



**THE EFFECT OF PROJECT MANAGEMENT DYNAMIC  
CAPABILITIES ON FIRM PERFORMANCE**

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## Introduction

Project management (PM) literature is getting closer to the Teece et al. (1997) idea of dynamic capabilities as the roots of firms' competitive advantage. Applying the dynamic capabilities framework to the PM discipline is especially suitable, given that the ultimate aim of any project is to implement changes inside the organization in order to address shifting market conditions (Irja, 2006).

Nowadays, scholars consider that PM dynamic capabilities are able to develop the organization's internal abilities, align short-term project goals with the long-term stable objectives of the organization's overall strategy, allowing to create lasting performance based on multiple projects and could be described as a necessary condition for achieving firm performance through multiple project success (Davies and Brady, 2000, 2016).

Empirical research shows this potential of PM dynamic capabilities. Biedenbach and Müller (2012) observe that absorptive, innovative and adaptive capabilities have an effect on short- and long-term project and portfolio performance. Recently, Biesenthal, Gudergan and Ambrosini (2018) have gained a deeper understanding of PM dynamic capabilities potential by measuring dynamic capabilities at both the firm and project level and by observing their effect on operational capabilities.

However, despite these attempts to link PM dynamic capabilities to firm performance, the existing empirical literature has not yet fully explained the consequences of PM dynamic capabilities on firm performance (Wójcik, 2020). PM dynamic capabilities have been treated as separate routines and performance measurement has failed to take account of the different levels of performance.

In this paper, our aim is to investigate the effect of PM dynamic capabilities on firm performance, both directly and indirectly, through the mediating effect of project and portfolio

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3 performance. Additionally, we test whether program performance might also affect the  
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5 relationship.  
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8 For this purpose, we use a sample of 63 international firms who engage in projects globally  
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10 and we test our hypotheses using a Partial Least Squares (PLS) methodology. The main results  
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12 show that PM dynamic capabilities are important for firm performance due to the mediation  
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14 effect of portfolio performance. Both project and portfolio performance have a mediation effect  
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16 on the relationship. However, portfolio performance absorbs all this effect when the two  
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18 performances are in the model.  
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22 The paper makes several contributions to the literature on dynamic capabilities and to PM.  
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24 First, we identify those managerial processes and PM routines that can be considered the micro-  
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26 foundations for PM dynamic capabilities, and we test the consequences of PM dynamic  
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28 capabilities by measuring three intermediate performance levels (project, program, and  
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30 portfolio) and the overall firm performance. Second, we add empirical evidence about the  
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32 importance of the role played by top and project managers in developing processes that are  
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34 crucial to firm performance. The main finding of this research is that PM dynamic capabilities  
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36 do not influence firm performance directly but do so indirectly by increasing firms'  
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38 performance in projects, programs, and portfolios. Specifically, the theoretically direct and  
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40 positive influence of PM dynamic capabilities on firm performance is mainly explained by  
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42 portfolio performance, hence highlighting the importance of issues such as strategic alignment,  
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44 project hierarchy, and project coordination.  
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50 The rest of the paper is structured as follows. First, we present the theoretical background on  
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52 PM dynamic capabilities. Next, we introduce the hypotheses. We then explain the research  
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54 method, followed by a description of the results. We conclude with the discussion, limitations,  
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56 and further research.  
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## Theoretical Background

### *Project Management Dynamic Capabilities*

Drawing on the seminal paper by Teece et al., (1997), the dynamic capabilities approach arises as an extension of the resource-based view in order to cope with the lack of a time dimension and dynamism problems. Dynamic capabilities allow a firm to extend, modify or create ordinary capabilities through access to and recombination of knowledge, thereby enabling success over time (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). Dynamic capabilities are considered to be an organization's capacity to intentionally create, extend or modify its foundation of resources (Helfat and Peteraf, 2009).

The conceptualization of PM dynamic capabilities started by linking projects to the dynamic capabilities approach (Killen and Hunt, 2010; Petit, 2012). Envisioned from this evolutionary theoretical perspective, PM dynamic capabilities are recognized to allow a firm reconfiguring its project assets and project management processes in the manner intended by the project managers (Davies and Brady, 2016, p. 318; Zahra *et al.*, 2006, p. 918). Therefore, we must distinguish the ability to manage projects, which is an operational capability, to the capability to reconfigure and change the way the firm manages its projects, which is the PM dynamic capability. As a consequence, PM dynamic capabilities have two interacting levels of learning (Teece, 2007, 2009) between the project-level routines and the organization-level routines.

Therefore, PM dynamic capabilities are considered a vehicle for implementing changes in organizations (Irja, 2006). Moreover, PM dynamic capabilities allow to build operational capabilities that avoid a cycle of forgetting and relearning (Davies and Brady, 2000). In short, PM dynamic capabilities have the objective to help the organization to address environmental changes using a collection of routines.

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3 At the project-level, PM dynamic capabilities allow project managers to address environmental  
4 and stakeholders' changes (PM sensing routines), to build structures, procedures, and designs  
5 that help the project team to identify changes required once opportunities or threats are sensed  
6 (PM seizing routines), and to manage threats and reconfiguration (PM transforming routines)  
7 (Hermano and Martin-Cruz, 2020).  
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12 At the organization-level, PM dynamic capabilities allow top managers to scan the performance  
13 of project-level processes to discover experiences gained during the project life cycle that can  
14 be employed in subsequent projects (organizational sensing routines), to identify which  
15 potential sensed projects should be given priority and which should be discarded, and which  
16 potential clients should be satisfied (organizational seizing routines), and to implement top  
17 management decisions to achieve evolutionary fitness and avoid path dependencies  
18 (organizational transforming routines) (Hermano and Martin-Cruz, 2020; Teece, 2007).  
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32 The objective of PM dynamic capabilities is to reconfigure and extend the firm's capabilities  
33 so the firm can fully exploit its project capabilities and achieve long-term performance through  
34 multiple short-term projects. Accordingly, PM dynamic capabilities might be seen as routines  
35 to reconfigure resources and managerial processes at different firm-levels (project and  
36 organization) and in the manner envisioned by top and project managers to address rapidly  
37 changing environments. PM dynamic capabilities are important to make learning embedded in  
38 stable routines and capabilities shapes future action and provides a source of valuable  
39 knowledge when applied repeatedly across multiple projects (Davies and Brady, 2016). As a  
40 consequence, PM literature claims that PM dynamic capabilities are needed to achieve  
41 performance in unstable and dynamic environments (Davies and Brady, 2000; Melkonian and  
42 Picq, 2011).  
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3 Recently, scholars have related PM dynamic capabilities to portfolio management (Biesenthal  
4 *et al.*, 2018; Davies and Brady, 2016), and they have considered project portfolio management  
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6 (PPM) dynamic capabilities as enablers for organizations to align projects with strategy and to  
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8 ensure adequate resourcing for projects, while PPM dynamic capabilities meet the  
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10 organization's needs over time (Killen and Hunt, 2010). In fact, knowledge transfer from one  
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12 unit to another contributes to organizational performance.  
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17 By exploring how PM dynamic capabilities affect projects, programs, and portfolio  
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19 performance, as well as overall firm performance, we contribute to the debate on the  
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21 consequences of dynamic capabilities (Cepeda and Vera, 2007; Helfat and Peteraf, 2003; Zahra  
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23 *et al.*, 2006).  
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### 26 27 *Dynamic Capabilities and Firm Performance* 28

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30 Firstly defined as unique sets of abilities allowing firms to address environmental changes,  
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32 dynamic capabilities reflect an organization's ability to achieve new and innovative forms of  
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34 competitive advantage (Teece *et al.*, 1997, p. 516). The initial view of dynamic capabilities  
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36 claim that dynamic capabilities have the potential for being a source of competitive  
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38 advantages, and they are direct and positive related to firm performance. However, this initial  
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40 view of dynamic capabilities was criticized as prescriptive and tautologic. Parallel, another  
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42 conceptualization of dynamic capabilities arise from the paper of Eisenhardt and Martin  
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44 (2000). This new view posits that dynamic capabilities are specific organizational and  
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46 strategic processes that present commonalities across different firms and so constituting best  
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48 practices (Eisenhardt and Martin, 2000).  
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53 Despite of the fact that the dynamic capabilities approach has developed under the influence  
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55 of two papers that are somehow, contradictory (Peteraf *et al.*, 2013), there seems to be a  
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57 consensus that dynamic capabilities affect firm performance in multiple ways (Baia and  
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3 Ferreira, 2019). However, the nature of that relation, the actual intensity of the relation, and  
4 the way the influence occurs remains unclear (Baia and Ferreira, 2019). Moreover,  
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6 throughout the literature, dynamic capabilities are giving a variety of roles, i.e. independent,  
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8 dependent and mediating variables, when exploring their influence on performance outcomes  
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10 (Baia and Ferreira, 2019). As Baia and Ferreira (2019) have recently presented, there are four  
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12 different models for hypothesizing the relationship between dynamic capabilities and  
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14 performance:  
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20 1. A direct approach where dynamic capabilities directly and positively influence  
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22 performance outcomes (Dynamic capabilities → Performance outcomes)  
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26 2. A modification of the direct approach where dynamic capabilities are recognized to  
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28 have antecedents, playing then the role of mediating variable (Antecedents to DC →  
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30 Dynamic capabilities → Performance outcomes).  
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33 3. An indirect approach where the influence of dynamic capabilities on performance  
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35 outcomes is mediated by an intermediate operative result (dynamic capabilities →  
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37 intermediate operative result → Performance outcomes).  
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40 4. An indirect approach where the influence of dynamic capabilities on performance  
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42 outcomes is mediated by a change in firm's resource base (dynamic capabilities →  
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44 change in resource base → Performance outcomes).  
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47 Conclusions of the article by Baia and Ferreira (2019) posit that the indirect role of dynamic  
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49 capabilities, such as the one on the third and fourth models previously presented, is the most  
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51 promising one since portrait dynamic capabilities in a more in-depth manner and so avoiding  
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53 the tautology of dynamic capabilities as an inherently good aspect of firms directly  
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55 enhancing overall firm performance.  
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3 For the purpose of this paper, we present a model for the influence of PM dynamic  
4 capabilities on performance outcomes that fit in the third category. As depicted in Figure 1,  
5 our model presents the direct effect of PM dynamic capabilities to firm performance but also  
6 indirectly link PM dynamic capabilities to firm performance through the operational  
7 performance of both projects and portfolios. We claim that project and portfolio performance  
8 mediate the relationship between PM dynamic capabilities and firm performance. Therefore,  
9 we claim that an intermediate operational performance such as project and portfolio  
10 performance represents the *generative mechanism* through which PM dynamic capabilities  
11 influences overall firm performance (Baron & Kenny, 1986). Thus, we acknowledge that  
12 dynamic capabilities enable superior firm performance by enhancing the operational  
13 efficiency of project-based organizations.  
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29 *Insert Figure 1 around here*  
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## 31 **Hypothesis Development**

### 32 ***Project Management Dynamic Capabilities and Firm Performance***

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35 The stream of research emerging from the Teece et al (1997) seminal paper claims that  
36 dynamic capabilities directly influence performance and that dynamic capabilities constitute a  
37 source of a sustainable competitive advantage since they meet the VRIO criteria of resources  
38 (Baia and Ferreira, 2019; Peteraf et al., 2013). On the other hand, papers emerging from the  
39 Eisenhardt and Martin (2000) seminal paper do not establish a direct relation between  
40 dynamic capabilities and firm performance. In fact, this stream of research considers that the  
41 output of dynamic capabilities is not firm performance but a modification of other operational  
42 capabilities of firms and intermediate performance outcomes (Cepeda and Vera, 2007).  
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55 Moreover, as best practices, dynamic capabilities are homogeneous among firms and any  
56 competitive advantage directly attributable to dynamic capabilities should be small and  
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3 insignificant (Baia and Ferreira, 2019; Peteraf et al., 2013). Thus, they claim that dynamic  
4 capabilities are necessary but not sufficient condition for competitive advantage since they do  
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6 not meet all the VRIO criteria (Baia and Ferreira, 2019).  
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10 Some scholars even advocate studies that focus on the drawbacks of dynamic capabilities,  
11 since these might be forcing firms to incur expenses (Drnevich and Kriauciunas, 2011). Thus,  
12 the costs of the extensive management required to handle dynamic capabilities might not be  
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14 offset by the increased performance that emerges from the new decisions taken (Drnevich  
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16 and Kriauciunas, 2011).  
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22 In addition to theoretical divergences, the extent to which the dynamic capabilities approach  
23 is supported by empirical evidence also remains unclear (Pezeshkan et al., 2016, p. 2950). In  
24 a systematic review of the empirical dynamic capabilities literature using vote-count  
25  
26 assesment, Pezeshkan et al. (2016) found 60% level of support for the positive effect of  
27  
28 dynamic capabilities on firm performance. Moreover, the operationalization of dynamic  
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30 capabilities is also heterogeneous ranging from generic sets to very specific dynamic  
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32 capabilities such as new product development, customer relationship management, it-enabled  
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34 capabilities, etc. For the purpose of this paper, we focus on the specific PM dynamic  
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36 capabilities that we have defined on the second paragraph of the subsection entitled Project  
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38 Management Dynamic Capabilities.  
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46 Regarding PM literature, traditional interest concerning performance relates to the critical  
47 success factors (CSF) affecting project performance (Cooke-Davies, 2002; Hermano *et al.*,  
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49 2013). Defined as a limited number of areas within a project that if satisfactory managed, will  
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51 ensure project performance, CSFs have been analyzed from various standpoints, and we now  
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53 know more about why projects succeed. However, the theoretical foundations of project  
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55 success are still in their infancy and the dynamic capabilities approach is progressively being  
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57 used to justify projects results over time (Davies and Brady, 2016). The impact of PM  
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3 dynamic capabilities on project and overall firm performance has scarcely been tested within  
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5 PM literature, and the few studies that do exist deal with the indirect effects of PM dynamic  
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7 capabilities on a domain specific performance outcome such as ERP implementation  
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9 (Bernroider et al., 2014), or operational capabilities (Biesenthal et al., 2018); rather than the  
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11 predominant wide-ranging overall firm performance approach of the general management  
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13 papers. Results of the empirical papers enhance our understanding of the potential positive  
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15 impact of PM dynamic capabilities on firm performance. Therefore, we hypothesize:  
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20 H1: PM dynamic capabilities have a positive effect on firm performance.  
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### 22 *The Mediating Effect of Project Performance*

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25 Projects are unique, temporary, multi-disciplinary and organized endeavors to realize agreed  
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27 deliverables with predefined requirements and constraints (IPMA, 2015). Project  
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29 implementation provides firms with flexibility and innovation capacity and so it is recently  
30  
31 viewed as optimum way to operationalize the organizational strategy of firms competing in  
32  
33 dynamic environments (Hernando and Martín-Cruz, 2016). In order to understand what  
34  
35 contribution projects make to company strategy and overall performance, organizations need  
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37 good project governance and benefit management (Artto *et al.*, 2008). Organizations  
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39 competing in traditional PM sectors such as construction or engineering as well as in dynamic  
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41 or creative industries (e.g. film-making, IT, or entertainment) carry out their core operations  
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43 through projects. Project performance is thus a critical part and becomes the main success  
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45 criteria for assessing and achieving organizational performance. Moreover, many  
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47 organizations in a wide range of industries use projects as the business mechanism for  
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49 developing specialized intellectual activities such as new product development and R&D  
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51 (Lindkvist, 2004). Given the strengths of project-based organizations (i.e. they possess an  
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53 intrinsically flexible and innovative nature coupled with a high capacity to address  
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55 environmental changes), they use external delivery projects for their business purposes rather  
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3 than continuing to manufacture service activities (Shenhar *et al.*, 2007). Furthermore, projects  
4 are increasingly being developed to implement organizational day-to-day activities (Irja,  
5  
6 2006). Thus, projects are now conceived as subordinates of organizational goals (Shenhar *et*  
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8 *al.*, 2007) and the means for implementing and operationalize the overall organizational  
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10 strategy (Mutka and Aaltonen, 2013).  
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15 PM dynamic capabilities provide project managers with a set of routines for sensing variations  
16 within the project environment and in the behavior of relevant stakeholders that might imply  
17 modifications in the project scope and project management plan (Petit and Hobbs, 2010). Since  
18 project constraints cannot be extensively recognized when the project starts, project managers  
19 need to continuously sense the project environment (Perminova *et al.*, 2008). Thus, PM  
20 dynamic capabilities allow project managers to address changes both in project environment  
21 and stakeholders' requirements by reconfiguring the project management plan during project  
22 execution (Hermano & Martin-Cruz, 2020). However, not every change in the project  
23 environment should lead to changes in the project plan. PM dynamic capabilities help to  
24 determine the importance of environmental changes and the corrective actions to be taken.  
25 Furthermore, PM dynamic capabilities encompass routines that test whether current project  
26 management processes are best suited, thus providing project managers with the possibility to  
27 renew inappropriate ones by redeploying project management assets (Hermano & Martin-Cruz,  
28 2020). Thus, we maintain that PM dynamic capabilities enhance project performance by  
29 helping project managers to develop the managerial skills needed to address relevant changes  
30 in both the project environment and client needs. Given this, we offer the following hypotheses:  
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53 H2. The relationship between PM dynamic capabilities and firm performance is positively  
54 mediated by project performance.  
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58 H2a. PM dynamic capabilities are positively related to project performance.  
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3 H2b. Project performance is positively related to firm performance.  
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### 6 *The Mediating Effect of Portfolio Performance* 7

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9 Portfolios are sets of projects not necessarily related, brought together to provide optimum use  
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11 of organizational resources and to achieve organizational strategic goals (IPMA, 2015). Formal  
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13 organizational investment strategy can be developed through successful project portfolio  
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15 management. Therefore, portfolio management plays an important part in determining the  
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17 organization's future in terms of shaping its structure, capabilities and businesses, and has the  
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19 potential to provide benefits beyond individual project performance (Kopmann *et al.*, 2017).  
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21 Traditional portfolio management is similar to the management of financial portfolios since it  
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23 highlights the importance of ensuring the alignment between projects in the portfolio to the  
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25 overall strategy, and the prioritization and selection of projects within the portfolio as the most  
26  
27 important aspects for achieving organizational goals (Petit, 2012). Thus, to provide the higher  
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29 organizational performance, projects within the portfolio are selected and prioritized in the way  
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31 that resource allocations and risks are balanced and properly aligned with overall  
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33 organizational strategy.  
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39 The literature also suggests that emerging strategies, those carried out despite formal strategic  
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41 intention, are implemented through a portfolio of projects (Kopmann *et al.*, 2017). Moreover,  
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43 scholars posit that projects could have a bottom-up effect in the overall business model or  
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45 organizational strategy since projects are not only servants to organizational goals, but the  
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47 source of new ideas and strategic opportunities (Artto *et al.*, 2008; Kopmann *et al.*, 2017).  
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49 Empirically, Kopmann *et al.* (2017) found that strategic control at portfolio level fosters the  
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51 realization of both a deliberate and emerging firm strategy. Moreover, many projects serve as  
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53 strategic arenas where new capabilities are developed and tested for further implementation  
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55 and improvement for future projects and business. In fact, modern project management does  
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57 not consider that a project has failed just because it has not achieved its original objectives,  
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3 since early project termination might enhance the performance of the portfolio as a whole if its  
4 resources and lessons learned are transferred to other projects as well as the rest of the firm.  
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8 At the portfolio level, PM dynamic capabilities address the consolidation of project knowledge,  
9 allowing the firm to use the acquired knowledge through project implementation in order to  
10 develop and reconfigure organizational capabilities (Hernando & Martin-Cruz, 2020). Thus,  
11 PM dynamic capabilities enable the firm to fully exploit its PM processes and achieve long-  
12 term performance through multiple short-term projects. PM dynamic capabilities encompass  
13 routines for transferring project knowledge and lessons learned to subsequent projects, thereby  
14 escaping the *reinventing the wheel* trap (Boh, 2007). PM dynamic capabilities prevent  
15 organizations from losing project knowledge due to the dissolution of the project team after the  
16 project concludes (Brady and Davies, 2004). Thus, PM dynamic capabilities enhance portfolio  
17 performance based on multiple individual project performance (Cooke-Davies, 2002).  
18 Moreover, PM dynamic capabilities scan for deviations in the strategic fit of the portfolio,  
19 providing project managers with a set of routines to reallocate organizational resources among  
20 the different projects within the portfolio and to reprioritize projects in time (Jonas, 2010).  
21 Given this, we offer the following hypotheses:  
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41 H3. The relationship between PM dynamic capabilities and firm performance is positively  
42 mediated by portfolio performance.  
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45 H3a. PM dynamic capabilities are positively related to portfolio performance.  
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48 H3b. Portfolio performance is positively related to firm performance.  
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## 51 **Research Method**

### 52 *Sample and Data Collection*

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54 In order to test the theoretical model of PM dynamic capabilities, we use a questionnaire that  
55 was subjected to both a pretest and a pilot test prior to use. The questionnaire was sent to CEOs  
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3 and project managers from firms listed in the *Thomson One database* that include the keyword  
4 “project” in their business description. We first made initial e-mail contact, introducing the  
5 study and then we sent a paper-based version of the questionnaire by ordinary mail that also  
6 included instructions for electronic completion. In order to encourage participation, we  
7 performed three different follow-up phone calls after initial contact. Of the 4650 firms  
8 including *project* in their business description, only 1832 offer some information about their  
9 postal address, and only 531 of them present an extensive two lines postal address information.  
10 We sent out 1832 paper-based questionnaires, but 148 of them were returned as unknown  
11 address.  
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14 The final sample size of 63 cases makes a 3.7% response rate from the 1684 questionnaires  
15 successfully sent out, and a 11.9% response rate from the 531 questionnaires sent out to firms  
16 with the most extensive address information. Although a low one, this response rate is  
17 consistent with the idea that “top managers are notoriously unwilling to submit themselves to  
18 scholarly poking” (Hambrick, 2007, p. 337). We consider ours to be a high quality sample since  
19 it is extremely diverse (Blair and Zinkhan, 2006). Organizations in our sample belong to 23  
20 different countries (58% from Europe, 24% from North America, 18% from the rest of the  
21 world), cover 21 sectors such as metal mining, management services, engineering services, oil  
22 and gas extraction, etc.), and present different sizes (60% of the organizations have less than  
23 250 employees while the remaining 40% are large firms).  
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26 In order to check for nonresponse bias, we split the sample into three different groups,  
27 comparing early and late responses (Armstrong and Overton, 1977). The mean comparison test  
28 shows no statistically significant differences between early and late responses. Moreover, we  
29 use the information in the *Thomson One database* to compare key attributes from respondents  
30 and non-respondents such as net income, number of employees and earnings before interest  
31 and taxes. Results show no differences between respondents and non-respondents. We  
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3 therefore consider our sample to be a good representation of the whole population (Blair and  
4 Zinkhan, 2006). Furthermore, to check for common method bias we conducted the Harman's  
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6 single-factor test finding no general factor that accounts for a significant proportion of the  
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8 variance.  
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### 11 12 13 *Measures*

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15 Table I shows the survey design used to test the theoretical model. We measure all items with  
16 a five-point Likert scale, ranging from *strongly disagree/never* to *strongly agree/always*<sup>[1]</sup>. We  
17 select the items based on a literature review that provided us with valid scales which were  
18 tested and refined during initial phases of the study.  
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25 PM dynamic capabilities are operationalized in 15 items (Hermano & Martín-Cruz, 2016),  
26 adopting Teece's framework of sensing, seizing, and transforming routines. These items  
27 describe processes and routines which correspond to generally recognized best practices in  
28 project management included in four of the most widely used PM standards (i.e. the  
29 PMBOK®; the ICB®; the OPM3®; and the IPMA OCB®) that can be considered the micro-  
30 foundations of PM dynamic capabilities<sup>[2]</sup>. Moreover, several empirical papers have measured  
31 dynamic capabilities through the processes they are based on (Prieto *et al.*, 2009).  
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42 Project performance is measured with six items covering a double perspective. Firstly, the scale  
43 accounts for certain aspects of PM processes such as schedule and budget objectives. Secondly,  
44 it focuses on project outputs and outcomes.  
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49 Portfolio performance is measured with five items. Specifically, the five items of the portfolio  
50 performance scale deal with aspects such as the balance of portfolio resources and the strategic  
51 alignment of portfolio projects.  
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56 Finally, firm performance is operationalized in five items. We use five perceptual indicators  
57 related to sales, market share and perceived adaptability. Thus, we understand organizational  
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performance to be the combination of three conceptual areas: profitability, market share, and adaptability (Pleshko and Nickerson, 2008).

*Insert Table I around here*

## Results

Partial Least Squares was adopted to conduct statistical analysis by using the SmartPLS 3.2.7 software package. PLS is particularly suited to testing theories that are still under development and when working with a small sample size, where covariance-based methods suffer from restrictions (Henseler *et al.*, 2009). The minimum threshold for running the PLS technique is a sample size equal to the larger of (1)10 times the number of items in the scale with the largest number of formative indicators or (2)10 times the largest number of structural paths directed at any of the constructs in the model (Chin, 1998). We only use reflective scales, and no more than four paths are directed at any one construct, making 40 the minimum allowable sample size for this study, which is below our sample size of 63 cases.

### *Measurement Model*

In order to verify our measurement model, we conduct an exploratory factor analysis. Results of the exploratory factor analysis unequivocally identify representative factors of PM dynamic capabilities, project performance, portfolio performance and firm performance. Table II exhibits several measures of the reliability and validity of the constructs. First, we assess individual item reliability by analyzing the item loadings. Almost every item loading exceeds the narrower limit of 0.7 (Carmines and Zeller, 1979), and the five item loadings below that limit are at least around the 0.6 limit, which is acceptable when testing scales at an early stage of development (Chin, 1998). As regards the internal consistency of constructs, we see that both the composite reliability and the Cronbach alpha exceed the 0.8 limit (Nunnally, 2010). Finally, all the constructs display good properties with regard to convergent and discriminant



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3 validity. Table 2 shows that the AVE exceeds the 0.5 limit meaning that more than 50% of  
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5 construct's variance is in its items (Fornell and Larcker, 1981). Regarding discriminant  
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7 validity, we verified that inter-constructs correlations were significantly lower than 0.71, which  
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9 means that constructs have less than half of their variance in common (MacKenzie *et al.*, 2005).  
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11 Since the correlation between project and portfolio performance is greater than the 0.71  
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13 threshold, we also apply a more stringent test for assessing discriminant validity and we find  
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15 that AVE's square root is larger than the inter-construct correlations (Fornell and Larcker,  
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17 1981; MacKenzie *et al.*, 2005). Finally, we apply the most recent criterion for assessing  
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19 discriminant validity and, as depicted in Table III, we find that the Heterotrait-Monotrait Ratios  
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21 are below the 0.90 threshold and that the confidence intervals for these ratios do not contain  
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23 the value 1 (Henseler *et al.*, 2015). We thus state that our constructs evidence good  
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25 measurement properties.  
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31 *Insert Table II around here*

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34 *Insert Table III around here*

### 35 36 37 *Structural Model*

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39 The results of the structural model including the path coefficients and the endogenous  
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41 variables' R squares are depicted in figure 2. As can be seen, the whole theoretical model  
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43 explains 45.5% of the variability of organizational performance. Moreover, PM dynamic  
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45 capabilities explain 36.9% and 34.7% of the variability of project and portfolio performance  
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47 respectively. To measure the fit of our structural model, we consider the standardized root mean  
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49 square residual (SRMR) since it is the only model fit index with some agreement in the PLS-  
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51 SEM community nowadays (Hair *et al.*, 2019). Defined as the difference between observed  
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53 correlation and model implied correlation matrix, SRMR is a model fit measure that assesses the  
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55 absolute model fit by considering the average magnitude of the discrepancies between observed  
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3 and expected correlations (Henseler *et al.*, 2014). In our structural model, HRMR takes the  
4 value of 0.083, which is below the 0.10 threshold that implies good model fit (Marsh *et al.*,  
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8 2004).  
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11 *Insert Figure 2 around here*  
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13 As regards hypotheses testing, results show that PM dynamic capabilities have no direct  
14 relation with overall firm performance (H1 is rejected). Thus, our results support the idea that  
15 *dynamic capabilities do not directly affect the output of the firm they reside, but indirectly*  
16 *contribute to the output of the firm through an impact on operational capabilities* (Helfat and  
17 Peteraf, 2003, p. 999). This result is in line with Drnevich and Kriauciunas (2011, p. 273) who  
18 discover that dynamic capabilities have a positive contribution to firm performance at the  
19 process level, but not at the firm level, suggesting that dynamic capabilities change a firm's  
20 processes, products and services, and customer relations. Furthermore, Makkonen *et al.* (2014)  
21 noticed that the relationship between dynamic capabilities and firm performance is indirect via  
22 the firm's operational capabilities and innovation outputs. In this paper, we found that project  
23 and portfolio performance are intermediate outcomes through which PM dynamic capabilities  
24 influence firm performance, as Pezeshkan *et al.* (2016) suggest.  
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41 At the 99% confidence level, PM dynamic capabilities are directly and positively related to  
42 project and portfolio performance. Thus, we do not reject H2a and H3a. Finally, the positive  
43 relation between project performance and firm performance is not statistically significant (we  
44 reject H2b). This result could be interpreted in line with the arguments of Davies and Brady  
45 (2016) who consider that project capabilities are part of an organization's capabilities at the  
46 operational level, and portfolio is a clearly identifiable dynamic capability. Thus, even there is  
47 an isolated positive effect of project performance on firm performance, the portfolio effect  
48 substitutes the operational one. Therefore, portfolio performance does have both a direct and a  
49 statistically significant positive influence on firm performance (we cannot reject H3b). This  
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3 result confirms the benefits of portfolio management as a way of planning, mapping and  
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5 scheduling a set of projects to achieve a firm's long-term strategic objectives (Davies and  
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7 Brady, 2016).  
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10 To properly test the mediation effects of hypotheses H2 and H3, we create specific mediation  
11  
12 models<sup>3</sup> checking for the mediating role of project and portfolio performance. When taken  
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14 individually, project performance, and portfolio performance, perfectly mediate the relation  
15  
16 between PM dynamic capabilities and firm performance, since they absorb the explanatory  
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18 power of PM dynamic capabilities, making it non-statistically significant (Frazier *et al.*, 2004).  
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20 In particular, a direct positive relation exists between the independent variable, PM dynamic  
21  
22 capabilities, and the dependent variable, firm performance. Moreover, direct positive relations  
23  
24 exist between the independent variable, PM dynamic capabilities and the mediator, project  
25  
26 performance; and between the mediator, project performance and the dependent variable, firm  
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28 performance. However, when these three relationships are tested within the same model, the  
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30 relation between PM dynamic capabilities and firm performance loses its significance. Thus,  
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32 project performance perfectly mediates the influence of PM dynamic capabilities on firm  
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34 performance and H2 is supported.  
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41 The same occurs when we study the mediating role of portfolio performance. Portfolio  
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43 performance perfectly mediates the influence of PM dynamic capabilities on firm performance  
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45 since it absorbs all the explanatory power of PM dynamic capabilities when testing within the  
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47 same model. Thus, H3 is also supported.  
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50 Moreover, results of the PLS analysis show that the total indirect effects raised in hypotheses  
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52 H2a, H2b, H3a and H3b are statistically significant at the 99% level, while the direct effect  
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54 raised in H1 is not significant. Regarding the significance of individual indirect effects, the  
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56 only indirect effect which is statistically significant at the 98% level is the PM Dynamic  
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58 Capabilities – Portfolio Performance – Firm Performance, while the PM Dynamic Capabilities  
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3 – Project Performance – Firm Performance, and the PM Dynamic Capabilities – Program  
4 Performance – Firm Performance are not significant. Thus, portfolio performance is the  
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6 strongest mediator of the relationship between PM dynamic capabilities and firm performance.  
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10 In order to increase the robustness of the results, we run the theoretical model including three  
11 control variables (sector, measured through two-digit SIC Code; firm size, measured through  
12 number of employees; and organizational age, measured through years of activity). The results  
13 show that both organizational size and age are statistically significant and increase the  
14 explained variability of firm performance to 56.5%. However, neither the explained variability  
15 of project and portfolio performance nor the results of hypothesis testing suffer any variation.  
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#### 25 *Intermediate Performance: Program Performance*

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27 Given the paradigm shift from studying projects in isolation to studying organizational  
28 performance through multiple projects, we see that not only portfolio management but also  
29 program management is gaining ever-increasing importance. We define program as a set of  
30 projects manage together to achieve a strategic goal (IPMA, 2015). Moreover, programs imply  
31 a collection of projects and other change actions purposefully grouped together for achieving  
32 organizational benefits (Thiry, 2002). Scholars have recently suggested that program  
33 management might act as a link between individual project objectives and organizational goals  
34 (Thiry, 2002). Because programs are long-term, they do not suffer from the narrow view of  
35 project managers who are too focused on their own project goals. Program management  
36 encompasses a strategic decision perspective allowing top managers to evaluate strategic  
37 objectives and strategic benefits (Thiry, 2002). Thus, program management allows for the  
38 achievement of multiple and sometimes conflicting aims that have a broader organizational  
39 goal than individual projects (Thiry & Deguire, 2007). Therefore, we consider that introducing  
40 program performance into our theoretical model of PM dynamic capabilities as a mediator  
41 variable might shed more light on the relationship between PM dynamic capabilities and firm  
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3 performance. PM dynamic capabilities might help program managers to re-evaluate program  
4 objectives and to regularly reassess the program's CSFs as the program's expected benefits  
5 change over time (Thiry, 2002). Moreover, PM dynamic capabilities help program managers  
6 to develop a strategic decision perspective that evaluates strategic objectives and strategic  
7 benefits rather than the narrow objectives of single projects. Thus, PM dynamic capabilities  
8 allow for continuous program re-formulation, such that they help to achieve organizational  
9 goals.

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11 As depicted in Table I, the program performance construct is measured through three items  
12 based on the work of DeGroff et al. (2010) and which reflect how program management might  
13 lead to achieving benefits that are above individual project objectives. Results from the  
14 structural model<sup>4</sup> confirm the results for the theoretical model of PM dynamic capabilities  
15 presented previously in this section. We confirm that PM dynamic capabilities have no direct  
16 relation with overall firm performance. We also see how PM dynamic capabilities are directly  
17 and positively related to the performance of projects, portfolios and programs, and that only  
18 portfolio performance has both a direct and statistically significant positive influence on firm  
19 performance (the positive relation between program performance and firm performance is not  
20 statistically significant). Thus, including program performance in the theoretical model of PM  
21 dynamic capabilities does not change any of the results of the hypotheses testing, but does  
22 confirm that PM dynamic capabilities are directly and positively related to organizational  
23 performance at the operational level (projects, programs and portfolios).

## 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 **Concluding Remarks**

### 51 52 53 *Discussion*

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56 The purpose of the paper is to shed light on the output of PM dynamic capabilities. Specifically,  
57 we examine if the relationship between PM dynamic capabilities and firm performance is  
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3 positively mediated in parallel by project, program, and portfolio performance. In doing so, we  
4 break down the concept of PM dynamic capabilities into the managerial processes and PM  
5 routines that operationalize the development and implementation PM dynamic capabilities.  
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10 Therefore, the contribution of this study is twofold. Firstly, we bring to light the managerial  
11 processes and PM routines behind PM dynamic capabilities by searching for those routines  
12 included in PM standards that allow the opportunities and reconfiguration of project plans and  
13 procedures to be both sensed and seized. We open the black box of dynamic capabilities and  
14 empirically operationalize the theoretical model of sensing-seizing-transforming as the three  
15 constituting routines of dynamic capabilities (Teece, 2007, 2009). Moreover, we provide  
16 project managers with a non-exhaustive list of 15 PM processes that constitute the micro-  
17 foundations of PM dynamic capabilities. In addition, our results show that the output of PM  
18 dynamic capabilities is not improved firm performance, but better performance at the  
19 operational level of the firm, which is achieved through enhanced performance of projects,  
20 programs, and portfolios. In fact, our results show that PM dynamic capabilities do not directly  
21 influence firm performance but do so indirectly by increasing the performance of the firm's  
22 projects, programs, and portfolios. In line with Pezeshkan et al. (2016), we claim that while  
23 PM dynamic capabilities' attributes as abstract, complex, and difficult to imitate make them to  
24 have an effect on performance, the focus on intermediate outcomes and other mechanisms  
25 through which dynamic capabilities may affect overall firm performance need to direct our  
26 attention. Recently, Hernandez-Linares et al (2021) discover that market orientation has a  
27 moderating effect on the relationship between dynamic capabilities (sensing) and performance  
28 in a sample of small and medium firms, confirming that dynamic capabilities could be not  
29 enough to improve firm performance. In the same vein, innovation or creativity have also been  
30 found to have a mediating effect between dynamic capabilities and firm performance (Ferreira  
31 et al., 2020).  
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3 Specifically, our results show that as we move from projects' performance, which have a very  
4 technical nature, towards the portfolio performance, which has an increased organizational and  
5 strategic essence, the mediation effect increases. As suggested by Davies and Brady (2016)  
6 project and program management could be considered part of a firm's capabilities at the  
7 operational level and portfolio management a high-order dynamic capability. In the same vein,  
8 other scholars consider portfolio management to be the dynamic capability of the firm (Kock  
9 and Gemünden, 2019). Thus, we contribute to the debate concerning the linkages between  
10 dynamic capabilities, operational capabilities and firm performance, since our empirical results  
11 help to consolidate the idea of operational capabilities as the output of dynamic capabilities  
12 (Cepeda and Vera, 2007; Helfat and Peteraf, 2003; Zahra *et al.*, 2006).  
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15 As regards PM literature, our results strengthen the argument that achieving individual project  
16 performance is not sufficient for achieving long-term organizational goals (Melkonian and  
17 Picq, 2011). Even though project performance perfectly mediates the relation between PM  
18 dynamic capabilities and firm performance, said mediation disappears when we test the whole  
19 theoretical model of PM dynamic capabilities. Indeed, when testing the whole model, we find  
20 that both project and program performance directly but not significantly influence  
21 organizational performance, while portfolio performance is directly and highly significantly  
22 related to firm performance. Thus, we posit that projects need to contribute to the overall long-  
23 term organizational strategy and that even if a project fails to achieve its individual objectives,  
24 it can still enhance organizational performance if it contributes to portfolio success (for  
25 example by transferring project knowledge via lessons learned, or by preventing project  
26 managers from repeating the same mistakes).  
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#### 29 *Implications for Practice, Limitations and Directions for Future Research*

30 For practitioners, this study offers three different insights that might modify the way they  
31 understand the role of projects and portfolios both in the way they are managed and the way  
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3 they are related to the overall organization. First, this study offers guidance vis-à-vis the  
4 routines and managerial processes that must be deployed for managing projects, programs and  
5 portfolios in uncertain environments. Project, program and portfolio (PP&P) managers should  
6 apply a more flexible approach that allow for modifications and reconfigurations into project  
7 plans and documents giving up the traditional optimization approach where everything was  
8 supposed to be modelled during project initiation. Specifically, we provide PP&P managers  
9 with the managerial processes and routines suitable to sense and seize changes within the  
10 project, program, and portfolio environment and to reconfigure existing routines so as to  
11 address such changes. Second, this study shed light on the nature of the influence of dynamic  
12 capabilities on firm performance. Managers must understand that a firm developing PM  
13 dynamic capabilities will not automatically and directly enhance firm performance but will do  
14 it indirectly by enhancing intermediate results such as project, program and portfolio  
15 performances. Finally, this study presents the new role that projects, programs and portfolios  
16 play within firm strategy. Projects, programs, and portfolios cannot be considered any longer  
17 as purely technical elements but as the most suitable tools for implementing changes and even  
18 as strategic business elements with the capacity to generate value and become a source of  
19 competitive advantage. Our results support the role of projects as precursors for new  
20 organizational capabilities and the integration of portfolio management into strategic processes  
21 as an instrument for increasing overall firm performance by adapting current strategy to  
22 environmental shifts.

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50 This study suffers from some limitations. The cross-sectional design hampers any proper  
51 evaluation of the long-term impact of PM dynamic capabilities on operational or organizational  
52 performance. In order to achieve a better understanding of the relations between dynamic  
53 capabilities, operational performance and organizational performance further studies might  
54 apply a longitudinal approach or case study research. Another limitation arises from the fact  
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3 that our data are taken from the subjective assessment of a single respondent, which might  
4 imply common method bias (Doty and Glick, 1998). In order to avoid these problems, we  
5 carefully designed the questionnaire in the manner suggested by Podsakoff, MacKenzie, Lee,  
6 and Podsakoff (2003), keeping questions as simple as possible and clearly separating dependent  
7 and independent variables in the questionnaire.  
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15 Future research might focus on the PM processes and routines responsible for sensing and  
16 seizing opportunities and on the reconfiguration of project plan and procedure. Moreover, the  
17 level of detail could be sharpened by differentiating between PM processes affecting project  
18 performance, those affecting program performance, those affecting portfolio performance, and  
19 those affecting the three levels of performance. Furthermore, we focus on the outcome of PM  
20 dynamic capabilities (i.e. project, program, and portfolio performance) without studying the  
21 output of PM dynamic capabilities, in other words the project, program and portfolio  
22 management processes already developed. Future studies should include the PP&P  
23 management processes that mediate the relation between PM dynamic capabilities, and the  
24 performance of projects, programs, and portfolios.  
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## 8 **Endnotes**

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12 [1] The full questionnaire is available at the following url: <https://cutt.ly/7EsFZpv>  
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14 [2] We looked for managerial processes and routines representing the sensing-seizing-  
15 transforming capabilities described by Teece (2009; 2007). Specifically, we rely on the  
16 description of the competence elements of both the ICB and OCB; in the OPM3 Self-  
17 Assessment Questions.  
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20 [3] Figures of the mediation models can be found here <https://cutt.ly/EnH3dPW>  
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22 [4] Figure of the structural model with program performance can be found here  
23 <https://cutt.ly/EnH3dPW>  
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Table I. Operationalization of the variables

Construct: Operational question	Sources	
<b>Project management dynamic capabilities</b>		
All company projects are managed using the same methodology		
Project managers are requested to adapt the project management methodology to individual project features and environmental conditions		
All projects are using a project management plan		
All projects are using a project management information system		
Information from project activities is routinely collected as the project progresses		
Project plan and documents are updated frequently as projects progress		
Project managers are requested to document the impact of change requests		
Organizational culture, structure and processes have a strong influence on the project management plan		
Project managers are requested to follow the organizational processes and procedures such as (standardized guidelines, templates, etc.)	Hernando & Martín-Cruz, 2016	
Project managers are requested to document lessons learned and apply them to future projects		
Project managers are requested to identify, define, combine and coordinate the various processes within projects taking into account the characteristics of project environment		
Project managers are requested to maintain, update and change the project organization during the project life-cycle if needed		
Project managers are requested to define a change management policy		
Project managers have to ensure compliance with the company's policies and any regulatory requirements		
Project managers have to consider specific structure, culture, and processes of their company		
<b>Project Performance</b>		
Projects meet their operational performance goals		Developed ad-hoc based on Biedenbach & Müller, 2012
Projects meet their technical performance goals		
Projects meet their schedule objectives		
Projects stay within budget limits		
Projects results meet stakeholders expectations		
Stakeholders are satisfied with project results		
<b>Program Performance</b>		
Programs implementation reflect the business strategy	Developed ad-hoc based on DeGroff et al., 2010	
Programs impact exceeds stakeholders expectations		
Programs achieve cost-benefits objectives		
<b>Portfolio Performance</b>		
Company has the right number of projects for the resources available	Biedenbach & Müller, 2012	
Company's portfolio contains high-value projects		
Company's portfolio has an excellent balance of projects		
Company's projects are aligned with the business strategy		
The budget allocation between projects in the portfolio reflects the business strategy		
<b>Firm Performance</b>		
Top managers are satisfied with company's sales in comparison with other companies in the industry	Pleshko & Nickerson, 2008	
Top managers are satisfied with company's sales growth in comparison with the strongest competitors		
Top managers are satisfied with company's market share in comparison with other companies in the industry		
Top managers are satisfied with company's adaptability to environmental conditions		
Top managers are satisfied with company's adaptability to customer needs		

**Table II. Latent variable, measurement item, composite reliability, average variance extracted (AVE) and Cronbach's alpha**

<b>Construct and indicator</b>	<b>Factor loading</b>	<b>t-statistic</b>	<b>Composite reliability</b>	<b>AVE</b>	<b>Cronbach's alpha</b>
PM Dynamic capabilities			0.948	0.550	0.940
PMDC_1	0.543	5.044			
PMDC_2	0.729	11.140			
PMDC_3	0.788	13.588			
PMDC_4	0.750	10.391			
PMDC_5	0.667	5.517			
PMDC_6	0.759	11.346			
PMDC_7	0.834	19.590			
PMDC_8	0.565	5.167			
PMDC_9	0.740	10.915			
PMDC_10	0.765	12.987			
PMDC_11	0.816	22.464			
PMDC_12	0.865	27.402			
PMDC_13	0.735	8.205			
PMDC_14	0.806	14.233			
PMDC_15	0.688	8.211			
Project Performance			0.927	0.680	0.905
ProjectPe_1	0.849	20.904			
ProjectPe_2	0.838	19.656			
ProjectPe_3	0.759	11.949			
ProjectPe_4	0.720	8.073			
ProjectPe_5	0.874	21.521			
ProjectPe_6	0.893	32.945			
Portfolio Performance			0.930	0.726	0.905
PortfPe_1	0.841	17.425			
PortfPe_2	0.863	28.688			
PortfPe_3	0.819	16.804			
PortfPe_4	0.866	19.655			
PortfPe_5	0.869	26.904			
Firm Performance			0.892	0.626	0.846
FirmPe_1	0.876	25.850			
FirmPe_2	0.875	28.172			
FirmPe_3	0.775	13.138			
FirmPe_4	0.646	7.301			
FirmPe_5	0.761	8.269			

**Table III. Inter-construct correlations, average variance extracted (AVE), and HTMT ratios**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1. PM Dynamic capabilities	<b>0.742</b>	<i>0.671</i>	<i>0.625</i>	<i>0.467</i>
2. Project Performance	0.608	<b>0.824</b>	<i>0.854</i>	<i>0.671</i>
3. Portfolio Performance	0.589	0.773	<b>0.852</b>	<i>0.753</i>
4. Firm Performance	0.426	0.585	0.665	<b>0.791</b>

Notes: diagonal elements are the square root of AVE

*elements in italics above the diagonal represent the HTMT ratios*

Figure 1. Theoretical model of the PM Dynamic Capabilities influence on performance outcomes

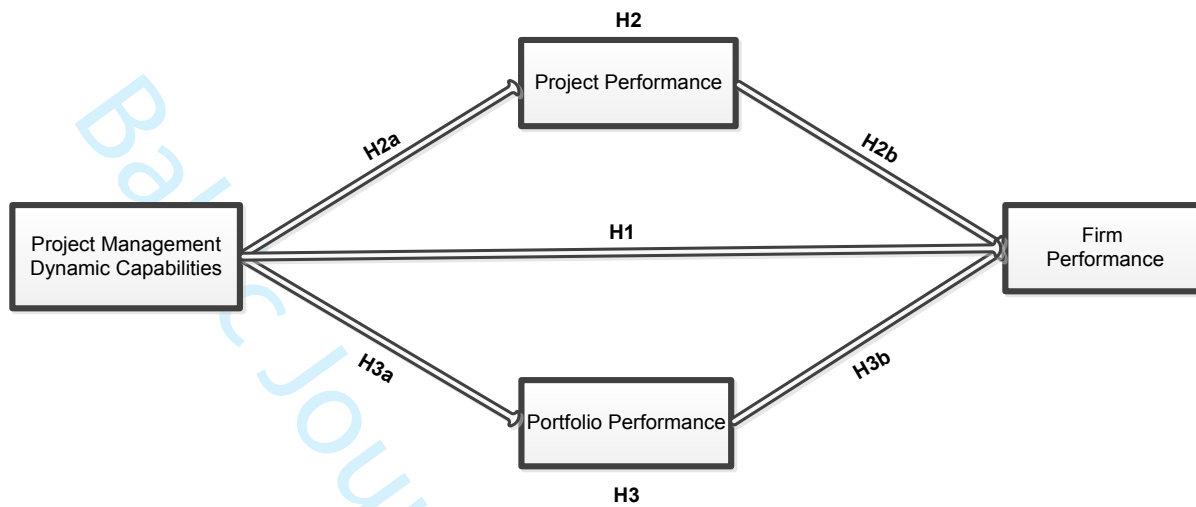
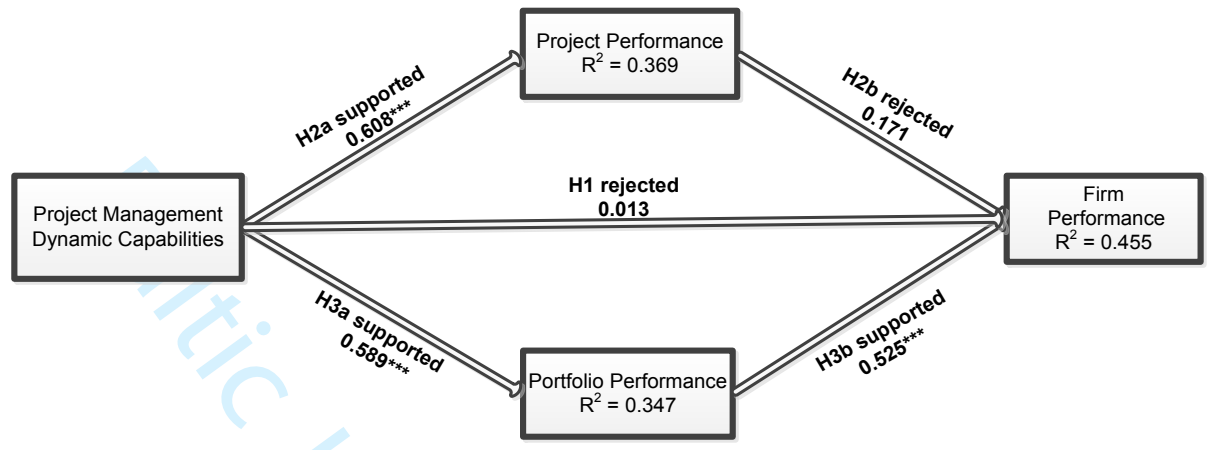


Figure 2. Results for the theoretical model of PM Dynamic Capabilities



Note: \*\*\*p < 0.01

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