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Waterfall, agile or hybrid approach: exploring organizational design for PMO

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Developmental paper:

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Abstract

Organizations can opt for different project management approaches to execute their project, such as waterfall, agile and hybrid. In this paper, we look for exploring how the Project Management Office (PMO) deal with the different approaches available to conduct projects. Specifically, we aim to understand which PMO design (functions to deliver) is more suitable for each project management approach. Based on a survey, we compare perceptions from 77 participants related to PMO function effectiveness to support project performance. In a waterfall and hybrid environment, PMO can deliver similar functions, such as control, serving and partnership. In agile environment, PMO is still pertinent if it adopts a support role by offering guidance and tools to ensure organizational learning, and communication and change management. Our research contributes to the theory by establishing that the project management approach is also a variable impacting the PMO design.

Track: Project experiences

Keywords: Project management office, PMO, waterfall, agile, hybrid, typologies

Word count: 1,950 (without tables and figures)

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Introduction

Organizations continuously invest in their project management approaches to increase their project performance, implementing complex strategies, products and/or services, and sustaining their competitive advantage (Pace, 2019). Since there is not one universal approach to apply to all projects (Jovanovic & Beric, 2018), they can opt for different options. In the past, organizations only employ traditional project management approach (i.e., waterfall) (Virani & Stolzar, 2014). However, the desire for additional flexibility to deal with highly dynamic environments brings them to explore new approaches such as the agility. Both approaches, waterfall and agile, have different foundations. While traditional approach is based on sequential, detail and structured plan that allows for a high degree of predictability for project scope and value delivery (Jovanovic & Beric, 2018), agile approach deemphasizes upfront planning by integrating recurring iterations, flexible work, and continuous reconsiderations of project scope and value delivery (Pace, 2019).

Despite this difference, borderlines between traditional and agile approaches have become unclear, and hybrid models is emerging (Niederman et al., 2018). Indeed, organizations are tailoring and combining waterfall and agile practices to better respond with the organization and project context and fit with the project/service nature (Reiff & Schlegel, 2022). As noticed by Serrador & Pinto, (2015) and, more recently, by Gemino et al. (2021), hybrid method becomes the most used approach in organizations. A hybrid model can also be observed at the organizational level when organizations execute several types of projects. They can deliberately opt to use side by side waterfall, agile and hybrid approach to manage some of their projects. Indeed, they can evaluate that waterfall is more suitable approach in some cases, but that other project should be conducted using either agile or hybrid approach.

In this paper, we look for exploring how the Project Management Office (PMO) deal with the different approaches available to conduct projects. Our research question is which PMO design (functions to deliver) is more suitable for each project management approach: waterfall, agile and hybrid?

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Based on the contingency theory, PMO design depends on the organizational context (such as the economic sector, organizational size, number of projects, level of maturity, among others) (Aubry et al., 2010), the project characteristics (size, duration, product or service to deliver, performance criteria, among others) (Aubry et al., 2010) and project governance (Müller et al., 2019). However, there is not research on how the project management approach can impact the PMO role and functions. In the best of our knowledge, research on PMO and its relationship with agile or hybrid approaches is scarce.

Conceptual model and proposition formulation

A PMO is defined as “an organizational structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques” (Project Management Institute, 2018). Several authors have proposed models and typologies to classify the activities offered by a PMO (Pansini et al., 2022) and every model presents a set of roles and activities that a PMO structure should deliver to support the project performance. For this research, we use the nine domains of functions proposed by Aubry (2023).

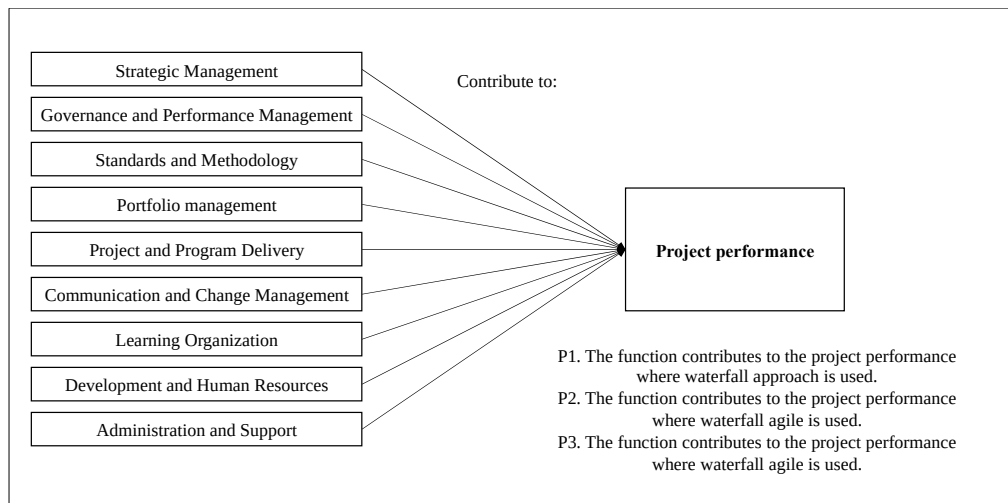


Figure 1. Domains of activities contributing to the project performance (adapted from Aubry, 2023).

Using a philosophical stance of post-positivism and based on a survey strategy, we define the following propositions:

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P1. The specific function contributes to the project performance where waterfall approach is used.

P2. The specific function contributes to the project performance where waterfall agile is used.

P3. The specific function contributes to the project performance where waterfall agile is used.

Research methodology

This research was conducted based on a survey of project managers using either waterfall, agile or hybrid approaches. Convenience sampling from the professional network of researchers was used to identify an initial group of professionals contributing to manage projects (such as, project management, project controller officers, scrum masters, product owners, among others) that were recruited for the study. Snowball sampling provided the additional participants. The questionnaire was applied on-line from mid-October to mid-December 2022. Participants worked in a diverse of organizations from government, manufacturing, financial, and aerospace, and manage different types of projects, such IT development, construction, product development and business transformation.

During the preliminary phase of the study, a series of interviews (six) was also conducted to verify the validity and relevance of the questions addressed in the questionnaire. The questionnaire had to be completed focus on the most important project that the participant has already executed or is executing. The data collected was used to measure how a specific PMO function is pertinent to contribute to the project performance. This questionnaire comprises four main parts: characteristics of the participants, characteristic of their organization, characteristics of the most important project that participants have already executed in the last five years, and the pertinence of PMO activities to deliver. The most important project part includes questions such as the type of project management approach and performance indicators. The last part includes a five-point Likert scale to evaluate participants perceptions related to the contribution of the PMO functions to the project performance based on the most important project that they have selected.

In total 88 participants answered our questionnaire, but we only kept 77 participants for our analysis since they report having a optimal project performance (related to the Golden Triangle): 25 reported using waterfall approach for their most important project, 14 agile approach and 38

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hybrid approach. The results were analyzed using the Statistical Package for the Social Sciences (SPSS). The analyses primarily deal with the ranking of the function, based on the mean values to determine their level of importance. It is then followed by comparing the mean values across the three groups: waterfall, agile and hybrid. The Kruskal-Wallis test One-Way ANOVA (Hecke, 2012) is used to examine the significant differences in the mean scores of the PMO functions, across the three groups. Finally, three different Mann–Whitney U tests (McKnight & Najab, 2010) were executed to compare one-by-one groups where the assumption of normality is questionable: the test 1 compares waterfall versus agile group, the test 2 compares waterfall versus hybrid group, and finally, the test 3 compares agile versus hybrid group.

Preliminary results

As shown in the table 1, hybrid group seems to assess positively the pertinence of the PMO domains of activities than the two other groups (means of 4,07). Waterfall groups evaluate its pertinence in a similar way that the hybrid group (means of 4,06). In contrast, agile group evaluates in general the domain of activities and specific functions less pertinence to support projects that use agile approach with a means of 3,86.

Based on the Kruskal-Wallis test One-Way ANOVA (see table 1), we identified differences among perceptions related to the domains of activities that a PMO should be delivered in function of the project management approach: Standards and Methodologies, Portfolio Management, Communication and Change, and Learning Organization. The domain with the significant difference is the Standards and Methodologies where waterfall and hybrid groups respectively report 4,25 and 4,24 for its pertinence and both groups prioritize this domain as the second and third most important over nine. However, the agile group ranks this domain lower in the seventh position out of nine with the pertinence of 3,79. In contrast, the agile group place the Learning Organization domain in the second position with a pertinence of 3,98; while waterfall and hybrid groups place it in the position 6 out of 9 and 5 out of 9 and respectively. Another importance difference between agile group with the other two groups (waterfall and hybrid) is assessed for the Communication and Change domain. Agile group reports 3,79 for its pertinence and places it in the fourth position s position over nine. In contradiction, the waterfall and hybrid groups place it in the last and second-last position respectively.

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Table 1. PMO domains of functions and their perceived contribution to the project performance according to the waterfall, agile and hybrid approach (Kruskal-Wallis test One-Way ANOVA)

Domains of functions	Waterfall, n= 25			Agile, n= 14			Hybrid, n= 38			p ²
	Means ¹	Std. dev.	Rank	Means ¹	Std. dev.	Rank	Means ¹	Std. Dev.	Rank	
Strategic Management	4,06	0,40	5	3,83	0,32	5	4,15	0,38	3	
Governance and Performance Management	4,38	0,85	1	4,15	1,12	1	4,50	0,74	1	
Standards and Methodologies	4,25	0,71	3	3,69	1,06	7	4,24	0,68	2	**
Portfolio Management	4,16	0,90	4	3,89	1,00	4	4,01	1,01	7	*
Project and Program Delivery	3,93	1,14	7	3,67	1,24	9	3,72	1,11	9	
Communication and Change Management	3,76	1,10	9	3,79	1,04	6	3,83	1,04	8	*
Learning Organization	3,94	1,04	6	3,98	0,90	2	4,12	0,82	5	**
Development and Human Resources	3,83	1,11	8	3,67	0,98	8	4,01	0,86	6	
Administration and Support	4,27	0,96	2	3,93	0,95	3	4,14	0,99	4	

Note 1: Means is based on weighted Likert scales where 1 means not agree at all and 5 totally agree.

Note 2: p indicates the level of significance for the t-tests where * means $p < 0,10$ and ** $< 0,05$.

Table 2. PMO function and their perceived contribution to the project performance according to the waterfall, agile and hybrid approach (Mann–Whitney U tests).

Domains of functions	Waterfall, n= 25		Agile, n= 14		Hybrid, n= 38		Mann–Whitney U test		
	Means ¹	Std. dev.	Means ¹	Std. dev.	Means ¹	Std. Dev.	p1 ²	p2 ³	p3 ⁴
Strategic Management									
Resolve issues (referring to the highest hierarchical level)	3,85	0,99	3,67	1,41	3,94	0,93			
Manage overall project benefits	3,50	1,24	3,56	1,24	3,52	1,15			
Advise senior management	4,30	0,66	4,11	1,05	4,48	0,51			
Participate in strategic planning	4,55	0,51	4,33	0,71	4,45	0,67			
Ensure alignment between strategy and projects	4,35	0,75	3,78	0,67	4,42	0,56	**		**
Analyse opportunities	3,80	1,20	3,56	1,13	4,06	0,61			
Governance and Performance Management									
Establish and facilitate effective project governance	4,65	0,49	3,89	1,45	4,73	0,45			
Inform senior management on project performance	4,15	1,09	4,22	1,09	4,30	0,77			
Develop and maintain a dashboard (KPIs)	4,35	0,88	4,33	0,71	4,45	0,83			
Standards and Methodologies									
Develop and implement a standard methodology	4,00	0,92	3,89	0,60	4,18	0,58			
Define metrics (KPI's)	4,60	0,50	3,44	1,51	4,30	0,77	**		
Develop and continuously improve processes	4,15	0,93	4,00	1,22	4,24	0,90			

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Portfolio Management									
Identify, select and prioritize projects	3,90	0,91	4,11	0,93	4,06	0,90			
Manage one or more project portfolio	4,45	0,60	3,89	0,78	3,79	1,14	*	**	
Coordinate between projects	4,25	0,91	3,78	0,97	4,03	1,05			
Management capacity	4,05	1,19	3,78	1,30	4,15	0,97			
Project and Program Delivery									
Perform specialized tasks for project managers	3,70	1,26	3,33	1,41	3,85	1,03			
Manage project delivery	3,85	1,27	3,89	1,27	3,48	1,33			
Manage program delivery	4,10	1,17	3,67	1,12	3,64	1,14		*	
Ensure effective planning	4,30	0,80	3,89	1,27	4,27	0,84			
Manage owner/supplier relationship	3,70	1,22	3,56	1,13	3,33	1,22			
Communication and Change Management									
Manage change and assess readiness to change	3,95	0,89	4,00	1,00	3,94	0,79			
Measure customer/stakeholder satisfaction	3,80	1,01	3,78	0,97	4,03	0,88			
Manage stakeholders	3,70	1,17	3,22	1,09	3,61	1,30			
Manage communications	3,60	1,35	3,78	1,09	3,76	1,20			
Learning Organization									
Implement and manage risk database	3,65	1,31	3,67	1,32	3,91	1,01			
Foster collaboration	4,25	0,85	4,56	0,53	4,45	0,56			
Conduct post-mortem reviews	4,00	1,17	3,67	1,22	3,97	0,95			
Conduct audits	4,15	0,99	4,00	1,00	4,15	1,12			
Implement and manage lessons learned database	4,25	0,97	4,22	0,67	4,52	0,71			
Monitor and control the performance of the PMO	4,00	0,92	3,89	0,60	4,18	0,58			
Manage intellectual property	3,30	1,08	3,89	0,93	3,64	0,82			
Development and Human Resources									
Provide a set of tools without standardization efforts	3,65	1,09	3,33	1,00	3,79	1,14			
Recruit, select, staff, evaluate and determine salaries of project managers	3,30	1,53	3,44	1,24	3,79	0,99			
Develop a career path	3,70	1,26	3,78	0,83	3,88	1,02			
Develop and manage certifications and qualifications	4,35	0,81	4,33	0,71	4,39	0,50			
Manage project management human resources	4,15	0,88	3,44	1,13	4,21	0,65	*		*
Administration and Support									
Document project status, finance and forecast	4,00	1,17	4,00	1,00	3,85	1,20			
Support technologies	4,20	0,95	3,78	0,97	4,24	0,94			
Provide advisory services (consulting)	4,60	0,75	4,00	0,87	4,33	0,82	**		

Note 1: Means is based on weighted Likert scales where 1 means not agree at all and 5 totally agree.

Note 2: p1 indicates the level of significance for waterfall and agile groups where * means $p < 0,10$ and ** $< 0,05$.

Note 3: p2 indicates the level of significance for waterfall and hybrid groups where * means $p < 0,10$ and ** $< 0,05$.

Note 4: p3 indicates the level of significance for agile and hybrid groups where * means $p < 0,10$ and ** $< 0,05$.

Based on the three different Mann–Whitney U tests (see table 2), we analyzed the pertinence of the specific functions offered by a PMO by comparing each group one by one. Waterfall and agile groups report five main significant differences: i) develop and improve processes, ii) promote project management and provide advisory services, iii) ensure alignment between strategy and projects, iv) manage human resources for project management activities and, v) coordinate between portfolios. For all these functions, the waterfall participants perceived these functions as most pertinent than the agile group. By contrasting the waterfall versus the hybrid group, we identified two main differences: i) coordinate between portfolios and ii) manage project and program delivery. In this case, waterfall group reports a greater pertinence for their projects. Finally, we compared the agile and hybrid groups where we determine two differences: i) ensure alignment between strategy and projects and ii) manage human resources for project management activities. In this last case, hybrid group perceives as most pertinent these two functions than the agile participants.

Discussion

The PMO's role and functions vary according to the context within which they are incorporated in an organization (Aubry et al., 2010) and according to the project characteristics (Aubry & Brunet, 2016). Martinez Sanz & Ortiz-Marcos (2019) also made similar findings indicating that the nature of services the PMO renders is largely driven by the configuration type of the PMO within an organization. Our results reveal that the PMO design is also influenced by the project management approach.

It seems that PMO can deliver similar functions for projects using waterfall and hybrid approach where we observe that PMO can play a balanced design including serving, controlling and partnership roles defined by Müller et al. (2013). Two reasons can explain this similitude between the waterfall and hybrid groups. First, hybrid approach still employs waterfall practices to manage projects (Gemino et al., 2021); therefore, PMO functions are still pertinent for this type of environment. Finally, Costantini et al. (2021) argue there is a general lack of methodological support for implementing hybrid methodologies. This is an organizational problem where the PMO can serve by developing a common methodology and common tools. However, this PMO design could evolve in the future if the organization sets up to solve the problem (Bredillet et al., 2018).

Our results suggest that in an agile project context, PMO should consider a different design. It was revealed that controlling functions such as project and program delivery, portfolio management, development and human resources, and standards and methodology development are less pertinent for agile projects. As noticed by Pellegrinelli & Garagna (2009), PMO can be the battleground between empowerment and control, between people and process, and between political pressures. Agile approach tends to deploy decentralization forces to offer autonomy and flexibility to the agile teams. Therefore, control or directive roles are less compatible with agile values and principles. However, PMO could get a partnership or serving role by offering guidance and tools to ensure organizational learning, and communication and change management.

Contributions

This paper contributes to the theory by establishing that the project management approach is also a variable for defining PMO function. This line of research should be developed in the future to better understand how organizations should design their PMOs. Indeed, organizations tend to use waterfall, agile and hybrid approach at the same time to manage all their projects. Should organizations implement a single PMO for all the project management approaches or should they implement an exclusive PMO for each approach?

Our results have some practical contributions. We have identified the most important and less important functions to consider based on the project management approach. PMO directors can use our results to update functions to deliver.

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