



Towards a comprehensive framework for risk assessment of organizational development project portfolios

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Abstract:

The benefits of risk management in the context of project portfolios have been widely recognized in the literature. However, approaches that assess the risk of organizational development project portfolios from the perspective of how the portfolio delivers value to the parent organization remain largely unexplored. To address this gap, our research takes a constructivist approach and an organizational perspective on project portfolios. We conducted twenty-eight semi-structured interviews and used thematic analysis to identify and relate four themes of a comprehensive project portfolio risk assessment (PPRA) framework: "project portfolio as the organizational unit for PPRA"; "organizational capabilities as portfolio outcomes in which PPR can be assessed"; "project portfolio levels as sources of risk factors in PPRA"; and "balance between project portfolio attributes complexity". Within the framework of organizational development project portfolios, this study contributes to our understanding of PPRA by providing two propositions: (1) The capabilities to be generated by the project portfolio can be used as the portfolio primary results on which PPRA can assess the risk of the project portfolio, establishing the impact of PPR on the project portfolio value delivering to the parent organization, and (2) The risk factors that impact the project portfolio expected results can be represented into PPRA as 'output-related' risk factors and 'outcome-related' risk factors.

Keywords:

project portfolio management; project portfolio risk; risk assessment; qualitative analysis; thematic analysis.

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1. Introduction

Project portfolio risk management seeks to maximize the value delivered to the organization through the impact achieved on strategic goals while managing limited resources, capabilities, and an assumed level of risk [1]–[4]. In this context, the strategic alignment of project portfolios is seen as a guiding principle for project selection [5], [6], and the positive influence of project portfolio risk management on the project portfolio success has been recognized in the literature [7]–[9]. Project Portfolio Risk Assessment (PPRA), like project portfolio risk planning, project portfolio risk identification, and project portfolio risk response, is an element of project portfolio risk management [10]. PPRA is designed to provide information about the significance of risks and risk trends, among other factors, to support risk response decisions [9], [10]. It enables managers to better monitor and prevent risks [11]. To achieve this, PPRA should generate greater approximations to reality and incorporate a portfolio-wide view through which inherent project portfolio characteristics would be recognized [8], [12], [13].

A project portfolio can be defined as an organization hosting temporary organizations (projects and programs) that interact with the parent organization and its strategy [14]. Thus, recognizing how the project portfolio delivers value to the parent organization is crucial when managing project portfolios [5], [15]. Then, the fact that project portfolios share resources with the parent organization, as well as the strategic impact of the portfolios does not come directly from the outputs of each project within the portfolio but is generated through a comprehensive process of value delivery to the parent organization are highlighted as inherent project portfolio characteristics [16]–[18]. However, these project portfolio characteristics have not been widely explored and incorporated into PPRA approaches [12], [16].

On the one hand, the most traditional PPRA approach focuses on evaluating the financial risk taken by the parent organization when investing in one or another project portfolio [11], [19], [20]. However, this approach does not consider how the project portfolio delivers value to the parent organization. On the other hand, from a second risk planning approach, PPRA has been oriented to evaluate the risk associated with achieving project objectives considering interdependencies between projects, and traditionally by assessing the impact on duration or cost of each project within the portfolio [20], [21]. However, this second risk planning approach did not explicitly consider the relationship between the portfolio and the parent organization's strategy.

Thus, in recent years studies have evolved to assess the impact of project portfolio risk on strategic goals [22], [23], including not only the risk derived from the projects and their interdependencies, but also the risk derived from the project portfolio level itself [2]. As a result, the traditional conceptualization and theory of PPRA has been complemented by an emerging approach based on the impact of risk at the strategic level. However, considerations on the implications for PPRA derived from considering the interaction between the project portfolio and the parent organization and its strategy, as well as how the project portfolio delivers value to the parent organization, remain absent.

Considering the above, the PPRA literature could benefit from adopting a comprehensive framework that recognizes the organizational perspective of project portfolios. The organizational perspective of project portfolios helps to understand the different portfolio levels and their interrelationships; as well as recognizing that the project portfolio interacts with the parent organization and its strategy while serving multiple stakeholders, organizational resource constraints and resource competition [14], [17], [24]. Therefore, the current study addresses the following research question: What could be the implications for PPRA when an organizational perspective of the project portfolios is adopted?

For this purpose, this study was developed based on the qualitative analysis of twenty-eight semi-structured interviews conducted with project portfolio practitioners. This research focused on organizational development project portfolios. This type of project portfolio is associated with structures that respond to changes in the competitive environment, marketing priorities, consumer demands, production technology requirements, Etc. In this regard, organizational development project portfolios comprise a set of mixed projects [25]. The empirical findings derived from this study provide insights into PPRA and suggest four interdependent themes that describe and conceptualize it from an organizational perspective. In addition, this research leads to recognizing the interaction between the project portfolio

and the parent organization and its strategy into PPRA through two propositions derived from the discussion, opening new avenues for theoretical and empirical studies in the field.

The remainder of the paper is organized as follows. Firstly, a PPRA background is presented, followed by a description of the research methodology used for the study. Then, the findings of the interview analysis are presented, leading to the description of a comprehensive framework for PPRA. The findings are followed by the discussion in which empirical propositions for PPRA are developed, and finally, conclusions are summarized.

2. Literature review

2.1 Project portfolio risk assessment

The literature on risk assessment in the project portfolio context can be classified into two main classical approaches: 1) Risk assessment carried out as part of project portfolio selection. This approach is derived from the Modern Portfolio Theory proposed by Markowitz in 1952; this theory mainly focuses on optimizing project portfolio investments [3], [13], [19]. 2) risk analysis in the project portfolio execution phase, where the literature has focused on integrating project interdependencies with project risk assessment models [21], [26], seeking a better representation of project portfolio risk as a network of interdependent projects and risk factors [24], [11]. According to Ahmadi-Javid et al. [20], the first group is related to general management, and the second group is related to the project management field.

Project portfolio risk management and PPRA developments applied to project portfolios mainly focus on analyzing risks from the project portfolio selection perspective. Thus, the problem of creating an optimal risk-reward portfolio has been actively considered in the literature [19], [27]. In this regard, the proposed model by Loperfido [27] is an example of recent work done from this perspective. Thus, from the investors' perspective, PPR has been mainly associated with the expected economic results. Consequently, risk measures derived from risk analysis of financial portfolios have been mainly used to assess the PPR [11]. However, assessing risk only in monetary terms does not consider the diversity of strategic objectives that make up the strategic orientation [22], [28]. Therefore, this perspective does not capture the diversity of organizational outcomes expected by the parent organization when a project portfolio is selected and executed [3]. It also neglects to acknowledge how the project portfolios deliver value to the parent organization [16].

Although assessing the financial risk derived from the portfolio investment is highly relevant from the investor's perspective, it does not assess the risk at the portfolio level in a manner that provides information to support the management of portfolio risk when it is being executed. In this vein, the literature suggests that the technical or operational risk associated with the result of the project portfolio execution should also be considered [21], [29].

Only in the last two decades have considerations of PPRA in project portfolio execution been introduced [30], [31]. In this regard, proposals for PPRA are initially focused on each project's technical and operational impacts [20], [21]. In this approach, the portfolio risk was assessed based on the risk of each project within the portfolio, specifically, the risk based on project measures such as the project's duration or total cost. More recently, proposals have been oriented to incorporate and evaluate the influence of project interdependencies and risk interdependencies on Project Portfolio Risk (PPR) [11], [21], [32]; and also considering the interdependencies between projects but focusing on selecting a suitable project portfolio to achieve a set of strategic goals [22], as is illustrated, for instance, in the study carried out by Han et al. [13]. Thus, broader perspectives have been adopted by introducing into PPRA some inherent characteristics of project portfolios, such as the influence of project interdependencies and risk factor interdependencies derived from the projects within the project portfolio.

Looking to incorporate the fact that the portfolio risk goes beyond the sum of the individual risk of each project in the portfolio [33], [34], Hofman and Grela [35] assess a set of project portfolio-level risk factors based on the likelihood and the impact on project portfolio goals. Based on that, the risk factors categorization is proposed based on risk likelihood and impact perspectives. Ghasemi et al. [12] identify risk factors caused by project interactions, and they also define risk factors at the project portfolio level as causes that could generate negative consequences on portfolio success factors and portfolio management objectives.

By focusing on the influence of resource interdependency between projects, Bai et al. [32] found that poor communication and cooperation among projects and lack of technology sharing are among the leading factors of the PPR. Later, Bai et al. [11] focused on considering project portfolios as a network through which the risk is propagated through the projects due to their interdependencies. To that end, the authors assess the risk as a unidimensional measure of impact level. Similarly, Zhang et al. [34] incorporated interdependencies between projects, which is complemented with considerations related to shared risk sources between projects and risk factors at the project portfolio level. In all these studies, PPR is presented as an aggregate measure, and the proposals do not allow the identification of the impact on the project portfolio's expected results.

Another perspective is adopted by Wang et al. [16], who study the uncertainty associated with the realized value of projects and their interdependency. In contrast to traditional project-based control, they establish that a strategic perspective is required for portfolio coordination to improve the overall strategic benefits. Similarly, considering risk factors derived from project- and project portfolio-level and their impact on a set of portfolio outcomes, Micán et al. [2] proposed a PPRA model where the risk impact on the strategic objectives is assessed. In this regard, the portfolio risk is established as a non-aggregate risk measure.

Thus, the risk associated with portfolio expected results and the incorporation of risk factors explicitly derived at the project portfolio level is being explored by some PPRA approaches. However, some types of risk factors identified in the literature have not been incorporated into PPRA, such as those associated with project portfolio management (PPM) (see [34] and [35]). Also, the focus on the project level has led to the recognition that the strategic relationship of project portfolios has not been explored from the perspective of portfolio risk nor its impact on portfolio expected results [2]. So, additional aspects should be considered when a PPRA is conducted [2], [3], [12], [32]. Furthermore, the interaction with the parent organization and its strategy, as well as how the portfolio delivers value to the parent organization, which are inherent project portfolio characteristics, have also been scarcely explored or incorporated in an explicit way into PPRA approaches.

2.2 Aspects to take into account in PPRA

Risk assessment is not isolated from the other elements of risk management. Therefore, the aspects to consider when designing and carrying out a PPRA should cover PPRA aspects and portfolio risk management more broadly. Table 1 shows nine 'aspects for PPRA' identified in the literature.

Table 1. Aspects for PPRA

Aspect	Description
Risk and uncertainty approach	There are different views of the specific means of risk and uncertainty. Three different approaches were identified: firstly, risk as a consequence or measure of the impact of uncertainty [1]; secondly, risk as the foreseeable component of uncertainty [36] and, thirdly, risk and uncertainty as separate approaches [1]. The risk or uncertainty approach to be adopted must be defined to enable the scope of the PPRA to be determined.
Opportunities incorporation	Opportunities analysis incorporation allows for the identification of positive impacts on the project portfolio expected results, as well as allowing for an assessment of the compensatory effects arising from threats and opportunities [37].
Portfolio operational risk and risk in the portfolio business phase	Generally, project portfolio selection with risk considerations focuses on the risks associated with the business phase (commercial, financial, and market factors), while risk management in the portfolio execution phase deals with the operational or technical risk. Operational risk and business phase risks within the portfolio should be incorporated into PPRA for a complete PPR overview [29], [38].
Project interdependencies	Interdependencies between projects generate both positive and negative effects on the projects and the project portfolio, meaning that identification and assessment of interdependencies between projects need to be incorporated into the PPRA [3], [21], [24], [32], [39].
Threat/opportunity interdependencies	Evaluating interdependencies and the correlation between threats/opportunities allows for identifying the threats/opportunities that have a more significant influence over the portfolio's objectives by considering the indirect effect they may generate through their effect on other threats/opportunities [2], [12], [20], [39].
Impact on higher levels	The literature shows that PPR can influence project portfolio success and the achievement of PPM objectives or organizational strategic objectives [12], [13], [31], [34].
Relation of risk among	PPRA is not independent of project and program risk management. Thus, PPRA should allow for risk-

Aspect	Description
portfolio levels	integrated management between all levels of the project portfolio [33], [40].
Environmental characteristics	The competitive dynamics of an organization's environment are determining factors in PPRA. Uncertainty or risk sources constantly and dynamically modify, making it necessary to develop risk management capabilities appropriate to each organization's environment [3], [13], [41]–[43]. In addition, dynamic changes resulting from the influence of the internal and external environment should be considered when assessing PPR [34].
Project portfolio and organizational processes	The characteristics of each organizational context can modify PPRA, evidencing the need to incorporate both common and specific project portfolio characteristics and their relationship to the organizational processes; these characteristics can influence the PPRA and the risk impact on the projects and project portfolio expected results [1], [24], [28].

These nine aspects represent the different types of considerations to be taken into account when designing a PPRA. For example, decisions regarding the risk approach adopted, the type of project interdependencies to be incorporated and how these are reflected in the portfolio risk, and considerations related to the portfolio environment and how they are incorporated into the PPRA must be made and explicitly represented in the PPRA. Thus, the PPRA should incorporate the decisions made concerning each aspect; these aspects and the related decisions frame the scope and characteristics of a PPRA.

3. Research methodology

This research has sought to deepen understanding of how PPR can be assessed. Thus, the project portfolio is understood to be an organizational subsystem; consequently, PPRA is to be framed in that subsystem. Organizational studies have mainly been framed in line with a classic functionalistic approach [44]. However, several limitations and inadequacies have been identified in organizational and project portfolio studies [14], [45].

The above has led to the integration of a constructivist epistemology in organizational research, the so-called constructivism-founded scientific paradigm for organization research [46]. In the constructivist view of organizational design science, constructivist epistemologies and organizational design science complement each other to generate further knowledge [45]. Then, a constructivism-founded scientific paradigm for organization research was adopted for this research. As in organizational design science, the goal of research using this approach is to develop knowledge to guide design processes [45], [46]. Therefore, the constructivism-founded scientific paradigm for organization research is an approach that is mutually beneficial for both constructivist epistemologies and organizational or process design science [45].

3.1 Data collection

A qualitative interview method is appropriate in studies that incorporate exploratory searches since interviews can provide relevant and reliable information and offer a rich overview and understanding of organizational realities [47]. Thus, as part of a broader research project on risk assessment in the project portfolio context in which the study here reported is framed, 28 semi-structured interviews were conducted.

As in Bos-de Vos et al. [48], a semi-structured interview guide or protocol was used to cover the broader scope of the research project. The interview protocol consisted of four main questions covering the entire scope of the research project, one of which is relevant to the focus of this paper: “Can you identify the main aspects that should be considered in PPRA?” However, information regarding aspects for PPRA may also be mentioned by interviewees in the other interview blocks.

Seeking to ensure an adequate interpretation, a definition of ‘aspect for PPRA’ was included in the briefing document. In some cases, it was also necessary to complement the question with exemplification, using the information provided by the interviewee in previous questions. In addition, the nine aspects identified in the literature were used to encourage or broaden the discussion. Thus, if the interviewee did not mention information related to a particular PPRA aspect

identified in the literature, the interviewer briefly introduced the aspect and subsequently asked the interviewee about his/her perception of that aspect.

The sample was focused on portfolios of organizational development projects, also acknowledged as internal development projects [25]. These projects can be strategic or operational but are always directly related to the organizational strategic perspective or strategic-level decisions. A portfolio of internal development projects could comprise business process development, internal information technology development, organizational change or re-engineering, investments in new equipment, major software, and other capital projects [25].

This decision was adopted considering two aspects. Firstly, portfolios of organizational development projects are composed of diverse projects; therefore, it is a more comprehensive view than adopting a sample based on portfolios composed of more homogeneous projects. Secondly, regardless of the type of portfolios included in the sample, as this is an exploratory study, the results will not be generalizable; however, focusing on a single type of portfolio would allow contrasting the results with future studies of a similar nature focused on other types of portfolios.

As in Mac Donald et al. [49], convenience sampling was used to identify an initial group of possible interviewees, while snowball sampling provided additional participants for the study. The target was Colombian professionals with experience related to PPM. As in studies carried out by Tam et al. [50] and Hofman et al. [1], this study focused on the interviewees' professional experience. The above enabled the researchers to obtain insights into the interviewees' portfolio management experience with project portfolios in their current and previous organizations. Thus, this study focused on how PPRA is perceived and understood by project portfolio practitioners based on their professional experience managing project portfolios rather than on how PPRA is performed in their current organizations. The interviews were recorded with the prior authorization of each interviewee, and handwritten notes were taken during interviews.

It is worth mentioning that the diversity of the sample is not given by the diversity of portfolio types but by the diversity of business sectors of the parent organizations in which the interviewees gained professional experience. With this, it was expected to get a sample with a broad representation of organizational development project portfolios across different business sectors to capture data for establishing the figurative core of the constructs under analysis. Also, it is clear that empirical results cannot be directly extended to other types of portfolios.

The interviews lasted an average of 53 minutes. The interviewees had high levels of project and portfolio management experience: 57% had more than 9 years of project management experience and 43% had between 4 and 9 years of PPM experience. All had, at least, a first degree, 46% held a post-graduate qualification, and 86% had some form of academic qualification related to the PM field. All appeared well qualified to provide valuable information. Most of the interviewees were male (64%). Regarding the type of organization, based on the classification proposed by Müller et al. [51], 50%, 29%, and 21% of the interviewees had their primary experience in process-oriented, project-oriented, and project-based organizations, respectively. Table 2 shows the general characterization of the interviewees.

Table 2. Aspects for PPRA

Current Role		PM experience (years)	
Project portfolio manager	20	Less than 5	3
Project manager	1	Between 5 and 9	9
Head of improvement office	1	Between 10 and 14	8
Head of Project Management Office (PMO)	5	More than 14	8
Executive director	1		
Type of organization: primary experience		PPM experience (years)	
Process-oriented	14	Less than 4	14
Project-oriented	8	Between 4 and 9	12
Project-based	6	More than 9	2

On the one hand, twenty of the organizations in which the interviewees are currently employed are classified as large companies, and the remaining eight are medium-sized companies. On the other hand, six organizations are in the engineering sector, developing activities such as installing refrigeration systems on an industrial scale; seven and fifteen are classified as manufacturing and service organizations, respectively.

3.2 Data analysis

All interviews were fully transcribed by the same researcher (interviewer) and subjected to a thematic analysis. In-depth analysis of qualitative data sets produces well-grounded and contextualized explanations; for this purpose, fragmenting these data sets and rearranging them into analytical categories associated with the research question is generally accepted [47].

Thematic analysis allows for complete and analytic analysis, and aims to identify patterns, or themes across qualitative data sets, leading to a rich seam of results, explanations, and opportunities for theorizing [47], [52]. According to Terry et al. [52], thematic analysis approaches can be classified as either coding reliability, codebook, or reflexive, differing in the way the themes are conceptualized. For this research, a reflexive thematic analysis was adopted. In a reflexive approach, a theme is conceptualized as an analytic output representing shared meaning-based patterns organized around a core concept or idea [53]. Thus, the set of themes for a PPRA, or themes derived from interviews, correspond to an analytic output of the qualitative data analysis process.

Based on Braun et al. [53], a six-phase procedure was carried out to implement the reflexive thematic analysis: 1) familiarization; 2) generating codes; 3) constructing themes; 4) revising; 5) defining themes, and 6) producing the report.

The familiarization phase was based on listening to a sample of interview records and reading all the transcriptions and handwritten notes. As a result of this phase, and considering that “in practice, any researcher will approach the data with preconceived ideas based on their existing knowledge and viewpoints” [53, p. 853], it was defined that the qualitative data should initially be grouped according to the nine aspects identified in the literature. In addition to this, since thematic analysis phases represent “a reflexive and recursive, rather than strictly linear, process” [53, p. 852], it was established that the analysis process would be carried out in blocks of four interviews at a time.

To obtain groups of data with shared meaning-based patterns, it was defined that the codes would be generated under an inductive orientation. Thus, in the generating codes phase, based on the information grouped in the nine aspects, the first possible set of codes derived from the analysis of the first block of four interviews was pre-defined. Consequently, the codes were updated in each analysis cycle; codes were merged, added, or split according to each new data group. For this phase, ‘a sentence’ was defined as the unit of data analysis. Finally, the data was coded into 26 codes (see Appendix 1).

The phases of constructing, revising, and defining themes were carried out recursively to obtain the final set of PPRA themes. To this end, two strategies were considered – either the analysis of codes as building blocks could construct a possible PPRA theme, or the possibility that a code could be directly promoted to a PPRA theme. However, after conducting the analysis, no single code was not promoted to a PPRA theme. A specific definition of the candidate PPRA themes and a check of the candidate PPRA theme against the dataset were strategies of analysis implemented as part of the recursive process. This process was oriented to ensure that each PPRA theme was related to a central meaning and PPRA themes comprised the whole dataset. It also analyzed how themes are related between themselves and that PPRA themes do not overlap. For this reason, thematic maps were developed from the candidate PPRA themes.

Fig. 1 shows how the implementation of reflexive thematic analysis led to defining the PPRA themes. It gives an example of how the interview data were classified into the aspects identified in the literature and then into codes produced based on qualitative analysis of each group of data. Finally, based on the analysis of shared meanings between codes, the PPRA themes were established.

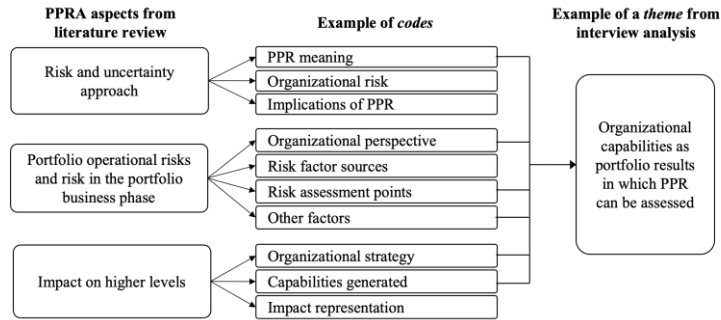


Fig. 1. Sample illustration of themes identification

Data analysis was supported by NVIVO software. The coding process for all interviews was carried out by the same researcher (interviewer), thus enabling consistency of coding. To ensure the validity of the coding process, the two other researchers involved in the project examined the audit trail of the key coding decisions and theme definitions arising from the research process. Through the analysis of shared meanings between codes, four themes were identified: ‘Organizational capabilities as portfolio results in which PPR can be assessed’; ‘project portfolio levels as risk factor sources in PPRA’; ‘project portfolio as the organizational unit for PPRA’; and ‘balance between project portfolio attributes and complexity’. Table 3 shows the relation between the nine PPRA aspects from the literature review and the codes for information classification, and it shows the categorization of the codes in themes.

Table 3. Structure for PPRA themes identification

PPRA aspect	Codes	PPRA themes*			
		T1	T2	T3	T4
Risk and uncertainty approach	PPR meaning	X			
	Organizational risk			X	
	Implications			X	
Opportunities incorporation	Relevance				X
	Complexity				X
Portfolio operational risk and risk in the portfolio business phase	Organizational perspective	X			
	Risk factor sources		X		
	Risk assessment points	X			
	Other factors	X			
Impact on higher levels	Organizational strategy	X			
	Capabilities generated	X			
	Impact representation				X
Project interdependencies	Interdependencies as risk				X
	Source of complexity				X
	Organizational issues		X		
Threat/opportunity interdependencies	Relevance and complexity				X
	Second level				X
Relation of risk among portfolio levels	Interaction between levels		X		
	Projects and programs		X		
	Portfolio		X		
	Organization		X		
Environmental characteristics	Strategic management			X	
	Technological context			X	
	Organizational culture			X	
Project portfolio and organizational processes	Risk management process			X	
	Processes influence			X	

*T1: Organizational capabilities as portfolio results in which PPR can be assessed; T2: project portfolio levels as risk factor sources in PPRA; T3: project portfolio as the organizational unit for PPRA; T4: balance between project portfolio attributes and complexity.

4. Findings

Fig. 2 shows the four interdependent PPRA themes and their main aspects, representing a comprehensive PPRA framework based on the analysis of the interviewees’ perceptions. The relationships between themes are represented with arrows that link one theme’s main aspects to another or the relationship between two themes. The themes, their main aspects, and the relationships between them are described in the following subsections. This section presents quotations from interviewees in brackets to distinguish them from quotations from the literature. For example, (I1) means the quote comes from Interviewee 1.

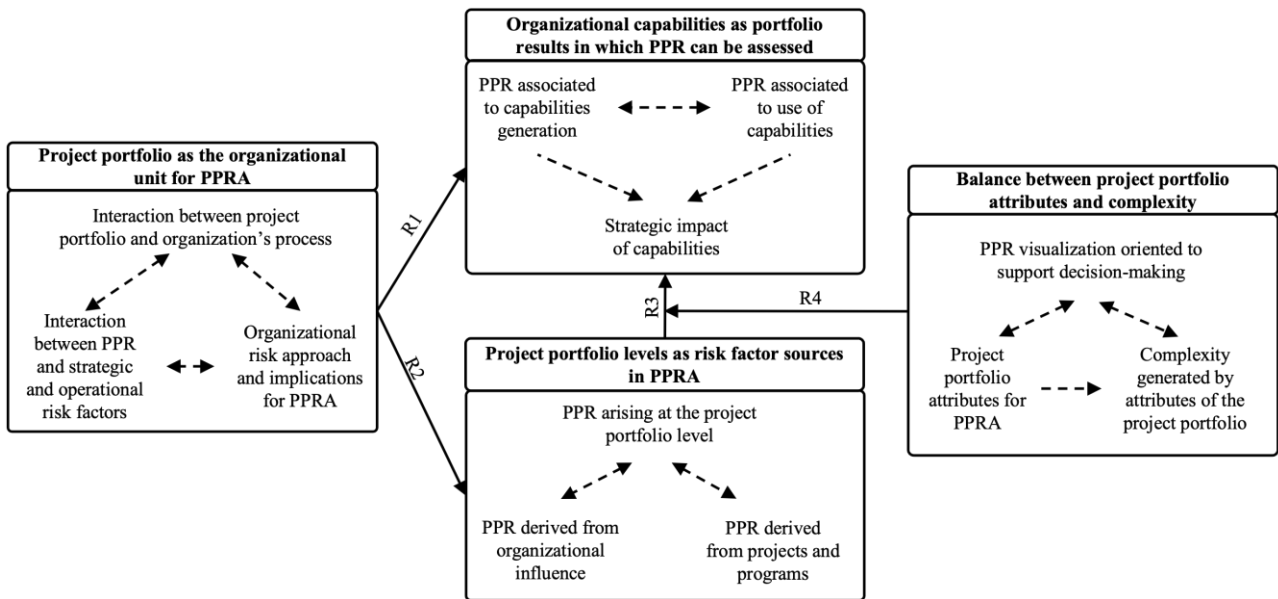


Fig. 2. A comprehensive framework for PPRA

4.1 Organizational capabilities as portfolio results in which PPR can be assessed

The project portfolio risk representation as a result of PPRA was anchored by the interviewees to the impact on the expected project portfolio outcomes at the organizational level. For example, interviewee 26 mentioned “I would imagine it as the risk of fulfilling and implementing the entire portfolio, if we are really achieving the expected results”. In this matter, it was specifically mentioned that “as result, a portfolio produces organizational capabilities to be used in the operation, but that is very difficult to measure” (I9). Then, influence on the organizational capabilities generated by the project portfolio could be denoted as a construct for the primary representation of the PPRA outcome.

Regarding the impact on the expected results of the portfolio, represented by the PPRA in the impact on the expected organizational capabilities, it is stated that “it translates into the non-achievement of the expected impact on the organization’s strategy, but the business measures are mediated by other factors that are no longer purely of the portfolio” (I9). Thus, the expected organizational capabilities to be generated by the portfolio are the path through achieving the expected strategic impacts derived from the project portfolio. PPRA oriented to capabilities also reflected the fact that “the capabilities are not delivered, we understand that it is the <<project or portfolio>> manager’s responsibility, but if the capabilities are delivered but not properly exploited, we have a shared responsibility” (I16). This suggests that a capabilities-based PPRA approach would recognize the project portfolio limits in terms of its organizational contribution.

In this regard, a PPRA based on the expected organizational capabilities also involves the organizational use of the capabilities generated by the portfolio. Specifically, interviewee 28 exemplifies this with one of their project portfolios

through which “we are going out with digital channels and in all these issues as so disruptive and innovative, there are some really delicate cyber-security risks”, mentioning in this regard that “those risks sometimes one does not see them, because they are end-user risks”. Regarding the above, the same interviewee highlighted “it is not about waiting to close the portfolio and say: parent organization there are the results, now invest quickly in some cybersecurity to be able to use them”.

In the case exemplified by interviewee 28, it is shown that a PPRA oriented to organizational capabilities would allow not only to assess risk factors associated with the projects that seek to generate digital channels, but also to incorporate the risk factors associated with cybersecurity, which is related to the use of the capability generated by the project portfolio. Thus, a risk assessment approach oriented to establish the impact on the organizational capabilities derived from the project portfolio could allow capturing into the PPRA how portfolios deliver value to its parent organization.

Therefore, PPR representation as a PPRA result was anchored by the interviewees to the impact on the expected project portfolio outcomes at the organizational level, being organizational capabilities produced by the project portfolio highlighted as an adequate representation of the portfolio outcomes. Thus, the ‘organizational capabilities as portfolio results in which PPR can be assessed’ is framed as such: The PPR associated to capabilities generation, i.e., the risks that affect capabilities generation; and PPR associated with the use of capabilities, i.e., the risks that might endanger adequate use of capabilities by the organization; and the organizational capabilities generated by the project portfolio leading to strategic impacts on the organization.

4.2 Project portfolio levels as risk factor sources in PPRA

The risk factors derived directly from the projects within the portfolio and from the interdependence between projects are proposed as the first level of factors to be considered in PPRA. However, other levels of influence could be incorporated into the PPRA, since, as stated by interviewee 9 “not necessarily the operational risk of the projects is what I would do the portfolio analysis with, suddenly there are other elements that determine that [...] some very important of them are those that I can control into my portfolio and others that are business or external which I do not control; some that are due to portfolio external factors but not necessarily external to the company; others related to industrial sector; and others at macro-economic level”. This suggests the PPRA could recognize the influence of risk factors derived at the project portfolio level and derived from the organizational level (internal and external).

Also, it was emphasized the inter-relationship between risk factors levels – project, portfolio, and organization, which is reflected in the PPRA both in the influence between risk factors derived from the different levels and how risk factors derived from these levels impact the project portfolio expected results. Regarding the representation of the influence between risk factors derived from the different levels, it was mentioned that “it is clearer in terms of delivering the capabilities; because I go from portfolio to project, and from project to portfolio, it is necessary that one does not lose sight of that integration” (I16). Additionally, that “at the project portfolio risk level, the first thing is the financial aspects, the financing of the portfolio. Inadequate cash flow management has an impact on the entire portfolio. In this concern, the right execution of the financial milestones of the projects is required according to the portfolio cycle” (I17), interrelating with this, project portfolio and project level risk factors.

As to how these levels are interrelated in terms of the impact on the project portfolio, it was identified that the risk factors derived from the different levels influence the project portfolio in different types of impacts. Interviewee 17 exemplifies the interconnection between project level and portfolio level by mentioning that “there are those that are common factors between projects and that can rise to the portfolio level, or risks that by their nature are very complex or large”; while, from a broader perspective, interviewee 14 mentioned “we value each risk factor as such, but not only associated to a single project, it may affect several and we modify the projects that are included in the portfolio”. This raises the first form of impact, which is associated with the influence on the portfolio through common risk factors of a specific subset of projects.

Other risk factors influence the portfolio's capability to produce the expected results, i.e., they have a generalized impact on all projects within the portfolio. For example, “the issue of capacity in terms of staff, in terms of equipment, and in terms of organizational infrastructure is one that should be considered at the project portfolio level to know whether

everything that is being planned for the project portfolio can be, or cannot be, actually implemented" (I27). Another group of risk factors impact the project portfolio through the changes generated directly on the portfolio's expected results or related to conditions regarding how the parent organization will be able to use those expected results. For instance, interviewee 6 posed that "a risk is that what was strategic before may not remain strategic for now and that change not be transmitted to the portfolio, for instance, to suspend it at the right time". And interviewee 7 mentioned that "some risks are left as a go-live commitment [...] and others that the PMO can assume in stabilization. [...] I go out to operations with those risks; the company has accepted them, but the PMO must close them in the stabilization phase and deliver them to operations".

Thus, the PPRA would have to recognize that the risk factors derived from the three identified levels are integrated into different impacts on the project portfolio – impact on a subset of projects, impact on all projects within the portfolio and, associated with how parent organization will use the portfolio results. The first two types of impact are related to portfolio's capability to produce the expected results, and the last one is associated with how the expected results will be used.

The PPRA could be oriented to establish the influence and importance of risk factors from each project portfolio level considering the extent in which these factors impact the project portfolio through their influence either on the projects or directly on the portfolio. Then, 'Project portfolio levels as risk factor sources in PPRA' is defined as another theme for PPRA which is defined as: Project portfolios are affected by a set of specific risk factors arising at the project portfolio level, as well as risk factors that emerge from the projects and programs as the operational units of the portfolio, and risk factors derived from the organizational influence, so that, PPRA should integrate the diverse ways in which these levels jointly influence the project portfolio.

Hence, considering that the integration between the risk sources from different levels would be represented in the way in which it influences the project portfolio, as well as that "projects are grouped for a reason, so the risk assessment should be performed on that reason" (I1) and that one of the themes for PPRA states that 'organizational capabilities as portfolio results in which PPR can be assessed'; the way in which risk factors generate different impacts on the portfolio of projects could be represented through the primary impact on the expected organizational capabilities and how the parent organization will use them (see relationship R1 in Fig. 2).

4.3 Project portfolio as the organizational unit for PPRA

In line with what has been identified in the literature regarding risk conceptualization perspectives (see Table 1), the interviewees put forward the risk conceptualization from different perspectives. However, they converge and emphasize that the risk approach to be adopted for PPRA should be aligned with the risk approach adopted at the organizational level. For instance, referring to the risk approach to adopt for PPRA, interviewee 16 mentioned "it is important to make visible how the <<PPR>> approach has to be aligned with the organizational level in terms of the corporate approach that the organization takes. I believe that this link is necessary because it already recognizes the particularities of the organization [...] if one becomes detached from the other, I think there is a problem there".

The above suggests that a first element that would allow recognizing the relationship between the project portfolio and the parent organization is the integration or transversality of the risk approach adopted. Specifically, to formalize this interconnection beyond just the risk approach to be adopted, it is proposed that the PPRA could incorporate organizational risk factors that, although not exclusively inherent to the portfolio, influence the project portfolio risk. For instance, interviewee 16 referred "what we try to do, a little bit from experience, is to recognize from the beginning not only the risk derived from the projects but also the corporate risks that one would be accepting". While, referring to this type of risk factor, interviewee 19 stated that "I know that it is said that there are some portfolio inherent risks, and I wonder, what are these risks? What are the risks that are only for the portfolio, and which are aside from the whole environment in which it is being framed?".

Thus, these organizational risk factors would make it possible to incorporate characteristics of the parent organization and its environment into the assessment, recognizing in turn, through the PPRA, that these factors associated with the organizational level influence the project portfolio risk. One of these organizational risk factors was exemplified by

interviewee 7, who mentioned that *“one that is always there and that we never included, but that, because lessons learned, we are now incorporating, is staff turnover at the organizational level, [...] it is a latent risk and for our company, it is one of the most significant risks”*; to which the interviewee 7 subsequently supplemented *“that always has an impact of slowing down the knowledge transfer when we close the projects [...] the turnover can slow down the knowledge transfer and stabilization for up to six months, so there are impacts that we already know about”*.

This suggests that organizational risks not solely influence how the project portfolio is executed, but also influence how it delivers or transfers results to its parent organization. That is, recognizing ‘Project portfolio as the organizational unit for PPRA’ would, in turn, lead to recognizing into PPRA the interaction between the project portfolio and its parent organization arising from the delivery or transfer of results, i.e., arising from the delivery organizational capabilities. In this regard, ‘organizational capabilities as portfolio results in which PPR can be assessed’ would acknowledge and operationalize this kind of interaction into the PPRA (see relationship R2 in Fig. 2).

Another aspect that would allow recognizing the interaction between the project portfolio and its parent organization is evidenced *“When I have internal resources, especially staff, I have a problem in terms of the fact that the staff will continue in their regular duties and they will participate in the portfolio, in one or more of the projects they are involved in. And there I have a risk in terms of the portfolio versus operation. They are going to have two bosses, and each one is going to pull in their own direction, and if another portfolio appears in which they also have to participate, then the risk level that I have in my portfolio will become more and more entangled”* (I1).

In this regard, interviewee 14 mentioned, *“if we are talking about a small company, with authoritarian leaders, for example, where there is no leadership model that allows these issues to flow more generally within the organization and that they are being worked on permanently, then the <<project portfolio>> risk increases”*. That is, project portfolio interaction with other organizational units can generate some risk factors for the project portfolio, so that, how this type of risk factors influences the project portfolio could be explored into PPRA. In this regard, organizational factors related to organizational culture, the current digital context, and strategic management were emphasized by the interviewees, and therefore, could be explored into PPRA.

Based on what has been described above, the ‘project portfolio as the organizational unit for PPRA’ is defined explicitly as a theme to be integrated into the design and analysis of the PPRA. This theme is defined as: the PPRA should recognize the organizational risk approach and its implications for PPRA, as well as acknowledge the interaction between project portfolio and the organization’s processes and the influence of the organizational risk factors in the PPR.

In addition, considering ‘project portfolio as the organizational unit for PPRA’ implies recognizing that risk factors derived from the organizational level can influence the project portfolio results, which implies their incorporation into PPRA to provide a comprehensive assessment. This is reflected in the inclusion of such factors as one of the ‘project portfolio levels as risk factor sources in PPRA’. Considering the above, a relationship between the themes ‘project portfolio as the organizational unit for PPRA’ and ‘project portfolio levels as risk factor sources in PPRA’ is suggested (see relationship R3 in Fig. 2).

4.4 Balance between project portfolio attributes and complexity

Attributes that have been previously recognized in the literature related to PPRA were also recognized by the interviewees. These attributes are associated to interdependencies between projects, the positive impact (opportunities) and negative impact (threats) of risk factors, and interdependencies between risks. Likewise, the fact that in PPRA, project interdependencies can be represented as part of the risk factors, was also highlighted by the interviewees.

However, interviewees highlighted as a critical issue the complexity of incorporating these attributes into PPRA. For instance, the risk interdependencies *“should only be worked on if you have a high maturity level both in the organization and in the portfolio management”* (I17). Likewise, it was also mentioned that its incorporation into the PPRA may take into account that *“The project world is dynamic, so, for me the point is in the balance in which it <<the risk assessment>> provides me with information in an agile and dynamic way and considers or not the inter-*

relationships between risks” (I17). That is, although the incorporation of these attributes in the PPRA could allow for a more detailed representation of the influence of risk factors, the incorporation of these attributes into the PPRA require to be analyzed considering the characteristics of each project portfolio and its parent organization, the complexity generated by their incorporation and the value they can add to the decision-making process.

In this regard, the considerations adopted in relation to the attributes to be incorporated in a PPRA would be reflected in the representation of how risk factors impact the expected outcomes of the project portfolio, i.e., in how PPRA represents the influence of the risk factors derived from the project portfolio levels on the expected organizational capabilities to be generated by the project portfolio (see relationship R4 in Fig. 2). In addition, from the perspective of the PPRA as a support for decision making, interviewee 9 stated that *“I do not know if it is by areas, by processes or by types of projects, but there has to be a risk classification and it has to be linked to the organization”*. Therefore, the PPRA requires to be supported on a strategy for the representation or visualization of risk factors and their importance, which is in line with the decision-making processes at both the portfolio and organizational levels.

Hence, the ‘balance between project portfolio attributes and complexity’ is established as the fourth theme for PPRA. This theme frames project portfolio attributes such as project interdependencies, opportunities incorporation, and risk interdependencies, which have been considered as part of the PPRA in the literature. However, the complexity generated by attributes of the project portfolio may also be considered. Particular attention should be paid to the visualization of the PPRA results, since PPR visualization oriented to support decision-making adds relevance and value to project portfolio decisions when considered from the organizational perspective. Thus, it is necessary to balance the relevance, complexity, and value added of PPRA. So, the fourth theme for PPRA is posited as the extent of incorporation of project interdependencies, opportunities, and risk interdependencies is relative to the balance between relevance for the project portfolio, organizational conditions, and added value for the decision-making process at the organizational level.

5. DISCUSSION

The empirical data suggested that a comprehensive PPRA framework, which considered the inherent project portfolio characteristics, could be obtained following four interdependent themes for PPRA (see Fig. 2). Recognizing PPRA as an element of project portfolio risk management [10], the study extends understanding of PPRA based on the adoption of the project portfolio as an organizational subsystem, which recognizes both that the project portfolio seeks to deliver value to the company, as well as the portfolio interaction with the parent organization and its strategy [10], [14], [16]. Based on the comprehensive PPRA framework derived from the findings, the discussion below led to building two propositions to be considered for PPRA. However, to become more generalizable, they may require further research.

5.1 Towards a PPRA based on expected organizational capabilities generated by the portfolio

As a consequence of considering ‘project portfolio as the organizational unit for PPRA’, it was identified that the PPRA could represent the interaction between the portfolio and the parent organization, based on the impact of risk factors on the delivery or transfer of project portfolio results to the parent organization. Although this portfolio-organization relationship has been recognized in the general project portfolio literature [14], it has not yet been explicitly integrated into PPRA approaches. In this regard, considering ‘organizational capabilities as portfolio results in which PPR can be assessed’ would acknowledge and operationalize this interaction into the PPRA.

Thus, in contrast to the traditional PPRA approaches which are mainly associated, on one hand, with portfolio risk at project-level attributes such as the duration or total cost of projects [20], [21]; or on the other hand, to business-level attributes such as the influence on the expected profitability derived from the portfolio [37]; This research findings, contrast with these PPRA proposals, by identifying that PPRA could represent the impact of risk factors in terms of the way in which these factors impact the achievement of the expected organizational capabilities to be generated by the project portfolio. This raises the recognition of a construct for impact representation into risk assessment which is explicitly associated with the project portfolio level more than a general level or project level.

A PPRA oriented to assess the impact on the organizational capabilities to be generated by the project portfolio is in line with the PPRA approach in which the impact on the organization's strategic goals is assessed. In this concern, a PPRA approach based on expected capabilities does not ignore the relationship between projects within the portfolio and the organizational strategy recognized in the literature [22], but it would recognize that strategic impacts are the result of the parent organization's management of the organizational capabilities generated by the project portfolio.

The above means that risk impact on a set of organization's strategic goals could be assessed based on the direct impact on the expected organizational capabilities to be generated by the project portfolio, impact that, later, is transferred to the strategic goals. This perspective allows to assess the portfolio risk based on the portfolio's expected results from the organizational perspective, i.e., directly on how the project portfolio delivers value to the parent organization – the expected organizational capabilities. Thus, this research extends that concept as a construct for the primary representation of PPRA outcomes.

In addition, according to Serra and Kunc [54], strategic impacts derived from projects within the portfolio are mediated by other factors which cannot be exclusively associated with the project portfolio, but rather with organizational, operational, or strategic factors. Hence, PPRA based on expected organizational capabilities would recognize that, although there is a relationship between portfolio and strategy, assessing risk directly on the expected strategic impacts would involve more than just assessing the risk of the project portfolio. Thus, this insight led to the first proposition:

Proposition 1: The capabilities to be generated by the project portfolio can be used as the portfolio primary results on which PPRA can assess the risk of the project portfolio, establishing the impact of PPR on the project portfolio value delivering to the parent organization.

5.2 Incorporating into PPRA diverse risk factor impacts

PPRA approaches have mainly focused on an inward risk assessment considering in most cases only the risk derived from projects and their interdependencies [8], [37]. In this concern, for instance, the literature has identified that the interdependence between risk factors influences the extent to which outputs are impacted [55], [56]. Likewise, current PPRA approaches suggest that project interdependencies represent project-derived risk factors which, in turn, influence both the projects and project portfolio expected outputs [12], [37]. These types of considerations typically addressed into PPRA were represented, according to the interviews analysis, in the theme 'balance of project portfolio attributes and complexity'.

However, although the literature recognizes that project portfolios are not an isolated element of its parent organization [14], [32], and that the study of risk factors at project portfolio level has recently been called upon [12], [57], PPRA approaches that comprehensively incorporate the influence of risk factors of an organizational nature, as well as those derived at the project portfolio level, as highlighted by interviewees, has been scarcely explored.

In this regard, according to the comprehensive framework for PPRA here presented, the deviation of the results derived from the project portfolio levels could lead to different impacts on project portfolio expected results. In this concern, the deviation between expected capabilities and realized capabilities provided by the project portfolio could be associated with both risk factors related to the capabilities development process and risk factors related to the preparation of the parent organization to use them. In this regard, the way in which capabilities are developed leads to generating the expected outputs, while the use of them to produce strategic benefits embodies the portfolio outcomes. The above is in line with the fact that project portfolios aim to achieve desired mid- or long-term outcomes [18].

Thus, analogous to the project-level analysis made by Serra and Kunc [54], but considering the project portfolio level, it is posed that deviations derived from both project portfolio outputs and outcomes may lead to not achieving the expected impacts on the parent organization. Therefore, both risk factors associated with the project portfolio outputs and outcomes could impact on project portfolio expected results, so that, both kinds of risk factors should be incorporated into risk assessment. Output-related risk factors are associated to impacts on the projects within the project portfolio that affect the organizational capabilities expected to be developed. Outcome-related risk factors are associated

with impacts on the use of the capabilities by the parent organization to produce the expected strategic benefits. Then, this insight led to the second proposition:

Proposition 2: The risk factors that impact the project portfolio expected results can be represented into PPRA as 'output-related' risk factors and 'outcome-related' risk factors.

6. Conclusion

Based on empirical evidence from project portfolio practitioners this study provides a conceptualization of PPRA considering the organizational perspective of the project portfolios. The study has identified four interrelated themes for a comprehensive PPRA: 'organizational capabilities as portfolio results in which PPR can be assessed'; 'project portfolio levels as risk factor sources in PPRA'; 'project portfolio as the organizational unit for PPRA'; and 'balance between project portfolio attributes and complexity'. These themes guide the design of PPRA for both scholars and practitioners.

This study contributes to existing knowledge by explicitly recognizing these four themes for PPRA, which have yet to be comprehensively recognized in the literature. Additionally, the two propositions for PPRA require further research to become more generalizable.

In this regard, new pathways are therefore open for further research, like the representation of risk factors influence on these expected organizational capabilities to be generated by the project portfolio, as well as the representation and assessment of the influence generated on strategic objectives derived from the risk impacts on these expected capabilities. Thus, for example, capability-based approaches, in which organizational capabilities are recognized as organizational competitive advantages, could be explored to be integrated in conceptualizing and operationalizing specific designs of PPRA proposals.

However, as in the study carried out by Van der Hoorn and Whitty [58], this study identified that theoretical and practical contributions are tempered regarding the qualitative nature of the study and the characteristics of the sample. In this concern, quantitative and qualitative studies are necessary to explore each PPRA theme addressed in this study further. In addition, research based on case studies could explore each established theme and its implications in depth.

As part of the theme "Project portfolio as the organizational unit for PPRA," organizational aspects were identified as influencing PPRA. In this concern, the authors of this research note that PPRA could be positively influenced in organizations whose risk management systems are more robust and have been internalized by the stakeholders. So, it is expected that differences in organizational aspects could influence how PPRA is conducted. Although the authors did not particularly perceive differences in PPRA due to, for instance, cultural differences, this aspect is worth exploring in further studies.

Furthermore, project portfolio managers were interviewed in this study, which, according to Teller [36], can represent a single informant bias. Therefore, further studies could be oriented to acquire a multi-perspective set of data from other portfolio stakeholders, for instance, research based on multi-stakeholder interviews or research based on case studies exploration. Each theme established for a comprehensive PPRA could then be analyzed to identify the key stakeholders and their roles.

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Appendix 1. Codes, sources, and references

Codes	Codes description	Sources	References
Risk and uncertainty approach			
PPR meaning	Means and definitions of PPR or risk and uncertainty in portfolio context.	14	21
Organizational risk	Relationship between PPR approach and organizational risk approach adopted.	5	8
Implications	Impacts of PPR approach on decision-making related to project portfolio.	7	9
Opportunities incorporation			
Relevance	Reason(s) why it is important to consider opportunities in a PPRA.	17	20
Complexity	Concerns and considerations regarding value added and difficulties when opportunities are incorporated.	10	11
Portfolio operational risk and risk in the portfolio business phase			
Organizational perspective	Scope of project portfolio in the organizational context and the perception of PPR in that context.	16	23
Risk factor sources	Project portfolio phases are in themselves sources of risk for project portfolio.	12	16
Risk assessment points	Expected results of each phase and the impact of PPR on them.	9	14
Other factors	Influence of factors external to project portfolio on organizational measures of portfolio impact.	5	7
Impact on higher levels			
Organizational strategy	Strategic expected results as a possibility of representation of PPR impact.	14	20
Capabilities generated	Capabilities generated by project portfolio as a direct result with which risk can be assessed.	7	10
Impact representation	PPR representation or visualization oriented to support decision-making process.	13	20
Project interdependencies			
Interdependencies as a risk	Relevance of interdependencies between projects for PPRA and their representation as a source of PPR.	13	17
Source of complexity	Concerns about complexity generated by project interdependencies representation in PPRA.	7	10
Organizational issues	The influence of interdependencies between the projects and the organizational processes (areas) on PPR.	9	11
Threats/opportunities interdependencies			
Relevance and complexity	Relevance and complexity of incorporating risk interdependencies in a PPRA and the complexity generated.	13	17
Second level	Incorporation of risk interdependencies conditioned to the incorporation of other attributes, such as project interdependencies.	4	4
Relation of risk among portfolio levels			
Interaction between levels	Different levels identified from portfolio as an organization and relationships between these levels.	11	15
Projects and programs risk	Projects and programs as an operational level of project portfolio representing a primary source of PPR.	11	15
Portfolio risk	Risks at project portfolio level represent more than the	9	12

Codes	Codes description	Sources	References
Risk derived from organization	sum of risks derived from projects and programs. Risk derived from organization as an external source of risk for project portfolio and its interrelation with PPR.	13	15
Environmental characteristics			
Strategic management	Influence of strategic context on PPR and strategic management as a bridge between organizational context and project portfolio.	10	13
Technological context	Importance of issues related to current technological context of a PPR.	8	13
Organizational culture	Organizational culture and its relationship with aspects related to PPR.	9	10
Project portfolio and organizational processes			
Risk management process	Organizational risk management processes as a basis for PPRA.	10	14
Processes influence	Influence of characteristics of organizational processes on PPRA.	18	24

Biographical notes



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Camilo Micán is an Industrial Engineering from Universidad del Valle (Colombia), holds a master's in engineering from the same university, and a Doctorate in Industrial and System Engineering of the University of Minho (Portugal). He is an Associate Professor at the Universidad del Valle, School of Industrial Engineering. His research interests are in Project Management, Project Risk Management, Project Portfolio Management, and related topics. He is a member of the Quantitative Finance Research Group at Universidad del Valle and of the ALGORITMI Research Centre at University of Minho. Has professional experience as a project manager and consultant in projects focused on process improvement both manufacturing and service organizations.



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