F.7	Implement and manage the database of lessons learned
F.8	Implement and manage the database of project risks
F.9	Monitor the projects' performance
F.10	Develop and implement a PM methodology
F.11	Implement and operate a PM information system
F.12	Report projects' status to top management
F.13	Participate in strategic planning

The PMO should be responsible for developing PM support tools (F.6), giving project managers and their teams a starting point for implementing their own project processes. Support tools should stimulate proactive thinking about what needs to be done and how to do it. PM support templates can sometimes contain more information than it is really needed. Thus, project managers should be able to adapt them to meet the needs of the project, focusing on critical areas (F.1, F.3, F.4). Because the PMO is responsible for keeping the lessons learned files, it should evaluate the data available to look for KPIs (Key Performance Indicators) that may dictate the improvement of the templates. Lessons learned are a way to avoid repetition of errors and problems in future projects, as well as being the basis for continuous improvement of the PM methodology adopted by the company (F.7).

Another of the PMO's proposed functions is the maintenance of a risk management database. By having a database of project risks, the PMO becomes a means to increase predictability and to facilitate the implementation of identified risk response plans. Vieira<sup>25</sup> emphasizes the extreme importance of risk management, arguing that risk management is the main work of PM, based on the view that management techniques are also risk prevention techniques (some reduce risk of delays, others reduce the risk that the budget will be exceeded, for example). In practice, project managers should begin to identify the risks associated with their projects since their initial phase and pass on that information to the PMO (F.8).

Monitoring and controlling project performance is considered by Hobbs and Aubry<sup>14</sup> as the most important function since it directly supports the management, provides the information needed for decision-making and project control. In performing these functions, the PMO provides top management with information to monitor projects' performance, and thus support "project governance" (F.9).

According to Kerzner<sup>26</sup>, the achievement of excellence in PM is not possible without a repetitive process that can be used in each project. As to this case study's company, several methodologies should be developed, one for each project category. PM methodologies, besides being flexible to meet businesses dynamic needs, should add value to projects through using new technologies and methods. Thus, the methodologies to be implemented must provide a roadmap for project managers. Given that the proposed PMO is the owner of the company's PM intellectual property, there must be processes and tools to capture and share this mindset (F.10). Well-structured processes and efficient information systems are very important for companies to face crises and oscillations in demand. To this end, the PMO must implement and operate an information system that allows the management and sharing of information related to the projects (F.11). With the implementation of a PMO structure, it is proposed that an easier-to-read report model should be created. This report would be a useful tool for enabling a more effective communication of project performance, by focusing on the most relevant project information. The PMO should also work closely with senior management in all portfolio management activities to ensure the alignment of projects with the organizational strategy (F.12, F.13).

#### 4.3 PMO implementation

Organizational re-structuring is fundamentally based on the need to readjust the organization to a new management model and project governance. The efficiency and success of a PMO depends on the choice of functions to be implemented and their adaptation to the needs of the organization. The challenges of implementing a PMO and sustaining it successfully are multiple, but include, according to Singh, Keil and Kasi<sup>23</sup>, problems in designing a PMO around a specific need, poor definition of the purpose of the PMO, lack of defined scope on PMO implementation, and lack of support from top management or key stakeholders. Yet, one of the main difficulties felt by the company

under study in the implementation of the proposed PMO was its inadequate organizational structure. Organizational restructuring is fundamentally based on the need to readjust the organization to a new management model and project governance. Hence, driven by PM new practices, it is necessary to adapt the organizational structure of the company, characterized by the literature as a functional structure. In this particular case, it was proposed, as a suggestion for improvement, that the organization should restructure into a weak matrix structure, as shown in Figure 1. In the presented proposal, the project manager appears as one of the members that integrates the project team, appointed as responsible for their coordination. The project managers are part of the project planning and control department, which is the department that manages the project from its conception and development stage till the construction stage. As, in practice, the project manager will have no hierarchical ascendancy over functional managers in each department, if conflicts arise, problems are escalated to hierarchical superiors (department directors) for discussion and deliberation. However, the project manager has power to control the execution of project team activities and report to a high-level manager, assuming the role of a project coordinator.

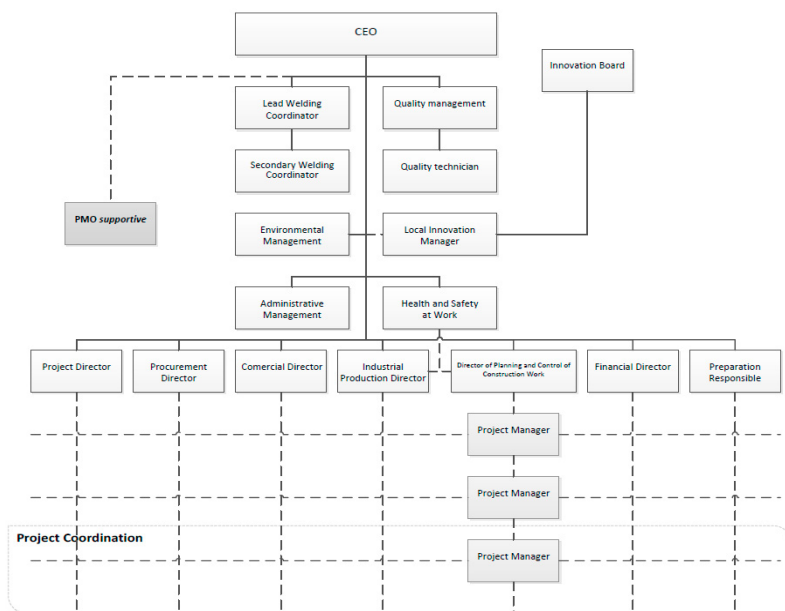


Figure 1. Position of PMO in the organizational structure.

**5. Conclusions**

In the presented case study, the implementation of the PMO was part of a major change project, with impact on the whole support structure of the company. The difficulty of implementing a PMO is based on the wide variety of PMOs and the lack of consensus on their value<sup>27</sup>. The literature clearly shows the huge variety of PMO structures, typologies and functions and this variety is not easily explained. However, it seems coherent to conclude that, to implement a PMO, the most important thing is not to determine its typology in advance, but rather to define the functions that dictate the level of authority in its operation. A clear point in the theoretical foundations was the finding that the PMO should be adapted to the context and needs of the organization where it is established<sup>19</sup>, which was confirmed in this research. Through the collection and analysis of the functions evidenced in the literature, the researchers created a set of functions that will respond to the specific problems of the organization. The strategies defended by Andersen et. al<sup>28</sup> were applied to the proposal of the case study. It suggests that the functions of the PMO should be started with the lowest level of complexity which is easier to implement. Crawford<sup>11</sup> argues that the PMO should focus on activities with less potential for risk and are less likely to generate resistance on the part of employees. Thus, the proposed PMO has as its basic principle the provision of models, best practices, training, centralization of project information and collection and sharing of lessons learned. In the medium/long term, the requirements aim to increase the number of employees with specific training in PM and to develop various PM methodologies according to the complexity of the projects. As Kerzner<sup>10</sup> points

out, training and education can accelerate, not only the PM maturity process, but also the ability to execute the methodology. Concluding, the research presented a set of functions, not as a one size fits all but rather as a set of configuration principles that produce certain performance results in certain contexts. In this sense, future work will be developed to measure the value of the PMO.

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