MEASURING PROJECT TEAM PERFORMANCE: A REVIEW AND CONCEPTUALIZATION

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Ignacio Pavez [a] [*], Hugo Gómez [a], Canlong Liu [b], and Vicente A. González [c]

[a] Facultad de Economía y Negocios, Universidad del Desarrollo. Av. Plaza 680, 4th floor, Las Condes, Santiago, Chile. Phone: +56 2 2327 9133, [*] E-mail: ignaciopavez@udd.cl (corresponding author). E-mail: hgomeza@udd.cl

[b] Department of Civil and Environmental Engineering, The University of Auckland, 20 Symonds Street, Auckland 1010, New Zealand. Phone: +64 9 923 4106, E-mail: cliu324@aucklanduni.ac.nz

[c] Department of Civil and Environmental Engineering, University of Alberta, 116 Street NW Edmonton, Canada. Phone: +1 780 695 1783, E-mail: vagonzal@ualberta.ca

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ABSTRACT

Performance measurement has been a central topic of study in project management research for many years. However, the literature on project team performance measurement is fragmented and underdeveloped. To address these limitations, we conducted a systematic literature review aimed at organizing the state-of-the art, providing a better conceptualization of project team performance measurement, and strengthening theory in the field. We used an inductive approach to synthesize the literature and, building upon the performance measurement design literature and the Input-Mediator-Outcome (IMO) model of team effectiveness, we propose a theoretical framework that organizes project team performance measures around two axes: the nature of performance (i.e., efficiency or effectiveness), and the nature of the measure (i.e., tangible or intangible). By combining these two axes, we propose a 2x2 performance measurement structure composed of four dimensions: (1) project team processes, (2) project team emergent states, (3) project team tangible outcomes, and (4) project team perceptual benefits. Our study advances theory by offering a comprehensive and integral understanding of project team performance measurement and providing an evidence-based framework that could help practitioners improve the design of performance measurement systems for project teams.

Keywords

Performance measurement, project performance, project teams, project team performance, team effectiveness

1 INTRODUCTION

Projects are usually described as temporal organizations, with a unique content and scope, that are created to support the strategy and business objectives of a firm (Project Management Institute, 2021). The increasing complexity and the rapid pace of changes in the business environment exert growing pressure on companies to use temporal (ad hoc) organizing structures to accomplish business goals with enhanced agility and flexibility (Darino et al., 2019; Geraldi & Söderlund, 2018; Kaufmann et al., 2020). Thus, developing systems and structures that measure and manage project performance (i.e., the efficiency and effectiveness of activities critical to accomplish successful projects) has been a central focus of project management research (He et al., 2022; Kerzner, 2017).

The literature on performance measurement encourages distinguishing between different performance hierarchies to capture the whole value stream of the business (Bititci, 2015). Hence, performance measurement disaggregates high-order measures relevant to business at the strategic level (e.g., market share) into lower-order measures that are relevant to business units or processes (e.g., production rates) (Franco-Santos et al., 2012; Okwir et al., 2018). According to this view, when organizations develop projects, overall organizational performance is influenced by project performance, which is in turn influenced by the quality of project teamwork (Bjorvatn & Wald, 2018; Scheepers et al., 2022). Consequently, project teams (i.e., a group of specialized and highly interdependent individuals who work collaboratively to generate identifiable products or services within a specific timeframe) constitute the core social unit that helps predict project performance (Cohen & Bailey, 1997; Liu & Cross, 2016).

Unfortunately, the literature concerning project team performance measurement is fragmented and underdeveloped. For example, the rationale for using some measures over others

is not clear (Liu & Cross, 2016), the use of efficiency or effective performance measures is an unresolved matter of inquiry (Crawford & Bryce, 2003; He et al., 2022), and the selection of the unit of analysis to measure project team performance remains very challenging (e.g., team, project, and/or organizational level) (Lvina et al., 2018; Rezvani et al., 2018). Moreover, because project teams must deal with specific challenges compared with other types of teams (e.g., high time, budget, and goal constraints) (Cohen & Bailey, 1997), an integrated, cogent framework for project team performance measurement becomes critical to strengthening the theory and practice of project team performance.

To address this issue and create robust knowledge and insight on managing project teams effectively, we conducted a systematic literature review aimed at: (1) organizing the state-of-the art, (2) providing a comprehensive conceptualization of project team performance measurement, and (3) showing new avenues to strengthen theory building. To be comprehensive, our review spanned over three decades (1990-2021). We searched high-impact academic management journals (the highest third percentile of the Web of Science database) and content-analyzed 139 studies containing project team performance as a dependent variable. We then used an inductive approach to synthesize the literature and, building upon the performance measurement design literature (Lebas, 1995; Richard et al., 2009) and the Input-Mediator-Outcome (IMO) model of team effectiveness (Ilgen et al., 2005; Mathieu et al., 2008), we propose a theoretical framework that organizes project team performance measures around two axes. The first axis refers to the nature of performance, which can be focused on *efficiency or effectiveness* (Bourne et al., 2003; He et al., 2022; Micheli & Mari, 2014). The second axis refers to the nature of the measure, which can be *tangible or intangible* (He et al., 2022; Nogeste & Walker, 2005; Rosen & Dietz, 2017). By combining these two axes, we propose a 2x2 structure for project team performance

measurement composed of four dimensions: (1) project team processes, (2) project team emergent states, (3) project team tangible outcomes, and (4) project team perceptual benefits.

Our framework integrates a wide variety of measures and measurement approaches, offering an integral and comprehensive understanding of project team performance. Accordingly, our theoretical contribution is twofold. First, we provide insight on how to approach and measure project team performance considering the complexity of the current working environment. Second, we offer an integrated framework for organizing the literature on project team performance measurement, thus advancing the knowledge base of the field by providing a robust foundation for theory building. From a practical standpoint, our study can help practitioners to better understand the nuances of project team performance measurement and provide an evidence-based, actionable framework that enables choosing a measurement system that is well suited to managing a wide variety of project teams.

2 THEORETICAL BACKGROUND

Project management is the business process of producing a unique product or service with a specific date for completion, a budget limit, and a set of preordained goals that should fulfill the expectations of various stakeholders and deliver business value (Project Management Institute, 2021; Scheepers et al., 2022). Thus, managing a project involves measuring activities that are temporary in nature, goal-oriented, and contingent on the project scope (i.e., budget, quality, or expected results). Project teams are essential to complete projects successfully (Liu & Cross, 2016). However, little is known about the characteristics of a measurement system that would enable project teams to set structural (i.e., measurement rules, procedures, and standards) and behavioral elements (i.e., affective or relational elements that govern individual and collective action) that could help the project goals to be achieved efficiently and effectively

(Rosen & Dietz, 2017; Varajão et al., 2022). The subsequent section describes the foundational concepts of performance measurement and project team performance measurement that lay the theoretical ground for our study.

2.1 Performance measurement

Performance measurement has long been recognized as a core issue for managing organizations (Bititci et al., 2012; Demartini & Taticchi, 2022; Richard et al., 2009). The literature reveals that the origins of the discipline can be traced back to the industrial age (early 1900s). However, its conceptual evolution took place in the 1990s, when the work of separate disciplines (primarily operations, strategy, and accounting) converged into a shared understanding of the topic (Bititci et al., 2012; Lebas, 1995; Neely et al., 1995). This process established key terms to provide a better foundation for performance measurement research (Bititci, 2015). Table 1 summarizes these key terms.

Table 1. Key terms of performance management research. Source: Bititci (2015).

Concept	Definition
Performance	"The efficiency and/or effectiveness of an action" (p. 17).
Performance measure/indicator/metric	"The qualitative or quantitative assessment of the efficiency and/or the effectiveness of an action" (p. 17).
Effectiveness	"The extent to which the result of an action meets our expectations/requirements/specifications" (p. 17).
Efficiency	"The amount of resources the action consumes to deliver the result/output" (p. 17).
Performance measurement	"The process of collecting, analyzing and reporting information regarding the performance of an action" (p. 17).
Performance measurement system	"The process (or processes) of setting goals, developing a set of performance measures, collecting, analyzing, reporting, interpreting, reviewing, and acting on performance data" (p. 17).
Performance management	"The use of performance measurement systems to manage the performance of an organization" (p. 25).

The theoretical foundation of performance measurement research lies in cybernetics and control systems theory (Bititci et al., 2018; Okwir et al., 2018), in which organizations are described as dynamic entities that operate in—and interact with—a constantly changing environment (von Bertalanffy, 1968; March & Simon, 1993). Under this view, organizations transform inputs (e.g., information and materials) into outputs (e.g., products and services), an action that consumes resources (e.g., time, money, and equipment) and requires *controls* to set expectations, establish rules/boundaries for action, monitor organizational processes and outcomes, and guide decision making (Bititci et al., 2018; Simons, 1994; Tessier & Otley, 2012). Over the years, theoretical perspectives approaching the phenomena have expanded with the growing number of publications, but concerns remain regarding the theoretical immaturity of the field (Bititci et al., 2018; Franco-Santos et al., 2012). For example, it has been argued that there is a lack of a meta-theory of performance measurement and management (Bititci et al., 2018), and that research has not kept pace with the evolution of business models that prioritize temporal (ad-hoc) organizing structures that foster learning, flexibility, and better integration of technology (Bititci et al., 2012; Demartini & Taticchi, 2022). In this study, we partly address this challenge by studying project teams, which are temporal (ad-hoc) organizational units that are increasingly important in modern organizations (Darino et al., 2019; Geraldi & Söderlund, 2018; Kaufmann et al., 2020).

2.2 Project team performance measurement

Team performance has been conceptualized as the taskwork (i.e., tasks each member performs without the input from another member) and teamwork processes (i.e., actions that team members perform together) that teams carry out to achieve their collective goals (Hackman, 1990; Salas et al., 2008). Team performance measurement thus refers to the holistic assessment

of how different aspects of team functioning (e.g., teamwork and taskwork activities) lead to the desired team outcomes, that is, the efficiency and effectiveness of the team actions (Rosen & Dietz, 2017). Although this definition applies to most types of teams, Kendall & Salas (2004) suggested that team performance measurement should be customized to the type of teams that one intends to study, as measures of performance assessment can vary depending on both the task and the contextual features teams need to manage.

Project management literature suggests that project teams, regardless of the business sector they work in, share enough commonalities to treat them as a type of team that can use common performance measures (Cohen & Bailey, 1997; Project Management Institute, 2021). Indeed, most projects tend to measure "The Iron Triangle" of project success (i.e., cost, time, and quality) (Atkinson, 1999; Zheng et al., 2019), and the working context places similar demands upon them, such as high uncertainty, interdependence, and emotional demands (Cohen & Bailey, 1997; Pavez et al., 2021; Walker et al., 2017). Thus, project team performance is influenced by the quality of taskwork and teamwork under time, budget, and goal constraints.

Due to these constraints, project teams tend to focus on operational issues and divert their attention from the project's business goals, causing what has been recognized as a *paradox* in project performance; namely, finishing the project on time, within budget, and with the desired quality might lead to disappointing business results (Shenhar et al., 2001; Zheng et al., 2019). The literature on performance measurement explains this *paradox* (in part) by looking at how measurement systems affect people's behavior, because the features of performance structures (e.g., focus on control/learning, or past/future orientation) influence how people make decisions and act (Bititci, 2015; Franco-Santos et al., 2012; Varajão et al., 2022).

Building on recent literature on project performance, and performance measurement and management, we suggest that a deeper understanding of project team performance measurement can help advance theoretical knowledge in four important domains relevant to project management research: (1) the role of technical and social controls when managing a project team (Huang Chua & Myers, 2018; Laine et al., 2020; Tessier & Otley, 2012); (2) the differential effect of a focus on control versus a focus on learning (Bititci et al., 2012; Chang et al., 2021; He et al., 2022); (3) the tension between measures that focus on description (past-oriented) versus measures that focus on prediction (future-oriented) (Lebas, 1995; Yun et al., 2016; Zheng et al., 2019); and (4) how team performance might contribute to the emergent multidimensional understanding of project performance measurement (He et al., 2022; Shenhar et al., 2001). To address these issues, we conducted a systematic literature review aimed at creating a robust knowledge base and insight on how to manage project team performance effectively and thus help overcome the *paradox* in project performance that remains a pending research issue.

3 REVIEW SCOPE AND METHODOLOGY

Although project team performance has been studied broadly in project management literature, the construct remains elusive and there are no well-established frameworks enabling scholars to achieve a comprehensive understanding of the topic. Thus, we conducted a systematic literature review aimed at (1) organizing the state-of-the art, (2) providing a comprehensive conceptualization of project team performance measurement, and (3) showing new avenues to strengthen theory building. We use an inductive approach to synthesize and analyze the literature (Booth et al., 2016; Tranfield et al., 2003), in order to answer the following research question: *How can project team performance measurement be conceptualized for the contemporary practice of project management?* To do so, we followed a three-step process that

consisted of searching for and selecting appropriate academic journals, choosing the papers to be included in the review, and conducting a careful analysis of them.

3.1 Step 1: Search for and selection of appropriate journals

We began by selecting academic journals containing papers that help answer our research question. We started our search with Web of Science Clarivate Analytics, one of the most widely used scientific databases to conduct systematic reviews and meta-analyses (Aguinis & Glavas, 2012; Calabrò et al., 2019; Nguyen et al., 2018). We conducted the search in top-tier journals belonging to the management category of the Social Science Citation Index (SSCI). We retrieved 226 journals and ranked them by impact factor (year 2020). From the complete list, we selected all journals whose impact factor was equal to or greater than 5.277 to include the highest third (33rd percentile) of journals for our detailed analysis. In addition, we included seven specialized journals that were below the threshold. Five of them focused specifically on teams, project teams, or project management teams (Project Management Journal, Group & Organization Management, International Journal of Managing Project and Business, Small Group Research, and Group Decision and Negotiation), and the other two have a history of publishing high-impact papers related to project teams in management and organizations (Organization Science and Management Science). Specialized journals tend to have lower impact factors than journals of a wider scope, but their inclusion is recommended to ensure a comprehensive review of the topic (Montiel, 2008; Valverde-Berrocoso et al., 2020). As a result, we selected 82 journals for further analysis.

3.2 Step 2: Search for papers (from the 82 selected journals)

We searched for papers within the selected journals—from both the Web of Science and Scopus databases to assure full coverage (Vieira & Gomes, 2009)—using the following search

syntax: (“project team”) or (“project teams”) or (“project management team”) or (“project management teams”). To have a comprehensive view of the evolution of project team performance measurement, the time span for the search was 1990-2021. Our search strategy consisted of searching in the paper’s title, abstract, and keywords, according to the words declared in the search syntax (Booth et al., 2016). From this search we retrieved 722 papers, but after checking that keywords were included in the title or abstract, we pre-selected 666 papers. As we were interested in project team performance measurement, we refined our analysis even further, choosing studies in which the project team was the unit of analysis and that used quantitative methods. As a result, we retrieved 335 papers belonging to 40 journals.

3.3 Step 3: Papers containing project team performance measures

To conclude, we tightened the selection criteria to consider papers that only contained performance, success[1], or related measures as dependent variables (e.g., team productivity, team effectiveness, and project completion time), and provided an operational definition of both dependent and independent variables. Papers that used the “team” concept as a context but measured individual performance were discarded. This process led us to retain 139 papers, from 29 journals, for our content analysis. Table 2 describes the number of papers categorized by journal.

Table 2. Number of selected papers by journal

N°	Full Journal Title	Number of papers
1.	International Journal of Project Management	31
2.	Project Management Journal	16
3.	Journal of Product Innovation Management	13
4.	International Journal of Managing Projects in Business	10
5.	IEEE Transactions on Engineering Management	8
6.	Group & Organization Management	8

[1] Extant research has shown a close relationship between project management performance and project success (Mir & Pinnington, 2014).

7.	Small Group Research	7
8.	Information & Management	6
9.	Academy of Management Journal	4
10.	Administrative Science Quarterly	4
11.	Journal of Applied Psychology	3
12.	Journal of Management	3
13.	Journal of Organizational Behavior	3
14.	Organization Science	3
15.	Technovation	3
16.	Management Science	2
17.	Journal of Management Information Systems	2
18.	MIS Quarterly	2
19.	Group Decision and Negotiation	1
20.	Personnel Psychology	1
21.	Research Policy	1
22.	Human Relations	1
23.	International Journal of Human Resource Management	1
24.	Journal of Intellectual Capital	1
25.	Journal of Knowledge Management	1
26.	Journal of Operations Management	1
27.	Long Range Planning	1
28.	OMEGA-International Journal of Management Science	1
29.	Asia Pacific Journal of Management	1
Total		**139**

4 FINDINGS

We began our analysis by exploring whether a multidimensional conceptualization of project team performance actually existed, as this is a matter of current debate within the field (He et al., 2022; Liu & Cross, 2016). We found that scholars used different measures when conceptualizing and operationalizing project team performance, finding support for the notion that project team performance can be understood using a multidimensional approach. Based on extant research in the fields of performance measurement (Lebas, 1995), organizational performance (Richard et al., 2009), project performance/success (He et al., 2022; Lauras et al., 2010; Pinto et al., 2022), and team performance (Rosen & Dietz, 2017), we organized our

findings according to three categories: (1) level of analysis, (2) focus of measurement (efficiency and/or effectiveness), and (3) nature of the measure (tangible and/or intangible).

4.1 Levels of analysis

A major challenge for organizing the literature on project team performance is that team performance and project performance are closely intertwined. Therefore, we started our analysis by classifying project team performance measures into the three levels of analysis used by scholars to operationalize the construct: (1) team, (2) project, and (3) organization. Table 3 provides a comprehensive summary of our findings, including levels of analysis, performance domains, performance measures, methods of measurement, and the number of papers reporting each of the performance measures described in the review.

Approximately 47% of the total number of papers reviewed (65) assessed performance at the team level, using 20 performance measurement constructs. In line with previous research (Mathieu et al., 2008; Rosen & Dietz, 2017), we found that team-level performance measures not only addressed team-level targets (e.g., quality or productivity), but also team performance behaviors (e.g., team learning) and team psychological states (e.g., team satisfaction) (Chang et al., 2021; Gevers & Peeters, 2009; Zhang & Guo, 2019). To organize the performance measures identified in our review, we used the team effectiveness framework (Mathieu et al., 2008), which identifies three performance domains: team processes, team emergent states, and team outcomes (see Table 3).

Compared with team-level outcomes, the project level of analysis represents the extent to which a project (as a whole) achieves targeted goals efficiently and effectively (He et al., 2022; Lauras et al., 2010). We found 32 constructs that measure project-level performance in 81 papers (58% of the total reviewed). Consistent with previous studies, 60 papers included at least one of

the metrics considered in the "The Iron Triangle" of project success (i.e., cost, time, and quality)—either as a direct measure or as an item in the scales of project performance/success (Liu & Cross, 2016; Stephens & Carmeli, 2016; Suprapto et al., 2015), and only a few studies discussed issues beyond the scope of those measures, such as safety, functionality, or knowledge (Bond-Barnard et al., 2018; Günsel & Açikgöz, 2013; Suprapto et al., 2015). A number of studies (19 papers) assessed stakeholder and customer satisfaction when measuring project-level performance, indicating the growing demand for project teams to include performance measures that can help assess the increasing complexity of the project environment (Project Management Institute, 2021; Walker et al., 2017). To organize the measures identified in our review, we used four performance domains that were identified by the 7th Edition of the PMBOK (Project Management Institute, 2021) and which fit into the scope of our research: planning, stakeholders, project work, and delivery (see Table 3).

Finally, 11 papers (8% of the total reviewed) assessed team performance using organizational-level metrics. These studies measure the impact of a project team's work beyond the boundaries of the project and focus on evaluating organizational-level outcomes (Keller, 2006; Omta et al., 1994). These studies include indicators such as profits, earnings, growth rate, and commercial/market success (Cronin et al., 2011; Keskin, 2009; Omta et al., 1994). In terms of research design, studying organizational-level outcomes requires a longer period to collect and analyze this type of data. Thus, it may be more difficult to assess project performance at this level of analysis. To organize the performance measures identified in our review, we used the organizational performance domains proposed by Hamann et al. (2013): profitability, growth, and operational performance (see Table 3).

Table 3. Performance measures by level of analysis

Level of analysis	Performance domain	Performance measure	Method of measurement (self-report or objective data)	Number of papers
Team level	Team processes	Team learning	Self-report	4
		Team performance behaviors	Self-report	2
		Teamwork effectiveness	Self-report	1
		Team ability to deal with risk	Self-report	1
	Team emergent states	Team satisfaction	Self-report	2
		Team working spirit	Self-report	1
		Team leadership	Self-report	1
		Team appreciation	Self -report	1
		Team commitment	Self-report	1
	Team outcomes	Speed-to-market	Self-report & Objective data	7
		Team effectiveness	Self-report	5
		Team innovative performance	Self-report	3
		Team productivity	Objective data	2
		Team task performance	Self-report	2
		Team efficiency	Objective data	1
		Satisfaction with performance	Self-report	1
		Knowledge management performance	Self-report	1
		Task output creativity	Self-report	1
		Impact on team	Self-report	1
		Overall team performance	Self-report	38
Project level	Planning	Adherence to schedule	Self-report	6
		Project duration or schedule performance	Objective data	6
		Development cost	Self-report	4
		Project cost	Objective data	4
		Cost overruns	Objective data	2
		Adherence to budget	Self-report	2
		Schedule overruns	Objective data	2
	Stakeholders	Customer/client satisfaction	Self-report	8
		Impact on client	Self-report	2
		Stakeholder satisfaction	Self-report	1
	Project work	Project efficiency	Self-report	11
		Project productivity	Objective data	2
		Project effectiveness	Self-report	2
		Operational effectiveness	Self-report	2
		Product development time	Self-report	1
		Development speed	Self-report	1
		Preparation for the future	Self-report	1
		Knowledge integration and innovation	Self-report	1
		Knowledge asset accumulation	Self-report	1
		Project closing efficiency	Self-report	1
	Delivery	Project quality	Self-report	8
		Product success	Self-report	7
		Product quality	Self-report & Objective data	5
		Project profit	Objective data	2
		Project investment success	Self-report	1

		Safety	Self-report	1
		Product (software) functionality	Self-report	1
		Product entry timeliness	Self-report	1
		Product novelty	Self-report	1
		Product creativity	Self-report	1
		Organizational strategic value integration	Self-report	1
		Overall project performance/success	Self-report	37
Organizational level	Profitability	Profit	Objective data	3
		Business success	Self-report	3
		Earnings	Objective data	1
		Return on investment (ROI)	Objective data	1
	Growth	Commercial/Market success	Self-report	4
		Growth rate	Objective data	1
		Length of development	Objective data	1
		Number of patents	Objective data	1
	Operational performance	Benefits to customers	Self-report	1

Notes:
1. This table provides a summary of the constructs reported in our review at different levels of analysis. When different authors approached the same underlying concept but used different names, those constructs were merged. The complete list of the authors that measure the constructs presented in this table, including their operational definition, can be found in Appendix B.
2. Given that a large number of authors assessed Team Performance and Project Performance/Success as overarching constructs, we provide a detailed description of how these constructs were measured in Appendix B, Table B.2 and Table B.4.
3. Note that one paper can report several measures.

A deeper analysis of how studies conceptualized and operationalized project team performance led us to discover two patterns within the data. First, as suggested by theory (see Table 1) (Bititci, 2015; Neely et al., 1995; Rosen & Dietz, 2017), we found that performance measures addressed both the efficiency and effectiveness of the project team's work. Second, in line with recent debates on the nature of performance (Bititci et al., 2012; He et al., 2022; Micheli & Mari, 2014), we found that authors use both tangible and intangible measures to assess project team performance.

4.2 The focus of measurement: Efficiency and effectiveness

A clear pattern within the data was a dual focus on both project team efficiency and effectiveness (Hoegl & Gemuenden, 2001; Liu & Cross, 2016). Effectiveness-oriented measures refer to the degree to which a team achieves its goals or whether the results of team activity meet

the expectations of different stakeholders (Salas et al., 2008; Scheepers et al., 2022). These types of measures include financial metrics (e.g., sales and profits) (Hsu et al., 2016; Omta et al., 1994), time-related indicators (e.g., project schedule and duration) (Maruping et al., 2015; Rauniar et al., 2019), goal achievement (Lai et al., 2018), quality metrics (Gopal et al., 2011; Ramasubbu et al., 2015), long-term benefits (e.g., preparation for the future) (Araujo et al., 2022), and client/stakeholder satisfaction metrics (Gardner, 2012; Serrador & Pinto, 2015).

Efficiency-oriented measures refer to the team's ability to accomplish its objectives (e.g., budget, time, and quality goals) with optimal—or minimal—use of resources (e.g., money, time, or human effort) (Liu & Cross, 2016). Efficiency measures include metrics such as team efficiency (Unger-Aviram et al., 2013), team productivity (Young-Hyman, 2017), and team innovative performance (Liu & Cross, 2016). We observed that researchers provided balanced attention to team efficiency (process/behavior) and effectiveness (outcomes), but their focus differed between studies. In general terms, 64 studies involved effectiveness-oriented metrics only, 48 studies involved efficiency-oriented metrics only, and 27 studies involved both effectiveness and efficiency measures.

4.3 The nature of measurement: Tangible and intangible measures

Finally, we found that researchers measure project team performance using both tangible and intangible measures (de Rooij et al., 2019; Lai et al., 2018). These two types of measures are considered essential, complementary, and enduring elements of measurement science, which has historically integrated the "objective/tangible description" as well as the "subjective/intangible evaluation" of the physical and social world as a two-core aspect of measurability (Micheli & Mari, 2014). Tangible measures refer to "quantitative facts," or specific numeric values that are measured against a standard. Therefore, they are usually not subject to distortion, biased

preconceptions, or subjective interpretations (Richard et al., 2009). Examples of tangible measures in our review included cost (Scott-Young & Samson, 2008), profits (Hsu et al., 2016; Keller, 2006; Omta et al., 1994), and number of patents (Omta et al., 1994).

Intangible measures refer to "qualitative perceptions" of performance that are usually operationalized through high/low or agreement/disagreement perception scales (Rosen & Dietz, 2017). Their value is subject to interpretations and can vary depending on how, where, and when they were measured (Richard et al., 2009; Nogeste & Walker, 2005). Examples of intangible measures are quality (Maruping et al., 2015), client/stakeholder satisfaction (Serrador & Pinto, 2015; Unterhitzenberger & Bryde, 2019), and perceived team/project performance (Liang et al., 2012; Rezvani et al., 2018). In our review, 17 studies used tangible metrics, 116 studies used intangible metrics, and six studies involved both tangible and intangible metrics.

5 TOWARD AN INTEGRATED FRAMEWORK FOR PROJECT TEAM PERFORMANCE MEASUREMENT

To make sense of our findings, we carefully reviewed the performance measurement and team performance effectiveness literature to identify a conceptual basis upon which to organize the state-of-the art, provide a better conceptualization of project team performance measurement, and offer new avenues to strengthen theory-building. Recent organizational and management research suggests that a performance measurement framework should consider (at least) three elements: (1) performance measurement purpose, (2) performance measurement principles, and (3) performance measurement dimensions (Bititci et al., 2012; He et al., 2022; Lebas, 1995; Richard et al., 2009). Therefore, we organized our findings around these elements and built an integrated framework of project team performance measurement composed of three pillars: purpose, principles, and dimensions.

5.1 Pillar 1: Purpose of project team performance measurement

Performance measurement requires answering two basic questions: (1) why do we want to measure? And (2) what do we want to measure? (Lebas, 1995). The first question seeks to clarify the purpose of a measure. Clarifying the purpose is important because measures are not objective or externally defined, but the result of a choice (implicit or explicit) carried out with intent (Bititci et al., 2018; Micheli & Mari, 2014). Lebas (1995) points out three reasons to measure performance. First, we use performance measures to assess where we have been. Second, performance measurement should help evaluate current performance with respect to the objectives we want to achieve. Third, performance measurement should support the definition of objectives and targets that we want to accomplish in the future.

A robust measurement system combines accomplishing these three complementary purposes by structuring measurement systems that make it possible to (1) support the activities of budgeting and planning, (2) encourage continuous improvement through feedback loops that indicate whether objectives have been achieved or not, and (3) provide information to feed reward systems that stimulate productive behaviors—in the present and the future (Franco-Santos et al., 2012; He et al., 2022; Lebas, 1995). Based on the findings of our study, we define the purpose of project team performance measurement as *providing information that helps a project team make timely decisions related to planning, budgeting, monitoring, controlling, and improving the execution of a project, as well as assessing the team's overall success.*

The second question addresses the basic concept of performance, as it indicates what the project team needs to measure to accomplish its purpose. Thus, it invites us to think about an operational definition of performance consistent with the purpose for which it was designed (Bititci, 2015; Lebas, 1995). Building upon our findings, we define project team performance as

the capability of a project team to perform interdependent activities (e.g., productive behaviors, processes, and interactions) that help reach its objectives efficiently and effectively.

5.2 Pillar 2: Principles of project team performance measurement

A proper understanding of project team performance needs to be grounded in theoretical principles that can support the *purpose* of project team performance measurement (Lebas, 1995). The study of performance in organizations has highlighted two important principles that need to be considered when approaching performance from a theoretical standpoint (Richard et al., 2009). First, a strong rationale on the nature of performance needs to be established, that is, what measures appropriately accomplish the performance purpose—Principle 1. Second, a strong rationale on the nature of measures must be established, that is, what types of measures can be combined and the methods to do so—Principle 2.

Based on our proposed purpose and definition (see Pillar 1), we suggest addressing Principle 1 by acknowledging the general orientation of a project team performance measure, which can be focused on *efficiency* or *effectiveness* (Bititci, 2015; Liu & Cross, 2016; Neely et al., 1995). Having clarity on this dual focus can enable project teams to do well on the "How" (efficiency) and the "What" (effectiveness) of project team performance. Namely, taking timely decisions related to planning, budgeting, monitoring, controlling, and improving the execution of project team activities (efficiency), as well as assessing the team's overall success (effectiveness).

Principle 2 invites the identification (or definition) of the nature of the measure and its relationship with measurement methods or tools. Our findings suggest two types of measures that, combined, can provide an integral understanding of project team performance measurement. The first type corresponds to *tangible measures* or "quantitative facts" (e.g., cost deviation or

number of errors) (He et al., 2022; Nogeste & Walker, 2005; Richard et al., 2009). The nature of this measure means project teams (or researchers) would need a reliable method to gather data that makes it possible to build performance indicators. The second type corresponds to *intangible measures* or "qualitative perceptions," which implies the use of perception scales aimed at assessing performance as a latent construct (e.g., client satisfaction or team commitment) (Bititci, 2015; He et al., 2022; Micheli & Mari, 2014). These types of measures require the use of scales that assign numerical values to people's subjective perceptions (e.g., 7-point Likert scale). These measures enable project teams to move beyond measurable facts and understand how a team's cognitive, motivational, and effective states influence team behavior (Mathieu et al., 2008; Rezvani et al., 2018; Salas et al., 2018). In the following section, we explain how these two principles can be combined to propose a four-dimension framework for project team performance measurement.

5.3 Pillar 3: Dimensions of a project team performance measurement framework

When multiple criteria for performance measures are employed, it can be difficult for a project team to monitor progress and reach the desired objectives efficiently and effectively (Beal et al., 2003; Hoegl & Gemuenden, 2001; Liu & Cross, 2016). Thus, it is important to provide clear measurement systems that can aid project teams in organizing their efforts and optimizing their working energy (de Rooij et al., 2019; Rosen & Dietz, 2017).

5.3.1 The Input-Mediator-Outcome (IMO) model of team effectiveness

To guide our theoretical development, we searched for theories or theoretical frameworks that helped us integrate the evidence we gathered from the systematic literature review. We based the selection of the theoretical framework on three criteria. First, it must help to accomplish the purpose of project team performance measurement that we previously defined

(Lebas, 1995). Second, it should have the ability to integrate the two theoretical principles of performance measurement design that we adopted as the second pillar of our framework (i.e., nature of performance and nature of measures) (Richard et al., 2009). Third, it must have the capacity to subsume the reviewed empirical evidence on project team performance (Booth et al., 2016; Goodson & Morgan, 1976).

After a rigorous search and analysis, we chose the IMO model of team effectiveness (Ilgen et al., 2005; Mathieu et al., 2008; McGrath, 1964) as our theoretical framework. This model builds on the notion of complex adaptive systems to understand team effectiveness in terms of inputs, mediators, and outcomes. *Inputs* describe antecedent factors that enable and/or constrain team members' interactions, such as individual member characteristics, team-level determinants (e.g., task structure), and organizational and contextual factors (e.g., organizational structure and contextual complexity) (Cohen & Bailey, 1997; Mathieu et al., 2008). Inputs affect (or drive) two types of *mediators,* named team processes and emergent states[2] (Marks et al., 2001; Waller et al., 2016), which describe how team inputs transform into outcomes or how efficient is a team at accomplishing its objectives. Finally, *outcomes* are the results and/or by-products of team processes, actions, cognitions, and behaviors (Ilgen et al., 2005; Mathieu et al., 2008). They can include performance indicators (e.g., profits or sales) as well as perceptions of results, such as team impact, and team viability (Mathieu et al., 2008).

The IMO model helped us address the purpose of project team performance measurement we proposed (Pillar 1) by explaining the mechanisms by which a project team can achieve its goals. These mechanisms are also closely aligned with the two principles of performance

[2] Emergent states are defined as "cognitive, motivational, and affective states of teams … that are dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (Marks et al., 2001, p. 357). The integration of emergent states into the theory of team effectiveness expanded the input-process-outcome (IPO) model of team effectiveness (McGrath, 1964) into the IMO model used in this paper (Ilgen et al., 2005; Mathieu et al., 2008).

measurement design proposed as Pillar 2 in our framework: the nature of performance (Principle 1) and the nature of measures (Principle 2).

By differentiating between mediators and outcomes, the IMO model helps to clarify the nature of team performance (Principle 1), which involves team efficiency (conceptualized as team processes and emergent states) and team effectiveness (conceptualized as team outcomes) (see Table 3). In addition, the IMO model implicitly integrates Principle 2 (nature of measures), as it includes tangible and intangible measures for both team mediators and outcomes (Mathieu et al., 2008). In the case of team mediators, the IMO model distinguishes between team processes and emergent states (Marks et al., 2001), team processes being a tangible measure of team interactions (i.e., members' actions) and team emergent states an intangible measure of the cognitive, motivational, or affective states that influence members' behaviors (Waller et al., 2016). In the case of outcomes, the IMO model also differentiates between tangible and intangible outcomes. Team tangible outcomes include quantifiable variables such as profit, earnings, and cost overruns (Cronin et al., 2011; Hsu et al., 2016; Rai et al., 2009), whereas intangible outcomes include perceived benefits of team results, such as client satisfaction and team innovative performance (Jiang & Chen, 2018; Rauniar et al., 2019).

Using the IMO model as a theoretical basis, we elaborate an integrated framework of project team performance measurement that is organized around two axes. The first axis (encompassing Principle 1) relates to the nature of performance, which focuses on efficiency or effectiveness. The second axis (encompassing Principle 2) relates to the nature of the measure, which can be tangible or intangible. By juxtaposing these two axes, we propose a multidimensional 2x2 structure of project team performance measurement that consists of four

quadrants: (1) project team processes, (2) project team emergent states, (3) project tangible outcomes, and (4) project perceptual benefits. Figure 1 shows a summary of our framework.

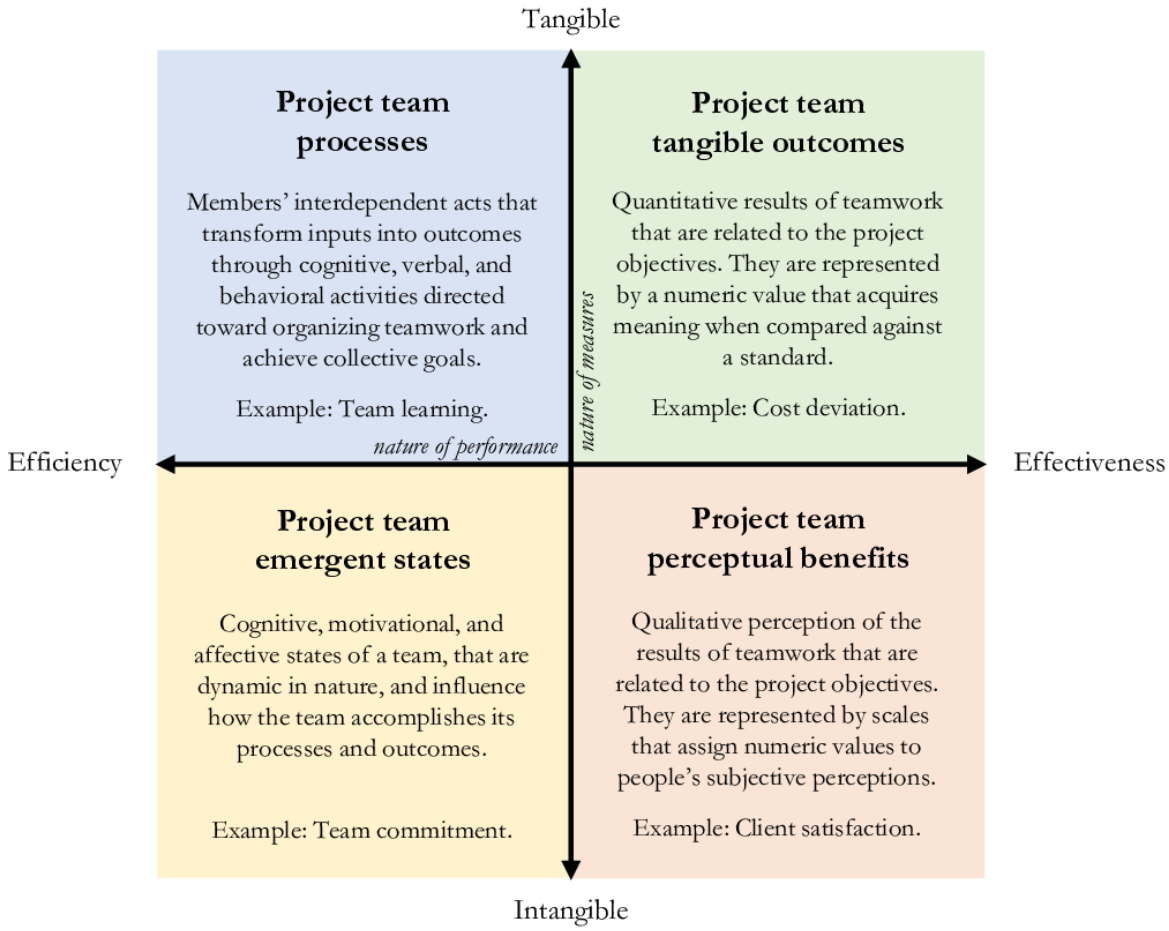
Pillar 1: Purpose	Providing information that helps a project team make timely decisions related to planning, budgeting, monitoring, controlling, and improving the execution of a project, as well as assessing the team's overall success.
Pillar 2: Principles	Principle 1: A strong rationale on the *nature of performance* (i.e., which measures are appropriate to accomplish the performance purpose). Principle 2: A strong rationale on the *nature of measures* (i.e., which types of measures can be combined and the methods to do so).
Pillar 3: Dimensions	

Figure 2. The integrated framework for project team performance measurement

5.3.2 Quadrant 1: Project team processes

Project team processes refer to members' interdependent acts that transform inputs into outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork and achieving collective goals (Marks et al., 2001). Team processes represent the means by which project team members work interdependently and use different resources (e.g., expertise, equipment, time, and money) to reach meaningful outcomes both for the team and project, such as profits, return on investment, and client satisfaction (Hsu et al., 2016; Keller, 2006; Zaman et al., 2021). In a project-based environment, team processes involve observable (or tangible) activities like planning, budgeting, monitoring, controlling, and improving the execution of a project. These activities require that project team members execute production tasks, coordinate their work, solve conflicts, and manage the team climate (Bain et al., 2001; Liu & Cross, 2016; Tabassi et al., 2019). Therefore, performance measures allocated in this quadrant should help assess and monitor how efficient the team is when working to accomplish project milestones, by-products, and outcomes. Examples of measures that can be useful for project teams in this quadrant are reliability of commitments, accuracy of plans, and number of unresolved conflicts with project parties (Jitpaiboon et al., 2019; Liu & Cross, 2016; Rezvani et al., 2018). In our review, project team processes have been measured using the following variables: team learning (Jetu & Riedl, 2013), team performance behaviors (Jiang et al., 2012), teamwork effectiveness (Bourgault et al., 2008), and team ability to deal with risk (risk assumption) (Thamhain, 2004). Given that team processes are observable behaviors (i.e., tangible in nature), it is preferable to measure them using tangible measures. However, most constructs were operationalized using perceptual scales, which provides an opportunity for future research to improve the assessment of these types of performance measures.

5.3.3 Quadrant 2: Project team emergent states

Project team emergent states refer to cognitive, motivational, and affective states of a team that are dynamic in nature and influence how the team accomplishes its processes and outcomes (Marks et al., 2001). Emergent states include collective psychological (or intangible) team phenomena, such as collective cognition (e.g., psychological safety), collective affect (e.g., team's affective tone), or other relatively enduring properties, such as team trust, team identity, and team cohesion (Ilgen et al., 2005; Mathieu et al., 2008). Team emergent states are important because they exert a downward influence on lower-level dyadic interactions, which shape and constrain individual behavior and members' interactions (McGrath et al., 2000; Waller et al., 2016). For instance, a high level of team trust may increase the probability of personal disclosures and feedback-seeking behaviors among team members. Consequently, team emergent states affect the efficiency of team processes by driving either productive or unproductive behaviors. Emergent states have become increasingly important in the literature on teams in organizations (Mathieu et al., 2017; Rapp et al., 2021). In line with this trend, our study shows that measures of project team emergent states have been increasingly used by scholars, especially in the last decade. These measures include team commitment (Thamhain, 2004), team working spirit (Jetu & Riedl, 2013), team leadership (Jetu & Riedl, 2013), team appreciation (Zhang et al., 2018), and team satisfaction (Zhang & Guo, 2019).

5.3.4 Quadrant 3: Project team tangible outcomes

Project team tangible outcomes refer to the results of teamwork that can be quantitatively measured and associated with the team's (or other project stakeholders') objectives. Examples of tangible outcomes in a project-based setting are profits, sales, earnings, and, of course, "The Iron Triangle" of project success (i.e., cost, time, and quality). These types of measures do not

consider the factors leading to performance (e.g., quality of team plans and team cohesion). Thus, these measures should be complemented by causal or efficiency measures, such as those related to team processes and emergent states (Mathieu et al., 2008). These types of outcomes were not so frequently reported by scholars in the review (only 18 studies), but they showed the highest level of agreement in terms of how they are operationalized. The most commonly used measures were: cost (Scott-Young & Samson, 2008), cost overruns (Rai et al., 2009), project duration (or completion time) (Reagans et al., 2004), schedule overruns (Maruping et al., 2019), productivity (Avgerinos et al., 2020; Young-Hyman, 2017), profit (Keller, 2006; Omta et al., 1994), earnings (Cronin et al., 2011), and return on investment (Hsu et al., 2016).

5.3.5 Quadrant 4: Project team perceptual benefits

Project team perceptual benefits refer to the qualitative perception of outcomes associated with the team's (or other project stakeholders') desired objectives. They are represented by latent constructs/variables (usually measured using Likert-type scales) that are aimed at capturing the intangible results delivered by project teams. Examples of perceptual benefits in a project-based setting are the perceived quality of the final product, client/stakeholder satisfaction, and fulfillment of specifications (Lee et al., 2011; Stephens & Carmeli, 2016; Unger-Aviram et al., 2013). As with tangible outcomes, these measures are usually beyond the direct control of the team and must be complemented by causal or efficiency measures. Importantly, in the absence of direct measures of project team tangible outcomes, most scholars have measured project performance/success (e.g., time, cost, and quality) using a composite score built upon participants' perceptual evaluations (e.g., Keller, 2006; Suprapto et al., 2015).

Similar to project team tangible outcomes, some general agreement exists about the perceptual measures that need to be assessed as project team outcomes, such as the fulfillment of

project objectives, project quality, and customer satisfaction. However, there is no agreement on how to measure those concepts (i.e., different scales are used by scholars to measure similar constructs) and an even wider variety of potential outcomes exists (e.g., innovation, functionality, safety, and stakeholder satisfaction—see Table 3, and Appendix B). The most common measures were: overall project performance/success (Aalbers et al., 2016; Bechtel et al., 2021; Bhatti et al., 2021), quality (Haas, 2006a; Maruping et al., 2019), stakeholder satisfaction (Serrador & Pinto, 2015), customer/client satisfaction (Rai et al., 2009; Rauniar et al., 2019), and product success (Akgün et al., 2006, 2008, 2010).

6 IMPLICATIONS FOR THEORY AND PRACTICE

Every project is a temporary endeavor, with unique content and scope, undertaken to deliver value to the strategy and business objectives of a firm (Project Management Institute, 2021). Thus, project team performance—in contrast to other types of teams—is severely affected by time, budget, and goal constraints (Cohen & Bailey, 1997). Since performance measurement is key to managing teams effectively (Bititci, 2015; Rosen & Dietz, 2017), we seek to extend the theory and practice of project team performance by answering the following research question: *How can project team performance measurement be conceptualized for the contemporary practice of project management?* In response, we organized the state-of-the art on project team performance measurement through careful analysis of the concept over the last three decades. As a result, we propose a framework that summarizes and synthesizes the purpose, principles, and dimensions of the current understanding of project team performance measurement research (see Figure 1). In this section, we describe the meaning of these findings for both theory and practice.

6.1 Implications for theory

An unresolved puzzle in the field of project performance management is what we have identified as a *paradox* in project performance; namely, finishing the project on time, within budget, and providing quality may lead to disappointing business results (Shenhar et al., 2001). Studying project team performance measurement can contribute to this debate by investigating how the structure of project measurement systems motivates, drives, or inhibits the performance of project teams, and in turn, project performance (He et al., 2022: Liu & Cross, 2016). Building on recent literature on performance measurement and management research, we organized our theoretical contribution around four topics: (1) multidimensionality of project team performance measurement; (2) technical and social controls; (3) focus on control versus a focus on learning; and (4) descriptive (past-oriented) versus predictive measures (future-oriented).

6.1.1 Multidimensionality of project team performance measurement

The complex, rich literature on project team performance presented the first important challenge of our study: to make sense of and organize the huge amount of data from the review. Figure 1 captures the richness and complexity of the team performance construct using four dimensions (i.e., project team processes, project team emergent states, project tangible outcomes, and project perceptual benefits), which provide a general categorization of the wide range of measures studied in the literature. The scope of our framework is necessarily general because it seeks to acknowledge and conceptualize the varied, complex, and multidimensional nature of project team performance. The rationale for this decision was to keep the parsimony of the model (Goodson & Morgan, 1976) without losing its capacity to integrate the observed nuances in measurement approaches, such as the varying performance measurement needs of project teams in different industries (e.g., a project in healthcare might need to consider patient satisfaction;

whereas, a project in construction might have to consider the safety of workers). Appendix C shows a summary of the performance measures most consistently used in the literature, which can assist project teams in selecting those to help accomplish the multidimensional nature of their performance.

From a theory-building perspective, we observed that the multidimensionality of project team performance has led scholars to assign different meanings and definitions to measures labeled with the same name, and even use different methods of measurement (e.g., self-report, observation, or objective data) to capture the same underlying concept. This issue may be related to the "theoretical immaturity" of the performance measurement field (Bititci et al., 2018; Franco-Santos et al., 2012), but it also demonstrates the need for more attention to defining and/or clarifying constructs/variables that can help build a stronger theory of project team performance measurement. An exception to this issue relates to tangible outcomes, wherein a higher degree of agreement has been reached by scholars in terms of relevant measures for assessing project performance (e.g., time, cost, profit, return on investment, and earnings) and how to operationalize them (Atkinson, 1999; Cronin et al., 2011; Young-Hyman, 2017).

6.1.2 Technical versus social controls

The theoretical basis of performance measurement is strongly anchored in organizational and management control theories emerging from general systems theory (Bititci, 2015; Bititci et al., 2018; Okwir et al., 2018). The initial emphasis of these theories was put on exerting control through the use of the rational, planned, and structural elements of the organization (e.g., rules, guidelines, codes of practice, or procedures), but this emphasis has shifted over the last two decades to include social, cultural, and relational elements (e.g., purpose, values, and social norms) (Bititci, 2015; Tessier & Otley, 2012). These two approaches to organizational control

have been labeled as *technical* and *social*, in order to acknowledge their different focus and contribution to performance measurement and management research (Smith & Bititci, 2017). Technical controls focus on setting rules, procedures, and standards aimed at specifying how tasks should be performed and how individuals and groups should be organized to accomplish day-to-day activities (Tessier & Otley, 2012). Social controls, on the other hand, appeal to the affective or non-rational elements that govern both individual and collective behavior. They refer to core values, symbols, beliefs, and social norms, which relate to the (inter)subjective experience of individuals (Simons, 1994). Technical and social controls are theorized as two separate but interdependent—and complementary—components of performance measurement and management (Bititci, 2015), and many researchers advocate using them in tandem to achieve more reliable outcomes (Beer & Micheli, 2017; Okwir et al., 2018; Smith & Bititci, 2017).

In our review, project team performance research has put a greater emphasis (historically) on technical rather than social controls, which contradicts current trends in the performance measurement literature (Bititci et al., 2018; Demartini & Taticchi, 2022). The reviewed papers present a combination of performance measures that acknowledge the complexity of projects. However, few insights are offered on how the combination of technical and social controls can be leveraged to improve both project team and project performance. Recognizing this problem, and in line with current trends in the field (Bititci et al., 2018; Demartini & Taticchi, 2022), our integrative framework recognizes both forms of control, providing a comprehensive perspective of the control mechanisms that are available for project teams (Laine et al., 2020; Simons, 1994; Tessier & Otley, 2012). In fact, we grant a special place in our model to team processes and emergent states as important dimensions of project team performance measurement (i.e., social controls), as they address the affective, cognitive, and behavioral components that can be

managed by a team to improve its performance (Mathieu et al., 2008; Rezvani et al., 2018). Consequently, our framework not only addresses the recent call for balancing technical and social controls, but offers important insights on how to improve the measurement of social controls in a project team context. In doing so, we integrated the often-neglected issue of the use of social controls in project management research, offering the possibility of developing more robust theory in this emergent field of knowledge (Bititci et al., 2018; Huang Chua & Myers, 2018; Laine et al., 2020).

6.1.3 Focus on control versus focus on learning

Performance measurement and management literature has recognized that performance measurement systems can have enabling or constraining roles in organizations (Simons, 1994; Tessier & Otley, 2012). These two roles have been related to how performance measurement systems impact employees' attitudes, which can be positive and negative depending on whether the system *enables* employees to enhance task execution and learning (i.e., positive impact) or *constrains* employees' efforts through control mechanisms that focus on assuring compliance (i.e., negative impact) (Adler & Borys, 1996). In modern organizations, there is increasing demand to develop business models that give priority to organizing structures that foster learning and flexibility (Bititci et al., 2012; Demartini & Taticchi, 2022). Thus, performance measurement systems are expected to have an *enabler* effect on employees to foster dynamic organizational capabilities (Bititci, 2015). That is, the ability of an organization to build, integrate, reconfigure, recombine, and exploit its existing resource base—efficiently and effectively—in rapidly changing environments (Eisenhardt & Martin, 2000; Teece et al., 1997).

In a project-based setting, dynamic capability-building is anchored in the learning capacity of project teams, which refers to the ability of acquiring technical, relational, and

managerial knowledge and skills that are required to design, establish, and execute successful projects (Davies & Brady, 2016; Zerjav et al., 2018). Through this process, project teams can create, and embody in an organization, project management practices that contain knowledge (both tacit and explicit) on how to set up and execute projects (Brady & Davies, 2004), helping to explore and develop (new) skills to deal with the changing and uncertain conditions of a project environment (Davies & Brady, 2016; Huang et al., 2015).

Promoting learning and flexibility in project teams requires *enabling* project performance measurement systems, namely a configuration of performance measures (and practices of performance management) that moves away from coercion and compliance to encourage team learning and development (Bititci et al., 2012; Davenport et al., 2010; Chang et al., 2021). This shift implies that project team performance measurement should embrace not only a combination of technical and social controls, but also relational activities that can help teams develop a culture of trust and respect, accept different views and ideas (i.e., multiple views and multiple truths), explore new ways of working, and encourage dialogue and reflection as an intentional practice (Bititci, 2015; Myers, 2021).

In line with performance measurement research (Bititci et al., 2012; Bititci, 2015; Davenport et al., 2010; Tessier & Otley, 2012), project team performance measurement has been slowly adopting the movement from control (or compliance) to learning and development. This shift is apparent in the increasing number of studies that address project team processes and emergent states as part of the conceptualization of project team performance (see Table 3), as these elements are essential to measuring the cognitive, affective, and behavioral components of teamwork that affect learning (Chang et al., 2021; Kostopoulos et al., 2013; Myers, 2021). Reflecting on this trend (75% of studies reporting learning-oriented measures were published

since 2010), our integrative framework for project team performance measurement can help researchers build a more solid theoretical basis for exploring and understanding how to design *enabling* project team performance measurement systems that, by providing an integral conceptualization of performance, can assist project teams in enhancing their learning capabilities for dealing better with today's dynamic and changing environment (Brady & Davies, 2004; Davies & Brady, 2016; Huang et al., 2015). We believe the shift from a focus on control to a focus on learning in project performance measurement has the potential to become a novel and growing area of research for the field, and more attention is needed to lay a solid theoretical basis for future studies in this area.

6.1.4 Lagging versus leading performance measures (past versus future)

The role of performance measures to assess both past performance and the possibility of achieving future performance goals is a persistent issue in the field of performance measurement and management (Bititci, 2015; Lebas, 1995). To conceptualize these two roles, scholars differentiate between *lagging* and *leading* performance measures, also labeled as *indicators of performance* (or reactive measures) and *determinants of performance* (or proactive measures), respectively (Bititci, 2015; Kerzner, 2017). A lagging performance measure is "a performance indicator that communicates the performance outcome of a past action" (Zheng et al., 2019, p. 534), whereas a leading performance measure is "a performance indicator that could be used to predict the future performance outcome of a process" (Zheng et al., 2019, p. 534). Recent research suggests that most studies are still using lagging performance measures (e.g., time, cost, and quality). Thus, there is a call to adopt a more balanced approach, wherein lagging and leading performance measures are combined to measure the multiple features of project performance (Yun et al., 2016; Zheng et al., 2019).

From a project team perspective, our review confirms these findings, as most measures can be qualified as lagging rather than as leading indicators. Our framework, however, can contribute to advancing knowledge in this area in three ways. First, from the four identified dimensions of performance, team processes and emergent states are solely focused on leading performance measures. Thus, the framework, by itself, offers a balanced view of lagging/leading performance measures for managing project teams. Second, our framework is anchored in the IMO model of team effectiveness, which differentiates between determinants and indicators of team performance (Mathieu et al., 2008; Salas et al., 2018). More precisely, team processes and emergent states (i.e., the mediators in the model) are conceived as determinants of performance (future-oriented or proactive), whereas team outcomes represent the accomplishment of objectives assessed through the efficacy of past action. Hence, our framework preserves the "causal logic" that is needed to integrate leading (proactive) and lagging (reactive) performance measures. Third, although the scope of our discussion and findings prevents elaboration on this issue, the multilevel nature of project team performance measures embraces the idea of leading and lagging indicators differently. Organizational-level measures represent the business/strategic contribution of the project. Thus, these measures constitute the primary aim of the project from a business standpoint. In the middle, we have project-based measures, which are (in some ways) a disaggregation of business indicators to the level of the project. Project-level measures, therefore, are determinants of organizational-level measures. Finally, team-level measures are a disaggregation of project goals at the level of the team, thus being determinants of project-level outcomes. The vertical/hierarchical understanding of the project team performance measures found in our review can also be helpful for designing performance measurement systems

wherein the contribution of project teams to the business is clearly established and managed (Ika & Pinto, 2022; Rosen & Dietz, 2017).

6.2 Implications for practice

From a practical perspective, our study seeks to help practitioners (e.g., team members or project leaders) to better understand the nuances of project team performance and provide an evidence-based model that could aid in choosing a measurement system well-suited for managing projects in the current business context (e.g., a mix of financial and non-financial measures that would balance both efficiency and effectiveness). The ability to better understand project team performance measurement from a multidimensional perspective can bring (at least) three concrete benefits for managing project teams more effectively. First, our framework can help project managers identify suitable metrics for monitoring and assessing the performance of their project teams (see Appendix C). Second, the multidimensionality of our framework offers managers a combination of measures for assessing project team performance (i.e., a mixture of efficiency/effectiveness and tangible/intangible measures), which can aid them in choosing the most appropriate methods for building, monitoring, and assessing the performance of their project teams. Third, our framework could be valuable in guiding project team managers to choose simple or complex performance measurement structures depending on the context or the characteristics of the project. For example, simple projects might require monitoring only conventional (tangible) outcomes (e.g., time, cost, and quality), but complex projects might require designing and monitoring a combination of project team processes, project team emergent states, project team tangible outcomes, and project team perceived benefits.

7 LIMITATIONS AND FUTURE RESEARCH

This review has limitations that are worth mentioning. First, although we follow a well-established criterion to classify measures, some were difficult to categorize. This happened when the same variable (e.g., productivity) was approached by scholars using both tangible and intangible measures (e.g., perceived level of team productivity versus total revenue earned from the project over the total labor hours). This problem, however, presents an opportunity for future research to refine and clarify the meaning of such constructs to increase the accuracy of research designs, as well as the interpretation of research findings. Second, since we used the Web of Science and Scopus databases, our systematic literature review excluded conference papers and reports. We made this decision intentionally to include only peer-reviewed studies, so we may have omitted some measures or approaches to the topic that have not achieved publication in indexed journals. To increase the validity of our findings and to test the robustness of our theoretical framework, we suggest testing the framework using new data that include new peer-reviewed papers and other relevant literature (e.g., book chapters and conference papers). Third, our integrative framework is based on published research. Thus, we suggest validating this framework in three different ways: (1) acquiring opinions from experts in the field to prompt future adaptations that can enhance its practical value, (2) selecting a set of variables from the model and theoretically relating them using a causal logic to test its empirical testability, and (3) testing whether an integral approach to project team performance (e.g., using measures from the four quadrants) can lead to successful projects (i.e., a testable hypothesis that assesses the core of our proposed model). Finally, the framework developed is a conceptual proposition based on the content of the papers that we reviewed and the IMO model of team effectiveness. This model may, therefore, not be suitable for all project teams. For instance, the level of complexity of the

project should match the level of complexity of the project team performance measurement system (e.g., using all or some dimensions of performance), which at times may not need to incorporate all the features of the proposed framework.

8 CONCLUSIONS

Our study confirms previous claims regarding the fragmented and underdeveloped state of project team performance measurement literature and offers the possibility of strengthening research in this area in several ways. First, our systematic literature review organized the state-of-the art and provided a strong conceptualization of the subject, offering clarity on how to approach and measure project team performance considering the complexity of the current working environment. Second, our study advances the knowledge base in the field by providing a robust basis for theory building. In doing so, we built a framework that subsumes different approaches into the topic (including both conventional and emerging perspectives), making it possible to integrate the heterogeneous nature of project team performance and shedding light on the multiple dimensions that represent the complex nature of performance management in contemporary projects (i.e., project team processes, project team emergent states, project team tangible outcomes, and project team perceived benefits—see Figure 1). Furthermore, our framework brings foundational elements of performance measurement theory to the team level and consolidates them into three pillars (i.e., purpose, principles, and dimensions), which provide a robust basis—but also offer flexibility—for conducting future research in this area (e.g., development, replication, and comparison of project team performance theories). For example, from a theory-building standpoint, our framework helps to: (1) acknowledge the emergent multidimensional understanding of project team performance measurement, (2) understand the role of technical and social controls when managing a project team (or a project), (3) pave the

way to move from a focus on control to a focus on learning when designing and managing a project team performance system, and (4) provide a more balanced view between lagging (or reactive) and leading (or proactive) measures of project team performance. Third, by integrating the theory of performance measurement with the IMO model of team effectiveness, we contribute to strengthen our understanding of project team dynamics, which is an area of growing interest in the field. Finally, from a practical perspective, our study can help practitioners to better understand the technical nuances of project team performance measurement and provide an evidence-based, actionable framework to aid in choosing a measurement well-suited for managing project teams.

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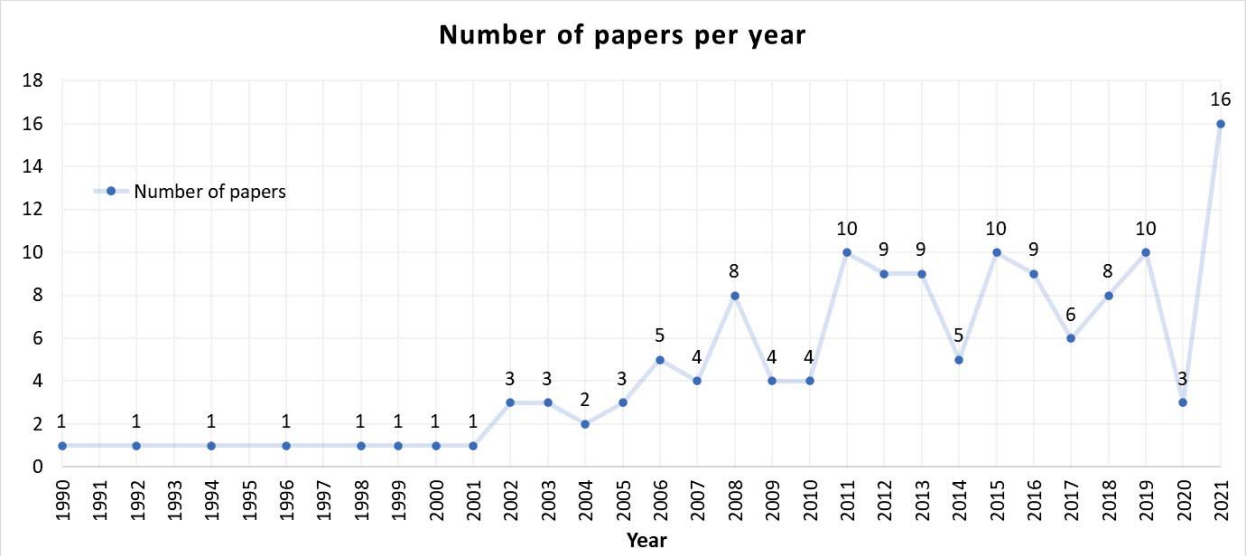
Appendix A. Number of papers per industry and year included in our review

Table A. Number of papers per industry

Industry	Number of papers
Multiple industries	30
Education (student project teams)	28
Information and communication technology (ICT)	27
Software development	13
Construction	11
Research & Development	6
Electronic	4
High-tech	4
Manufacturing	3
International development agency	3
Automotive	2
Healthcare	2
Pharmaceutical	2
Accounting and consulting	1
Defense	1
Hydropower	1
Service	1
Total	**139**

Figure A. Number of papers per year



Note: Year 2021 includes 2022 printed version of papers that were published online in 2021.

Appendix B. Detailed description of performance measures

Table B.1. Detailed description of the constructs presented in Table 3 that measured project team performance at the team level.

Performance domain	Performance measure	Representative operational definition	Authors using the measure
Team Processes	Team learning	"The existence of the creation, sharing, utilization, and application of knowledge to enhance individual and collective contribution to project performance and self-development" (Jetu & Riedl, 2013, p. 433).	(Akgün et al., 2010, 2007b; Chang et al., 2021; Druskat & Kayes, 2000; Jetu & Riedl, 2013)
	Team performance behaviors	"Behaviors which are directly relevant to performing team tasks (e.g., better locate resources, make better plans, coordinate activities more effectively, and solve more quickly and easily any problems that arise)" (Jiang et al., 2012, p. 619).	(Jiang et al., 2012)
	Teamwork effectiveness	"The team members' perception of activities such as setting common objectives, planning and organizing tasks, holding meetings, information sharing, problem solving, and creating and sustaining a good working environment" (Bourgault et al., 2008, p.103).	(Bourgault et al., 2008)
	Team ability to deal with risk	"The ability among team members for dealing with risks and uncertainties" (Thamhain, 2004, p. 536).	(Thamhain, 2004)
Team Emergent states	Team satisfaction*	"The extent to which team members are satisfied with the composition and pleasantness of the team, and the willingness to participate in a similar project with the same team" (Gevers & Peeters, 2009, p. 387).	(Gevers & Peeters, 2009; Zhang & Guo, 2019)
	Team commitment	"The team's commitment to agreed-on objectives" (Thamhain, 2004, p. 536).	(Thamhain, 2004)
	Team working spirit	"Existence of shared vision and unified sense of purpose that is needed to provide members with successful integration of individual thoughts and actions to achieve project objectives" (Jetu & Riedl, 2013, p. 433).	(Jetu & Riedl, 2013)
	Team leadership	"The existence of good project team leadership that fosters a favorable team environment, as well as mutual responsibility and accountability for project results" (Jetu & Riedl, 2013, p. 433).	(Jetu & Riedl, 2013)
	Team appreciation*	"Task collaboration was fulfilling, task completion was satisfactory, project results were pleasing, and project deliverables met expectations" (Zhang et al., 2018, p. 1106).	(Zhang et al., 2018)
Team outcomes	Speed-to-market	"The extent of a team's ability to develop and launch a new software product rapidly" (Keskin, 2009, p. 391)—*self-report*; "The number of months needed to bring a product to market relative to the development time of all new products in the firm" (Keller, 2006, p. 205)—*objective data*.	(Akgün et al., 2007a, 2007b, 2010, 2011; Keller, 2006; Keskin, 2009; Günsel & Açikgöz, 2013)
	Team effectiveness	"The extent to which a team's project deliverables met all client requirements and was of a high quality" (Magni et al., 2013, p. 1018)	(Jiang et al., 2003; Magni et al., 2013; Lvina et al., 2018; Revilla & Rodríguez, 2011; Unger-Aviram et al., 2013)
	Team innovative performance	"The intentional introduction and application of ideas, processes, products, or procedures that are new to the team and designed to be beneficial" (Jiang & Chen, 2018, p. 1822).	(Gonzalez, 2022; Jiang & Chen, 2018; Liu & Cross, 2016)

	Team productivity	"The logged value of the total revenue earned from the project over the total labor hours" (Young-Hyman, 2017, p. 192).	(Avgerinos et al., 2020; Young-Hyman, 2017)
	Team task performance	"The degree to which a team member is competent and gets his or her work done effectively" (Zhang et al., 2020, p. 502-503).	(Harrison et al., 2002; Zhang et al., 2020)
	Team efficiency	"The extent to which the project team deviated from planned project schedule and project cost (as a continuous variable measured in percentages) in comparison with the initial schedules and costs set at the start of the project" (Unger-Aviram et al., 2013, p. 584).	(Unger-Aviram et al., 2013).
	Satisfaction with performance*	"The degree of satisfaction with performance and with the quality of project output" (Gevers & Peeters, 2009, p. 387).	(Gevers & Peeters, 2009)
	Knowledge management performance	"The outputs of a knowledge management process" (Zhang & Zhang, 2014, p. 36).	(Zhang & Zhang, 2014)
	Task output creativity	"Task output ideas that are both original and useful" (Rodríguez-Sánchez et al., 2017, p. 532).	(Rodríguez-Sánchez et al., 2017)
	Impact on team	"How the project positively or negatively influences team members, through their professional life in terms of performance and the project's outcome" (Araujo et al., 2022, p. 177).	(Araujo et al., 2022)

Note: Papers that measured project team performance/success as an overarching construct are excluded from this list and are analyzed in Table B.2. The constructs indicated with (*) did not have an explicit operational definition. In all those cases, we built a definition based on the content of the measurement scale as it was reported in the manuscript.

Table B.2. Concepts used by the authors to measure project team performance/success as an overarching construct (i.e., different types of items used in the scales that measure the variable)

Label of items (underlying concept)	Authors using the item
Overall team performance	(Bertolotti et al., 2015; de Poel et al., 2014; Lorinkova & Bartol, 2021; Myers, 2021; Rezvani et al., 2018; Thamhain, 2004; Van Veelen & Ufkes, 2019; Webber, 2008a)
Quality of the project/work	(Bijlsma-Frankema et al., 2008; Bradley et al., 2012, 2013, 2021; Courtright et al., 2017; Evans & Sanner, 2021; He, 2012; He et al., 2007; Hsu et al., 2012; Jones & Harrison, 1996; Kostopoulos & Bozionelos, 2011; Lee et al., 2011; Lee et al., 2015; Maruping et al., 2015; Myers, 2021; Nauman et al., 2022; Park & Lee, 2014; Savelsbergh et al., 2012; Tabassi et al., 2017, 2019; Van Veelen & Ufkes, 2019; Wang et al., 2005; Webber, 2008b; Xiang et al., 2016; Zhang & Farh, 2019; Zhang & Min, 2019)
Adherence to schedule	(Bertolotti et al., 2015; Faraj & Sambamurthy, 2006; Han & Hovav, 2013; He, 2012; He et al., 2007; Hsu et al., 2012; Jitpaiboon et al., 2019; Jones & Harrison, 1996; Kostopoulos et al., 2013; Lee et al., 2011, 2015; Maruping et al., 2015; Myers, 2021; Nauman et al., 2022; Park & Lee, 2014; Rezvani et al., 2018; Savelsbergh et al., 2012; Van Veelen & Ufkes, 2019; Wang et al., 2005; Zhang & Min, 2019)
Adherence to budget	(Bertolotti et al., 2015; Faraj & Sambamurthy, 2006; Han & Hovav, 2013; Hsu et al., 2012; Jitpaiboon et al., 2019; Kostopoulos et al., 2013; Lee et al., 2015; Maruping et al., 2015; Nauman et al., 2022; Park & Lee, 2014; Rezvani et al., 2018; Savelsbergh et al., 2012; Wang et al., 2005; Zhang & Min, 2019)
Goals/objectives/milestones/scope accomplishment	(Bain et al., 2001; Faraj & Sambamurthy, 2006; Hsu et al., 2012; Jitpaiboon et al., 2019; Lee et al., 2015; Liu & Leitner, 2012; Jones & Harrison, 1996; Kostopoulos et al., 2013; Park & Lee, 2014; Rezvani et al., 2018; Rodríguez-Sánchez et al., 2017; Wang et al., 2005; Xiang et al., 2016; Zhang & Min, 2019)
Efficiency of operations (include speed and use of resources)	(Evans & Sanner, 2021; He, 2012; He et al., 2007; Hsu et al., 2012; Jones & Harrison, 1996; Kostopoulos & Bozionelos, 2011; Kostopoulos et al., 2013; Lee et al., 2015; Nauman et al., 2022; Tabassi et al., 2017, 2019)
Productivity/quantity of work produced	(Chen, 2005; Evans & Sanner, 2021; He et al., 2007; He, 2012; Hsu et al., 2012; Jones & Harrison, 1996; Myers, 2021; Park & Lee, 2014; Zhang & Min, 2019)
Innovation	(Kostopoulos & Bozionelos, 2011; Myers, 2021; Tabassi et al., 2017, 2019; Xiang et al., 2016)
Customer/client satisfaction	(Bertolotti et al., 2015; Evans & Sanner, 2021; Han & Hovav, 2013; Lee et al., 2011; Savelsbergh et al., 2012)
Stakeholder satisfaction	(Lee et al., 2011; Van Veelen & Ufkes, 2019; Wang et al., 2005)
Response to (or solving) problems	(Kostopoulos et al., 2013; Myers, 2021; Rezvani et al., 2018)
Effectiveness of team external interactions	(He, 2012; He et al., 2007; Myers, 2021)
Effective communication/cooperation	(Myers, 2021; Xiang et al., 2016)
Good technical decisions	(Tabassi et al., 2017, 2019)
Achieving team potential	(Liu & Leitner, 2012)
Satisfaction with performance	(Liu & Leitner, 2012)
Team dynamics	(Jitpaiboon et al., 2019)
Alignment of project activities	(Jitpaiboon et al., 2019)
Mission fulfillment	(Evans & Sanner, 2021)
Ability to work together (cohesion)	(Myers, 2021)

Note: This table provides a summary of the concepts that authors most consistently used to scale project team performance/success as an overarching construct. We also included some concepts used in only one paper that might be useful to acknowledge the complete landscape of project team performance/success as an overarching construct.

Table B.3. Detailed description of the constructs presented in Table 3 that measured project team performance at the project level

Performance domain	Performance measure	Representative operational definition	Authors
Planning	Adherence to schedule*	"The extent to which the project was completed within the scheduled time" (Unterhitzenberger & Bryde, 2019, p. 61).	(Akgün et al., 2007a; Bstieler, 2005; Hempelmann & Engelen, 2015; Keller, 2006; Suprapto et al., 2015; Unterhitzenberger & Bryde, 2019).
	Project duration or schedule performance	"The number of months from the start of the concept development to the time of market introduction for a given project (or time to the end of the study period or cancellation of the projects respectively)" (Hansen, 1999, p. 93).	(Avgerinos et al., 2020; Gopal et al., 2011; Hansen, 1999, 2002; Reagans et al., 2004; Scott-Young & Samson, 2008; van Oorschot et al., 2018).
	Development cost	"The extent to which the project was developed and launched at the pre-determined cost" (Keskin, 2009, p. 391).	(Akgün et al., 2007b; Keller, 2006; Keskin, 2009; Rauniar et al., 2019).
	Project cost	"Cost included all owner and contractor costs for engineering (process design, production engineering, and project management services), as well as any other project-related costs normally capitalized, such as licensing fees and initial catalyst charges. Cost also included expenditure for post-mechanical completion modifications" (Scott-Young & Samson, 2008, p. 758).	(Maruping et al., 2019; Scott-Young & Samson, 2008; van Oorschot et al., 2018; Brown et al., 1990).
	Cost overruns	"The percentage difference between actual project costs and budgeted project costs" (Rai et al., 2009, p. 625).	(Rai et al., 2009; Zwikael & Unger-Aviram, 2010)
	Adherence to budget	"The adherence to the budget and financial performance" (Stephens & Carmeli, 2016, p. 867).	(Stephens & Carmeli, 2016; Unterhitzenberger & Bryde, 2019).
	Schedule overruns	"The actual project schedule as a percentage of the original plan" (Zwikael & Unger-Aviram, 2010, p. 417); "Schedule overruns in days (Maruping et al., 2019, p. 140).	(Zwikael & Unger-Aviram, 2010; Maruping et al., 2019)
Stakeholder	Customer/client satisfaction	"Satisfaction of internal and external customers, as well as product performance and delivering more than was promised." (Gobeli et al., 1998, p. 436).	(Gardner, 2012; Gobeli et al., 1998; Lai et al., 2018; Rai et al., 2009; Rauniar et al., 2019; Unterhitzenberger & Bryde, 2019; Zaman et al., 2021; Zwikael & Unger-Aviram, 2010)
	Impact on client	"Techniques and functions in the team's relationship with the client and follows protocols such as improving quality of life to satisfy needs" (Araujo et al., 2022, p. 177).	(Araujo et al., 2022; Popaitoon & Siengthai, 2014)
	Stakeholder satisfaction	"The extent to which the project satisfies the expectations of project stakeholders" (Serrador & Pinto, 2015, p. 1043)	(Serrador & Pinto, 2015)
Project work	Project efficiency	"Team's adherence to schedules and budgets" (Weiss et al., 2011, p. 201).	(Araujo et al., 2022; Barbalho & Silva, 2022; Dietrich et al., 2013; Huang et al., 2015; Lai et al., 2018; Liu & Cross, 2016; Mainga, 2017; Popaitoon & Siengthai, 2014; Serrador & Pinto, 2015;

			Suprapto et al., 2018; Weiss et al., 2011)
	Project Productivity	"Overall efficiency in delivering the project (output/input)" (Ramasubbu et al., 2015, p. 11).	(Ramasubbu et al., 2015; Young-Hyman, 2017)
	Project effectiveness	"The extent to which the project outputs achieved the performance expectations of key stakeholders" (Liu & Cross, 2016, p. 1152).	(Liu & Cross, 2016; Suprapto et al., 2018)
	Operational effectiveness	"Planning and executing a sequence of project activities to ensure completion of the project scope on time and within budget" (Coetzer, 2016, p. 588).	(Coetzer, 2016; Suprapto et al., 2015)
	Product development time	"Time required from product concept to product introduction" (Rauniar et al., 2019, p. 246).	(Rauniar et al., 2019)
	Development speed	"The achieved decrease in percentages of time goals" (Ignatius et al., 2012, p. 456).	(Ignatius et al., 2012)
	Preparation for the future	"Long-term project-related influences by planning the organization's infrastructure for the future and innovating in business" (Araujo et al., 2022, p. 177).	(Araujo et al., 2022)
	Knowledge integration and innovation	"A product of knowledge exchange/transfer and collaboration which is supported by an environment of trust" (Bond-Barnard et al., 2018, p. 441).	(Bond-Barnard et al., 2018)
	Knowledge asset accumulation*	"Organization knowledge base augmentation, accumulation of project experience, and improvement in the capability of delivering future projects" (Wen & Qiang, 2019, p. 371).	(Wen & Qiang, 2019)
	Project closing efficiency*	"Timely project closure and transfer to end user, budget control in the closing phase, quality defect detection and elimination, and key customer satisfaction" (Wen & Qiang, 2019, p. 371).	(Wen & Qiang, 2019)
Delivery	Project quality	"The extent to which the project specifications have been met by the time of handover" (Unterhitzenberger & Bryde, 2019, p. 61).	(Haas, 2006a, 2006b; Keller, 2006; Maruping et al., 2019; Scott-Young & Samson, 2008; Siangchokyoo & Klinger, 2022; Suprapto et al., 2015; Unterhitzenberger & Bryde, 2019).
	Product success	"Whether the product was meeting (or exceeding) managerial, profit, and technical expectations" (Akgün et al., 2007a, p. 630).	(Akgün et al., 2006, 2007a, 2007b, 2008, 2010; Carmeli et al., 2021; Ignatius et al., 2012)
	Product quality	"A combination of performance, functionality, and reliability" (MacCormack & Verganti, 2003, p. 223)—*self-report*.	(Liang et al., 2010; MacCormack & Verganti, 2003; Ramasubbu et al., 2015)
		"The inverse of total number of unique software defects reported by customers" (Ramasubbu et al., 2015, p. 797)—*objective data*.	(Gopal et al., 2011; Ramasubbu et al., 2015; van Oorschot et al., 2018)
	Project profit	"The net of project revenue over project expenses, including all labor costs and overhead cost allocations" (Boh et al., 2007, p. 600).	(Boh et al., 2007; Gopal et al., 2003)
	Project investment success	"The actual value generated through the project investment" (Zaman et al., 2021, p. 876).	(Zaman et al., 2021)
	Safety	"The extent to which the project is driven by safety" (Suprapto et al., 2015, p. 1353).	(Suprapto et al., 2015)

	Product (software) functionality*	"The software delivered by the project achieved its functional goals, met end-user requirements, fit end-user needs, and met technical requirements" (Günsel & Açikgöz, 2013, p. 374).	(Günsel & Açikgöz, 2013)
	Product entry timeliness	"Timing accuracies for product market entry" (Ignatius et al., 2012, p. 456)	(Ignatius et al., 2012)
	Product novelty	"Covers aspects of product and process technology, market characteristics, and fit with internal and external capabilities" (Weiss et al., 2014, p. 284)	(Weiss et al., 2014)
	Product creativity	"The degree to which a new product is novel and its introduction changes market thinking and practice" (Akgün et al., 2008, p. 223).	(Akgün et al., 2008)
	Organizational strategic value integration*	"Alignment of organizational strategy, termination of non-value-adding efforts, and strategic partnership development and maintenance" (Wen & Qiang, 2019, p. 371).	(Wen & Qiang, 2019)

Note: Papers that measured project performance/success as an overarching construct are excluded from this list and are analyzed in Table B.4. The constructs indicated with (*) did not have an explicit operational definition. In all those cases, we built a definition based on the content of the measurement scale as it was reported in the manuscript.

Table B.4. Concepts used by the authors to measure project performance/success as an overarching construct (i.e., different types of items used in the scales that measure the variable)

Label of items (underlying concept)	Author
Overall project success/performance	(Aalbers et al., 2016; Bonner et al., 2002; Carmeli et al., 2021; Gobeli et al., 1998; Lee et al., 2021; Sakka et al., 2016; Serrador & Pinto, 2015; Thomas et al., 2008; Unterhitzenberger & Bryde, 2019; Yamin & Sim, 2016)
Adherence to budget	(Bhatti et al., 2021; Aalbers et al., 2016; Bonner et al., 2002; Caerteling et al., 2013; Carmeli et al., 2021; Chan et al., 2008; Chang et al., 2021; Chiocchio et al., 2015; Ford & McLaughlin, 1992; Gobeli et al., 1998; Hempelmann & Engelen, 2015; Hsu et al., 2011; Jitpaiboon et al., 2019; Lee et al., 2021; Liberatore & Luo, 2010; Pinto et al., 2009; Shafi et al., 2021; Stephens & Carmeli, 2016; Unterhitzenberger & Bryde, 2019; Wang et al., 2011; Wu et al., 2017; Yamin & Sim, 2016; Zhang et al., 2018)
Adherence to schedule	(Aalbers et al., 2016; Bonner et al., 2002; Caerteling et al., 2013; Carmeli et al., 2021; Chan et al., 2008; Chang et al., 2021; Chiocchio et al., 2015; Ford & McLaughlin, 1992; Gobeli et al., 1998; Hsu et al., 2011; Jitpaiboon et al., 2019; Lee et al., 2021; Liang et al., 2012; Liberatore & Luo, 2010; Pinto et al., 2009; Shafi et al., 2021; Stephens & Carmeli, 2016; Unterhitzenberger & Bryde, 2019; Wang et al., 2011; Wu et al., 2017; Yamin & Sim, 2016; Zhang et al., 2018)
Quality of the product/output	(Bhatti et al., 2021; Bonner et al., 2002; Caerteling et al., 2013; Gemino et al., 2015; Hsu et al., 2011; Liberatore & Luo, 2010; Jitpaiboon et al., 2019; Stephens & Carmeli, 2016; Wang et al., 2011; Zwikael & Unger-Aviram, 2010)
Customer satisfaction	(Bhatti et al., 2021; Gemino et al., 2015; Handzic et al., 2016; Hempelmann & Engelen, 2015; Jitpaiboon et al., 2019; Khosravi et al., 2020; Pinto et al., 2009; Unterhitzenberger & Bryde, 2019; Shafi et al., 2021; Wu et al., 2017; Yamin & Sim, 2016)
Meeting functional requirements and specifications	(Bhatti et al., 2021; Carmeli et al., 2021; Chang et al., 2021; Chiocchio et al., 2015; Lee et al., 2021; Stephens & Carmeli, 2016; Unterhitzenberger & Bryde, 2019; Wu et al., 2017; Zhang et al., 2018)
Achievement of project goals/objectives	(Chan et al., 2008; Hempelmann & Engelen, 2015; Hsu et al., 2011; Liang et al., 2012; Sakka et al., 2016; Wang et al., 2011; Yamin & Sim, 2016)
Achievement of scope objectives	(Barbalho & Silva, 2022; Ford & McLaughlin, 1992; Hsu et al., 2011, 2012; Jitpaiboon et al., 2019; Liang et al., 2012; Wang et al., 2011)
Process satisfaction/quality/success	(Handzic et al., 2016; Liberatore & Luo, 2010; Pinto et al., 2009; Sakka et al., 2016; Shafi et al., 2021; Wu et al., 2017)
Problem-solving	(Aalbers et al., 2016; Bhatti et al., 2021; Pinto et al., 2009; Shafi et al., 2021; Wu et al., 2017)
Meeting profit/revenue objectives	(Bechtel et al., 2021; Gobeli et al., 1998; Hempelmann & Engelen, 2015)
Cooperation with external parties	(Aalbers et al., 2016; Ford & McLaughlin, 1992; Wu et al., 2017)
Task/execution efficiency	(Gemser & Leenders, 2011; Hsu et al., 2011; Liang et al., 2012; Wang et al., 2011)
Impacts or benefits on clients/users (e.g., increased efficiency)	(Aalbers et al., 2016; Shafi et al., 2021; Wu et al., 2017; Yamin & Sim, 2016)
Satisfaction with the team	(Barbalho & Silva, 2022; Bhatti et al., 2021; Khosravi et al., 2020)
Project duration (or delivery time)	(Carmeli et al., 2021; Hempelmann & Engelen, 2015)
Stakeholder satisfaction	(Khosravi et al., 2020; Wu et al., 2017)
Meeting operational objectives	(Pinto et al., 2009; Sakka et al., 2016)
Work morale	(Hsu et al., 2011; Liang et al., 2012)
Market impact	(Bechtel et al., 2021; Gemser & Leenders, 2011)

Number of defects	(Gobeli et al., 1998)
Return on investment	(Gemser & Leenders, 2011)
Gained knowledge and experience	(Hempelmann & Engelen, 2015)
Increased organizational reputation	(Hempelmann & Engelen, 2015)
Competitive advantage	(Hempelmann & Engelen, 2015)
Product and service innovativeness	(Aalbers et al., 2016)
Productivity	(Aalbers et al., 2016)
Enable continuous improvement	(Khosravi et al., 2020)
No harmful effect on organizational culture or values	(Bhatti et al., 2021)
Meeting planned payback period	(Bechtel et al., 2021)

Table B.5. Complete list of the authors that measure the constructs presented in Table 3 (project team performance at the organizational level)

Categories of performance	Performance measure	Representative operational definition	Authors
Profitability	Profit	"The operating profit margin or operating result/revenues. It is obtained after deduction of normal operating charges and before financial income and expenses, taxes, etc." (Omta et al., 1994).	(Hsu et al., 2016; Keller, 2006; Omta et al., 1994)
	Business success*	"The extent to which the project was an economic business success, increased the organization's profitability, had a positive return on investment, increased the organization's market share, contributed to shareholder's value, and contributed to the organization's direct performance" (Araujo et al., 2022, p. 191).	(Araujo et al., 2022; Popaitoon & Siengthai, 2014; Suprapto et al., 2015)
	Earnings	"The gross income of a company minus cost of goods sold and operating expenses" (R&D, salaries, marketing, etc.) (Cronin et al., 2011, p. 838).	(Cronin et al., 2011)
	Return on investment (ROI)	"The ratio of money gained or lost on an investment relative to the amount of money invested" (Hsu et al., 2016, p. 85).	(Hsu et al., 2016)
Growth	Commercial/ Market success	"The extent to which the product meets or exceeds managerial, profit, and market expectations" (Günsel & Açikgöz, 2013, p. 366).	(Akgün et al., 2011; Günsel & Açikgöz, 2013; Keskin, 2009; Suprapto et al., 2015)
	Growth rate	"The annual growth rate of the company, both organic growth and growth through acquisition" (Omta et al., 1994, p. 211).	(Omta et al., 1994)
	Length of development	"Length of the development phase, the average time span between patenting of the lead and the registration of the drug (in $years^{-1}$)" (Omta et al., 1994, p. p. 211)	(Omta et al., 1994)
	Number of patents	"The average annual number of patents" (for new products) (Omta et al., 1994, p. 211).	(Omta et al., 1994)
Operational performance	Benefits to customers	"The improvement of the technology relative to the previous technology generation. This improvement reflects the features that customers are likely to find important: increased operating efficiency, reduced environmental impact, increased reliability, and improved safety standards" (Caerteling et al., 2013, p. 354).	(Caerteling et al., 2013)

Note: The constructs indicated with (*) did not have an explicit operational definition. In all those cases, we built a definition based on the content of the measurement scale as it was reported in the manuscript.

Appendix C. Project team performance measures categorized by dimension

Table C. Summary of the performance measures most consistently used in the literature using our integrated framework of project team performance

Project team processes	**Project team tangible outcomes**
Team learning	Cost and cost overruns
Team performance behaviors	Project duration (or completion time)
Teamwork effectiveness	Product development time
Team ability to deal with risk	Profit
Team cooperation*	Earnings (at the organizational and project levels)
Team coordination*	Product quality (number of defects)
Team conflict*	Sales growth
Operations efficiency*	Length of development
Response to problems*	Speed-to-market
	Number of patents
	Growth rate
	Return on investment
	Productivity
Project team emergent states	**Project team perceptual benefits**
Team commitment	Overall project performance/success
Team working spirit	Perceived quality
Team leadership	Innovation
Team appreciation	New product creativity
Team satisfaction	Stakeholder satisfaction
Team cohesion*	Customer/client satisfaction
Team trust*	Safety
	Product functionality
	Product commercial/market success
	Product novelty/creativity
	Project efficiency
	Project effectiveness
	Adherence to schedule/budget
	Knowledge integration and innovation

* These constructs were not measured directly by the papers but were mentioned in the literature as relevant dimensions of project team performance when referred to team processes or emergent states.