Research Article

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Prior literature recognizes two schools of thought on value creation in projects: one based on transaction cost economics and the other on relational-based theories. There is little empirical research on the impacts of these approaches within different project contexts. This study aims at analyzing the effect of value creation processes on the project value moderated by requirements uncertainty and project complexity, two critical contextual variables. We used a cross-sectional survey to collect data from 168 project managers in Chile. Three groups were distinguished from a cluster analysis considering the requirements uncertainty and project complexity. A proposed conceptual framework is validated globally and for each group through a multigroup analysis via partial least squares structural equation modeling (PLS-SEM). The global model results indicate an $R^2$ of 0.37, and for the groups, the $R^2$ ranges from 0.33 to 0.85, and the path coefficients range from 0.57 to 0.92. Additionally, the PLS-SEM multigroup analysis shows significant statistical differences. Group 3 (low complexity and low uncertainty) is different from Group 1 (high complexity and high uncertainty) and Group 2 (high complexity and low uncertainty), with $p$ values of 0.027 and 0.023, respectively. Therefore, these empirical findings contribute to the literature demonstrating that value creation processes impact the project value. In particular, these effects are moderated by the current level of project requirements uncertainty and complexity in different contexts.

1. Introduction

Nowadays, projects are recognized as platforms for effectively managing business risks and opportunities to create value in terms of economic, societal, and environmental benefits. Value creation is then known as a valuable lens to gauge the long-term sustainability and competitiveness of organizations, industries, and nations [1] and represents one of the most critical business objectives [2, 3]. As Ghoshal, Bartlett, and Moran [4] (p.9) claim, “managers need to define their companies as value creators rather than value appropriators.” Many scholars have looked through different theoretical lenses to explain the value creation process in organizations. For instance, transaction cost economics (TCE) focuses on minimizing the transaction costs of exchange [5], where the value creation process is related to maximizing shareholder profits [1, 6–8]. Meanwhile, stakeholder theory and other relational-based theories suggest that value is generated by relationships with the interested parties [9]. Although traditionally the value creation perspective on economic-financial gains has represented a unique and meaningful measurement of organizational success, value maximization through close relationships and permanent interactions with...
involved parties increases the stakeholders’ satisfaction and long-term returns in the form of benefits realization [10]. Hence, the processes of value creation can be defined regarding the activities and capabilities of the organization [10, 11] and as a collaborative and close work of cocreation with critical stakeholders [12]. In the same vein, the independent value creation process refers to a series of activities performed by a firm independently [13] without the need to seek the collaboration of other firms [14], relying solely on the organization’s resources, competencies, and capabilities [11]. Conversely, the value cocreation process refers to a system where parties need to work closely together through continuous interactions, active dialogue, motivation, and cobuilt experiences with clients [6, 15, 16] and other stakeholders [17]. On the other hand, at the project level, requirements uncertainty and project complexity are two contextual contingency factors that are considered critical [18–20] for managing inherent risks and opportunities in projects. Requirements uncertainty reflects the extent to which the client is unsure about the project’s purpose or how to achieve it [21]. In contrast, project complexity directly refers to the arrangement of elements, subsystems of the whole project, and changing relationships between project components and between the project and its context over time [22]. Hence, a defined (or undefined) scope and dynamic changes (or not) always suggest risks and opportunities that should be effectively managed in projects in business environments.

Understanding how the complexity and requirements uncertainty influence the value creation processes’ effects is critical for the effective delivery of project values. For instance, from the contingency theory, when requirements uncertainty or complexity in a project are high, collaborative relationships support effective project delivery. They are conducive to project value maximization [18, 23, 24]. In contrast, when the requirements uncertainty or complexity levels in a project are low, formal controls and coordination suffice to deliver the expected project values [18]. Extant studies on the two value creation processes require specific organizational configurations, especially interorganizational governance mechanisms, modes of interaction, and management foci [25–29]. However, there is a shortage of empirical examination of the fit between the value creation processes and project value in the diverse context of requirements uncertainty and project complexity. Therefore, the following research questions are addressed [30]: how do value creation processes impact the project value? And how do requirements uncertainty and project complexity moderate this relationship?

The objective of this study is to analyze empirically the effect of value creation processes on the project value moderated by two critical contingent variables: requirements uncertainty and project complexity. Thus, this research proposes and validates a conceptual project-level conceptual model about the effects of value creation processes on the project value, contingent upon the requirements uncertainty and project complexity. The literature review identifies governance strategies, modes of interaction, and management foci as the triple enabling factors underpinning the value creation processes to impact project performance and project success. Also, this study provides analyses indicating that the combined effects of these triple factors have a contingent impact on the project value, moderated by the project’s requirements uncertainty and complexity.

Partial least squares structural equation modeling (PLS-SEM) is now a well-established multivariate method for analyzing complex causal relationships among latent variables [31]. The effectiveness of PLS-SEM in predicting and the fact that no assumptions are required have contributed to its use in different disciplines [32]. By focusing on the problem of heterogeneity, a widely used approach is multigroup analysis with reported applications for a multitude of contexts [33–35]. In this study, this approach is used to validate the research model.

This article presents the literature review and the development of the conceptual framework and hypotheses in Section 2. After that, Section 3 shows the materials and methods applied, followed by the results in Section 4. Finally, the study ends with the discussion and conclusion sections (Sections 5 and 6), highlighting theoretical and managerial implications and proposed future research.

2. Literature Review

2.1. Conceptualization of Value Creation Processes.

Strategic project management literature has emphasized the relevance of value creation from different perspectives, highlighting its critical role in business models. Pekuri et al. [36] agree that business models represent how organizations create value for clients and key stakeholders, including their benefits. Project-based organizations that understand the value creation processes of different projects develop particular business models, better meeting the needs of specific clients or market segments while also providing organizational competitiveness and sustainability [36]. A business model should support a sustainable competitive advantage [37], representing a critical issue to address the created value better and cross the intra- and interorganizational boundaries of firms and projects [38].

A value creation process aligned with a business model depends fundamentally on the organization’s activities and core competencies, and capabilities. To maximize value, however, it is also necessary to work with joint stakeholders [9] through interorganizational strategies oriented toward generating relational and mutual collaboration among parties [12, 39]. From this standpoint, two value creation processes can be conceptualized. The first is based on the organization’s activities and competencies. It is recognized as an “independent” value creation process, and the other accords with interdependent and continuous interactive processes among parties, known as a “cocreated” value process [6].

The independent value creation process appears when a firm creates value and distributes it in the market, usually through exchanging goods/services and money [11]. This process of value creation is often thought of as a series of activities performed by [13] independent of the activities or
actions of other organizations, including the clients and potential users [6, 14, 15]. TCE, resource-based view, and agency theory form the theoretical foundations for conceptualizing this individual process of creating value. Typically, the provider has the resources, competencies, and capabilities to deliver what has been requested without seeking extensive help from the buyer. In such cases, the product or service provided is relatively simple, routine, straightforward, and within the provider’s expertise.

On the other hand, value cocreation is defined as joint value creation based on interactions, active dialogue, and co-building experiences between the organization and its clients and stakeholders [6, 15–17]. This collaborative process requires generating opportunities for coproduction, integrating resources, and applying individual competencies [13], where the beneficiary determines the perception of what is received [17]. In this case, social exchange theory, relational view of the firm, relational contracting, and stakeholder theory provide strong support for conceptualizing value cocreation. Prahalad and Ramaswamy [16] proclaimed that cocreating value is how clients and suppliers jointly create value, mainly through high-quality interactions above and beyond an independent process. Accordingly, a relational approach underpinned by effective collaboration regarding high resource complementarity, distinctive competencies, and vital, broadly linked interest [14] becomes a critical undertaking to face more hazardous environments.

2.2. Drivers of Value Creation Processes. A value creation driver is “any factor that enhances the total value created by a business” [40] (p.494). The literature review of prior empirical studies in management and business research, governance strategy, mode of interaction, and management foci represents three drivers that optimize value creation for all involved parties. Figure 1 displays a representation of these three components.

2.2.1. Governance Strategy. Governance involves a structure to reduce conflicts among different stakeholders and a framework to establish and achieve organizational objectives [41]. In other words, governance “constitutes the overall framework for management decisions in an organization” [42] (p.959). There are two types of governance strategies: contractual and relational. A contractual governance strategy is based on formal contracts that commonly include specifications of promises, obligations, and actions to solve disputes, the parties’ responsibilities, procedures for monitoring delivered outcomes, and punishments in the case of noncompliance [43]. This contract-based governance mechanism incorporates patterns of formal relationships between partners [44]. Suppliers and clients can reduce opportunistic behavior and asymmetric information through defined controls and frequent monitoring [45] and fostering trust, cooperation, and win-win relationships by using strong legal enforceability [46]. The mechanism here is based on forcing compliance, so contractual governance could align with an independent value creation process. In contrast, a relational governance strategy lays the foundation for close collaboration among parties [47], incorporating different interorganizational relationship mechanisms between stakeholders, such as trust, long-term commitment, and cooperation [48], based on the norm of solidarity [49] and fairness [10]. This relational approach represents the principal mechanism of protection against opportunistic behaviors [10, 50], mainly within lower legal enforceability contexts [46]. Thus, this approach is directly associated with cocreation.

2.2.2. Mode of Interaction. Interactions refer to physical, virtual, or mental situations between suppliers and clients, or vice versa about influencing expected benefits [15]. Indeed, Ranjan and Read [51] point out that interaction is a primary interface to coproduce an offering where the participation, dialogue, and sharing of information and knowledge are essential elements to solve issues and propose solutions to any interorganizational relationship. In agreement with Spekman et al. [52], coordination and collaboration are critical types of interaction in value creation. Coordination involves “the process of managing dependencies among activities and linking together different parts of an organization to accomplish a collective set of tasks” [53] p.1. Consequently, it is part of the independent value creation process. In comparison, collaboration is an evolving process where the parties actively work together actively and closely to achieve the desired outcomes [54], based on mutual trust and commitment. As such, it is intimately connected to value cocreation.

2.2.3. Management Foci. According to Ghoshal et al. [4], there are two dominant approaches to strategic organizational management. One approach is focused on monitoring and controlling what the organization captures value (mainly economic value) from the products or services put on the market by the managers to maximize shareholder returns by exploiting available financial options and resources as efficiently as possible [4]. Through TCE, Williamson [5] points out that this logic of static efficiency requires exhaustive coordination of monitoring and controlling tasks to avoid opportunistic behavior and asymmetric information from the other party in the relationship. Control refers to the mechanism that a controller uses to regulate the actions of controleses to achieve the desired objectives [55]. Thus, the independent value creation logic is closely related to this management focus. Value can also be created collectively by continuous innovation by generating new resources and new ideas to maximize mutual benefits between the parties involved [4]. In a relational environment of collaboration, innovating adds value. Organizations with shared goals and practices support an active value creation process characterized by close communication, knowledge exchange, risks/gains sharing, and continuous learning and improvement [14]. This innovation capability refers explicitly to the organization’s capacity to continuously transform knowledge and ideas into new products, processes, systems for the firm’s benefits, and stakeholders
under an atmosphere of cocreation [56, 57]; thus, innovating can be seen to be closely related to cocreation.

Critical factors in each value creation process include three defined drivers: governance strategy, mode of interaction, and management foci, formalized from the empirical research analysis and summarized in Table 1.

2.3. Project Value. Traditionally, project performance is assessed by examining time, budget, and scope (i.e., based on “triple constraint”) [20]. However, sometimes, it can include client satisfaction [58], environmental impacts, and work environment (regarding health and safety) [18]. These performance measures fail to capture the effect on the project business objectives [20, 58, 59] and the benefits that can flow from those impacts only during the operation stage [59], which are necessary elements for evaluating an overall “project value.” In this line, project benefits are measurable outcomes that meet stakeholder needs [8], or the addition of value produced by accomplishing the project results desired by stakeholders (e.g., owner, user, contractor, subcontractors, suppliers, regulatory agencies, society) [60]. Thus, value determination is measured as the difference between the stakeholder’s benefits and the sacrifices made by the stakeholder [61]. Satisfying stakeholder needs involves more than delivering what was specified in the project requirements or prescribed in the “triple constraint” view. It also includes initiatives for project contractors to identify ways of adding value to the client. In contrast, the owner and contractor share the gains or value additions and the associated business risks and opportunities.

Consequently, the project value includes project efficiency in terms of cost, time, and scope and “the satisfaction of the project stakeholders on the explicit and implicit benefits generated from the project versus the tangible and intangible resources invested to achieve those benefits” [8] (p.2142). The project value then includes project management success that considers project efficiency and the impact on the client; secondly, project success is defined by organizational and business success and preparing for the future.

2.4. The Impact of Value Creation Processes on Project Value. The independent value creation process motivates organizations to concentrate on protecting the transactions wrapped in contracts. Contracts contain promises and obligations of the parties and actions, among other things [62]. Contracts can be relied on to govern the transactions because there is limited potential for synergy between the parties [5]. These contractual agreements include clauses that define the modes of intertwining technical information for planning and controlling [63]. In other words, they support procedural coordination based on efficient information flow to provide feedback between parties and adjust delivery performance [64] and specify the parties’ rights and obligations to be fulfilled throughout the project [53], commonly defined before the work begins. Coordination is the process of managing dependencies between activities to facilitate the exchange of technical information and monitor and control the tasks and the project’s progress [65]. It is associated with formal control modes (i.e., outcome and behavior control). Outcome control is related to defining and monitoring the project’s desired goals [66]. In contrast, behavioral control includes specific rules and procedures that must be followed to ensure appropriate behavior when working to deliver outcomes [67]. For example, Gopal and Gosain [68] demonstrated empirically from 96 Indian IT/IS projects that outcome and behavior control modes significantly impact efficiency and effectiveness. Similarly, after analyzing data from 128 IS projects, Liu [69] points out that outcome and behavior controls positively affect the success of projects. Hence, the relationship between monitoring and control and project success is significant.

On the other hand, relational engagement faces the parties to engage in active dialogue and interactions under relational norms. Here, the parties (i.e., the contractor, the client, and other interested actors) work together to achieve project objectives by contributing resources, specialized skills, expertise, and scoping [16, 51, 70]. This commitment represents a platform that lays the foundation for effective coordination and close collaboration between the parties [47]. These are complementary modes of interaction for identifying risks and opportunities during the project [71]. Relational governance mechanisms such as trust, shared norms, fairness, and a “no blame culture” enable mutual positive reinforcement for coordination and collaboration.

While coordination motivates an exchange of information about critical tasks, know-how, and parties’ interests [29, 71] to align their tasks with project goals [26]; in collaboration, the engaging context of cocreation supports project stakeholders to work together proactively and closely to achieve project outcomes [54]. Thus, during both the

<table>
<thead>
<tr>
<th>Independent Value creation</th>
<th>Contractual agreements</th>
<th>Coordination</th>
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<tbody>
<tr>
<td>Value co-creation</td>
<td>Relational engagement</td>
<td>Collaboration</td>
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<tr>
<td>Governance strategy</td>
<td>Mode of interaction</td>
<td>Management foci</td>
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<td>Monitoring &amp; controlling</td>
<td>Innovating</td>
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**Figure 1: Drivers of value creation processes.**
design and the execution stages, relational engagement based on capable interactions and proper relational norms facilitates collaborative work and joint problem-solving between parties to achieve innovative solutions [18, 64]. This cocreation process enables project actors to exchange strategic information, engage in collective decision-making, exhibit greater openness to learn from each other, and demonstrate a willingness to apply new ideas to improve performance [72]. A collaborative environment facilitates innovation to value creation by jointly solving technical difficulties and management challenges [73].

Lastly, innovation relies mainly on the collaborative partners’ compatibility and history of business interactions, relational engagement, and expertise [74]. Also, innovating is arguably initiated to address the challenges, opportunities, and risks encountered at work to meet the project’s objectives or improve performance [75]. This perception of change and creativity encourages risk-taking into new ideas in a cocreation process of innovation where the partners have little or no previous experience [76]. A collaborative environment for value creation motivates continuous interactions conducive to solving complex problems through the project, encouraging innovative solutions to achieve the project outcomes [77]. The adoption of project innovations must ensure a higher likelihood of meeting project objectives or outcomes. These include cost reduction, increase in profit margins, productivity improvement, early project completion, and other sustainable benefits. Consequently, of all the above, we can hypothesize the following:

**Hypothesis 1. (H1).** Value creation processes impact positively on project value.

### 2.5. The Moderating Effect of Requirements Uncertainty and Project Complexity

Project uncertainty [78] and project complexity [79] have been identified as contextual variables that moderate project performance in the contingent project management literature. Requirements uncertainty reflects the extent of changes in the project requirements and the degree to which project stakeholder requirements differ in the criteria to be met [80, 81]. Project complexity pertains to elements’ arrangement and subsystems in the whole project and the changing relationships among components in the project and between the project and its context over time [22]. It is much more challenging to create value through a project’s lifecycle with a high level of requirement uncertainty and project complexity than when the ranks of those variables are low. Where there is a high level of uncertainty and complexity, collaborative client-contractor relationships may support effective project delivery and are thereby conducive to maximizing project performance [18, 23]. In contrast, for small, straightforward, and routine projects with low levels of requirement uncertainty [18] and complexity, the need for close collaboration between stakeholders is less imperative. These projects are characterized by a precise definition of requirements and parties’ relationships; both are usually included in the contract. The contract then serves as a basis for planning and coordinating the project and controlling the outputs without the need for close and continuous interaction between the parties. Conversely, as Ning and Ling [82] point out, when the project context becomes complex or uncertain, a more robust demand arises for collaborative project partnership adaptation. In other words, more collaborative value creation is essential for adding value for the stakeholders and efficient delivery of risky, complex, and uncertain projects [70, 83]. Then, we can hypothesize the following:

**Hypothesis 2. (H2).** Requirements uncertainty and project complexity moderate the effect of the value creation processes on project value.

### Table 1: Factors of value creation processes.

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<th>Driver</th>
<th>Dimensions of value creation processes</th>
<th>Cocreation</th>
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<tbody>
<tr>
<td><strong>Contractual agreements</strong></td>
<td>Including the rights and obligations of parties by defined rules, terms, and procedures, they explicitly state how future contingencies and conflicts will be addressed.</td>
<td>Engaging in active interactions with a set of relational norms so that the supplier applies its specialized professional skills, methods, and expertise. At the same time, the client contributes to resources, needs, and linked interests.</td>
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<td><strong>Relational engagement</strong></td>
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<tr>
<td><strong>Coordination</strong></td>
<td>Managing dependencies among activities and linking different parties to accomplish a standard set of tasks facilitate the exchange of technical information.</td>
<td>Working cooperatively in activities whereby two or more parties (e.g., clients and suppliers) actively exchange strategic information and jointly solve problems to achieve shared goals, reduce risks, and share gains and pains through a rational and transparent interaction.</td>
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<td><strong>Collaboration</strong></td>
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<tr>
<td><strong>Monitoring &amp; controlling</strong></td>
<td>Securing that the objectives are reached as planned, including corresponding changes to the plan as required.</td>
<td>Transforming knowledge and ideas jointly for new products, processes, or systems encourages change, creativity, and risk-taking. The parties have little or no prior experience for their benefit and that of their stakeholders.</td>
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<td><strong>Innovating</strong></td>
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**Hypothesis 1. (H1).** Value creation processes impact positively on project value.

**Hypothesis 2. (H2).** Requirements uncertainty and project complexity moderate the effect of the value creation processes on project value.
3. Materials and Methods

3.1. Research Design. The project management context benefits from theoretically acceptable literature about the relationship between value creation processes and project value. Accordingly, this study adopts a deductive approach to testing theory. Survey research is suitable for a quantitative (deductive) method [84], and the outcomes can be generalized by testing the hypothesis [85]. A self-administered questionnaire is the preferred data collection method for this study. In the first place, questionnaires are strongly linked to survey research strategies and quantitative (deductive) research design [85, 86]. Second, survey questionnaires represent the most appropriate method for cross-national studies like this (i.e., data gathered from project managers in Chile) [84]. Moreover, as shown in the literature review, a good body of knowledge about value creation provides appropriate definitions and validated measures of key constructs.

Projects, recognized as a collection of economic transactions and social interactions, are a preferred unit of analysis in project management research (some examples in [87, 88]). By the research aim, the “completed project” is the unit of analysis. The questionnaire and complementary information such as participant information statement, participant consent form, and guidelines are distributed by “Google Web-Forms,” generating a hyperlink to the inquiry website. That procedure is followed by the first contact with potential respondents through an e-mailed personalized invitation to complete the questionnaire, providing a detailed explanation of the research. The potential respondent is asked to tick the consent form before answering the questionnaire to present clear reports of voluntary participation and the option to leave the survey at any time. Reminders are sent after one week and again after three weeks following the first message as a means to complete data collection in six weeks to correspond with the propositions of Saunders et al. [84]. The database from PMI® Antofagasta Chile Potential Chapter that provides personal details about its members was used to distribute the questionnaire. From that databank, 362 project managers were selected as the target sample and 168 valid completed questionnaires were received (i.e., the sample size). All the replies are saved automatically. Only the aggregate results from the data that are gathered are published. The participants are not individually identifiable in publications, ensuring their anonymity. The response rate is 46%, satisfactory for a web-based survey [84].

Tables 2 and 3 show the profiles of the participants and the surveyed projects. About profile, most of the respondents (74.4%) are project top managers, and 54.2% have more than ten years of experience working on projects. Half of the respondents (50%) are more than 40 years old, and 85.7% possess a master’s degree, mainly in project management or business administration. Most of the completed projects surveyed are associated with engineering and construction (71.4%) and IT (13.7%). Finally, the planned budget varied with more than 49% exceeding US$ 7 million, and early 70% of the projects have an expected duration of over six months and under two years.

To rule out nonresponse bias, this research adopts the approach recommended by Armstrong and Overton [89], where the behavior of late respondents can be considered similar to nonrespondent practice because it is necessary to make a considerable effort to stimulate participation. The Mann–Whitney U-test [90] is then conducted to analyze the difference in means between the two respondent groups; in this case, the first third (i.e., early responses) and the last third (i.e., late responses) of the data by utilizing IBM SPSS Statistics 24. Initial responses were coded 1 ($N=56$), while late responses were coded 3 ($N=56$). The U-test results in two ordinal variables—age and years of experience in projects—reveal nonsignificant differences (>0.05) among the means of early and late respondents. Thus, these results demonstrate that nonresponse bias is not an issue of concern in this study.

3.2. Data Preparation. The web-based questionnaire is carefully designed to reduce the possibility of missing data. For this reason, the survey does not include filter questions to skip sections. All the respondents are obligated to answer every question because each item is obligatory. The respondent cannot progress to a new survey section until all the questions are answered. Also, the questionnaire includes a “not sure/not know” answer to address any potential issues related to unclear queries or the refusal to answer. Missing values represent a low value per indicator. The worst-case shows only one sign of 5.4% missing values, and most of the items have less than 2%. Hence, missing values are adequately addressed by the mean value replacement recommended by Hair et al. [91].

IBM SPSS 24 is also used to draw box plots and identify outliers in each indicator variable (i.e., univariate outlier detection analysis). The report demonstrates the existence of extreme outliers. Nevertheless, because all the variables are ordinal scales from 1 = fully disagree to 6 = fully agree, unusual erroneous scores do not arise. As expressed by high or low values are exceptionally part of reality, there are no reasons to believe that these values are wrong. This research retains all the defined outliers from the analysis, in line with the instructions in [92]. Subsequently, scatter plots are also used to establish the presence of outliers between each construct relationship specified in the structural model (i.e., bivariate detection analysis). In this case, “observations that fall markedly outside the range of the other observations will show as isolated points in the scatterplot” [92] (p.95). Thus, a few outliers for specific paths are removed. This decision is made after evaluating the influence of the results by comparing them with, before, and after deletion. The indicator variables used to measure the constructs and their source are presented in Table 4.

4. Results

The model analysis was conducted in five steps: 1. Assessment of the hierarchical structure; 2. assessment of the global model; 3. evaluation of the measurement model; 4. assessment of the structural model; and 5. multigroup analysis.
4.1. Assessment of the Hierarchical Structure. In this study, the value creation processes and the project value were operationalized in two levels of abstraction: the higher-order component (HOC) captures the more abstract entity, and the lower-order components (LOCs) capture the subdimensions of the abstract entity.

According to Hair et al., Riel et al., Beker et al. [91, 93, 94], second-order models can be calculated by three different methods. The first type is the two-stage approach, where the values of the variables with indicators (first-order) are calculated first and, with these scores in a second stage, converted into indicators. The second type is repeated indicators, where the indicators of the first-order variable are the same in the second-order variable for calculating the entire model. A third type is a hybrid approach, which is very similar to the repeated indicator but uses each indicator only once so as not to have artificial correlation residues. The two-step method with the reflective-reflective-type approach was used to assess these constructs’ LOCs and HOC.

For the subdimensions of both constructs, reliability and validity measures have been applied. This indicates that all variables reach the requirements recommended by the literature [95--99]. The reliability of each item is appropriate since their loads are greater than 0.5 (see Tables 5 and 6). The latent variable is reliable as the composite reliability of each variable is greater than 0.7, and convergent validity will be achieved since the average variance extracted (AVE) figures are above 0.5 (see Tables 7 and 8). Finally, there is a

<table>
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<th>Table 3: Summary of project profiles.</th>
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<td>Profile items</td>
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Table 2: Summary of respondent profiles.

<table>
<thead>
<tr>
<th>Profile items</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation/job title</td>
<td>Project top managers (e.g., executive manager, project director, contract manager)</td>
<td>125</td>
<td>74.4</td>
</tr>
<tr>
<td></td>
<td>Project middle managers (e.g., project engineer, project planning and controlling manager, project technical manager)</td>
<td>43</td>
<td>25.6</td>
</tr>
<tr>
<td>Project experience (years)</td>
<td>Under 10</td>
<td>77</td>
<td>45.8</td>
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<td>Between 10 and 19</td>
<td>65</td>
<td>38.7</td>
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<td>Between 20 and 29</td>
<td>20</td>
<td>11.9</td>
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<td>Over 30</td>
<td>6</td>
<td>3.6</td>
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<td>Age (years)</td>
<td>Under 30</td>
<td>6</td>
<td>3.6</td>
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<tr>
<td></td>
<td>Between 30 and 39</td>
<td>78</td>
<td>46.4</td>
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<tr>
<td></td>
<td>Between 40 and 49</td>
<td>55</td>
<td>32.7</td>
</tr>
<tr>
<td></td>
<td>Between 50 and 59</td>
<td>26</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td>Over 60</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Level of education</td>
<td>Bachelor/professional</td>
<td>24</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>Master’s degree (business/project management)</td>
<td>144</td>
<td>85.7</td>
</tr>
</tbody>
</table>
Table 4: Summary of research constructs and indicators.

<table>
<thead>
<tr>
<th>Constructs and indicators</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contractual agreements (CA): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>CA1. Written contracts primarily governed the client-contractor relationship.</td>
<td>[44]</td>
</tr>
<tr>
<td>CA2. The client and the project contractor made contractual agreements that detailed both parties’ rights and obligations.</td>
<td></td>
</tr>
<tr>
<td>CA4. Each party considered the contingencies that might emerge in the future at best and provided an exhaustive explanation in the contract.</td>
<td>[120]</td>
</tr>
<tr>
<td>CA5. The client and the project contractor permanently referred to the contract to resolve disputes and conflicts during the project.</td>
<td></td>
</tr>
<tr>
<td><strong>Relational engagement (RE): second-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of interactions (QI): First-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>QI1. The interactions between both parties produced novel insights.</td>
<td>[121]</td>
</tr>
<tr>
<td>QI2. Both parties displayed a sound strategic understanding of each other in their interactions.</td>
<td></td>
</tr>
<tr>
<td>QI3. Both parties played a proactive role during the interaction.</td>
<td>[51]</td>
</tr>
<tr>
<td><strong>Relational norms (RN): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>RN1. Both parties were intentionally open and honest in their interactions.</td>
<td></td>
</tr>
<tr>
<td>RN2. . . . were enthusiastic about achieving the project objectives.</td>
<td>[122]</td>
</tr>
<tr>
<td>RN3. . . . felt confident that the other party was reliable and trustworthy.</td>
<td></td>
</tr>
<tr>
<td>RN4. . . . believed the other party provides its best efforts.</td>
<td></td>
</tr>
<tr>
<td>RN5. . . . adopted a “no blame culture” whenever problems arose.</td>
<td></td>
</tr>
<tr>
<td><strong>Coordination (CO): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>CO1. The different job and work activities between the project contractor and the client fit well.</td>
<td>[48]</td>
</tr>
<tr>
<td>CO2. The routines between the project contractor and the client were well established during the project.</td>
<td></td>
</tr>
<tr>
<td>CO3. The decisions were well-coordinated between both parties.</td>
<td>[123]</td>
</tr>
<tr>
<td>CO4. Both parties linked together to achieve the project objectives.</td>
<td>(New item)</td>
</tr>
<tr>
<td>CO5. . . . provided the technical information needed by the other.</td>
<td>[49]</td>
</tr>
<tr>
<td>CO7. . . . were expected to keep the other party informed of changes that could affect the project.</td>
<td>[124]</td>
</tr>
<tr>
<td><strong>Collaboration (CL): second-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Strategic information exchange (SIE): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>SIE1. Both parties shared information on successful and unsuccessful experiences with deliverables exchanged in the relationship.</td>
<td>[125]</td>
</tr>
<tr>
<td>SIE2. . . . exchanged information related to changes in the users’ needs, preferences, and behavior.</td>
<td></td>
</tr>
<tr>
<td>SIE3. . . . exchanged sensitive information, such as financial performance and organizational know-how.</td>
<td></td>
</tr>
<tr>
<td>SIE4. . . . exchanged information that is sensitive to them, such as financial performance and organizational know-how.</td>
<td></td>
</tr>
<tr>
<td><strong>Collaborative work (CW): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>CW1. Both parties worked effectively on a joint project tailored to joint needs.</td>
<td>[124]</td>
</tr>
<tr>
<td>CW2. . . . worked together effectively to exploit unique opportunities.</td>
<td></td>
</tr>
<tr>
<td>CW3. . . . were always looking for synergistic ways to do business together.</td>
<td></td>
</tr>
<tr>
<td><strong>Joint problem-solving (JPS): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>JPS1. When conflicts arose, both parties found a proper solution jointly.</td>
<td>[48]</td>
</tr>
<tr>
<td>JPS2. When the project contractor’s performance did not match the client’s expectations, the client helped or provided suggestions.</td>
<td></td>
</tr>
<tr>
<td>JPS3. . . . exchanged information as soon as any unexpected problems arose.</td>
<td>[125]</td>
</tr>
<tr>
<td>JPS4. . . . worked closely to reduce risks, sharing gains and pains throughout the project.</td>
<td>(New item)</td>
</tr>
<tr>
<td><strong>Monitoring and controlling (MC): first-order latent variable</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Table 4: Continued.

<table>
<thead>
<tr>
<th>Constructs and indicators</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC1. The project contractor had several objective data sources that indicated how well the project met the goals.</td>
<td>[126]</td>
</tr>
<tr>
<td>MC2. ... frequently discussed progress toward the project objectives with the client.</td>
<td></td>
</tr>
<tr>
<td>MC3. ... monitored/controlled whether the project (or deliverable) was completed on time.</td>
<td>(New items)</td>
</tr>
<tr>
<td>MC4. ... monitored/controlled whether the project (or deliverable) was completed within budget.</td>
<td></td>
</tr>
<tr>
<td>MC5. ... monitored/controlled whether the project (or deliverable) satisfied the client’s requirements.</td>
<td></td>
</tr>
<tr>
<td>MC6. ... monitored/controlled whether the project tasks were being performed efficiently.</td>
<td></td>
</tr>
<tr>
<td>MC7. ... applied mechanisms for the identification and resolution of project issues requiring corrective actions</td>
<td></td>
</tr>
<tr>
<td><strong>Innovating (IN): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>IN1. Both parties collaboratively and frequently tried out new ideas for the project.</td>
<td>[76]</td>
</tr>
<tr>
<td>IN2. ... collaboratively and frequently sought new ways of doing things for the project.</td>
<td></td>
</tr>
<tr>
<td>IN3. ... were creative in operating methods during the project.</td>
<td></td>
</tr>
<tr>
<td>IN4. ... put much value on taking risks even when failure was possible during the project.</td>
<td></td>
</tr>
<tr>
<td><strong>Requirements uncertainty (RU): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>RU2. Project requirements identified initially were quite different from those at the end.</td>
<td>[80, 81]</td>
</tr>
<tr>
<td>RU4. Project users/stakeholders often differed among themselves in the requirements to be met.</td>
<td></td>
</tr>
<tr>
<td>RU5. Much effort had to be spent reconciling the project users/stakeholders’ requirements.</td>
<td></td>
</tr>
<tr>
<td>RU6. It was difficult to customize the project output to one set of users/stakeholders without reducing support to other users/stakeholders.</td>
<td></td>
</tr>
<tr>
<td><strong>Project complexity (PC): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td>PC1. The project had a high degree of task novelty.</td>
<td></td>
</tr>
<tr>
<td>PC2. ... had a high degree of complexity concerning content.</td>
<td>[79]</td>
</tr>
<tr>
<td>PC3. ... had a high degree of complexity about interdisciplinary participants and specialties.</td>
<td></td>
</tr>
<tr>
<td>PC4. ... was characterized by high risk and uncertainty.</td>
<td></td>
</tr>
<tr>
<td>PC5. The country’s regulations and politics were challenging.</td>
<td>[122]</td>
</tr>
<tr>
<td>PC8. The pressure from external stakeholders was high.</td>
<td></td>
</tr>
<tr>
<td><strong>Project value (PV)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Project management success (PMS): first-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Project efficiency (PE)</strong></td>
<td>[20]</td>
</tr>
<tr>
<td>PE1. The project was completed within or below budget.</td>
<td></td>
</tr>
<tr>
<td>PE2. ... was completed on time or earlier.</td>
<td></td>
</tr>
<tr>
<td><strong>Impact on the client (IC)</strong></td>
<td></td>
</tr>
<tr>
<td>IC1. The product (or deliverable) improved the client’s performance.</td>
<td>[20]</td>
</tr>
<tr>
<td>IC2. The client was satisfied.</td>
<td></td>
</tr>
<tr>
<td>IC3. The product (or deliverable) met the client’s requirements.</td>
<td></td>
</tr>
<tr>
<td>IC5. The client came/will come back for future work.</td>
<td></td>
</tr>
<tr>
<td><strong>Project success (PSU): second-order latent variable</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Organizational and business success (OS): First-order latent variable</strong></td>
<td>[20]</td>
</tr>
<tr>
<td>OS1. The project was an economic business success for the contractor.</td>
<td></td>
</tr>
<tr>
<td>OS2. ... increased the contractor’s profitability.</td>
<td></td>
</tr>
<tr>
<td>OS3. ... has a positive return on investment.</td>
<td></td>
</tr>
<tr>
<td>OS4. ... contributed to the contractor’s direct performance.</td>
<td></td>
</tr>
<tr>
<td><strong>Preparing for the future (PF): first-order latent variable</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Continued.

<table>
<thead>
<tr>
<th>Constructs and indicators</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF1. The project outcome contributed/will contribute to future projects.</td>
<td>[20]</td>
</tr>
<tr>
<td>PF2. . . led/will lead to additional new products.</td>
<td></td>
</tr>
<tr>
<td><strong>Project size (PS): first-order latent variable—control variable</strong></td>
<td></td>
</tr>
<tr>
<td>PS1. What size was the project in terms of the total budget (in millions of AU$)?</td>
<td></td>
</tr>
<tr>
<td>PS2. . . the total planned duration (in months)?</td>
<td></td>
</tr>
<tr>
<td>PS3. . . the number of people involved?</td>
<td></td>
</tr>
</tbody>
</table>
4.2. Assessment of the Global Model. Although it is not a consensus in the literature on analyzes via PLS-SEM, Henseler et al. [100] consider it essential to perform the global model’s adjustment test, as the data often have more information than the model provides. This test is carried out via standardized root mean square residual (SRMR), and values less than or equal to 0.08 are expected [96, 101]. The SRMR has been calculated for this model, and the results guarantee the global adjustment of the model (SRMR = 0.08).

4.3. Assessment of the Measurement Model. Four tests were performed: two for reliability and two for validity. Item reliability and internal reliability tests (composite reliability) were performed to guarantee reliability. Table 9 presents item reliability (loadings) and composite reliability values. Hair et al. [102] explain that the item reliability values must be greater than or equal to 0.5, and the internal reliability indicators must be greater than or equal to 0.7.

It can be observed that the indices reached the values necessary to achieve the reliability of the measurement model, except for the CA, which presented a value below 0.5. However, Hair et al. [99] explain that if the item’s reliability does not affect the later stages, amounts equal to or greater than 0.4 may be used.

Table 10 presents the values of convergent validity and discriminant validity. The AVE seeks to understand how the indicators converge for their respective variables; cross-loading aims at determining whether the variables have a difference.

It can be noticed that the AVE value exceeds 0.5, ensuring that the indicators converge well for their variables. Cross-loading indicates that the items are better correlated with their variables than the others, which shows their discrimination. Additionally, the HTMT calculated is 0.689. Thus, the model is valid, reaching the thresholds recommended by the literature [100].

4.4. Assessment of the Structural Model. Figure 2 shows the calculated structural model. It can be noted that there is significance in the relationship between the value creation

| Table 5: Loading of LOCs of the value creation processes. |
|-----------------|-------|-------|-------|-------|-------|-------|
| Item | CA    | CO    | CL    | IN    | MC    | RE    |
| CA1  | 0.680 |
| CA2  | 0.813 |
| CA4  | 0.765 |
| CA5  | 0.634 |
| CO1  | 0.738 |
| CO2  | 0.722 |
| CO3  | 0.812 |
| CO4  | 0.805 |
| CO5  | 0.652 |
| CO7  | 0.705 |
| CW1  | 0.850 |
| CW2  | 0.826 |
| CW3  | 0.847 |
| JPS1 | 0.810 |
| JPS2 | 0.663 |
| JPS3 | 0.835 |
| JPS4 | 0.777 |
| JPS5 | 0.774 |
| JPS6 | 0.629 |
| JPS7 | 0.661 |
| IN1  | 0.880 |
| IN2  | 0.898 |
| IN3  | 0.885 |
| IN4  | 0.583 |
| MC1  | 0.740 |
| MC2  | 0.807 |
| MC3  | 0.733 |
| MC4  | 0.809 |
| MC5  | 0.853 |
| MC6  | 0.848 |
| MC7  | 0.744 |
| Q11  | 0.731 |
| Q12  | 0.797 |
| Q13  | 0.862 |
| RN1  | 0.886 |
| RN2  | 0.791 |
| RN3  | 0.855 |
| RN4  | 0.868 |
| RN5  | 0.781 |

| Table 6: Loading of LOCs of the project value. |
|-------|-------|-------|
| Item | PMS | PSU   |
| IC1  | 0.775 |
| IC2  | 0.918 |
| IC3  | 0.888 |
| IC5  | 0.768 |
| PE1  | 0.738 |
| PE2  | 0.668 |
| OS1  | 0.865 |
| OS2  | 0.862 |
| OS3  | 0.826 |
| OS4  | 0.810 |
| PF1  | 0.704 |
| PF2  | 0.500 |

| Table 7: Construct reliability and convergent validity of LOCs of the value creation processes. |
|-----------------------------------------------|-----------|-------|
| Latent variable | Composite reliability | Ave   |
| CA   | 0.816 | 0.528 |
| CL   | 0.941 | 0.595 |
| CO   | 0.879 | 0.549 |
| IN   | 0.890 | 0.676 |
| MC   | 0.921 | 0.627 |
| RE   | 0.944 | 0.677 |

| Table 8: Construct reliability and convergent validity of LOCs of the project value. |
|-----------------------------------------------|-----------|-------|
| Latent variable | Composite reliability | Ave   |
| PMS  | 0.912 | 0.635 |
| PSU  | 0.890 | 0.547 |

discriminant validity of the subdimensions of constructs since the heterotrait-monotrait ratio of correlations (HTMT) is less than 1 in all cases.
processes and the project value ($\beta = 0.61$ and $p$ value < 0.001) [99].

Value creation processes explain the project value by 37%, which is considered a weak but satisfactory amount [99]. However, features related to the project can alter this degree of influence. Usually, it is associated with requirements uncertainty and project complexity. A multigroup analysis was carried out regarding assessing whether this effect is substantial to find possible heterogeneity in the data collected.

4.5. PLS-SEM Multigroup Analysis. Sometimes, the researcher establishes criteria that can reveal differences in a model, making it heterogeneous. At other times, however, this heterogeneity cannot be observed because it is a characteristic that is undetectable to the human eye. However, with the increase in computer capacity and specialized programs, it is possible to identify patterns imprecise to human beings in a sample. A known technique is multigroup analysis. In PLS-SEM, some studies have adopted this type of analysis effectively [101], ensuring a clearer understanding of the research problem.

Before developing a multigroup analysis to compare different projects, we conducted a two-step cluster analysis to distinguish these types; this procedure identified three clusters concerning the medians of requirements uncertainty and project complexity. Clusters have been recognized as Group 1, Group 2, and Group 3 (see Table 11). Group 1 is the largest cluster and corresponds to 42.9% of the sample;

Table 9: Reliability values.

<table>
<thead>
<tr>
<th>Item</th>
<th>Loading</th>
<th>Composite reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project value</td>
<td></td>
<td>0.923</td>
</tr>
<tr>
<td>PMS</td>
<td>0.926</td>
<td></td>
</tr>
<tr>
<td>PSU</td>
<td>0.926</td>
<td></td>
</tr>
<tr>
<td>Value creation processes</td>
<td>0.916</td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>0.497</td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td>0.925</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>0.844</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>0.803</td>
<td></td>
</tr>
<tr>
<td>MC</td>
<td>0.788</td>
<td></td>
</tr>
<tr>
<td>RE</td>
<td>0.915</td>
<td></td>
</tr>
<tr>
<td>PMS</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td>PSU</td>
<td>0.499</td>
<td></td>
</tr>
</tbody>
</table>

Table 10: Model validity.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value creation processes</th>
<th>Project value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-loading</td>
<td></td>
<td>Ave</td>
</tr>
<tr>
<td>CA</td>
<td>0.497</td>
<td>0.279</td>
</tr>
<tr>
<td>CL</td>
<td>0.925</td>
<td>0.511</td>
</tr>
<tr>
<td>CO</td>
<td>0.844</td>
<td>0.543</td>
</tr>
<tr>
<td>IN</td>
<td>0.803</td>
<td>0.466</td>
</tr>
<tr>
<td>MC</td>
<td>0.788</td>
<td>0.467</td>
</tr>
<tr>
<td>RE</td>
<td>0.915</td>
<td>0.548</td>
</tr>
<tr>
<td>PMS</td>
<td>0.594</td>
<td>0.926</td>
</tr>
<tr>
<td>PSU</td>
<td>0.499</td>
<td>0.926</td>
</tr>
</tbody>
</table>

Average variance extracted (AVE) Ave 0.653 0.857

Figure 2: PLS-SEM results.
this cluster is characterized by high requirements uncertainty and project complexity. Group 2 corresponds to 41.1% of the sample and has a low level of requirements uncertainty and a high level of project complexity. Group 3 is the smallest cluster in size and matches 16.1% of the sample; this cluster is characterized by a low level of both requirements uncertainty and project complexity.

This study uses the gamma-exponential method to determine the minimum sample size for each group, according to steps performed by Ramírez-Correa et al. [95]. According to this method, for a power level of 0.8 and a significance level of 0.05, the minimum sample size required was met in all cases (see Table 12).

We examine the measurement and structural models separately for each of the three groups. The results indicated reliability, convergent validity, and discriminant validity. Additionally, the measurements’ invariance was assessed to ensure that any difference noticed in the coefficients of the structural model between the groups is not due to variances in the measurement model. For this, the steps of invariance measurement of the study of Ramírez-Correa et al. [95] have been followed. The assessment outcome offers support for the invariance and equivalence of the measure.

Finally, we developed a multigroup analysis (MGA) to compare different groups (see Figure 3). Table 13 shows the result of this procedure.

From Figure 3 and Table 13, we can affirm that Group 3 shows a different behavior compared to the model than Group 1 and Group 2. Concretely, the value creation processes-project value relationship is significantly more substantial among projects with a low level of both requirements uncertainty and project complexity. Also, Group 3 presents a much higher coefficient of determination than the other two groups.

5. Discussion

This research investigates the effects of value creation processes on the project value and analyzes the moderating influence of requirements uncertainty and project complexity on these effects. Specifically, the research questions addressed are (1) how do value creation processes impact the project value? And (2) how do requirements uncertainty and project complexity moderate the effects of value creation processes on the project value?

5.1. The Impact of Value Creation Processes on Project Value

In addressing the first research question and contributing to the literature, value creation processes impact the project value. In detail, project governance strategies (i.e., contractual agreement and relational engagement) drive two critical modes of interorganizational interaction for mobilizing resources into the project: coordination and collaboration. While contractual agreement encourages coordination, relational engagement is underpinned by a favorable quality of interactions, and relational norms enable coordination and collaboration. For this part, prior research has accepted that contractual governance mechanisms are complemented by relational mechanisms, such as trust and interactions, that prevent conflicts and adversarial behavior between the parties involved and also promote problem-solving and information sharing (e.g. [83, 103, 104]).

In contributing to knowledge, this research identifies contractual agreements as an enabler of coordination and relational engagement as an enabler of both coordination and collaboration. Additionally, coordination is strongly associated with monitoring and controlling, whereas collaboration between the parties involved has a marked influence on innovation. Both managerial approaches (i.e., monitoring and controlling and innovating) significantly impact project management success. The findings contradict the paradoxical view of control versus innovation in organizations, as Fonseca [105] elucidated, who established the

<table>
<thead>
<tr>
<th>Feature</th>
<th>Mean 1 (42.9%)</th>
<th>SD</th>
<th>Mean 2 (41.1%)</th>
<th>SD</th>
<th>Mean 3 (16.1%)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements uncertainty</td>
<td>5.583</td>
<td>0.628</td>
<td>2.594</td>
<td>0.871</td>
<td>2.704</td>
<td>1.281</td>
</tr>
<tr>
<td>Project complexity</td>
<td>5.701</td>
<td>0.744</td>
<td>5.732</td>
<td>0.662</td>
<td>2.870</td>
<td>0.816</td>
</tr>
</tbody>
</table>

Table 12: Samples size.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>72</td>
<td>69</td>
<td>27</td>
</tr>
<tr>
<td>The minimum sample size required</td>
<td>11</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

Note. *Power level = 0.8 and significance level = 0.05.
divergence between controlling and innovating. Additionally, this research shows that the traditional control paradigm based on coordination is complemented by collaboration [106].

5.2. The Moderating Effect of Requirements Uncertainty and Project Complexity. Regarding the moderating effects of requirements uncertainty (RU) and project complexity (PC), this study proposes a combination of two dichotomy levels (i.e., low and high) of RU and PC. Thus, projects are clustered into three groups: uncertain complex projects (Group 1), certain complex projects (Group 2), and certain simple projects (Group 3). Overall, the multigroup analysis results show patterns consistent with the relationship between value creation processes and project value being moderated by RU and PC.

For complex projects with low levels and high requirements uncertainty (Groups 1 and 2), value creation processes positively affect the project value, supported by both governance strategies and contractual and relational. Formal contracts significantly influence coordination, whereas relational governance strategies affect coordination and collaboration. These findings partly contradict the previous research (e.g., [107, 108]) that shows marked differences between managing complex projects with high and low uncertainty. Perhaps a good explanation for this contradiction is that increased requirements uncertainty in the project amplifies its complexity. In other words, uncertainty is inherent to complexity. Consequently, the management of highly complex projects encompasses a holistic view of value creation. Complex projects are characterized by cause-effect relationships that are typically ambiguous, where both contractual and relational governance approaches can be effective. Effective relational mechanisms such as trust, continuous interactions, and mutual norms reduce the need to guard against opportunistic behavior by exerting full control and concentrating on project delivery, amplifying the effects of contractual governance through resources, task coordination, and outcome controls. Those relational mechanisms enhance collaboration between organizations and stimulate performance gains and manage risks and opportunities at the project level by creating platforms for new ideas, creativity, and innovation. Hence, monitoring and control, and innovating become levers for adapting the project’s delivery to these challenging environments of complexity. Previous research (e.g., [19, 69, 109–111]) partially shows similar findings.

Additionally, integration among project actors is required to improve flexibility, adaptation, and collaboration during project execution when uncertainty is high, where relational norms and interactions are essential for effective governance [25, 112, 113]. Collaborative efforts toward reducing requirements uncertainty based on sharing knowledge, joint problem-solving, and goal conflict resolution prove to be useful ways to increase project innovativeness and, as a consequence, improve project performance [28, 114–119].

Conversely, in projects where RU and PC are low (Group 3), there is a positive effect of monitoring and controlling project management success, supported by relational governance strategies and coordination. Also, relational engagement motivates collaboration among parties and, as a result, stimulates innovation that adds the project value. Because these certain simple projects are characterized by stability, known requirements, and direct cause-effect relationships, the decision-making process is often unquestioned. The parties share a common understanding so that they rely on relational mechanisms such as trust and commitment rather than on a pressing need for formal contracts. Hence, the project execution follows a predictable and controllable path where the best practices apply standardization and efficient coordination for managing any minimum variation throughout the project. Moreover, these projects can be evaluated using traditional project management success measures such as time and cost performance and other means directly related to delivered products, such as client satisfaction [110, 111].

### 6. Conclusions

The objective of this research is to investigate the effects of value creation processes on the project value empirically and to analyze the moderating influence of requirements uncertainty and project complexity on these effects. Findings contribute to the literature underscoring that value creation processes have an impact on project management success as measured by project efficiency (i.e., cost, time, and scope), client satisfaction (i.e., quality) and, project success, measured by business and organizational success and preparation for the future. Additionally, this empirical study contributes to confirming theoretical patterns that show the relationship between value creation processes and project value moderated by requirements uncertainty and project complexity in different contexts.

Drawing mainly from transaction cost economics and interorganizational relationships research, value creation processes were identified, including independent and co-creation. The former process focuses on realizing value through formal agreements that motivate permanent coordination for monitoring and controlling the project targets
and milestones, ensuring the delivery of the project outcomes on time, within budget, and according to agreed scope and quality. The latter process emphasizes identifying emerging value propositions and realizing values innovatively through strategic information exchange, knowledge sharing, trust, and collaboration.

Further contributing to the literature, the findings confirmed that requirements uncertainty and project complexity moderate the relationship between value creation processes and project value. This moderating effect represents a theoretical contribution to proposing a new way to deal with uncertainty and complexity in projects. Although more collaborative value creation actions have been indicated as the best method to face uncertain and complex projects, the empirical evidence of this research emphasized value creation drivers’ fundamental role in complex contexts. Also, it is less relevant when the project is simple with certain requirements.

From a practical perspective, governing value creation processes provide an adequate sounding board for project managers to identify better ways to maximize the project value in diverse environments of complexity and uncertainty. Thus, practitioners must pay much attention to governance strategies, modes of interaction, and management foci in creating value as fundamental for successful projects. For example, the findings empirically show that collaborative project delivery models (PDMs) such as early contractor involvement, project alliance, or integrated project delivery could best suit projects where requirements are uncertain and complex. Identifying the most suitable PDM under diverse contexts can reduce the risks of failure, strengthen opportunities, and help accomplish superior project value. Also, this model could help to generate a methodology to evaluate and choose a management project approach in the early project stages. This methodology could include the following steps: Step 1) measure complexity and uncertainty based on the proposed instrument; Step 2) determine the belonged group; Step 3) select the approach according to the defined group; Step 4) plan and control the project considering the defined group; and Step 5) evaluate the created value from the project. Another possible application of these research results would be proposing a system for managing a portfolio of project initiatives that allocate resources according to the three groups identified: high complexity and high uncertainty, high complexity and low uncertainty, and low complexity and low uncertainty. This system would efficiently use critical resources such as senior project managers and financial funds and ensure alignment with the strategic business goals.

Future research could extend this work to include a broader spectrum of project stakeholders. It should seek to explore longitudinal data to see the pattern of change in value creation processes throughout the project life cycle, including the operational phase. Thus, this longitudinal approach based on case studies research could compare the three groups of projects analyzed to confirm or explore new organizational settings to govern value creation processes in projects with complexity and requirements uncertainty in business contexts.

Data Availability
The data used to support the findings of the study are available from the corresponding author upon request.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

Authors’ Contributions
B.H-R. and L.L. conceived the study; B.H-R., L.L., and P.R-C. helped with the methodology; B.H-R. collected the data; B.H-R. and P.R-C. helped with software; B.H-R. validated the study; B.H-R. did the formal analysis; B.H-R. investigated the study; B.H-R. helped with the resources; B.H-R. curated the data; B.H-R., P.R-C., and A.M-M. wrote the original draft of the manuscript; B.H-R., P.R-C., and A.M-M. reviewed and edited the manuscript; B.H-R. and P.R-C. performed visualization; B.H-R. and L.L. supervised the study; B.H-R. and P.R-C. helped with the project administration; and B.H-R did funding acquisition.

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