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# The Effect of Stakeholders' Satisfaction and Project Management Performance on Transitions in a Project Management Office

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**ABSTRACT** This paper aims, through a longitudinal case study, to present and analyze the transitions in operational activities and the performance of a Project Management Office (PMO) in a technology-based company. The paper discusses functions, tensions, stakeholders' interfaces, performance and how they drove the major changes faced by the PMO. The changes in the PMO were mainly based on non-planned events rather than in a change of the management process. The results demonstrated that political tensions in the organization, rather than project management performance, explained the PMO transitions. Managers must look for identifying tensions in the project management environment, project performance and stakeholders' satisfaction in order to propose and direct PMO changes and the sustainability of project ongoing best-practices. This study also contributes to the collection of evidences that corroborate previous literature appointments, as well as to question some results that need to be contextualized according contingencies for avoiding mimicry in the PMO implementation and transformation.

**INDEX TERMS** Project management office, longitudinal case study, high-technology company, project management performance.

## I. INTRODUCTION

A Project Management Office (PMO) is a contemporary structure for organizing companies in order to reach projects results. It is an organizational unity created in response to a perceived need [1]. It is commonly designed to facilitate the activities of Project Management (PM) and to improve an organization's performance by managing the project portfolio according to corporate strategy [2]. The responsibilities range from being providers of project support functions to directly managing projects [3], [4]. A main area of PM research is related to the role of PMOs as enablers and conductors of organizational change [5], [6], [7]. Moreover, studies analyzed different aspects of the PMO, such as its integrative role in the front end of innovation [8]; its knowledge broker characteristic [9], [10], [11], [12], [13]; its function in the project portfolio management [14], [15], [16], [17], [85]; and in the project management maturity [7], [18], [19].

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Researches by [1], [4], [8], [9], [10], [12], [20], [21], [22], [23], [24] and [84] exemplified the multiplicity of functions performed by PMOs. These researches also discussed the role of PMOs, which can vary from being focused on monitoring and controlling project activities to reporting to senior management in developing methodologies for PM. However, there is variance in these factors based on the sector and even under the same set of functions [1], [4]. Empirical data demonstrate that PMOs are difficult to typify [10], [25]. It shows that PMOs are not organizationally static, but instead it undergoes through a constant transition to reflect changes in business strategies [1], [7], [23], [24], [26], [27], [28]. Reference [7] indicates that the outcomes from a PMO transformation improves some aspects of PM performance and maturity, as well as business performance.

Research on PMO adaptation to organizational changes or to other business circumstances can be obtained from many references [1], [7], [23], [24], [26], [27], [28]. However, these researches have not differentiated PMOs providing specific kinds of projects and organizations or even their reality in

emergent economies. Moreover, recent editorials on project management encourage authors to step forward by describing which are the variables and concepts involved and how are the relationships between the variables in order to aggregating explanations for the reasons behind the relationships [29].

Therefore, the aim of this paper is to analyze the PMO evolution performed in a Brazilian technology-based company. The paper focuses on the dynamics of the PMOs, to better understand the drivers leading those changes, considering how and why they occurred, and their relation to project performance data. A longitudinal case study is deemed most appropriate to explore this particular theme as it allows for improved comprehension within a specific context. This context is a high-growth company which invests massively in new product development (NPD) projects as a way to fit business opportunities in a turbulent emergent economy. The core of projects carried out are new high-technology products for the defense, medical and aerospace industries. This article can provide better guidance for managers in the implementation, configuration, management and modeling of new or existing PMOs, specifically in product development organizations. A contingent theory background [30], [31] must be considered in order to understand its results because the high-technology development projects in a business context are drivers of our results [73], [74].

This paper is divided in six sections. The next section presents the theoretical background, followed by section three covering the methodological approach. Section four details the case study performed so that an integrated analysis of data and discussion could be done in section five. Finally, section six highlights conclusions, identifies the contributions of this study for theory and practice, and acknowledges the study's limitations.

## II. THEORETICAL BACKGROUND

As stated on [86], a research on PMO's role showed that it is evolving from a reductionist functional view to an organizational and service-oriented perspective and, at the same time, evolving from an organizational dependency. It causes a reconfiguration problem to aspects of organizational design and organizational project management. These topic-based research is discussed as our theoretical background.

### A. PROJECT MANAGEMENT OFFICE: FUNCTIONS, TENSIONS, TRANSITIONS AND CONTINGENCIES

Reference [20] described a study with 500 Canadian, American and Australian PMOs showing that their functions were categorized in eight group of activities shifting from a more strategic function to a more operational and supportive function. Reference [14] discussed project portfolio functions of PMOs and their impact on the PM success. Reference [12] identified PMO's functions as a knowledge broker, while [8] reported 59 distinct tasks within a PMO. Additionally, [16] studied the role of PMOs in a project governance, by using project and portfolio reports to support the decision-making process.

Reference [23] studied the creation and changes of PMOs and verified that companies reconfigure their offices every three or four years, motivated by changes in a company's strategy, internal events, management philosophy or internal tensions. Furthermore, [23] described some tensions within a PMO's structure that determine a PMO's transformation to a new structure: economic—related to project performance and the cost of the PMO; political—related to project performance and communication concerning, deadlines and costs; client relationships—related to either the final customer or internal client-supplier relations; standardization and flexibility—a rough focus on business results can impose demands that often require flexibility not found in the process managed by the PMO; and control over the project—reflecting the tensions between PMOs and the project team and/or functional areas in relation to the resources for project activities.

Reference [1] proposed that companies created PMOs in response to a perceived need, and as that need is progressively addressed, the relevance and value of the PMO decreases, thus generating a pattern of change which [27] nominates as an emptying process. Reference [26] revealed a “*tenuous nature of the current PMO position in organizations,*” whose frequent reconfiguration would reflect the fragility of the sustainability of the added-value to companies. They think that PMO changes as a continuous process of building PM competencies. They based their argument on the Good to Great [32] and the Built to Last [33] principles: PM practices are a core ideology from which PMOs must develop hedgehog concepts for having a flywheel and the doom loop. According to [26], the former PMO functions must be frozen, possibly outside the PMO boundaries.

Reference [34] propose a framework by relating organizational context, roles and functions, structural characteristics and performance, in order to understand PMOs nature. This framework is partially or wholly applied by [4], [13], [24], [27]. Reference [4] analyzed the organizational design in public companies of different sectors. In general, there is empirical evidence that the types of projects are moderators of functions, project performance or organizational characteristics of PMOs, and consequently influence their designs.

References [13], [24], and [27] reviewed PMOs in transition, considering the previously mentioned process view. Reference [24] analyzed data from 17 case studies and identified 35 factors that can drive PMO changes. They concluded that the transitions are driven by factors that are internal or external to the organization, from which the most important factors are internal tensions and events. They also tried to identify patterns of change but noticed that there is a wide variety rather than a pattern, because the PMO is deeply embedded in the organization. This analysis is ambiguous, because it does not clarify the differences of the transitions in PM practices from those in PMO structure, functions and organizational characteristics.

Based on an organizational dynamic background, [27] attempted to identify driving forces to PMO changes. First, the authors identify two factors representing conditions for change: an external movement regarding politics, economy, market or regulatory pressures; or a change in top management. Second, the authors found evidence of four groups of issues driving PMO changes: “portfolio management and methods”, “collaboration and accountability regarding stakeholder management”, “PM maturity and performance”, and “work climate”. From this framework, they found out that internal drivers represent more in PMO changes than external ones. Third, the authors identified three reasons for the nature of PMO transformations: they change to improve their supportiveness for projects; they change to increase the scope of their control mandate; or they change to increase autonomy.

Reference [28] developed a new approach for understanding changes in PM by researching six Iranian PMOs. They found out patterns suggesting the co-evolution of PMO and portfolio management. Reference [35] analyzed three PMOs in the University hospitals in Canada. They applied contingency theoretical background, historical approach, and social theory to reach insights for an organizational design theory that explains projects as temporary organizations.

According to [36], contingency is one of the nine PM schools. In spite of being understood as a governance strategy for PM, PMOs, like other PM tools, it must suffer contingencies according to project categorization, the size of the company and project, or its complexity [37]. Contingency theory focuses on finding the effect of one variable on the effectiveness of an organization which is moderated by a contingency [38], and consequently it can be a foundation to identify how the aspects of the theory affects project management. Contingencies are explicit elements of PMO studies in [1], [7], [23], [39], [40], but all the investigations conducted on PMO transformation, as previously mentioned, explore some kind of contingency for describing such changes. However, the list of PMO functions, and even the guidelines for understanding PMO changes, are still deterministic. Our research intends to describe the functions and transformations of a PMO thorough thirteen years in a company that relied on NPD projects to grow revenues by 400% over five years. The purpose is to understand how and why the PMO changed within this timeframe. Our results suggest an intrinsic relationship among PM performance and stakeholders' satisfaction as an answer to understanding why a PMO changes.

### **B. ORGANIZATIONAL PROJECT MANAGEMENT (OPM) AND CRITICAL SUCCESS FACTORS FOR PMO PERFORMANCE**

Researches in Project management started focusing on the systematization of techniques and methods, but the discussion evolved to an environment where project, programs and portfolios are jointly considered [36]. In such a context, these researches contemplated the conceptualization of projects as unique and temporary entities, and it is important to

consider the distinction between projects and repetitive operations [3], [41]. Additionally, even in project-based organizations, the temporality that characterizes projects is a challenge to the maintenance of the organization's processes [7], [12], [42], [43], [44], [45]. Project temporality condition and the need to establish coherence between different projects and their measurability, contributed the establishment of techniques, methods and theory related to the organizational project management [23], [28], [46], [47], [48]. OPM is a hot research topic in project management theory and has a potential to explain in a whole view the relations between projects and repetitive operations as means to design well balanced organizations [86]

From a theoretical viewpoint, establishing a PMO is a manner to reinforce the OPM in companies for driving PM maturity [2], [7], [20] but these concepts can be used separately, as stated. Literature analysis show that the presence of certain factors, either in the organization or in PMO procedures, influences the success of the PMO and, therefore, the impacts of its activities within the company. These factors are: (1) the results achieved from incorporating best practices in PM; (2) the stakeholders' support; and (3) the existence of a professional dedicated to the implementation of PM practices, also known as a champion.

Regarding the first factor, [49] considered the results as seminal aspects to define PMO functions and structure. Yet, the authors did not detect a significant relationship between PMOs and project performance when comparing companies with and without PMOs. Reference [39] reported PMO results when projects are developed in high uncertainty environments. Reference [1] advocate for the redefinition of the PMO's roles and objectives according to company performance needs. Reference [11] found a direct relation between PMO's procedures and knowledge performance of transfers among projects. Reference [14] found a correlation between coordination and controlling roles of PMO and the quality of a project portfolio. Reference [50] argued that both the PM performance and the maturity of the PMO are triggered by the existence of conflicts related to the project achievements. Reference [7] analyzed the relation of PMOs' roles and results, and concluded that PMO transformation can lead directly to some improvements in project and business performance. Reference [7] also found that supportive roles, rather than controller roles, influence project performance and maturity. Reference [84] found from 31 PMO functions, that a driving PM performance was “benefits management” which influence cost performance in NPD projects.

Reference [47] analyzed the question of whether different perspectives of organizational performance impact the work established by PMOs. They found out that PMOs are centers of numerous perspectives on organizational performance. Reference [13] used the same framework and found in a unique company and in a single project different conceptions of performance. It suggests the complexity of this entity for researching PMOs roles, and allows us to introduce the second factor.

The stakeholders' support is considered a success factor for PMOs performance, because PMO architecture is a result of "...the battle ground between empowerments and control, between people and processes, and between political factions" [1]. Stakeholders' positions vary according to the support of senior management in the definition of the political space [23]; report requirements [16], [49], [51]; project teams' activities to mitigate tensions between the teams and the PMO [52]; relationships with project managers [14], [53]; support of functional managers [9], [11]; communication problems which can be addressed by PMOs [42]; and the tension involving PMO costs [19], [23]. Researches about changes in PMOs also identify stakeholders' issues as key drivers for PMO transformation [23], [27].

The stakeholder involvement in projects are a central theme nowadays. [37] explained the history from managing stakeholders in order to engage them. Reference [54] discussed the difference between "management of stakeholders" versus "management for stakeholders". Reference [55] researched stakeholders' involvement on breakthrough projects in a large company, and found out three profiles of legitimacy along with a large R&D effort: technical experts, innovation design strategists and internal collaboration strategists. Reference [56] criticized the theory of project success based only on project managers' views and proposed a multiple stakeholder model, which could increase the likelihood of all stakeholders agreeing on the parameters that constitute the project success.

Reference [37] stated that one of the most important success factors on projects is stakeholder satisfaction. Among a set of megaprojects, [57] found out that information on stakeholder satisfaction has more impact on strategic value than information about project or corporate performance. Reference [58] identified nine scales to predict stakeholder satisfaction as a whole at the end of a project, taking into account owners, executives, contractors, and suppliers. Reference [59] found out that from ten success criteria, team satisfaction has the biggest impact on project success, followed by user satisfaction and customer satisfaction.

Finally, the role of the PMO leader has been emphasized in the literature [1], [26], [50], [52], [60], especially as a champion for PM practices [22], [61], [62]. Literature also suggests that changing the PMO leader can reduce [26] or improve project performance [7], and can leverage interfaces between organizational areas [42]. The leader also need a strong technical background when working in high-technology companies [50]. According to [1], PMOs evolve according to the efforts of their leaders, wider organizational undercurrents, strategic shifts and political tensions.

Among the mentioned success factors, projects and PMOs results are the only ones that can be measured. Literature analysis showed that the relationships between these elements have not been well established, and some questions remain unanswered: Do the functions performed by the PMO create tensions that impact critical success factors of PMOs? How do PMO functions create tensions? If those tensions impact PMO transitions, how and why do they generate the

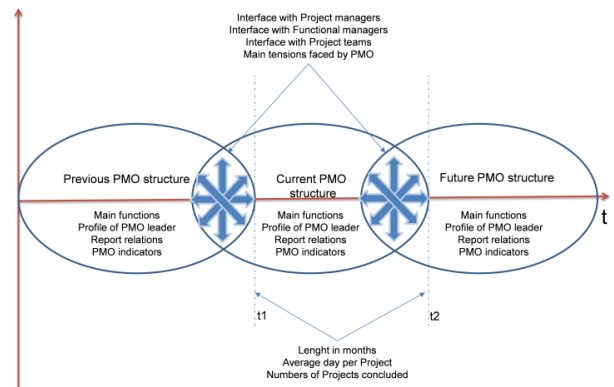


FIGURE 1. Research model designed for this work.

latter? How should these transitions be characterized? What is the influence of projects performance and products in these transitions? Despite the existence of answers to the *what* questions, the *how* and *why* questions are not well established in the literature.

### C. CRITICAL VIEW AND RESEARCH MODEL

We noticed three main limitations in the previous literature regarding PMO transformations. The first limitation is about how to capture the logic under these transformations. As [23], [24], [27] and [7] gather data for the first PMO implementation and for only one transition or reconfiguration, and in [28] authors simulate changes from an initial state to only one end state, the meaning of each company transformation is lost.

The second limitation focuses on the difference between changes in PM practices versus changes in PMO itself. When describing the kind of change they are capturing for their analysis, in [27] and in [28], the description fits more to which is understood as PM practices, rather than structural characteristics or functions of PMOs. The latter also do not consider time in their analysis of change, which weakens their results because history and context are important conditions for change [40], [63]. The foundation to discuss PMO changes in [7] and [27] is more focused on PMO functions, which is more aligned to our study.

Additionally, when discussing performance results, previous studies use only qualitative data from the perception of improvements. This research strategy has fragilities as the people who are engaging on the topic of PMO changes are commonly the same people who respond to the research instruments about improvement perception; and these people can also be those in charge of the current PMO structure. Consequently, some bias may be generated.

That being said, the previous section helped us to build a general understanding of PMO's characteristics. The process view as presented in [23] and the previous discussion led to a more practical view of PMO stakeholders, which comprise the basis for our research model, presented in Fig. 1. Also, in our work, quantitative data was gathered to triangulate results from qualitative analysis of PMO changes.

Fig. 1 is based on grounded theory as modeled by [23], and in the figure, a PMO within a specified period can be



recognized as a temporary organization [41] resulting from tensions generated by a previous period of stakeholder interface. Each period is characterized by the following elements of PMO structure: main functions, the profile of PMO leader, report relations, internal stakeholders' interfaces, and PMO indicators. After each period of transition, when a new PMO structure is in place, project performance data from the previous PMO make it feasible to triangulate PMO structure, tensions and performance [75], [76], [77], [79], [79], [80], [81], [82], [83].

### III. METHODOLOGICAL APPROACH

This research adopted an inductive approach [64] because it intends to gain knowledge from a specific sample of a general phenomenon. The research is exploratory as the literature is relatively limited in the studied domain. Both contexts and the phenomenon itself are important in this study. All of these characteristics justify the adoption of the case study approach used here. Thus, the paper explores a longitudinal case study of a Brazilian technology-based company, in order to understand the factors involved in PMO transitions. According to [65], the longitudinal case study is applied to study a single case from two or more different points in time. These data were captured based on the functions that the PMO performed; how it dealt with the success factors detected; and if and how the tensions in each PMO stage could explain the transitions between them. Data collection for this study occurred over 13 years. According to [64], the longer the phenomenon is studied, the greater the opportunity to observe the sequence of related events.

As the period considered is large, it may be difficult for the researcher to remember a few important events [66]. Due to this limitation, it is critical to record information and register field data in conjunction with event occurrence. This data gathering was facilitated by the fact that the company has a practice of using individual project notebooks for managers and their teams. These notebooks were used for registration, and we had access to them for our research.

Following the research model presented in Fig. 1, most of the data gathered in this study are intrinsically qualitative due to the nature of the variables. Thus, the results are presented in a descriptive way with causal relationships identified. Quantitative data were collected to verify the relationship between project performance and PMO transitions.

It is important to use multiple sources of data to obtain more consistent results [65], [67] hence this research used the following approach [68]: participant observation where the researchers could observe the situation within the company, collecting data sets that would otherwise be difficult to compile; analysis of documents and records from the company's quality system; and semi-structured interviews with engineers, medium and senior level managers (Table 1).

The main selection parameter of the case studied was the access to historic data regarding the PMO, and the ability to observe the objects of our study: PM practices and PMOs. One of the authors acted for 10 years as a project engineer and

later as a manager of the PMO in the company studied. Therefore, the author had detailed knowledge on the company's PM history; the technology basis of the company's market and its constant project demand for new products; the existence of an active NPD process; and the company's fast revenue increased from 5 million USD to 25 million USD in 6 years, growing from 150 employees to more than 400. NPD projects and engineering contracts were at the core of this growth. These conditions indicated a dynamic environment demanding more PMO activities with possibilities of changes in PMO focus, because of changes in the organizational structure, technology, and market. The company develops products and works in their manufacturing. As products are designed for the sectors of aerospace and medical devices/equipment, they are subjected to international regulations. The period studied was that length in which the company suffered transformation to consolidate its markets and main products.

The resulting data of the author's experience was the starting point of this research. It was compiled based on his personal notebooks, which was full of records of the PM system, according to the ISO 9000 quality system of the company. These records contained project and PM activities, including planning, participation in formal reviews with clients, project monitoring and control with the status of ongoing projects. A documentary analysis of operational procedures, executive reports and minutes of meetings were also performed. Additional documents relating to new products and containing information about projects were issued and studied, including customer reports with warnings to be fulfilled by the company (particularly related to PM practices). Moreover, the authors analyzed contracts or bidding terms that the company firm or participated in.

Data from the sources above were used to write a history of the PMO and already suggest the various stages within the period. This version was compiled in a picture using the elements of the main PMO functions and interfaces with key stakeholders, as presented in Fig. Research step number 1 was the first version of Table 2. This initial summary was used in discussions with project managers, engineers, experienced technicians and functional managers in order to validate the identified stages, their characteristics and time frames. At this time in the company, approximately twenty people were able to talk about the timeframe discussed here. Each of them was contacted and asked to reflect about the initial version. A meeting was also held, in the format of a focus group [68], to compile a final picture of the PMO stages and to agree upon the key functions and key stakeholders' interfaces. This discussion generated changes outlined in the initial proposal.

Quantitative data were then compiled regarding the projects' performance over the stages previously consolidated. We chose only to gather performance data for time management because of the ease of access to it and more confidentiality issues related to data of costs. The author who worked in the company, together with the PMO team, attempted to understand the tensions and their relations with performance data along with key functions and stakeholder

**TABLE 1. Summary of research steps, profile of respondents and research techniques.**

Research Steps	Participant observation	Documentary analysis	interviews	Individual validation	Group validation
1. Literature review, as described in the previous section	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
2. Data gathering through participant observations and documentary analysis	One research - author	One research – author			
3. Qualitative data analysis for the proposition of the first picture used for describing PMO transitions	One research 2 PMO members	One research 2 PMO members			
4. Submission of the first picture version for Project managers and teams				10 Project Managers 6 Engineers 2 Experienced technicians 5 functional managers	
5. Systematization of a second picture already with stages of PMO tensions and performance data					One research 4 PMO members
6. Validation with more experienced people and PMO personnel			One research – author 5 Project Managers 4 PMO members		
7. Validation with R&D manager			R&D Director		10 Project Managers 18 Engineers 3 Experienced technicians 7 Functional Managers
8. Writing the final report and submission for confidentiality protocols	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Total of participants			10 Project Managers 18 Engineers 3 Experienced technicians 7 Functional Managers 4 PMO Members		

interfaces previously validated. An interview occurred with five engineers who used to coordinate the tasks of PM at the company. Their experience consisted of 5 to 10 years of work as project managers or PMO staff. This interview was deeper than the discussion in the previous step. As examples used in the interviews, some literature results were presented to support the discussion. This data collection aimed to test and validate the stages proposed in the previous research step, in order to better characterize them in terms of functions performed and to identify the elements that could explain their transitions.

Each month the R&D staff had a meeting to discuss current project progresses. These meetings were only in the presence of the R&D director, project managers, the prototype assembly manager, the quality assurance manager and the

PMO manager. We used one of these meetings to validate our research results. First, an individual presentation was done to demonstrate the results to the R&D director. Some discussion and changes occurred. In the next staff meeting, the results of the research were presented in form to validate their results with the whole group. The entire research model (Fig. 1, Table 2) was presented. Some discussions regarding previous steps occurred because some members understood functions or tensions differently, but with some changes the results were validated. Finally, the research team developed an initial descriptive text of the case study. It was submitted to the company for verification of confidentiality protocols. Then, it was compiled in the form of a research summary report and as a result this article is based on that report.

**TABLE 2.** Summary of the researched elements in the evolution of the PMO.

	<b>Initial Stage (1)</b>	<b>ISO 9001 Stage (2)</b>	<b>Centralized Management Stage (3)</b>	<b>Multi-project Management Stage (4)</b>	<b>Portfolio Management Stage (5)</b>
<b>Main functions</b>	Quality management in projects	Quality planning and control along product design efforts	Management of project schedules and costs. Interface with manufacturing.	Management of project costs. Interface with manufacturing. Multi-project management	Financial management of the department. Interface with manufacturing. Multi-project management. Management of KPI's.
<b>Profile of the PMO leader</b>	Quality	Management of New Product Development	Management of New Product Development. Project Management		Management of New Product Development. Project management. Production Planning Control.
<b>Support of Top Management</b>	Director of R&D	Director of R&D	Director of R&D	Director of R&D	Director of R&D
<b>Interface with Project Managers</b>	Support for certification with parties and quality management with the contractor	Support for certification with third parties and secretariat of project planning	Preparation and monitoring of schedules. Supply of manufacturing, acquisitions and support for assembling and testing.	Monitoring of schedules. Supply of manufacturing, acquisitions and support for assembling and testing	Monitoring of schedules. Supply of manufacturing, acquisitions and support for assembling and testing. Planning of prototype production
<b>Interface with Functional Managers</b>	Support for certification with third parties	No function	Interfacing projects with manufacturing, IT and administrative areas.	Interfacing projects with manufacturing, IT and administrative. Participation in management committees.	Interfacing projects with manufacturing, IT and administrative areas. Participation in management committees. Support for strategic planning
<b>Interface with Project Teams</b>	Support for certification with parties and quality management with the contractor.	Support for certification with third parties and product documentation.	Product documentation. Supply of manufacturing, acquisitions and support for assembling and testing	Configuration management. Provision of manufacturing, acquisitions and support for assembling and testing.	Configuration management. Provision of manufacturing, acquisitions and support for assembling and testing.
<b>Main tensions faced by the PMO</b>	Prominent role with the client, but without exerting technical.	Staff of the PMO could not find for improvements in project management.	Project managers with no control over programmatic aspects and hierarchical ascension in the company.	Pressures from central administration about: project costs and deadlines	Increased pressure for the creation of independent business units
<b>Length in months</b>	51	15	48	29	14
<b>Average days per project</b>	1589, 75	1019	746,61	602,75	366
<b>Number of projects concluded by period</b>	4	2	16	4	2
<b>PMO Indicators</b>	Inexistent	Qualitative (perception of improvement)	Quantitative (project results on time and product quality)	Quantitative (project results on time and product quality)	Quantitative (project results on time, product quality, portfolio planning and metrics of results)

#### IV. CASE STUDY

The researched company is located in a technology hub in Brazil. At the time of the research, it was in operation for 26 years and it is a Brazilian pioneer in developing and manufacturing of the Helium-Neon Laser.

The company is composed of four areas: thin films; research and development (R&D); commercial; and manufacturing. Each area has one of the company's owners as a senior manager. The director of R&D is responsible for projects related to medical and aerospace equipment. It consists of an engineering group with mechanical, electronic, software and physical engineers, who work alongside specialized assemblers, and technicians in electronics and mechanics. The R&D area is also responsible for the integration of equipment that is internally developed and for the assembly of prototypes. The commercial, thin films and manufacturing areas provide services to R&D via the PMO. Thus, the PMO is located at the R&D department and is the formal interface to other areas of the company.

##### A. DESCRIPTION OF STAGES OF THE PMO EVOLUTION

Table 2 presents a summary of the PMO's evolution stages and characterizes it according to the data gathered under our research model previously presented.

We present a detailed description of each stage in the following sections.

##### 1) INITIAL STAGE

The PMO was created in 1999. Its initial stage was focused on technical design support. There was not an organizational structure in charge of PM, but rather internal quality management personnel who dealt with the demands of project contractors from the Brazilian Government.

The main function of the company's PMO was to provide technical services in quality management, especially regarding to product certifications to fulfill contractors' requirements. The PMO leader was a development engineer with expertise in quality auditing. The interface of the PMO with project managers and their teams was related to quality demands. The PMO communicated the demands to the project manager, project team and functional managers that developed the necessary products and processes, while also supplying the PMO with information to be passed over to the contractor.

The PMO was designed to relieve project teams of quality demands, such as traceability aspects, calibration of metrological devices, document encryption, etc. These activities were considered non-value-adding; senior management felt that they were best performed by personnel not directly involved with the design. There was a high degree of tension between the project team and the PMO staff regarding two aspects intrinsically related to the PMO's architecture: (1) the PMO neither directly performed the activities of quality management nor exercised management over the team and, therefore, the PMO met its demands by asking team members for favors or reporting to management any non-compliance

not yet addressed by them; and (2) the PMO did interact with customers even though the PMO did not perform quality management activities, and this did not please teams, who felt that their role should have been operational.

##### 2) ISO 9001 STAGE

In this stage, which lasted 14 months, the PMO management changed. A person whose profile was more closely related to NPD management was recruited as the new PMO leader. He began to perform some of the technical functions demanded by project contractors in partnership with project teams. This profile helped mitigate the tensions between the PMO and the project teams. Additionally, the PMO incorporated functions related to technical documentation of products (i.e., development of user manuals, assembly procedures, etc.), which helped product engineers to balance their workload.

The main feature of this phase, however, was related to the ISO 9001 certification in project development. The activities of project teams were systematized and standardized, both in terms of planning and monitoring design results and recording project outcomes. The PMO started to perform regular planning and to hold tracking meetings with project teams, while also providing technical support for project managers regarding the use of planning and control methodologies and software.

Concerning the managers from other functional areas, the PMO became the bridge of project specifications between various departments of the company. In this phase, the R&D experienced an initial awareness of PM activities. Some of the tensions that arose in the previous stage seem to have been mitigated. However, the support profile embedded in the PMO used to create difficulties for project teams and PMO personnel regarding the use of best practices in PM. The PMO was required to focus on mitigating existing pressures while maintaining projects in progress, so there was no emphasis on proposing methods for improving project planning and monitoring. Instead, the PMO merely maintained project documentation and compliance to procedures previously agreed upon with staff and the responsible board of directors. Despite the success regarding other stakeholders, this system caused dissatisfaction among the PMO members.

##### 3) CENTRALIZED MANAGEMENT STAGE

The next stage was characterized by the centralization of a large set of PM functions in the PMO. Via an organizational climate that was helpful for PMO members, whether relating to the project teams, the board, or other functional areas of the company, the PMO had a favorable advantage for introducing new PM tools. Supporting this scenario, PMO personnel wanted to implement PM best practices. Furthermore, new contracts were negotiated by the company, which doubled its revenue. These contracts demanded better project time management, otherwise the company should pay penalties for delays.

The PMO began to develop schedules for projects along with the teams and their project managers and to report them to the board. In partnership with the accounting department,



the PMO started to manage development costs on a monthly basis. The PMO began to perform more systematic and standardized project risk management. The responsibility for technical product quality became more distributed among project teams and was based on a checklist of requirements previously generated. Quality audits were conducted by the PMO, focusing on the use of the established management procedures.

The interfacing performed by the PMO regarding the manufacturing and transferring of new products to ongoing production were increased. The PMO started to interface with production throughout the NPD process. Prototype manufacturing planning became a formal process for managers to follow, including activities related to the management of the projects' most critical suppliers, partners and co-developers.

The visibility brought by the PMO's interfacing with manufacturing and the lessons learned from the previous stage influenced the PMO to incorporate other interfacing functions: (1) with the IT department for controlling project members' access to general project documentation and to the corporate IT systems; (2) with Purchasing for processing purchases and dealing with acquisition priorities among projects; (3) with Costs and Controlling for allocating expenses to projects and planning the cost structure of the department; (4) with Quality for assuring the PM procedures and for the quality control requirements of new products; (5) with Production Planning and Control (PPC) for managing the product structure of the developed equipment; and (6) with Maintenance for maintaining the department's infrastructure and requesting of maintenance services. These functions are beyond the traditional operating areas of PMOs found in the literature.

In order to interface with project teams, the PMOs reduced their operations to support product quality, but began to perform configuration management procedures, regarding developed products for triggering and analyzing product changes.

This stage lasted four years. If the previous stage was marked by practices that sought to reduce tension between the different actors involved in the projects, especially their managers and teams, this phase focused on the implementation of methods and tools to increase productivity of the project teams. As this stage progressed, new projects were added to the company's portfolio, which increased the budget five times, and new tensions emerged, especially with project managers: (1) firstly, it was the managers' responsibility to meet the technical specifications of products. As high-technology products require a deep technical expertise, these professionals are highly valued and powerful in the company; (2) secondly, these managers felt that their projects were controlled by a third party, the PMO, and the more the PMO specialized in PM, the more it was distanced from the daily project activities; and (3) finally, the visibility achieved by the PMO, especially by its manager, was causing discomfort to these managers, specifically in relation to their potential career advancement. This occurred as the company was medium-sized and had few opportunities for promotion. These tensions led the PMO to the next stage.

#### 4) MULTI PROJECT MANAGEMENT STAGE

Project managers began to handle the activities related to projects' time management and status reporting reducing PMO's directive functions and increasing project managers' authority. Additionally, the project managers and their teams carried out risk management and did some aspects related to quality control. This stage can be conceptualized as focused on multi project management as the following activities remained PMO duties: consolidation of project schedules; integration of project planning with R&D budgets; execution of these budgets; and defining inter-project priorities when allocating resources across the company.

Instead of being an advisory unit to the R&D director, the PMO became an organizational unit formally linked to him and the project leaders began to be formally titled project managers. The PMO started to conduct training activities related to the PM system, transferring their knowledge to the teams and project managers.

At this stage, company management committees were created. Those committees' representation of the R&D department was delegated to the PMO, reinforcing PMO's role in consolidating information and prioritizing resources. The volume of PMO's product documentation tasks were reduced, and the PMO became more devoted to configuration management and interfacing with PPC. Projects' cost management and budget planning evolved into a function of approving the daily expenses of all projects.

Tensions between the PMO and project managers were reduced as the role of the former became more specialized and focused on the interfacing of R&D within the whole company. The senior managers planned to internationalize the company and open its capital. Central administration exerted strong pressure to reduce project costs and deliver products on time. It was applied directly on the R&D director and in the PMO as its interdepartmental representative. These pressures boosted the PMO to the next stage.

#### 5) PORTFOLIO MANAGEMENT STAGE

The last stage was operative in the company when this study was concluded. It is characterized by a transition in which the company was divided into business units. Multi project management was emphasized and a transition to more professional administration, based on portfolio management indicators, was utilized. The PMO began to conduct financial management based on the corporate planning in partnership with the financial and accounting departments. The interfacing with Manufacturing incorporated medium and long-term plans and a better system of PPC in the short term. The PMO also started to manage the manufacturing plant for contracted projects, incorporating both scheduling and shop floor control. Again, these functions surpassed the traditional activities found in the PMO literature.

In portfolio management stage, the interaction between the PMO and project managers was emphasized. Managers were responsible for project schedules and execution of its activities, while the PMO was responsible for tracking and monitoring contractual milestones, at which there were

payments and deliveries. Time, costs and financial results used to be consolidated monthly and discussed by the PMO with the R&D director and project managers. Strategic planning was highlighted, consisting of a coordination of project managers to compile project and business units' performance indicators as well as action plans to achieve company goals.

The interface with project teams remained in configuration management and administration of bills of materials. A specific software for labor costs management was implemented and used in collaboration with the human resources department. Financial planning activities were systematized in partnership with the financial manager to reconcile contracts with cash flow in the company's information system. Frequent requests of senior managers to PMO personnel perform marketing activities, such as participation in business meetings, and deeper interfacing with clients. While the changes made in the previous stages were brought mainly because of the PMO's relationships with internal stakeholders, changes in the current stage were motivated by the organizational context of new business units' arrangements.

### **B. PERFORMANCE OF PROJECTS AND PMO IN EACH STAGE**

This section discusses the last four rows of the Table 1. The performance measurement was focused on time-to-market calculated as the total lead time of the projects. According to [69], engineering productivity, product quality, and project lead-time are the main performance indicators in NPD projects. The number of projects and the lead times are exhibited in Table 1. Only large projects for new platforms were considered.

The lead time over the PMO stages shows a downward trend. Following the PMO's evolution, no stage presents a worsening in average lead times. This demonstrates that the evolution of PM procedures, involving project managers, project teams and PMO personnel, has brought positive results to the company.

The literature also mentions a PMO's performance as a driver for changes [7]. In the early stages of the case studied, the company's PMO did not measure its performance. In the second stage, only a review of the perceptions of improvement in project planning and control was carried out. As more PM tools were implemented and more projects were finished, the PMO staff developed internal indicators, maintaining systematic measurements of them.

The quantification of the PMO results is not easy as they depend on the variety of functions the PMO performs [20]. For the PMO examined, this observation certainly applies. In fact, the delivery of project outcomes on time is usually more significant than partial measurements of specific PMO processes. Additionally, the project results represent a more accurate performance indicator for management actions.

During the time of this research, the PMO developed and maintained schedules from 35 different new product-platform projects, built and release progress reports from four large projects for more than 60 months, requested more than 6000 production orders, manage them and deliver their

parts, materials and processes for helping project teams in design-build-test cycles. In this time, the PMO coordinate the work for comply to at least six third-part auditory every year. It worked for monitoring and manage more than 2000 documents from medical equipment and more than 5000 from aerospace and defense projects. Engineering changes represented more than a hundred incremental projects every month. These practices started to be monitored by performance metrics. Summarily, in the beginning 3,5 days by a manufacture order are spent, and this indicator decrease to less than 2 hours lead time in average. Acquisitions for imported items decrease from 190 days to around 50 in average, and projects cycle-time reduced from 1800 days to 260 days. Ramp-up times for stabilize manufacture went from more than 24 months to 10-12 months in medical equipment businesses.

In general, a strict analysis of the data presented in this section corroborates the fact that the project performance remained successful throughout the stages of the PMO evolution in spite of the PMO changes, maybe an effect of the flywheel [32] reached by PM procedures at the company.

### **V. DISCUSSION**

This exploratory study shows that over 13 years there were four transitions in the profile of the PMO functions at the company. These transitions were characterized by the functions undertaken by the PMO and their interactions with project managers, project teams and functional managers, along with a performance improvement engine. In this case, although the top management support factor could not be used to analyze these transitions (as the support remained constant over the stages), its influence on the results achieved should not be neglected. In fact, it did not just generate the tensions that prompted the transitions that were observed. Data also suggest that maintaining consistency in this factor can contribute to the improvement of project performance, a proposition to be tested in future studies.

The main elements that allowed the authors to explain transitions through empirical data were the tensions that the PMO experienced in each stage, which are linked to different PM's stakeholders over the period investigated. Furthermore, the projects show performance improvement throughout the duration of the research, unaffected by the transitions. This could be understood by the theory of flywheel [32], [26], however a specific research protocol must be employed for studying this proposition.

Internal or external triggering of transitions are common discussions in PMO literature. Among the transitions studied here, three were internal and the other was motivated by both, internal and external factors. The first transition was prompted by the necessity for the PMO to align with the company's strategy on the internationalization of its operations, but changing the PMO leader, an internal decision. The second was driven by the external need to comply with stricter PM requirements and mainly by PMO staff dissatisfaction. The third transition was a result of tensions with project

managers and team members. The last transition was to align the project area to the strategy of business unit development, an effective external driver. The profile of strategizing and structuring [31] determines all the transformations following evidence from [27] and [7]. The third transition and partially the second, were driven by internal forces reflecting the political scenario within the company [70] and a transformation more in line with a middle-up-down pattern [71] and theories of adhocracies [31].

The results of the case study, focusing on the organizational tensions and conflicts as possible ingredients for PMO changes, are corroborated by the political image of organizations characterized by pluralism, confrontation and conflict [70], which tend to disconnect people and can influence performance diseases [31]. Thus, it was possible to identify several conflicting goals, or interest groups, competing for priority in the PM context. Because of these conflicts, the PMO framework was broken and a balance of power is achieved between the opposing entities, which leads to stability or change. Additionally, the literature states the PMO's structure alternates between periods of tension and others of relative stability [23]. Yet, this allows us to see the establishment of new tensions and the consequent structural transformation in the PMO repeats itself over time, but our data suggest that there is no moment of stability [72]. It appears that the PMO is continually evolving over the period in which it was investigated. As the company experienced spectacular growth, it is possible that this external environment was affecting internal project practices and the PMO itself as their core business entity. It is possible that only companies considered good to great [32] have this kind of pattern. More research could address this issue in the future.

The scenario identified in this research is also in accordance with the results obtained by [27], because the four factors that drive PMO changes have been identified. "Work climate" and "collaboration and accountability" address problems of human interaction and power imbalance, and are mainly related to delegation of work, an issue we dealt with on our stakeholders' interfaces element. These interfaces are the main drivers in all transformations. That is, even more than company strategy, the stakeholders' satisfaction explains the design of PMO functions and structure at each stage. The Aubry et al.'s factor called "project management maturity and performance" [27] was not researched as a whole because we choose not to analyze PM maturity. The fact that PM performance increased over time, even when some functions were removed from the PMO mandate in the third and fourth stage, could suggest that PM skill levels were continually improving within the company throughout all stages. Perhaps the flywheel concept in the PM field could be related to PM maturity. The fourth factor, "portfolio management and methods", was presented as early as the second PMO stage, but was reinforced throughout the period the PMO was rising within the company hierarchy. Our results suggest some connection between the PMO and portfolio management, corroborating to the results of [28].

The performance data showed that all transitions occurred in an environment in which the results of the projects and PMO were positive, showing at all stages a reduction of the time required for project completion. The risk to harm this indicator was most likely considered when PMO functions were being redefined. However, the case demonstrates that mitigating tensions among internal stakeholders—project managers, functional managers and project teams—was considered more important than the risk of worsening lead times. This occurs because the bonds between these stakeholders are considered a critical success factor, confirming our research model.

As stated before, PMO outcomes did not directly drive the change. In our case contingently stated as a high-growth company under a high technological background and in an emergent economy, good results and performance began to generate tensions regarding career advancement in the company hierarchy and the status of "being helpful" for performance. This PMO empowerment was reinforced by the implementation of more substantial functions under the PMO's command, where the responsibilities for monitoring and control, multi-project management and strategic management were gradually incorporated into its *modus operandi*. Some tensions experienced by the PMO were consequences of political disputes between staff managers, project managers, and the PMO personnel. These conflicts occurred due to the limited hierarchical levels separating these groups from the company's senior management. The conflicts manifested through disputes among managers seeking to benefit from the project results, such as new staff, new roles and better salaries. In summary, good results generated tensions between the PMO and the actors involved in the projects. This environment required changes, which resulted in transitions. That is the *why* answer for the changes in the researched case.

## VI. CONCLUSION

Different from [27] and [7], but aligning with the study of [24], transitions mainly occurred due to internal and not external factors. These transitions were driven by internal stakeholders, especially project managers and their teams, and not mainly to senior management. Understanding tensions in each stage, as identified in [23], especially relating performance results and political issues, allowed us to explain PMO transitions in our case. The case showed that every tension in every stage of the PMO history is potentially being triggered by stakeholders' dissatisfaction. The case also suggested that for a high growth company in an emergent economy, the rational meaning represented by economic and project machine reasoning were less critical as drivers for changes than internal politics. Corroborating to [59], our case brings evidence for the power of project teams as stakeholders in projects.

The literature supports that, in general, PMO changes occur to achieve performance improvements ([24]; [7]). Data gathered by [7] showed that PMO transformations contribute to solving tensions and conflicts but are driven

by the goal of increasing PM performance. In this paper, the changes were motivated by the necessity to deal with existing tensions that were not directly driven by requirements for improvements in project performance, but on the contrary, could worsen it. A contingency approach must be considered because the organization was growing exponentially and presenting good project results, then the performance increment did not seem to be a priority.

In the case study, the stage of centralized management was the period when the company adopted the greatest number of PM tools. This centralization of PM in the PMOs with control focus, is recurrent in the literature [1], [6], [7], [11], [53]. The limitations of such PMOs are commonly pointed out despite existing evidence of positive results when the focus is portfolio management [14]. In contrast, literature found that PMO's support roles better drives PM performance when no external changes exist [7]. Here, no external change occurred and a mandatory and controlled role incremented the use of best practices and drove PM performance.

Throughout the description of the PMO stages, it can be seen that the office used to incorporate new space in the company, achieving good quality results. After that, as supported by [1], its operation used to be questioned and its roles began to be performed by other actors, fully or partially. The emptying process described by these authors, however, were not observed, because while other actors sustained previous improvements [26], the PMO personnel started to perform new functions to increase and deepen their knowledge. Data suggest that for sustaining previous PM improvements, company allocated PMO functions in other organizational areas for exploitation, and at the same time proposed new challenges for PMO personnel to explore.

The main tension faced by the PMO was related to the appropriation of performance results. In our study, as results improved, the PMO incorporated important roles in the companies PM design, and the PMO leader used to face development staff and project managers, disputing limited career opportunities within the company. Thus, the main contribution of this paper is to shed light on why issues about PMO changing in dynamic markets and high-profitable companies. In our study, PMO changes because of good results, and not by trying to reach them. Some Brazilian culture characteristics can influence this result, but it is beyond the scope of this article to analyze this determination. In future research, this changing profile can be tested on other cultures and market contexts as means to understand these determinants.

Finally, the study was designed to overcome the limitations identified in previous literature on PMO changes. We analyzed four PMO transformations, interviewed and involved most than 30 people for gathering data and validation, and used actual data from project lead times for performance analysis. This study also contributes to collecting evidence corroborating some literature suggestions, but also questions some previous findings which need to be contextualized in a contingency approach to avoid mimicry of PMO implementation and change.

The first managerial implication obtained from this study is to allocate people as staff in the PMO that present broad technical and managerial knowledge on the company's business. This will allow the PMO participants to occupy different roles over time and contribute to the company in different areas. As the PMO develops managerial procedures considered necessary to consolidate PM practices, the managers could plan to transfer these functions to other departments to sustain PM knowledge.

One efficient manner to plan PMO transitions is to systematically manage stakeholders for avoiding abrupt changes. Our case demonstrates that the transfer of functions to other areas of the company did not slow the PMO, but prompted a change in focus. Therefore, a good way to improve PM capabilities within the entire company is to develop solutions in the context of the PMO and later transfer these roles to other stakeholders under a controlled change management process. Consequently, the actors evolve to perform the necessary roles that boost the projects to be successful allowing PMO members to focus on new PM challenges.

The fact that this study is a description of only one case is its main limitation. Yet, it is scientifically useful for two purposes. First, it contributes to a contingency theory on project offices. Consequently, all contributions must be understood as results for an academic and high-technology spin-off that develops new products for government contracts and for high value and low volume production. Secondly, the case description can be used as a proposition for future studies, which could expand elements demonstrated in this paper, such as roles of PMOs, casual relationships among stakeholders' tensions with project performance, and PMO transitions. This study is a first part of a post-doctoral research. Some of the achievements reached here will be tested on next research steps.

Considering that the company is analyzed with focus on the development of high-technology products, a further limitation of this study is the application of the results obtained in organizations that execute more repetitive projects, such as civil engineering projects and technology implementation. In a contingent theory background [30], we need to avoid generalizing the kind of theory based on the PM field, as this phenomenon is so dependent on the structuring-strategizing movement [31]; also, because of the organizational configuration of the company studied here, an adhocracy, the generalization would be unlikely in a civil engineering company, for example. In addition to the aforementioned, a suggested future study is an exploratory analysis in situations where there are changes in the senior manager to whom the PMO reports for verifying its impact on office transitions and project performance.

Another aspect to be better investigated is the fact that even under the occurrence of changes in the PMO's operating structure, the performance of the lead time of projects continued to improve. This condition can be due to the momentum already achieved in the PM performance in the previous stages of office implementation. A deep study of



this phenomenon would be scientifically relevant, as well as, incorporate concepts of PM maturity into the research model here proposed, aiming to verify its impact on transitions in PMOs once PM maturity could be understood as the engine for the aforementioned momentum.

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