

**TEAM CAPABILITIES AND PROJECT SUCCESS: THE MEDIATING ROLE OF THE GOVERNANCE
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Abstract

This study investigates the influence of governance on the relationship between Project Team Absorptive Capacity (ACAP) and Capital Project Success (PS) within Brazil's oil and gas sector. Integrating Agency Theory, Absorptive Capacity Theory, and the Temporary Organization Concept, a model is proposed and tested using PLS-SEM on 173 industry responses. The study has found that governance serves as the essential mechanism through which ACAP translates into PS. This mediation effectively aligns project outputs with desired business outcomes enabling investment success. Results reveal that: (1) governance framework imposed by the parent sponsor organisation is the essential mechanism through which team capabilities are translated into project success, mitigating integration challenges in capital projects; (2) Potential ACAP (PACAP) significantly predicts Realized ACAP (RACAP), emphasizing knowledge absorption as a collective team capability; and (3) project success is achieved when governance mechanisms effectively align and synchronize project temporary organization (focused on output delivery) with permanent owner structures (focused on realizing business-as-usual outcomes). By empirically validating governance's mediating effect, this research advances project success understanding beyond traditional "iron triangle" metrics. It offers actionable insights for sponsors and managers to design governance frameworks that leverage team capabilities and reduce capital project underperformance.

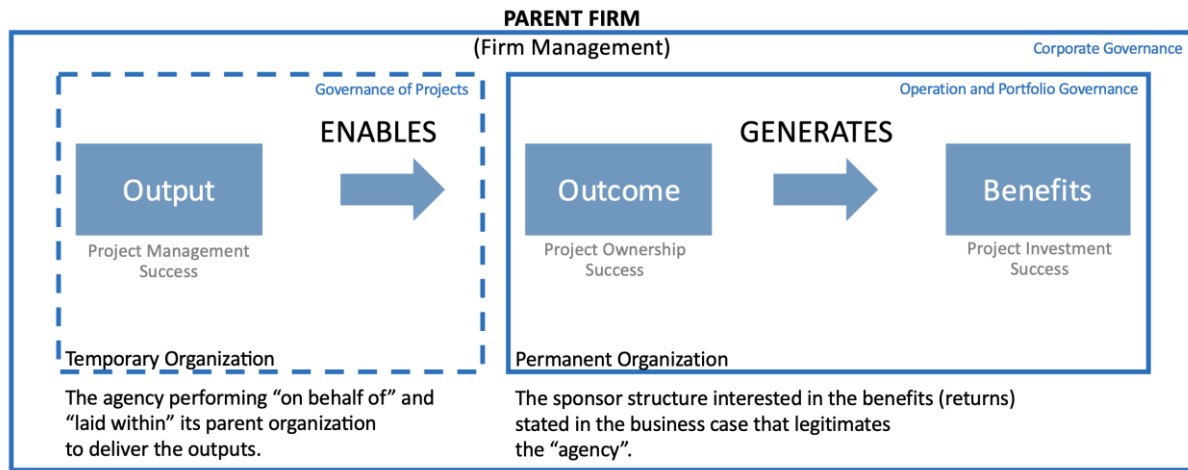
Keywords: Absorptive capacity, Capital project, Project governance, PLS-SEM, Project Success

1 Introduction

This study investigates how governance translate project team's absorptive capacity into project success within Brazilian oil and gas capital projects. Utilizing Agency Theory (Jensen & Meckling, 1976) and the concept of projects as temporary organizations (Turner & Müller, 2003), we developed an integrated model to understand the combined effects of project team capabilities and governance on project investment success. The study has adopted a deductive approach to investigate the phenomenon of capital asset development projects. The unit of analysis is the capital project, viewed as a temporary organization embedded within the sponsoring firm. It is investigated how these project "agencies" perform under the governance of the "principal", highlighting the interaction between project manager and project owner structures, both operating under the sponsor's oversight to achieve project investment success.

This research provides insights into how both the project team knowledge absorption (as a temporary organization capability) and the governance framework (put in place by the permanent sponsor organization) jointly contribute to project investment success.

Fig. 1, 2 and 3 illustrate the observed phenomenon from different perspectives: (i) Fig. 1 adopts governance perspective; (ii) Fig. 2 adopts business organization perspective; and (iii) Fig. 3 adopts oil and gas industry perspective.



$$\text{Corporate Governance} = \text{Portfolio Governance} + \text{Governance of Projects} + \text{Operation Governance}$$

Fig. 1 Capital Project Management and Development (Governance Perspective)¹

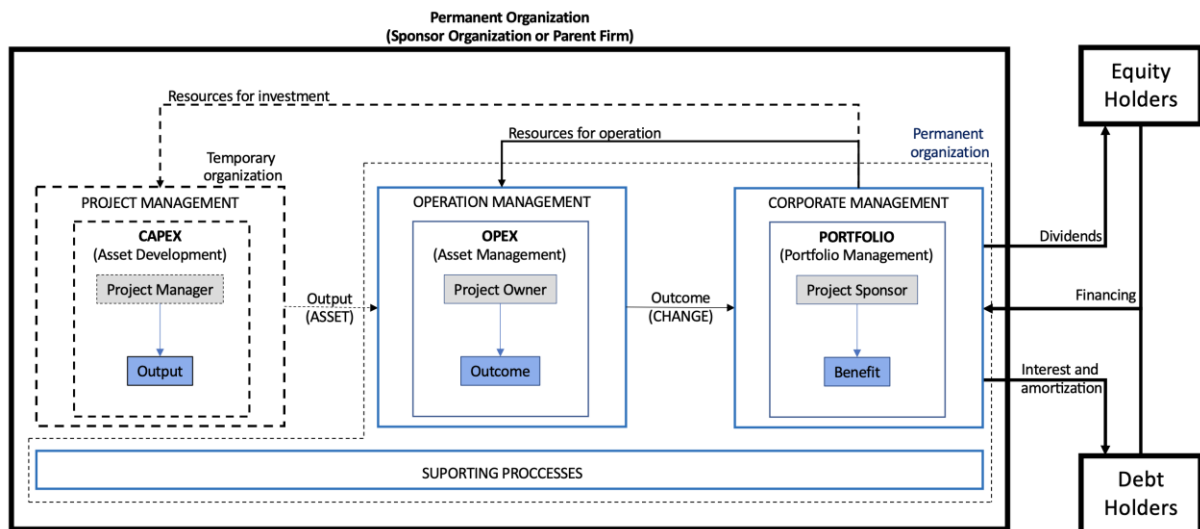


Fig. 2 Capital Project Management and Development (Business Organization Perspective)²

¹ Schematic based on the "Project Flow of Value" and the "Definition of Project" as per proposed by PRINCE2® (Projects IN Controlled Environment, a process-based methodology and a "de facto" worldwide standard, commonly adopted by the UK Government): "Projects deliver outputs in the form of products, the use of which results in changes in the business. These changes are called outcomes. These outcomes allow the business to realize the benefits that are set out in the business justification for the project" (Managing Successful Projects with PRINCE2 – PRINCE2, 2017).

² This figure presents the author's perspective on the relationship between capital projects and routine operations (business as usual) within business organizations and their investors (equity holders and debt holders).

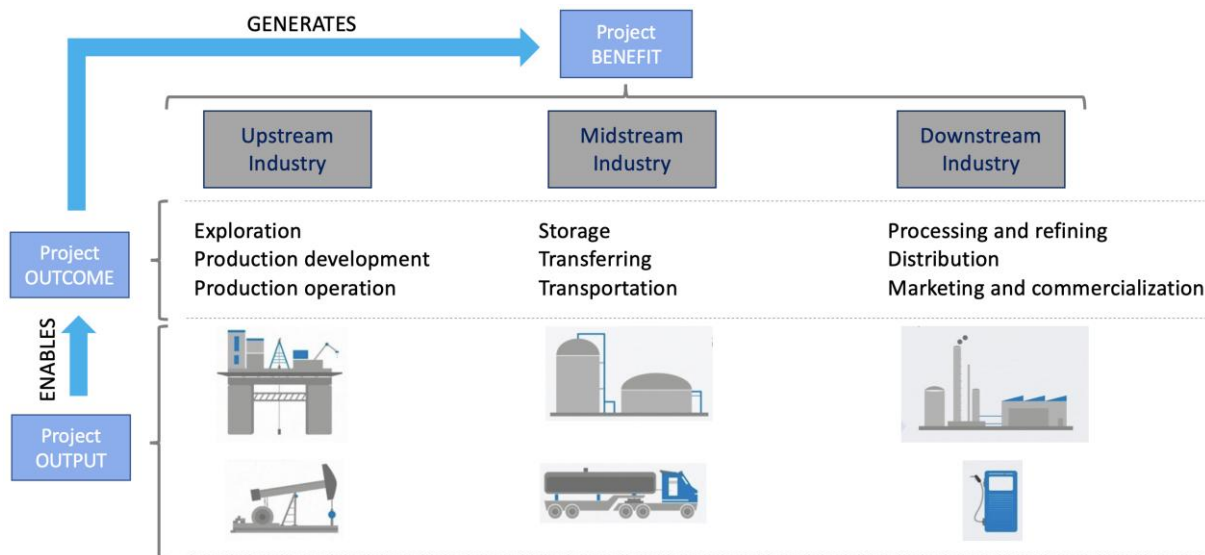


Fig. 3 Capital Project Management and Development (Oil and Gas Industry Perspective)³

1.1 Research problem, objective and contribution

1.1.1 Research Problem

Knowledge-intensive, large-scale capital projects in oil and gas, as temporary organizations, operate under parent organization governance aiming for investment returns (Merrow, 2011; Shenhar & Dvir, 2007). Achieving investment return-defined project success is crucial (Flyvbjerg, 2014; da Silva, 2021), yet megaprojects face high failure rates (Flyvbjerg et al., 2002; IPA, 2020). While team capabilities are vital (Shenhar & Dvir, 2007; Turner, 2009), the mechanisms translating them to investment returns, especially the mediating role of governance, are under-theorized. Governance is acknowledged as influential (Too & Weaver, 2014; Müller et al., 2016), but its mediation of team absorptive capacity (ACAP) on project success in capital-intensive industries lacks quantitative validation.

Absorptive capacity (Cohen & Levinthal, 1990) enables project teams to leverage knowledge. While ACAP's direct impact on performance is studied (e.g., Floricel & Miller, 2003; Todorova & Durisin, 2007), organizational mechanisms like governance facilitating its translation into strategic investment outcomes require further investigation.

Despite governance focus in oil and gas capital projects, significant underperformance persists (Merrow, 2012; IPA, 2021). While project management in traditional constraints improved, strategic investment success, aligning outputs with business outcomes, remains elusive (Zwikael & Meredith, 2019). Recurring failures in integrating temporary team deliverables with permanent benefit-realizing structures suggest a missing link: structured integration mechanisms within parent organization-imposed governance (Bradley, 2010; Breese, 2012; Serra & Kunc, 2015).

Although individual contributions of team ACAP and governance to project success are noted (e.g., Aubry et al., 2010; Williams, 2005), their synergistic effect, specifically governance mediating team ACAP's

³ A description of the oil and gas business segments can be found in the reference Thesis (da Silva, 2021).

benefits towards enhanced project success, remains underexplored in high-stakes industries like oil and gas.

This study sheds light on a key literature gap by empirically investigating the mediating role of the “**governance framework**” in the relationship between “**project team absorptive capacity**” and “**capital project success**” in Brazil’s oil and gas capital asset development projects.

Fig. 4 represents the research model with the latent variables relationship as per the question.



Fig. 4 Research Model with the Latent Variables Relationship

1.1.2 Research Objective

The objective is to develop a quantitative model and empirically explore the predictive capacity of specific project governance mechanisms, operationalized as “lead indicators”, in enhancing the effectiveness of the mediating role of the governance framework in ensuring the realization of intended project value and benefits, as defined by the business case of the capital project, thereby increasing the probability of investment success within the context of capital-intensive industries.

The purpose of the study: *“To propose a quantitative integrated model (Structural Equation Modeling - SEM) to investigate whether a structured governance framework mediates the relationship between project team absorptive capacity and capital project success”*.

The central research question: *“Does the governance framework of the parent firm mediate the relationship between project team absorptive capacity and capital project success in the oil and gas industry?”*

1.1.3 Theoretical and Practical Contributions

This study rigorously investigates capital project performance, yielding key theoretical and practical contributions.

Theoretical:

- Advances ACAP in Project Management: Empirically examines project team-level ACAP's influence on project outcomes, enhancing understanding of knowledge integration in temporary organizations.
- Refines Multi-Dimensional Project Success: Validates a framework beyond the "iron triangle," encompassing outputs, outcomes, and strategic benefits for a holistic view of project effectiveness.
- Provides Inter-Organizational Dynamics Insights: Offers novel empirical evidence on the interplay between parent sponsor governance and temporary project teams in capital-intensive settings, through Agency Theory and the Temporary Organization Concept.

- Validates Mediating Role of Project Governance: Empirically demonstrates project governance as a critical mediator translating team ACAP into enhanced project success, addressing a literature gap.

Practical:

- Offers Evidence-Based Governance Guidance: Provides actionable insights for executives and sponsors to strategically design and optimize governance frameworks for maximized investment returns.
- Elucidates ACAP-Governance Synergy: Clarifies the interplay between project team capabilities (ACAP) and structural governance, offering implications for aligning these to enhance project performance in capital-intensive environments.

1.1.4 Research context and background

As a capital-intensive industry, Oil and Gas is within the top revenue generating business in the world, with an estimated US\$ 4.3 trillion only in the exploration and production segment (upstream) in revenue annually (source: IBISWorld. "Global Biggest Industries by Revenue in 2025." Accessed Mar. 10, 2025). Petroleum is still crucial to the world economy structure, particularly for the largest producers countries as China, Canada, Russia, Saudi Arabia, and United States (source: United States Energy Information Administration. "What countries are the top producers and consumers of oil?" Accessed Mar. 10, 2025.), as per illustrated in Table 1.

Table 1 Largest Petroleum Producers Countries

Country	Million barrels per day	Share of world total
United States	21.91	22%
Saudi Arabia	11.13	11%
Russia	10.75	11%
Canada	5.76	6%
China	5.26	5%
Iraq	4.42	4%
Brazil	4.28	4%
United Arab Emirates	4.16	4%
Iran	3.99	4%
Kuwait	2.91	3%
Total top 10	74.59	73%
World total	101.81	-

Data source: United States Energy Information Administration, International Energy Statistics, Total oil (petroleum and other liquids) production, as of April 11, 2024.

Table 1 shows the top 10 oil producers and share of total world oil production in 2023, where:

- oil – Includes crude oil, all other petroleum liquids, and biofuels.
- production – Includes domestic production of crude oil, all other petroleum liquids, and biofuels and refinery processing gain.

Persistent underperformance plagues petroleum sector capital projects due to inadequate governance (Shenoy & Zabelle, 2016; Ochieng et al., 2016). Surveys reveal frequent cost overruns and schedule delays in megaprojects. This stems from lacking robust governance frameworks for effective project management and delivery (Ochieng et al., 2016), exposing forthcoming energy projects to significant economic, operational, and technical risks.

Capital asset development projects in the petroleum industry commonly suffer budget overruns, schedule delays, and deviations from business case projections, especially megaprojects (Morrow, 2012; IPA Global, 2021). Despite increased project management research, comprehensive studies on fundamental project and organizational processes remain limited (Midler, 1995; Morris, 2009). Further theoretical frameworks are needed to understand core issues in energy projects (Ochieng et al., 2016; Andhini, 2017).

1.2 Literature review

This section presents the inferences gathered from the literature review that has supported the foundations of this study. The section includes discussions on the adopted concepts and theories, on the latent variables inherent to the phenomenon of interest, on the constructs chosen to assess relationships, and presents the hypothetical framework and the theoretical basis of the research model. Agency Theory is adopted as a lens to observe the phenomenon and to frame the mediating role of the governance framework within the research model.

1.2.1 Theories and general concepts adopted

The phenomenon object of the study is “The management and implementation of capital asset development projects in the oil and gas industries to achieve investment success”. The unit of analysis of the study is “The capital project”.

To observe the phenomenon and analyze the unit, the adopted theories are:

- Agency Theory (Mitnick, 1973; Ross, 1973; Jensen and Meckling, 1976) as lens.
- Theory of Absorptive Capacity (Cohen and Levinthal, 1990; Zahra and George, 2002) to get inferences to model the team capabilities.
- Theory of the Temporary Organization (Lundin and Söderholm, 1995; Packendorff, 1995) to frame the unit of analysis.
- Theory and concepts of Project Success (De Wit, 1988; Shenhar and Dvir, 2001; Turner, 2009; Cooke-Davies, 2002; MacLeod, 2012; Zwikael and Smyrk, 2012; Serra and Kunc, 2015; ul Musawir, 2017) to assess the objective function within the observed phenomenon.
- Governance concepts in the project management context are reviewed (Müller, 2011; Too and Weaver, 2014; Müller et al., 2015; Joslin and Müller, 2016; ul Musawir et al., 2020).

Main scientific references adopted to characterize and frame the observed phenomenon are:

- Cohen and Levinthal, 1990; Zahra and George, 2002; Turner and Müller, 2003; Winter et al., 2006; ul Musair et al., 2017 – Supporting the assumption that both the project management team capabilities and the governance framework of a firm integrate its corporate competitive advantages to bridge the gap between the current value and the desired value of this firm by implementing projects in a temporary organization format.
- Lundin and Söderholm, 1995; Packendorff, 1995; Turner and Müller, 2003 – Supporting the conceptualization of the capital project as a temporary organization performing “on behalf of” and “laid within” the sponsor permanent organization. The temporary organization is characterized as an agency delivering value to its principal, the sponsor permanent organization.
- Turner and Müller, 2003; Müller et al., 2005; Turner, 2006; ul Musawir et al., 2017 – The project manager is characterized as the agent empowered and legitimated by the sponsor to lead and manage the project temporary organization and its team. Thus, the project management team is in charge of delivering the project products (outputs) accordingly to the project business case, toward fulfilling the objectives of the sponsor (benefits).

- Turner and Müller, 2003; Müller et. Al, 2005; Turner, 2006; Müller, 2011; ul Musawir et al., 2017; Meredith and Zwikael, 2020 – The project owner is characterized as the agent empowered and legitimated by the sponsor to lead and manage the ownership permanent organization structure in the acceptance and in the operation of the project products (outputs). Thus, the project ownership team is in charge of realizing the changes (outcomes) defined within the project business case, toward fulfilling the objectives of the sponsor (benefits).

- Turner and Müller, 2003; Müller et. Al, 2005; Turner, 2006; Meredith and Zwikael, 2020; ul Musawir et al., 2017 – The project sponsor is characterized as the principal, which empowers, legitimate, monitors and control the agents, the project management and project ownership structures, in their performance toward the objectives of the sponsor (benefits).

- De Wit, 1988; Baccarini, 1999; Shenhar and Dvir, 2001; Shenhar and Dvir, 2002; Cooke-Davis, 2002; Winter et al., 2006; Shenhar and Dvir, 2007; Ika, 2009; Serrador and Turner, 2014; Bradley, 2010; Zwikael and Smyrk, 2012; ul Musawir, 2017; Meredith and Zwikael, 2019 – Supporting the adoption of project success as a multidimension and time dependent second order construct in this study, indicating project success as a key objective function for firms.

The philosophical positioning of the study adopts a positivist perspective along with a deterministic view of the observed phenomenon. Positivism is associated with a value-free manner of conducting a research study, and by the adoption of quantitative methods and other means to reach objectivity. Positivism has been the dominating epistemology in project management research; it aims to identify universal rules and guidelines to observe a phenomenon (Smyth and Morris, 2007; Bredillet, 2008).

Project management, set as a knowledge field, encompasses research studies adopting different perspectives associated to nine schools of thought (Turner et al., 2013). Fig. 5 presents the nine schools and the decade they have born (Turner et al., 2013).

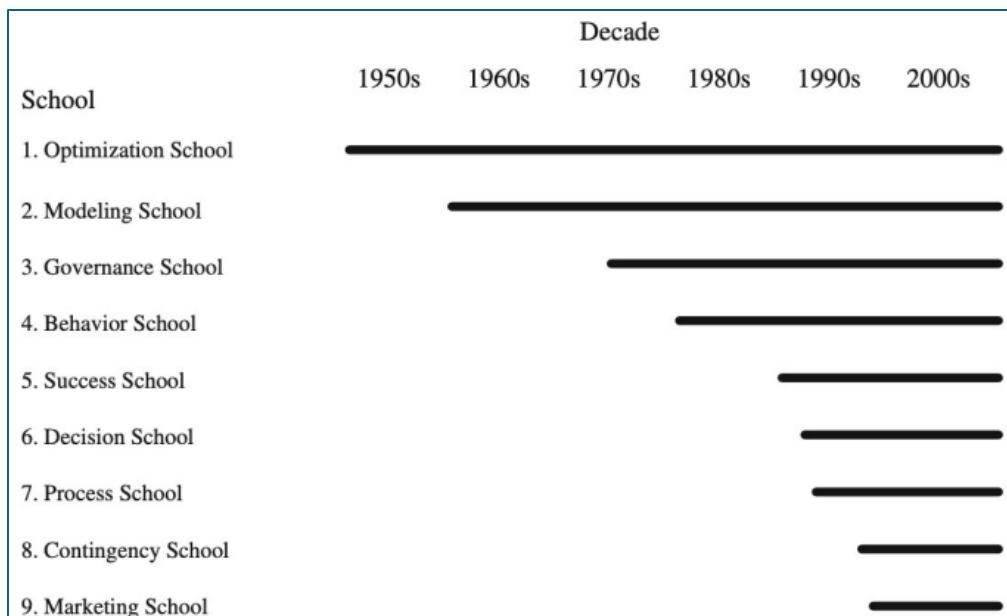


Fig. 5 The Nine Schools of Project Management Research (Adapted from Turner et al., 2013)

This study adopts a multi perspective approach and is mainly supported by the concepts of 3 (three) research schools (Turner et al., 2013; da Silva, 2021):

- “Governance School” – This school adopts Agency Theory as lens to observe the project management and implementation phenomenon. In this school, monitoring and control practices, and incentive and reward mechanisms, are important in aligning interests. The project involves entities interacting among each other, acting as agents of the principal. The project is conceptualized as a temporary entity, in the form of a temporary organization, interacting with permanent entities.
- “Behavior School” – This school is closely associated with the governance school. It assumes the project as a temporary organization within a social system, and includes several areas focused on organizational behavior, as per leadership, team building, human resource management, giving relative importance to collective knowledge and team capabilities. This school encompasses studies on politics and dynamics between the project entities, and on the relationship among the project agents and its principal party.
- “Success School” – Project success factors and criteria are the focus of this school. This school has added fertile grounds for research putting the project to be viewed as an entity sanctioned, established, and monitored and governed to create value to the sponsor party.

Adopting a multiple perspective, the study conceptualizes the oil and gas capital asset development project manager, and its team, as an agent party, in the form of a temporary organization, sanctioned and authorized to deliver the project outputs needed to create value to its principal, the sponsoring and governing party (da Silva, 2021).

The permanent organization embedding the project temporary organization (the project as a temporary agency), encompasses another agent party, the project owner (the ownership structure as an agency). The project owner, and its related structure, form the second agent party. The ownership party is also sanctioned and authorized by the principal sponsor party. The ownership party performs on behalf of the principal sponsor party to assure the project outcomes and the business case compliance. This conceptualization is supported by Agency Theory (Mitnick, 1973; Ross, 1973; Jensen and Meckling, 1976), once it is adopted as a lens to observe the phenomenon of capital asset development projects.

The theoretical grounding of this research is a core element of its contribution, particularly through the integration of multiple theoretical lenses to construct a comprehensive model: Agency Theory, Absorptive Capacity Theory, and the Temporary Organization Concept.

This section aims to clarify the specific role of Agency Theory in framing the relationship between the project sponsor and the management and ownership as agents, thereby providing a robust foundation for understanding governance as a mediating variable.

Agency Theory provides a powerful framework for analyzing relationships where one party, the Principal, delegates work to other parties, the Agents. Within this relationship, two primary challenges, known as “agency problems,” can arise: information asymmetry and goal incongruence. Information asymmetry occurs when the Agent possesses more or better information than the Principal regarding the tasks, efforts, and capabilities required for the project. Goal incongruence arises when the interests of the Agent and Principal are not perfectly aligned, leading the Agent to potentially act in their own self-interest rather than in the best interest of the Principal. In the context of capital projects, Agency Theory offers a valuable lens to examine the interaction between the project's permanent owner structures (the Principal) and the temporary project team responsible for project delivery (the Agent). Agency Theory provide solid theoretical grounding to conceptualize the sponsor as the principal and the project owner and project manager as authorized agents working on behalf of the principal (Mitnick, 1973; Ross, 1973; Jensen and Meckling, 1976; da Silva, 2021).

The theoretical grounding of this research is a core element of its contribution, particularly through the integration of multiple theoretical lenses to construct a comprehensive model.

Agency Theory (Mitnick, 1973; Ross, 1973; Jensen and Meckling, 1976) – The specific role of Agency Theory is in framing the relationship between the project sponsor and the project team, thereby providing a robust foundation for understanding the mediating effect of governance. Agency Theory provides a powerful framework for analyzing relationships where one party, the Principal, delegates work to another party, the Agent. Within this relationship, two primary challenges, known as "agency problems," can arise: information asymmetry and goal incongruence. Information asymmetry occurs when the Agent possesses more or better information than the Principal regarding the tasks, efforts, and capabilities required for the project. Goal incongruence arises when the interests of the Agent and Principal are not perfectly aligned, leading the Agent to potentially act in their own self-interest rather than in the best interest of the Principal. In the context of capital projects, Agency Theory offers a valuable lens to examine the interaction between the project sponsor (the Principal) and both agents: the project management temporary agency and the project ownership permanent agency structure. As explained above, agency problems occurs when agents perform on behalf of the principal party, as in large-scale capital projects. For instance, information asymmetry is a key concern, as the project or the ownership teams hold critical knowledge about its collective capabilities, which may not be fully transparent to the sponsor. Furthermore, goal incongruence can manifest when the agent's focus conflicts with the Principal's goal of incorporating the outputs with predictability and competitiveness, achieving long-term business outcomes and capital investment success. These potential misalignments pose significant risks to the sponsor organization overall performance. It is through this theoretical lens that the central role of governance in our model becomes clear. Governance Framework put in place is the Principal's primary mechanism for mitigating agency problems. It serves as a crucial mechanism to align the objectives of the agents with those of the sponsor, reduce information asymmetry, and ensure the agent's efforts are directed toward the desired benefits. Thus, governance is not merely an administrative function but the essential bridge that translates the team's capabilities (Absorptive Capacity) into tangible and sustained project success for the parent sponsor organization, thereby supporting our hypothesis of governance as a mediating variable.

Absorptive Capacity Theory (Cohen and Levinthal, 1990; Zahra and George, 2002) – Connecting Zahra and George (2002) and Turner and Müller (2003) conceptualizations, "Absorptive Capacity" (ACAP) is considered as the set of organizational routines and strategic process by which the project temporary organization, and its team, in charge of the project, and performing as an agency, "on behalf of" and "laid within" the parent firm, acquire, assimilate, transform, and exploit knowledge to achieve project success. By effect, ACAP contributes to generate value for the parent firm (Zahra and George, 2002 and Turner and Müller, 2003). In this conceptualization, the ACAP of the project team constitutes a potential source of the dynamic organizational capabilities of the project temporary organization. It is the capability available associated with the collective knowledge of the project temporary organization team, i.e., the team of the agency that manages and performs the project work on behalf of the parent firm, the principal party. This project team is under the leadership of the project manager, acting as the CEO of the project temporary organization, i.e., the CEO of the agency (Turner and Müller, 2003). Although associated with Research and Development (R&D) studies, new product development (NPD), and innovation, ACAP is envisioned as a construct to be explored beyond these contexts (Lane, 2006). Towards this direction, a valid measure that captures the multiple dimensions of ACAP was conceived by Flatten (Flatten, 2011) and adopted in this study. In this way, the project team absorptive capacity is envisaged in this study as a human resource effector to the project success, represented herein by both components of "Absorptive Capacity" (ACAP) as a multidimension construct, as reconceptualized by Zahra and George (2002): "Potential Absorptive Capacity" (PACAP) and "Realized Absorptive Capacity" (RACAP). To model "Absorptive Capacity" as a construct affecting "Project Success" in the realm of capital projects, this study develops on the measurement scale of absorptive capacity (ACAP) and its **4 (four) constituent parts** (Zahra and George, 2002; Flatten, 2011): **(i) Acquisition capacity** – This part of ACAP entails close personal interaction and mutual trust and respect within project temporary organization team members in order to capitalize on different areas of expertise to successfully import knowledge. This part is associated with the capacity of a project team in developing and exploring connections within and outside their temporary organization to

shortening the time to acquire knowledge. These features of the project team facilitate the time and cost-efficient, and effective, identification and acquisition of new and relevant knowledge to perform within the project as a temporary organization. **(ii) Assimilation capacity** – This part of ACAP is characterized by the ability of the project temporary organization team to work together across professional and structural divisions, including the ability to interact within the parent firm organizational structures to make an effectively use of the routines and processes to analyze, process, interpret, and understand the information obtained from external sources. The setting of some complimentary skills and the use of a common professional language aid the project team in analyzing and interpreting the new knowledge, thus ensuring timely and economical knowledge processing within the project temporary organization. **(iii) Transformation capacity** – This part of ACAP reflects the ability of the project temporary organization team to combine old and new knowledge, i.e., the ability to combine existing knowledge and newly acquired and assimilated knowledge. It is related to the capability of a project team to yield new insights, fostering an entrepreneurial mindset in its actions. **(iv) Exploitation capacity** – This part of ACAP is defined by the skill and expertise of the project temporary organization team in knowledge utilization and application. It is related to the capacity of the project team in incorporating knowledge into its operations in a systematic way. It depends on the routines and processes that allow the project team to refine, extend, and leverage existing competencies or to create new ones.

Theory of the Temporary Organization (Lundin and Söderholm, 1995; Packendorff, 1995) - The conceptualization of projects as temporary organizations has been developed and explored by researchers in a variety of project management studies (Lundin and Söderholm, 1995; Midler, 1995; Packendorff, 1995; DeFillipi, 1998; Turner and Müller, 2003; Modig, 2007; Simard, 2014). This work extends this concept to the case of “capital asset development projects”, or “capital projects”. Since the middle of the 20th century, the conceptualization of a project was associated to “an organizational unit dedicated to the attainment of a goal — generally the successful completion of a developmental product on time, within budget, and in conformance with predetermined performance specifications” (Gaddis, 1957). This led to a valid proposition in which it can be stated that the “organizational unit” exists while the project exists. In the 80’s, a dictionary of terms in the field of project management has proposed to define a project as “a combination of human and non-human resources pulled together into a temporary organization to achieve a specific purpose” (Cleland and Kerzner, 1985). In the 90’s, this “specific purpose”, the project objective intent, as proposed by Cleland and Kerzner (1985), was then associated to a change, put as a needed (or desired) transition as follows: “when transition becomes necessary within a permanent organization, temporary organizations are often created to deal with it” (Lundin and Söderholm, 1995). Today, in the project management knowledge domain, the concept of a project as a temporary organization is broadly accepted and is still being explored and developed by researchers. This concept puts the project temporary organization, and its team, as an agency performing “on behalf of” and “laid within” its parent organization (Turner and Müller, 2003) to perform the needed (or desired) transition for a change (Lundin and Söderholm, 1995) and, finally, to generate benefits as end results (Bradley, 2010). In this way project management has evolved from product creation to value creation (Winter et al., 2006).

Governance concepts in the project management context (Müller, 2011; Too and Weaver, 2014; Müller et al., 2015; Joslin and Müller, 2016; ul Musawir et al., 2020) – The oil and gas parent organization sponsors, embeds, and governs both the project temporary organization, in charge of the project outputs, and the project owner structure, accounting for the project outcomes. An effective governance (in the realm) of projects is the one that ensures that benefits are constantly reviewed and aligned with organizational strategic objectives (Hjelmbrekke et al., 2014), what suggests that benefit management practices is a key part of the governance framework. Additionally, the governance framework may provide the much-needed senior management support to champion the benefits-oriented view of projects (Paivarinta et al., 2007), as opposed to the limitations and harmful short-termism of an excessive emphasis on project management success, i.e., the project capacity in delivering the project products (outputs) in attainment on schedule, within budget and complying with customer required quality and predefined scope (time, cost, and scope).

The approach of measuring project success only based on cost, time and scope dimensions is known as the iron triangle approach. This approach is limited once there are projects that, even delivering the outputs on schedule, within budget, and accordingly to the baseline scope dimensions, were considered unsuccessful ones by owners (or customers), sponsors, and other stakeholders. A qualitative study has confirmed that “even though we have gotten better at meeting the iron triangle of cost, time, and scope, many projects still do not achieve the strategic benefits – especially those that are nonmonetary – desired in most contemporary projects” (Meredith and Zwikael, 2019). The study indicates that “no one is specifically accountable for delivering these benefits” and consider that a more acceptable and effective approach is to assign the “project owner” as the accountable for managing the business case throughout the project lifecycle. Thus, an adequate approach to assess success of capital projects is to go further, reaching the ownership success in achieving the outcomes, and reaching the investment success as the end benefits needed (or desired) by the sponsor party. The capital project, as an investment project, will be considered successful if both the performance of the project temporary organization (project management success) and of the owner organization (project ownership success) are achieved accordingly to the sponsor expectations. In this context, the performance of the project organization and the owner organization are both dependent on its own team capabilities and are under the influence of the overall governing rules and practices of the parent firm, what confirms Agency Theory as an adequate lens to observe the phenomenon of capital asset development projects.

Theory and concepts of Project Success (De Wit, 1988; Shenhar and Dvir, 2001; Turner, 2009; Cooke-Davies, 2002; MacLeod, 2012; Zwikael and Smyrk, 2012; Serra and Kunc, 2015; ul Musawir, 2017) – In the case of oil and gas capital asset development projects, as investment projects, the core value to be created is the return on investment, which is the core benefit needed (or desired) by the permanent organization. Project success is a key objective function in the process of generating benefits and value for firms and is set as the dependable variable in this study. “The assessment of success of complex projects can be made by a range of stakeholders over different time scales, against different levels of project results, which includes: the project’s outputs at the end of the project; the project’s outcomes in the months following project completion; and the project’s impact in the years following completion” (Turner, 2009). In this study “Project Success” incorporates the conceptual framework proposed by De Wit (De wit, 1988), Turner (Turner, 2009), and other researchers (Shenhar and Dvir, 2001; Cooke-Davies, 2002; McLeod, 2012). Herein “Project Success” follows the basis of Zwikael and Smyrk (Zwikael and Smyrk, 2012) and Serra and Kunc (Serra and Kunc, 2015) studies, and is modeled and assessed as the dependent variable as proposed by ul Musawir (ul Musawir et al., 2017). In this study, project success is modeled as a multi-dimension and time-dependent construct, encompassing three project success dimensions. Due to the strategic implications of capital asset development projects in the value of the firms, “Project Success” is envisaged and modeled as the “Dependent Variable” in the research model. Therefore, in this study, “Project Management Success” (PMSucc), “Project Ownership Success” (POSucc), and “Project Investment Success (PISucc) are the adopted first order constructs associated to project success as the second order construct. “Project Investment Success” (PISucc), is the dependent construct in the inner model. To assess this multi-dimensional and time-dependent construct this study integrates and develops the project success frameworks proposed by De Wit (De wit, 1988) and Turner (Turner, 2009), and other researchers (Shenhar and Dvir, 2001; Cooke-Davies, 2002; McLeod, 2012), which was framed and developed by Zwikael and Smyrk (Zwikael and Smyrk, 2012) and Serra and Kunc (Serra and Kunc, 2015), and tested in an study by Musawir (ul Musawir et al., 2017). This conceptualization is in line with the perspective of practical and applied methodologies, as the “Projects in a Controlled Environment” (PRINCE2®) methodology. Project success can be assessed by its efficiency in the short term and its effectiveness in the medium and the long term (Jugdev et al., 2001; Müller and Jugdev, 2012). The value of the project is associated to the degree it complies with cost, time and scope requirements, to the level it satisfies customer needs and expectations, to the alignment with the parent organisation's strategy and, at the end, to the return on investment (Thomas and Mullaly, 2008), the desired end result of a capital project. Benefits justify the project undertaking and are the desirable end result of a project (Bradley, 2010). In this way project

management has shifted from product creation to value creation (Winter et al., 2006). To assess success in the realm of capital asset development projects, this study adopts a framework that incorporates and recognizes 3 (three) separate and distinct levels at which judgements can be made about project success (Zwikaël and Smyrk, 2012; Serra and Kunc, 2015; ul Musawir et al., 2017). The project success framework proposed here addresses the time-dependency inherent to the outputs, outcomes, and benefits, in the project 'flow of value'. The dimensions adopted in this study to assess "Project Success" as a multi dimension and time dependent construct are 3 (three): **(i) Project management success (PMSucc) dimension** – It is represented by the performance of the project manager, including his (or her) project team as a whole, in delivering the outputs and complying with the project plan that was approved and baselined in the business case that has justified the project. This level of success is assessed by the level in which the outputs are delivered in attainment on schedule (baseline delivery dates), within budget (baseline cost of the outputs) and complying with customer specifications (required quality and pre-defined scope of the outputs). **(ii) Project ownership success (POSucc) dimension** – It is represented by the project owner's performance in using (or operating) the outputs to produce the desired changes, i.e., in realizing the desired outcomes, as stated and approved in the business case that has justified the project. It includes the assessment of the resulting outcomes that are realized and achieved through the use of the outputs delivered by the project. The outcomes are dependent on the changes; the changes are dependent on the use of the products of the project; the products are the project's outputs. **(iii) Project investment success (PISucc) dimension** – It is represented by the value generated by the project accordingly to the desired firm's benefits qualified and quantified in the business case that has justified the project. It includes the assessment of the end-benefits as stated within the business case that justified the project. Benefits come in a variety of forms, as per investment returns, gains in the value of the firm, improvements in market share, new competitive advantages, and others benefits.

An in-depth discussion on the literature review and on the adopted theories and concepts is detailed in the referenced Doctorate Thesis (da Silva, 2021).

1.3 Methodology

This study employs a deductive research approach, grounded in Agency Theory (Jensen & Meckling, 1976) as lens and the conceptualization of a project as a Temporary Organization (Lundin & Söderholm, 1995) to model the capital project management phenomenon. The phenomenon under investigation is the "management and implementation of capital asset development projects" within the Brazilian oil and gas (da Silva, 2021). The individual capital project is the unit being analyzed, which is conceptualized not as an isolated entity but as a temporary organization embedded within and governed by its sponsoring parent firm, the principal, with the aim of achieving investment success.

Drawing upon Agency Theory, the capital project temporary organization, encompassing the project manager and project team, is viewed as a "temporary agency acting 'on behalf of' and 'within' the permanent sponsoring organization, the principal" (da Silva, 2021). The sponsor organization establishes the governance framework and delegates authority to two primary agent structures: (1) the project management structure, led by the project manager and responsible for project delivery (the outputs of the project), and (2) the project owner structure, representing the sponsor's interests and responsible for business results (the outcomes of project) for benefit realization. Both management and ownership agent structures interact under the governance of the principal to achieve the value and benefits articulated in the project's business case.

The study adopts a positivist philosophical stance, assuming a deterministic view to observe the relationships between the adopted constructs. To empirically examine the observed phenomenon, a quantitative theoretical research model is tested using validated constructs: Project Team Absorptive

Capacity (ACAP), Effective Project Governance (EPG) and Benefit Management Practices (BM) as exogenous variables; and Project Success (PS) as endogenous variable (da Silva, 2021).

The proposed structural model was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) via the SMARTPLS software (version 3.3.3) (Ringle et al., 2015). PLS-SEM was chosen due to its suitability for analyzing complex relationships among latent constructs with a focus on prediction and its robustness with moderate sample sizes (Hair et al., 2017). The analysis involved assessing both the “measurement model (“reliability and validity of the constructs”) and the structural model (“path coefficients, explained variance, and significance of hypothesized relationships”)”, as per detailed in the reference thesis (da Silva, 2021).

1.3.1 Theoretical justification

While most project management studies focus on identifying theoretical gaps or developing new concepts, this research adopts a pragmatic and consolidationist approach. This study adopts established theories to frame and empirically investigates under-validated relationships in capital projects, prioritizing theoretical robustness over conceptual novelty. The study is grounded in well-established theoretical pillars:

- Absorptive Capacity (Cohen and Levinthal, 1990; Zahra and George, 2002) – To model project team capabilities converting collective knowledge into performance. The study incorporates the multidimensionality of ACAP, set as a dynamic capability relevant in the processes of knowledge creation (potential ACAP) and knowledge utilization (realized ACAP), as per the studies of Cohen and Levinthal (1990) and Zahra and George (2002).
- Agency Theory (Mitnick, 1975; Ross, 1973; Jensen and Meckling, 1976) – As lens to observe the phenomenon of management and implementation of capital projects as principal-agent relationships incorporating governance as a mechanism to mitigate agent-principal issues.
- Governance of Projects (Müller, 2011; Too and Weaver, 2014; Müller et al., 2015; Joslin and Müller, 2016; ul Musawir et al., 2020) – To develop the hypotheses, where the governance framework works as a mediator variable between project team capabilities and project success.
- Temporary Organization (Lundin and Söderholm, 1995; Packendorff, 1995) – To frame the unit of analysis, the capital project temporary organization embedded within its parent sponsor organization.
- Success in Projects (De Wit, 1988; Shenhar and Dvir, 2001; Turner et al., 2009; Cooke-Davies, 2002; MacLeod, 2012; Zwikaël and Smyrk, 2012; Serra and Kunc, 2015; ul Musawir et al., 2017) – To model the multidimension and time dependent characteristic of project success, including management, ownership and investment success as objectives within the observed phenomenon.

This study emphasizes practical application over theoretical novelty. It follows established theory-testing approaches to empirically test relationships using Structural Equation Modeling (SEM), and adopts validated scientific constructs rather than developing new ones.

1.3.2 Constructs

This study operationalizes 4 (four) validated and tested scientific constructs with its measurement scales:

- Capital Project Success (a second-order construct with three dimensions) - Zwikaël & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017.
- Effective Project Governance - Alvarez-Dionisi, 2012; ul Musawir et al., 2017.
- Benefit Management Practices - Serra & Kunc, 2015; ul Musawir et al., 2017; Bradley, 2010; Breese, 2012.
- Absorptive Capacity (a second-order construct with two dimensions) - Cohen & Levinthal, 1990; Zahra & George, 2002; Flatten, 2011.

An in-depth discussion on the constructs is detailed in the referenced Doctorate Thesis (da Silva, 2021).

The definitions and measurement scales (measured on five-point Likert scale) for each are detailed below:

⇒ Capital Project Success (CPS)

A multi-dimensional and temporally dependent second-order construct (Zwikael & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017) representing the extent to which a capital project achieves its objectives across different levels and timeframes. It comprises three first-order dimensions:

- Project Management Success (PMSucc): Performance of the project manager and team in delivering outputs within the approved project plan (schedule, cost, specifications, quality) (Zwikael & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017; da Silva, 2021).
- Project Ownership Success (POSucc): Performance of the project owner in utilizing project outputs to realize intended business-as-usual outcomes as defined in the business case (Zwikael & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017; da Silva, 2021).
- Project Investment Success (PISucc): Value generated by the project in relation to the financial and strategic benefits qualified and quantified in the business case (Zwikael & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017; da Silva, 2021).

Table 2 presents the measurement items for Capital Project Success (Zwikael & Smyrk, 2012; Serra & Kunc, 2015; ul Musawir et al., 2017; da Silva, 2021):

Table 2 Capital Project Success Measurement Items

PMSucc
PMS1 - The project satisfactorily met the budget goals.
PMS2 - The project satisfactorily met the schedule goals.
PMS3 - The project satisfactorily delivered the required outputs.
PMS4 - Undesired outcomes were managed and avoided.
PMS5 - The project was successful in achieving the project plan.
POSucc
POS1 - The project's outputs have supported the business to produce the target outcomes.
POS2 - The project's outcomes adhered to the outcomes planned in the business case.
POS3 - The project was successful in realizing the business case.
PISucc
PIS1 - The project's outcomes supported the achievement of overall project objectives.
PIS2 - The project has provided the expected return on investment.
PIS3 - The project was successful in realizing its investment objectives.
PIS4 - The project was a total failure in realizing its investment objectives (inverted item to check valid responses).

⇒ Effective Project Governance (EPG)

The governance of projects by the parent firm, acting as a “bridging mechanism between corporate governance and project management” (Alvarez-Dionisi, 2012; ul Musawir et al., 2017). It establishes the principles for how the firm oversees its projects and manages the relationship between the temporary project team and the permanent sponsoring organization (Alvarez-Dionisi, 2012; ul Musawir et al., 2017; da Silva).

Table 3 presents the measurement items for Effective Project Governance (Alvarez-Dionisi, 2012; ul Musawir et al., 2017; da Silva, 2021):

Table 3 Effective Project Governance Measurement Items

EPG
EPG1 - The management board of the sponsoring firm had overall responsibility for the Governance of projects.
EPG2 - Disciplined governance arrangements were applied throughout the project life cycle.
EPG3 - Roles and responsibilities for the governance of projects were defined clearly.
EPG4 - The project's business case was supported by relevant and realistic information that provided a reliable basis for making authorization decisions.
EPG5 - A clearly defined criteria was used for reporting project status and for the escalation of risks and issues to the relevant organizational levels.
EPG6 - Decisions made at authorization points (or gates) were recorded and communicated to the relevant stakeholders.
EPG7 - The project had a project owner who was the single point of accountability in and to the organization for realizing project outcomes and benefits.
EPG8 - The project had a project manager who was accountable to the project owner for achieving project objectives and deliverables.
EPG9 - The parent firm sponsoring the project fostered a culture of frank internal disclosure of project management information.

⇒ Benefit Management Practices (BM)

The set of practices and processes implemented by the parent firm to monitor and control the realization of project outcomes and benefits throughout the project lifecycle and beyond (Serra & Kunc, 2015; ul Musawir et al., 2017; Bradley, 2010; Breese, 2012). It encompasses activities aimed at ensuring project outcomes align with strategic objectives and deliver the intended value and benefits.

Table 4 presents the measurement items for Benefit Management Practices (Serra & Kunc, 2015; ul Musawir et al., 2017; Bradley, 2010; Breese, 2012; da Silva, 2021):

Table 4 Benefit Management Practices Measurement Items

BM
BM1 - Expected outcomes (the changes and / or upgrades provided by project outputs) were clearly defined.
BM2 - The value created to the sponsor firm by the project outcomes (the changes and / or upgrades provided by the project outputs) was clearly measurable.
BM3 - The strategic objectives that project outcomes (the changes and / or upgrades provided by the project outputs) were expected to support the achievement of were clearly defined.
BM4 - A business case was approved at the beginning of the project, describing all outputs, outcomes and benefits that were expected from the project.
BM5 - Project outputs (project products) and outcomes (changes provided by project outputs) were frequently reviewed to ensure their alignment with expectations.
BM6 - Stakeholders were aware of the results of project reviews and their needs were frequently assessed with a view to make changes.
BM7 - Actual project outcomes adhered to the expected outcomes planned in the business case.
BM8 - Activities aiming to ensure the integration of project outputs to the regular business routine (training, support, monitoring, and outcomes evaluation) were executed as part of the project's scope.
BM9 - After project closure, the sponsor firm kept monitoring project outcomes in order to ensure the achievement of all benefits expected in the business case.
BM10 - From the first delivery to the project's closure, the sponsor firm performed a pre-planned, and regular process to ensure the integration of project outputs into the regular business routine (including outcomes evaluation).
BM11 - A project benefits management strategy is applied throughout the firm that sponsored the project.
BM12 - A project benefits management strategy was applied for the project under analysis.

⇒ Absorptive Capacity (ACAP)

A second-order construct (Cohen & Levinthal, 1990; Zahra & George, 2002; Flatten, 2011) representing the project temporary organization's ability to acquire, assimilate, transform, and exploit knowledge for project success. It comprises two first-order dimensions:

- Potential Absorptive Capacity (PACAP): The organization's capacity to acquire (Acq) and assimilate (Ass) new external knowledge.
- Realized Absorptive Capacity (RACAP): The organization's capacity to transform (Tra) and exploit (Exp) assimilated knowledge.

Table 5 presents the measurement items for Absorptive Capacity (Cohen & Levinthal, 1990; Zahra & George, 2002; Flatten, 2011; da Silva, 2021):

Acquisition (Acq)
Acq1 - The search for relevant information concerning the project was the every-day business in the project environment.
Acq2 - The management, including the project manager and the functional managers, has motivated the project team members to use information sources outside of the project environment.
Acq3 - The management, including the project manager and the functional managers, has expected that the project team members deal with information beyond the project environment.
Assimilation (Ass)
Ass1 - In the project environment the ideas and concepts were communicated cross- functional.
Ass2 - The management, including the project manager and the functional managers, has emphasized cross-functional support to solve problems.
Ass3 - In the project environment there was a quick information flow, e.g., if a project unit or function obtains important information it communicates this information promptly to all other project units or functions.
Ass4 - The management, including the project manager and the functional managers, has demanded periodical cross-functional meetings to interchange new developments, problems, and achievements.
Transformation (Tra)
Tra1 - The Project Team members had the ability to structure and to use collected knowledge.
Tra2 - The Project Team members were used to absorb new knowledge as well as to prepare it for further purposes and to make it available.
Tra3 - The Project Team members successfully linked existing knowledge with new insights.
Tra4 - The Project Team members were able to apply new knowledge in their practical work.
Exploitation (Exp)
Exp1 - The management, including the project manager and the functional managers, has supported the development of prototypes and/or tests (to anticipate information and / or potential performance).
Exp2 - The management, including the project manager and the functional managers, regularly reconsiders technologies and adapts them accordant to new knowledge.
Exp3 - The management, including the project manager and the functional managers, has had the ability to work more effective by adopting new technologies.

An in-depth discussion on the constructs and its items is detailed in the referenced Doctorate Thesis (da Silva, 2021).

1.3.3 Research model and hypotheses

Developing on Fig. 4, Fig. 6 presents the research model with the adopted constructs: ACAP, EPG, BM set as independent (exogenous) variables, while PS set as the dependent (endogenous) variable.

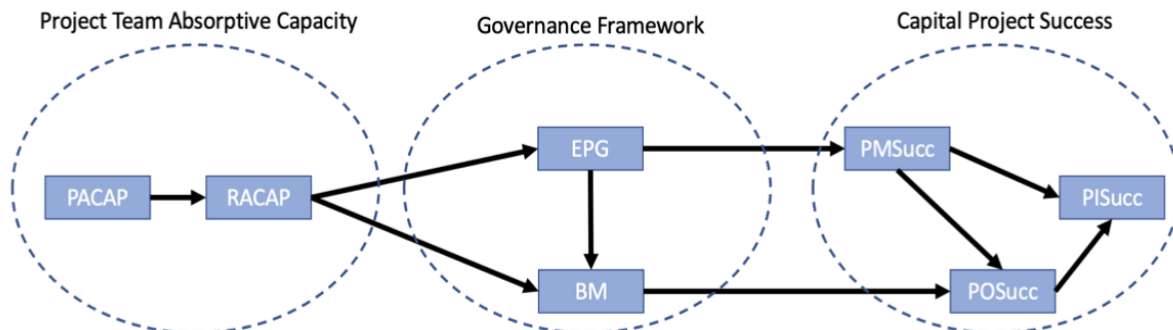


Fig. 6 Research Model with the Adopted Constructs

The study encompasses 15 hypotheses to be confirmed and supported:

- 9 (nine) positive relationship hypotheses (H1 to H9), represented by arrows in Fig. 6; and
- 6 (six) other hypotheses, not shown in Fig. 6 once they are associated to mediation relationships.

All 15 (fifteen) hypotheses are described in Table 6.

Fig. 7 presents the research model with constructs, items and hypotheses.

An in-depth discussion on the research model and hypotheses is detailed in the referenced Doctorate Thesis (da Silva, 2021).

Table 6 Hypotheses

H1 – There is a positive relationship between project management success (PMSucc) and project ownership success (POSucc).
H2 – There is a positive relationship between project ownership success (POSucc) and project investment success (PISucc).
H3 – There is a positive relationship between project management success (PMSucc) and project investment success (PISucc).
H4 – There is a positive relationship between project team potential absorptive capacity (PACAP) and project team realized absorptive capacity (RACAP).
H5 – There is a positive relationship between effective project governance (EPG) and benefit management (BM).
H6 – There is a positive relationship between project team realized absorptive capacity (RACAP) and effective project governance (EPG).
H7 – There is a positive relationship between project team realized absorptive capacity (RACAP) and benefit management (BM).
H8 – There is a positive relationship between effective project governance (EPG) and project management success (PMSucc).
H9 – There is a positive relationship between benefit management (BM) and project ownership success (POSucc).
H10 – Effective project governance (EPG) mediates the relationship between project team realized absorptive capacity (RACAP) and project management success (PMSucc).
H11 – Benefit management (BM) mediates the relationship between project team realized absorptive capacity (RACAP) and project ownership success (POSucc).
H12a (H8-H1) – Project management success (PMSucc) mediates the relationship between effective project governance (EPG) and project ownership success (POSucc).
H12b (H5-H9) – Benefit management (BM) mediates the relationship between effective project governance (EPG) and project ownership success (POSucc).
H13 – Project management success (PMSucc) mediates the relationship between effective project governance (EPG) and project investment success (PISucc).
H14 – Project ownership success (POSucc) mediates the relationship between benefit management (BM) and project investment success (PISucc).

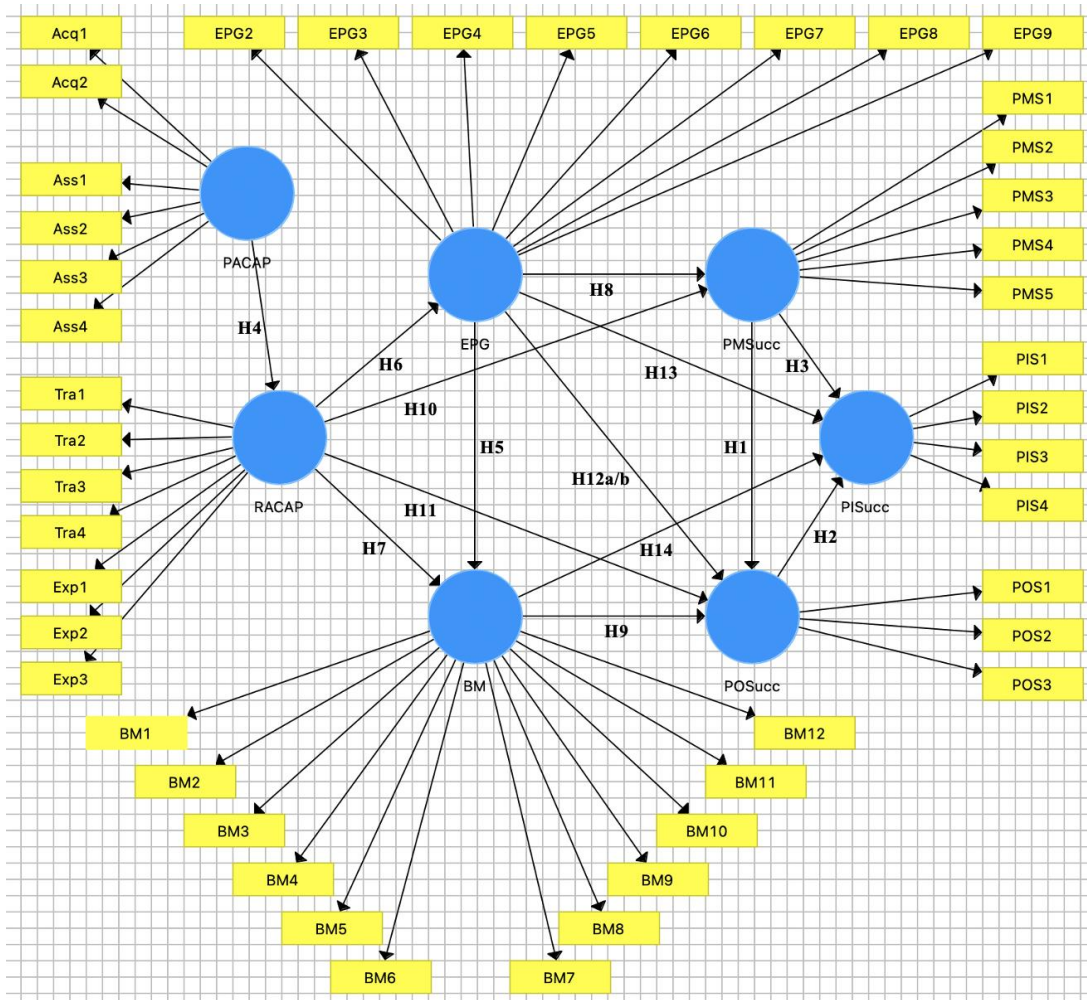


Fig. 7 Research Model with Constructs, Items and Hypotheses

Research model is shown as per calculated. During calculations, items Acq3 for the PACAP construct, and item EPG1 for the EPG construct were eliminated from the measurement criteria once their path coefficients were lower than 0.500 (Hair et al., 2013; Wong, 2019).

1.3.4 Sample and data collection

This study employed a cross-sectional survey to collect data, administered over a six-month period (January to June 2020). The target population comprised experienced project management professionals actively involved in Brazilian oil and gas capital asset development projects. A total of 449 professionals were identified and invited to participate via professional networks and industry associations. Participants were requested to provide data related to a completed Brazilian capital project in which they had significant involvement. This resulted in 186 responses, yielding a response rate of 41.4%. Following data screening for completeness and consistency, 173 responses (93.0% of the initial responses) were deemed valid and included in the final analysis. Sample demographics is summarized in Table 7. The questionnaire form, with inherent items, is available in the reference Thesis (da Silva, 2021).

Table 7 Sample demographics

Respondent 's Role	%
Project Temporary Organization	66%
Ownership Permanent Structure	24%
Sponsorship Permanent Structure	10%
Respondent 's Project Management Experience	%
Greater than 30 years	8%
From 20 to 30 years	14%
From 10 to 20 years	38%
From 5 to 10 years	28%
From 2 to 5 years	9%
Less than 2 years	3%
Project CAPEX (US\$)	%
Less than 1 million	5%
From 1 to 5 million	7%
From 5 to 25 million	9%
From 25 to 150 million	8%
From 150 million to 1 billion	20%
Graeter than 1 billion	51%

1.3.5 Research Model Assessment and Validation

Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized to test the proposed model. It is an adequate method to estimate complex interrelationships simultaneously and is recognized by its ability in supporting predictions in quantitative studies (Chin, 1998; Haenlein & Kaplan, 2004; Albers, 2010; Statsoft, 2013; Rigdon, 2014; Wong, 2019). The research model has adopted consolidated and tested constructs with valid reflective measurement scales. The typical and adequate Research Model Assessment procedures and tests applied in the variance-based Structural Equation Modeling (SEM) method were adopted and no relevant issues have been detected as per detailed in da Silva (2021).

Fig. 8 shows the path coefficients and R Square numbers (SMARTPLS Calculation report).

Fig. 9 shows the p-values (SMARTPLS Bootstrapping test Report). Both statistics were adequate.

As per the R Square numbers, the research model explains:

- 80.7% of the variance in PISucc, the dependent variable.
- 62.5% of the variance in BM.
- 39.2% of the variance in EPG.
- 44.6% of the variance in PMSucc.
- 74.2% of the variance in POSucc.
- 54.1% of the variance in RACAP.

Construct reliability checks for model and data collection instrument validation were performed and all parameters were found as adequate and complying with recommended metrics. Discriminant validity test was performed, and no statistical discrepancies were identified. Collinearity statistics has confirmed the inexistence of unexplainable spurious collinearities in the structural model. Model fit assessment has indicated a well-fitted status, with no measurement and structural model misspecification. Additionally, no issues in outer loadings and significance were identified.

All hypotheses were supported, and all statistics parameters were within the adequate ranges.

The quantitative procedures adopted are detailed in the referenced Doctorate Thesis (da Silva, 2021).

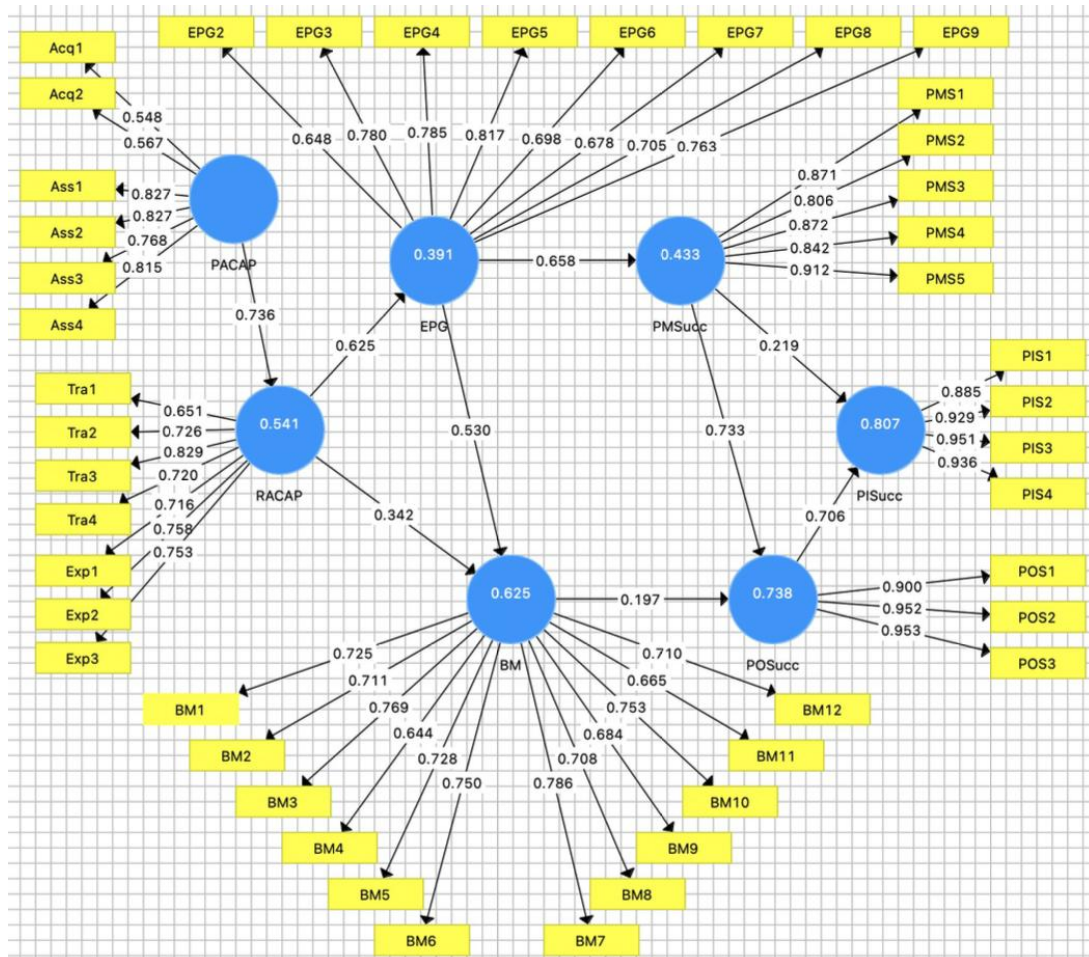


Fig. 8 Research proposed model as the “Calculation Report” (SMARTPLS)

Regarding outer loadings, all path coefficients are greater than 0.500, what indicates an adequate statistical significance (Hair et al., 2013; Wong, 2019). As mentioned in 1.3.3 above, items Acq3 for the PACAP construct, and item EPG1 for the EPG construct were eliminated from the measurement criteria (path coefficients were lower than 0.500 for these items).

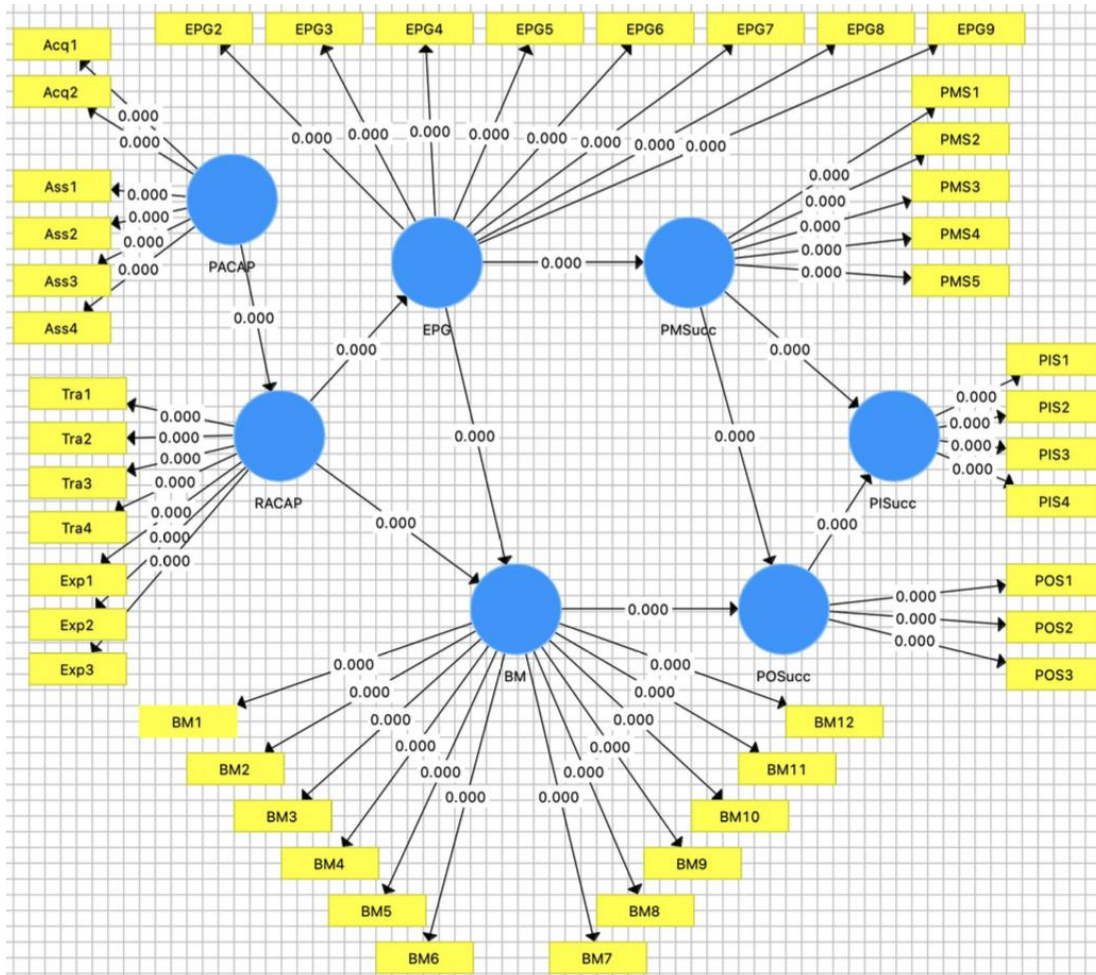


Fig. 9 Research proposed model as the “Bootstrapping Test Report” (SMARTPLS)

1.4 Findings

1.4.1 On Project Success

“Project Success is modeled as a second-order construct, composed of three first-order dimensions: PMSucc, POSucc and PISucc”, a robust and coherent structure within the context of capital projects (ul Musawir et al., 2017; da Silva, 2021). This finding supports the multi-dimensional conceptualization of project success proposed in prior literature (Zwikael and Smyrk, 2012; Serra and Kunc, 2015; ul Musawir et al., 2017) and aligns with the temporal flow of value inherent in project delivery, from initial outputs to subsequent outcomes and ultimate benefits, as recognized in frameworks such as PRINCE2®.

The analysis confirmed that POSucc (ownership success) acts as a significant partial mediator, explaining how PMSucc (management success) leads to PISucc (investment success). While the project team's successful delivery has a direct impact on investment results, a substantial portion of this positive effect is a result of the project owner successfully utilizing and operating the project's outputs.

This partial mediation is consistent with the nature of capital projects. Achieving project management success, characterized by on-time, within-budget, and on-specification delivery of project outputs, lays a

foundational groundwork for investment success. However, the subsequent realization of the anticipated financial returns is significantly dependent on how effectively the project owner utilizes and operates the outputs to generate the intended business outcomes and associated cash flow, as envisioned in the project business case. Therefore, the ultimate investment success of a capital project is contingent upon both the efficient execution of the project itself and the subsequent effective management and exploitation of its deliverables.

1.4.2 On Absorptive Capacity

The structural model confirmed “ACAP's conceptualization as a second-order construct, with PACAP and RACAP serving as its formative first-order dimensions” (Zahra & George, 2002; Cohen & Levinthal, 1990; da Silva, 2021; Flatten, 2011). Statistical analysis revealed a significant positive association between PACAP and RACAP, indicating that the foundational capacity of a project team to acquire and assimilate external knowledge is a key determinant of its subsequent ability to transform and apply that knowledge effectively.

This finding aligns with ACAP Theory (Zahra & George, 2002; Cohen & Levinthal, 1990), supporting the notion that a foundation of prior knowledge and the ability to recognize and internalize new information (PACAP) are critical antecedents to the subsequent creation of value through knowledge transformation and application (RACAP). Results underscore the sequential nature of knowledge absorption, where the effective acquisition and assimilation of external knowledge are prerequisites for its successful transformation into new insights and its exploitation in operational processes to enhance project outcomes.

Additionally, empirical evidence was provided for the relevance of team-level ACAP as a potential source of dynamic capabilities within both temporary project organizations and their permanent parent firms. While ACAP has been predominantly examined in the context of Research and Development (R&D), New Product Development (NPD), and innovation initiatives, these findings contribute to the broader applicability of ACAP theory within project management, as suggested by prior scholars (Lane, 2006). The study confirms the role of ACAP as a key human resource effector capable of positively influencing project investment success, expanding the understanding of ACAP's impact within the domain of project management.

1.4.3 On Governance Framework

The study confirmed the significant influence of the EPG, acting as a crucial bridging mechanism between corporate governance and project management (Alvarez-Dionisi, 2012), and as a key conduit for the impact of ACAP on PISucc.

The governance framework (EPG and BM) serves as a critical mechanism for ensuring alignment between the principal party (parent sponsor) and the project agent (project temporary organization), consistent with Agency Theory (Mitnick, 1973; Ross, 1973; Jensen and Meckling, 1976; da Silva, 2021). This alignment, which also integrates key project roles, is shown to be a prerequisite for achieving project success.

EPG, as the parent firm's oversight of its projects, directly influenced the performance of the project temporary organization in terms of PMSucc. Furthermore, EPG indirectly impacted the performance of the sponsoring organization in realizing POSucc and ultimately PISucc, with BM acting as an intermediary mechanism. EPG, operationalized as the governance of the project management function (ul Musawir et al., 2017), thus plays a pivotal role in shaping both project delivery and the subsequent realization of benefits.

While a positive relationship between BM and POSucc was observed, its statistical significance was noted to be relatively weaker. This observation may be attributed to the documented challenges in the widespread and mature adoption of benefit management practices across industries (Ward et al., 2007; Coombs, 2015; ul Musawir et al., 2017; Doherty, 2014; Breese et al., 2015; Meredith and Zwikael, 2020). The findings suggest that the effective implementation and communication of benefit management practices within the governance framework may still be evolving, potentially limiting its full impact on the project ownership phase. Organizations with a stronger orientation towards benefit realization are more likely to achieve expected outcomes (Ward et al., 2007), highlighting the potential for variability in the effectiveness of BM implementation. The study's context, the Brazilian oil and gas sector, may also reflect this relative immaturity of BM practices (Doherty, 2014). The findings emphasize the importance of embedding BM principles throughout the project lifecycle, particularly within the responsibilities of the project owner, rather than treating it as a post-project activity (Bradley, 2010).

1.5 Discussion and conclusion

This study empirically supports the proposed model, demonstrating the significant influence of internal (project team absorptive capacity) and external (governance framework) factors on capital project performance from the temporary organization's perspective. Critically, it confirms the governance framework's mediating role in channeling absorptive capacity towards project success through key mechanisms:

- EPG's influence on the temporary organization's output delivery and PMSucc.
- BM's role in the permanent owner structure's outcome realization and POSucc.
- The model's capture of the temporal and multi-dimensional nature of capital project success (PMSucc, POSucc, PISucc).
- The adaptation of PRINCE2®'s "project flow of value" into a "capital project success triangle" (Fig. 10), mapping temporal progression to multi-dimensional success.
- The operationalization of ACAP as a second-order construct (PACAP, RACAP) for nuanced understanding of knowledge contribution.
- Empirical validation of the governance framework (EPG, BM) mediating ACAP's impact on project success, illustrating how organizational structures translate team knowledge into tangible results.

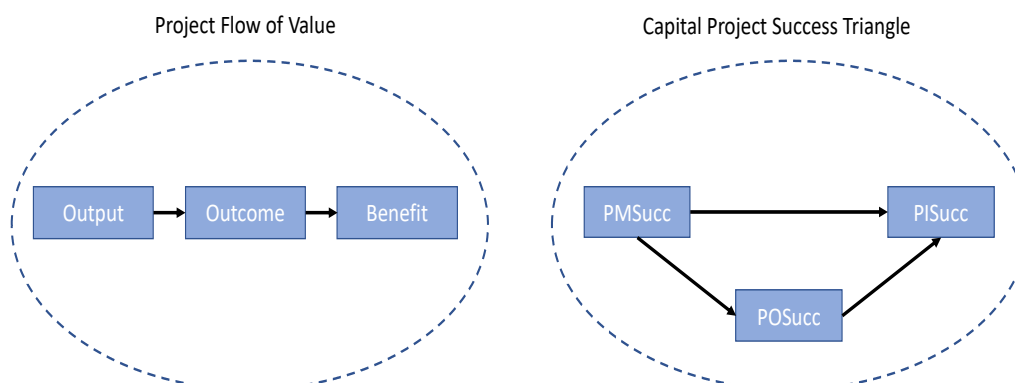


Fig. 10 “Project Flow of Value (PRINCE2®)” vs. “Capital Project Success Triangle”

The validated model offers a comprehensive framework for understanding capital project success drivers, potentially applicable beyond the Brazilian oil and gas industry. Its statistical robustness supports the validity of these findings and their implications.

1.5.1 Theoretical implications

The study addresses a relative paucity of quantitative research that simultaneously models the interconnected influences of both internal (project team capabilities) and external (governance frameworks) factors on project outcomes from the perspective of the temporary project organization. Specifically, it offers novel empirical insights into the integrated roles and interrelationships of key agents (project manager, project owner, project sponsor) and organizational entities within a defined governance structure, a domain that has seen limited holistic quantitative investigation.

The findings reinforce the significant mediating role of the governance framework in translating collective project team capabilities, specifically absorptive capacity, into tangible project success. This study supports the view that project entities are not isolated but function as interdependent components within a broader organizational ecosystem (Müller & Turner, 2007; Morris, 2009; Derakhshan, 2019; Riis, 2019), where the sponsoring organization provides overarching governance.

While the literature acknowledges the supportive role of project governance in enhancing project success (Jenner, 2016; Bradley, 2010; Atkinson, 1999), this research provides empirical evidence elucidating the mechanisms through which this enablement occurs. The study sets the governance framework as a mediating variable: BM mediating EPG and POSucc relationship, and EPG mediating RACAP and PMSucc relationship. Governance is channeling the impact of ACAP towards overall project success. This establishes a foundation for a more granular theory explaining the transmission of capability effects through governance structures (da Silva, 2021).

By empirically validating the limitations of the traditional triple constraint, our research offers a new perspective: the "capital project success triangle." This model provides a more comprehensive and time-dependent view of value, showing that success in project management (**PMSucc**) influences investment success (**PISucc**) both directly and indirectly. The partial mediation of **Project Ownership Success (POSucc)** in this relationship underscores the critical, interconnected sequence of value creation in capital projects.

The study also suggests the need for a more unified and formally defined understanding of project governance within the project management research field, irrespective of the specific governance theory adopted as a lens (da Silva, 2021). This call for definitional clarity is crucial given the intuitively acknowledged yet often diffusely explored influence of project governance on project performance (Müller, 2017; ul Musawir et al., 2020).

Consistent with prior research (Hjelmbrekke et al., 2014; Badewi, 2016; ul Musawir et al., 2017), the findings indicate a stronger impact of EPG compared to BM practices on realizing PISucc. This reinforces the foundational role of robust governance structures in shaping both project delivery and benefit realization. The study's emphasis on governance as a key mechanism through which project team capabilities influence project success aligns with the growing recognition of the socio-technical complexities inherent in project delivery (Winter et al., 2006), urging researchers to further explore the interplay of human action, social dynamics, and formal governance structures in shaping project outcomes.

1.5.2 Practical implications

The results of this study offer practical guidance for practitioners on how to improve capital project outcomes. The empirical evidence underscores the critical importance of establishing a balanced and well-designed governance framework, coupled with strategic investments in developing project team capabilities. These factors emerge as key value drivers positively influencing the ultimate financial outcomes of capital projects.

Specifically, sponsoring organizations should prioritize the implementation of governance frameworks that clearly delineate responsibilities and provide commensurate authority for both project management and project ownership roles. This balanced allocation of accountability mechanisms is crucial for facilitating and fostering project success across all its dimensions.

The study confirms the "project flow of value" as a "project success triangle". Success in using the outputs, post-project success, partially mediates the link between project management success and project investment success. This highlights the importance of a holistic governance model that integrates project delivery with long-term benefit realization. Project sponsors and leaders must actively manage these interconnected elements to ensure overall investment success.

Furthermore, the demonstrated relevance of both PACAP and RACAP as collective team capabilities highlights the strategic importance of knowledge management within sponsoring organizations. Practitioners should focus on establishing corporate standards and practices that foster the continuous improvement of overall ACAP, enabling project teams to effectively "acquire, assimilate, transform, and exploit knowledge" (Zahra & George, 2002; Cohen & Levinthal, 1990). Leveraging these positive effects of ACAP, facilitated by robust governance mechanisms (EPG and BM), can significantly enhance the likelihood of achieving project success across its management, ownership, and investment dimensions.

In practical terms, this research suggests that organizations should:

- Invest in robust and equitable governance frameworks: Ensure clear roles, responsibilities, and authority for project managers, project owners, and sponsors, fostering accountability and alignment.
- Recognize the distinct phases of value creation: Understand and manage both project outputs (PMSucc) and outcomes (POSucc) as critical, yet partially independent, and drive investment success (PISucc).
- Cultivate project team absorptive capacity: Implement knowledge management strategies that promote knowledge acquisition, assimilation, transformation, and exploitation at both project team and permanent structure levels.
- Integrate governance and knowledge management: Design governance frameworks that actively support and leverage the absorptive capacity of project teams to enhance project outcomes and investment returns.

The study indicates that, by strategically addressing these practical implications, organizations in capital-intensive industries can improve the effectiveness of their capital project endeavors and increase the probability of achieving their intended investment objectives.

1.5.3 Limitations of the study

While the survey design was effective for testing our model, it provides a static view, which limits our ability to observe how the relationships among governance, team capabilities, and project success unfold over time. Future research employing qualitative methodologies could provide richer insights and refine the measurement scales.

The focus on capital asset development projects within the Brazilian oil and gas industry represents a potential contextual limitation, as governance mechanisms and project dynamics may vary across different countries, project scales, and industry sectors (Müller & Lecoeuvre, 2014). Furthermore, the application of Agency Theory as a primary lens may have inadvertently simplified the socially embedded and institutionally influenced principal-agent dynamics (Davis et al., 1997; Wiseman et al., 2012).

While project team capabilities and the governance framework are identified as significant predictors of project success, the model does not account for other potentially influential independent, mediating, or moderating variables. Additionally, the study's focus on successful projects, inherent in the reliance on experienced professionals reporting on completed projects, may limit the generalizability to project failures. The predominantly success-oriented focus in the referenced literature may also contribute to this bias.

Specific to the Brazilian context, the understanding and application of Benefit Management (BM) practices may deviate from established theoretical frameworks, potentially introducing measurement error despite the use of a validated scale. BM's prevalent association with portfolio-level project selection rather than lifecycle-wide implementation by the ownership party could have influenced respondent interpretations.

Finally, the study's assessment of Project Investment Success (PISucc) does not explicitly account for the distinction between "doing projects right" (implementation efficiency) and "doing the right projects" (strategic selection) (Bradley, 2010). The success of poorly selected projects, regardless of implementation quality, remains a confounding factor. Cultural and psychological variations in the perception of project success across different national contexts (Serra & Kunc, 2014) also present a potential limitation to the broader generalizability of the findings.

1.5.4 Directions for future research

To better understand what drives project success, "future research should explore how additional variables might influence or connect team capabilities and project outcomes" (da Silva, 2021). This alternative is even more accessible, breaking down the concepts into simpler terms like "what drives project success" and "connect team capabilities and project outcomes". Potential additional variables include:

- Projectification Level: Investigate its influence on inter-entity relationships and knowledge flow within the temporary project organization (Maylor et al., 2006; Milder, 1995; Lundin et al., 2015; Müller et al., 2016; Schoper et al., 2018).
- Governmentality: Analyze its impact on the interaction dynamics between governing and governed entities within project contexts (Müller et al., 2016; Müller & Wang, 2017; Müller & Shao, 2015).
- Project Overall Complexity: Examine the moderating effects of novelty, technology, complexity, and pace (urgency) (Shenhar & Dvir, 2007).
- Project Management Methodology and Maturity: Assess their influence as potential independent or moderating factors.

Given the significant investments in megaprojects (Flyvbjerg, 2014), future studies should integrate qualitative and quantitative methodologies for robust moderation-mediation analyses. Validation of the proposed model across diverse industries, organizational settings, and cultural contexts is also warranted, incorporating multiple stakeholder perspectives (e.g., internal/external suppliers, support entities).

Addressing project typification is crucial. Future research should investigate how governance frameworks should be tailored to different project types (Shenhar & Dvir, 2007; ul Musawir et al., 2020), acknowledging that a uniform approach may not be optimal (Müller et al., 2016).

Expanding the conceptualization of project success to include dimensions like "preparing for the future" (Shenhar & Dvir, 2001) could provide insights into organizational learning and sustainable performance in capital project management. Investigating the link between this future-oriented dimension and organizational absorptive capacity warrants further exploration.

Finally, future research could quantitatively evaluate the IPMA DELTA® assessment and certification model (Fig. 11) as a holistic framework for improving project success probability, given its alignment with the study's key latent variables (Fig. 12): individual competence (ACAP), organizational competence (EPG & BM), and project excellence (Project Success).



Fig. 11 IPMA DELTA® Model (adapted from <https://ipma.world/ipma-certification/delta/>)

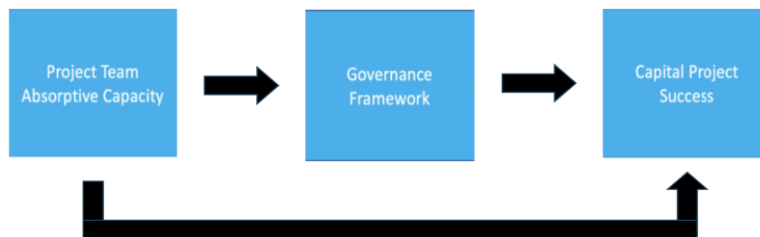


Fig. 12 IPMA DELTA® Model (adapted from Fig. 6)

1.5.5 Conclusions

This study provides significant insights into the dynamics of capital project success in the realm of oil and gas investment initiatives, demonstrating the crucial mediating role of the parent firm's governance framework in translating project team absorptive capacity into tangible investment returns. By integrating Agency Theory, Absorptive Capacity Theory, and the Temporary Organization Concept, the research empirically validates a model that elucidates how governance aligns the efforts of temporary project teams and permanent sponsor structures towards shared strategic objectives. The confirmed positive influence of a balanced governance framework and the cultivation of team capabilities underscore their importance as value drivers for capital project success.

This study makes a theoretical contribution to project management by providing empirical proof that governance is a critical mechanism for translating team capabilities into project success. The model we validated explains a substantial amount of the variance in project investment success, offering a strong framework for understanding these relationships in capital-intensive settings. Furthermore, the study reinforces the multi-dimensional and temporal nature of project success, advocating for a holistic perspective that encompasses project delivery, operational outcomes, and strategic benefits. To gain a holistic view of capital project success, it's essential to consider other key dimensions: strategy realization, stakeholders satisfaction, incorporating competitive advantages, sustainability performance and regenerating initiatives, not limited to these.

While acknowledging inherent limitations, this work addresses critical gaps in existing literature by providing a combined perspective on team capabilities and governance as drivers of project success. The

integrated theoretical model, built upon well-established theories and validated constructs, offers a foundation for future research in diverse capital project contexts. Ultimately, a deeper understanding of how human resource factors and organizational governance interact is vital for firms seeking to enhance the predictability and repeatability of success in their capital asset development endeavors. Recognizing the distinct yet intertwined roles of project management and ownership under an effective governance framework is key to aligning organizational efforts and achieving the desired competitive advantage in capital project management and implementation.

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