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Project management performance in Ecuador: proposal for a structural model

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Abstract
This research aimed to evaluate a structural model that explains the performance of projects based on four critical success factors: client communication, monitoring and planning, senior management, and technical activities, resulting from the process of adaptation and validation of the Project Implementation Profile (PIP) instrument in the Ecuadorian context. The adapted PIP was distributed online to directors involved in projects conducted in Ecuador, obtaining 328 responses. SMART PLS 4 was used to study the equations of the structural model and its multi-group analysis among project team leaders and members. The evaluation showed that the model's explanatory power was moderate, and the proposed relationships between technical capabilities, senior management, and performance were positive and statistically significant. The multigroup analysis demonstrated differences in the perception of project success between leaders and team members. The results of this study contribute new knowledge in the area of project management to the Ecuadorian Academy.

Keywords: project management; critical success factors; success criteria, PLS-SEM; multigroup analysis

Desempeño de la gestión de proyectos en Ecuador: propuesta de un modelo estructural

Resumen
Esta investigación tuvo por objeto evaluar un modelo estructural que explica el desempeño de los proyectos a partir de cuatro factores críticos de éxito: comunicación con el cliente, seguimiento y planeación, alta gerencia y capacidades técnicas, resultante del proceso de adaptación y validación del instrumento Perfil de Implementación del Proyecto (PIP) al contexto ecuatoriano. El PIP adaptado fue distribuido online a directores e involucrados en proyectos realizados en Ecuador, obteniéndose 328 respuestas. Para el estudio de las ecuaciones del modelo estructural y su análisis multigrupo entre líderes y miembros de equipos de proyectos se utilizó SMART PLS 4. La evaluación dio como resultado que el poder explicativo del modelo es moderado y que las relaciones propuestas entre los factores críticos capacidades técnicas y alta gerencia y el desempeño son positivas y estadísticamente significativas. El análisis multigrupo demostró diferencias de percepción sobre el éxito del proyecto entre líderes y miembros de equipo. Los resultados de esta investigación contribuyen con nuevo conocimiento en el área de la gestión de proyectos a la academia ecuatoriana.

Palabras clave: gestión de proyectos; factores críticos de éxito; criterios de éxito, PLS-SEM; análisis multigrupo

1 Introduction

All organizations, without exception, face changes in their environment that generate problems or new opportunities, which they must resolve [1,2], and that is when they turn to project management since this is a relevant factor for achieving their strategic objectives and a means to become competitive [3-5], as long as the proposed projects are successful [6]. This has been the motivation for academics in the last fifty years to propose several models of criteria that define the success of projects [7]: the Barnes triangle (time, cost, and quality) [8], the Project

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Implementation Profile (time, cost, performance, perceived quality, and client satisfaction) [9], a theoretical model of information systems [10], the diamond approach (efficiency, client impact, team impact, business and success, and preparation for future) [11], the success of project management and deliverables [12], and the generic model of Zwikael and Meredith [13].

However, for the study of project success, in addition to the success criteria, the critical success factors are the other components that define it [14]. Like success criteria, critical success factors have also been studied over the same time, resulting in some frameworks [15]: the Project Management Environment Survey [16], the survey of Baker, et al. [17], whose dimensions are project manager, team engagement, team project capacities, planning and control among others, the seven factors of Morris and Hough [18], the Project Implementation Profile [19], the practices of project management, deliverables management, and corporative success [6], the project, team project, organization and environment factors [20], and the factors by stage of Khang and Moe [21].

When asked why critical factor frameworks and project success models continue to be proposed, the answer is that no single list can be applied to all projects equally since the characteristics of the context influence the project itself [22-26].

Organizations in Latin America are not characterized by good performance in managing their projects, which is reflected in the fact that they register a rate of 15% of failed projects and monetary losses of 122 million for every billion dollars invested [27,28]. Such organizations are less likely to realize their strategic goals, obtain expected benefits, and become more competitive [29]. However, in these studies [27,28], no indicators were reported by country, so the specific situation of Ecuador was not known. Starting from the fact that research on project performance in Ecuador is scarce, Arteaga [30] conducted an exploratory study that revealed that of every 100 projects, only 27 were classified as high performance. That is to say, in Ecuador, the performance of project management, as in Latin America, has a lot to improve, and it is relevant to identify the critical factors and success criteria of Ecuadorian projects, the first step being the identification of a measuring instrument for each of these components.

Among the critical success factor frameworks identified by Ika and Pinto [15] is the Project Implementation Profile (PIP) by Pinto and Slevin [19], recognized as a project diagnostic instrument that covers human and managerial aspects through 10 factors that have positive and statistically significant relationship with project success [31]. Shortly after, Pinto and Slevin [9] added a section to measure project performance to the PIP among the success models reported by Ika and Pinto [7]. Consequently, the PIP facilitates the measurement of the two components of project success [14]. However, despite its versatility, it has not been used in the Ecuadorian context, except in the study by Padilla et al. [32], who analyzed the ten critical success factors in technological projects. For all of the above, Arteaga-García and Portalanza-Chavarría [33] adapted and validated the PIP to the Latin American context, resulting in an instrument of 28 items (23 for factors and 5 for success criteria) with adequate consistency and validity indices to evaluate the performance of Latin American projects, mainly Ecuadorian.

In addition, they proposed a measurement model to explain project performance based on four factors: Client communication, monitoring and planning, technical activities, and senior management. Among future research, the authors suggested evaluating the structural model and using multigroup analysis techniques to carry out comparative studies of the model. Therefore, the purpose of this article is to evaluate the structural model to determine whether the resulting four critical success factors positively and significantly impact project performance and to employ multigroup analysis techniques to make comparisons of the model according to the role played in the project by the interviewee (leader or team member).

2 Methodology

To evaluate the structural model, 328 responses were considered, corresponding to professionals who had led or participated in Ecuadorian projects, collected through an online questionnaire available on the Question Pro platform between July 2022 and the end of January 2023. The questionnaire link was distributed to members of the PMI Guayas chapter, postgraduate students in Project Management, and professional members of thematic groups on Project Management on the professional network LinkedIn. This social network was selected because it brings together professionals who are primarily active in the workplace, and they can be segmented by area of interest, in this case, project management. In addition, it is possible to access groups interested in specialized topics in project management, which facilitated sharing the questionnaire with the study's target population.

Since there is no access to the databases of project managers from the three sources mentioned to apply probability sampling, non-probability convenience sampling was used.

Of the study participants, 63% were male, 70% were under 40, and 97% had completed university education, with 42% holding a master's degree. The projects evaluated were diverse, with 57% being carried out in large companies, 79% having a duration of less than two years, and 70% having a budget of less than US$500,000. These projects were managed with various approaches, with 70% using predictive and hybrid methods. However, what stood out was the influence of the Project Management Institute, with 43% of the cases using their best practices.

In this quantitative research, the adapted PIP proposed was used, composed of 28 items measured with a seven-point Likert scale (1 strongly disagree—7 strongly agree). The critical success factors were calculated with 23 items: Client Communication (7), monitoring and planning (8), technical activities (3), senior management (5), and five items for performance.

A translation and re-translation procedure was used since the PIP instrument was originally written in English. It included the collaboration of professional and academic project management experts and certified translators to validate its content and adapt it to the Latin American context. For the validation of constructs, exploratory factor analysis was used with the unweighted least squares method and Varimax rotation.

Convergent validity is confirmed. This instrument registers a Cronbach's Alpha and a composite reliability greater than .7 [34, 35], factor loadings equal to or greater than .7, and an AVE greater than .5 [35,36]. It also meets discriminant validity under the Fornell and Larcker [37].

The Smart PLS 4.0 software was used to evaluate and analyze the structural model in multigroups according to each participant's role in the project [38].

PLS-SEM was selected as a multivariate statistical modeling technique because it is robust with small samples and does not require the normality of the variables' data, unlike the SEM technique.

3 Results

3.1 Structural model evaluation

A structural equation model was estimated to determine if the critical success factors, client communication, monitoring and planning, technical activities, and senior management positively and significantly impact the projects' performance. As seen in Table 1, technical activities and senior management have a positive and statistically significant association with the performance of projects in Ecuador. However, client communication, and monitoring and planning factors positively affect project performance but are not statistically significant. The model's absolute and incremental goodness-of-fit indices are satisfactory (SRMR=.048; NFI=.879) [36]. The independent constructs have no collinearity problems since the VIF values are less than five [39].

Regarding the explanatory power of the model, it is considered moderate, given that the coefficient of determination (R^2) is .572 [40,41]. The PLS prediction procedure was executed to evaluate the model's predictive power: its ability to predict new or future or future observations [42]. Since the prediction errors are biased, the MAE (mean absolute error) was used as a metric, whose values are compared with those generated by the linear regression model (LM) (see Table 2). For all performance indicators, except D2, the PLS-SEM analysis records lower MAE prediction errors than the LM, indicating that the model has medium predictive power [43].

Table 1.
Coefficients of the structural model.

Relation	Coefficient	P- value	VIF	Hypothesis
Technical activities -> Performance	0.328	***	2.144	Supported
Senior management -> Performance	0.244	***	2.451	Supported
Client communication -> Performance	0.145	0.056	2.362	Rejected
Monitoring and planning -> Performance	0.153	0.093	2.853	Rejected

Footnote: *** p < .001
Source: Prepared by authors

Table 2.
The predictive power of the structural model.

Performance	PLS-SEM_MAE	LM_MAE
D10	0.63	0.659
D11	0.655	0.707
D2	0.973	0.972
D3	0.718	0.754
D4	0.721	0.73

Source: Prepared by authors

3.2 Multigroup analysis

For the multigroup analysis, the variable Role in the Project was used, from which two groups were established, the one made up of leaders or coordinators of projects G1 (n = 164) and that of the project team members G2 (n=164). Before proceeding with the multigroup analysis, measurement invariance was checked using the compound modeling procedure (MICOM) [44], demonstrating the invariance of all compounds, as well as the equality of their means and variances (see Table 3).

Subsequently, the multigroup analysis was carried out under the PLS-MGA option, the results of which are presented in Table 4. The existence of a positive and statistically significant relationship between the technical activities and senior management constructs with the performance of the projects is confirmed for both project managers and project team members, while only for project managers it is confirmed that there is a positive and statistically significant relationship between client communication and performance. For their part, for team members, it is confirmed that there is a positive and statistically significant relationship between monitoring and planning and project performance.

Table 3.
MICOM results

Compound	Original correlation	5% quantile empirical distribution	Permutation p-value	Original mean difference	Permutation p-value	Original variance difference	Permutation p-value
Technical activities	0.999	0.998	0.136	0.051	0.651	-0.232	0.358
Senior management	1	0.999	0.736	0.086	0.44	0.076	0.726
Client communication	0.999	0.998	0.084	0.04	0.722	0.162	0.414
Performance	1	0.999	0.578	0.18	0.107	-0.244	0.395
Monitoring and planning	1	0.999	0.638	0.022	0.844	0.151	0.456

Source: Prepared by authors

Table 4.
Structural model: Multigroup analysis of Project Managers vs. Team Members

Relation	G1: Project Managers			G2: Team members		
	Standardized Coefficient	P-value	Hypothesis	Standardized Coefficient	P-value	Hypothesis
Technical activities -> Performance	0.429	***	Supported	0.209	**	Supported
Senior management -> Performance	0.209	**	Supported	0.27	**	Supported
Client communication -> Performance	0.237	**	Supported	0.113	0.254	Rejected
Monitoring and planning -> Performance	-0.005	0.97	Rejected	0.293	**	Supported

Footnote: *** p < .001 ** p < .05
Source: Prepared by authors

1 Conclusions

The Project Implementation Profile is among the most notable frameworks in the literature regarding critical factors and measurement of project success [7,15]. Because of its versatility, it has been used to evaluate projects with diverse characteristics in different contexts [45-48] and with limited use of the instrument in technological projects in Ecuador, and this motivated the adaptation and validation of the complete PIP for the Ecuadorian context, which resulted in a new instrument and a measurement model that proposes to explain the performance of projects based on four factors: Client communication, monitoring and planning, technical activities and senior management [33].

The structural evaluation of this proposed model, based on the entire sample collected, generated results that partially coincide with Pinto [31] since although the four factors present positive standardized coefficients, only two are statistically significant to explain the performance (success) of Ecuadorian projects: Technical activities (availability of technology and experience required to carry out specific technical activities) and senior management (willingness of senior management to grant resources and authority necessary for the success of the project). Additionally, the model does not present collinearity problems between constructs, its goodness of fit indices is satisfactory (SRMR= .048; NFI = .879), its explanatory power is moderate (R^2 = .572), and its predictive power is medium.

Contrary to what was stated by Malik et al. [49] regarding the fact that the factors associated with communication positively and significantly impact the success of the projects, since the participation and commitment of those involved are ensured [50], the client communication factor (consultation and validation with the involved-on project topics) was not significant in explaining the performance of the projects. Likewise, although Ward [51] points out that effective planning and control of work, resources, and time ensure the success of the project, categorizing it as a success factor [52], monitoring and planning (planning and control of the scope, budget, schedule, resources, and project risks) is also not a significant factor. To investigate this finding further, the variable role in the project was selected to perform a multigroup analysis of the structural model, classifying the sample into two groups: leaders or coordinators (G1) and members of project teams (G2).

In both groups, the finding is reconfirmed that the factors of technical activities and senior management have a positive and significant impact on the success of the projects. Furthermore, it is confirmed that client communication and, monitoring and planning factors also positively and significantly affect project performance in different groups. For managers, client communication is the second most relevant construct to explain project performance after technical activities, while monitoring and planning do not affect the model. On the contrary, for team members, the construct of monitoring and planning is the most important, followed by senior management, and they consider client communication as the factor that contributes the least to predicting the project's success.

These results highlight the different perspectives of those involved in a project, depending on their role. A manager values having the most qualified technology and technical personnel to achieve their results, which is impossible if they do not maintain constant communication with those involved to validate their deliverables and the support of senior management to complete their project successfully.

The team members value that the project manager applies good project management practices that generate robust planning and monitoring processes and that the most appropriate technology is available to effectively carry out the project work. They also hope to have the support of senior management so that if there are problems during the project's life cycle, immediate solutions can be reached. In business practice, these findings help human resources departments develop training and coaching plans that are differentiated by the employee's role in the project to enhance their management of critical success factors to achieve more effective project management. Project managers can also use the adapted PIP to evaluate their projects and identify whether they are appropriately managing the four critical success factors considered relevant in the Ecuadorian context, thus also quantifying the degree of success in managing their projects and deliverables. The results of the evaluations will contribute to the detection of strengths and opportunities for improvement to achieve successful project management that contributes to the attainment of sustainable competitive advantages in the beneficiary organizations.

Among the limitations of the study, it could be considered that in the analyzed sample, the participation of projects with an agile approach was low, so the results obtained are not generalizable to this category of projects. The use of the agile approach is deeply rooted in projects with a high degree of innovation, which implies that the definition of objectives, deliverables, and expected benefits is built incrementally or iteratively. A study focused on this type of project would be appropriate to determine their critical success factors and what criteria determine whether or not they are successful.

In addition, there is bias due to the common method variance because it is research based on the survey method, and the selection and accessibility biases are due to the use of the LinkedIn social network in the collection of cases. For the common method variance bias, the procedural remedies of Podsakoff et al. [53] were applied, such as the careful construction of the items and the request to read and subsequently accept the informed consent to the participant before filling out the questionnaire, where anonymity is guaranteed. He is encouraged to respond objectively and honestly to minimize socially desirable responses. To mitigate the selection and accessibility biases from compromising the study results, two additional sources of cases were considered: the postgraduate courses in project management and the PMI Guayas chapter.

As future research, it is proposed to make other comparisons of perspectives through multigroup analysis considering variables such as the size of the project, size of the organization benefiting from the project, or approach to the project (predictive vs. hybrid) to investigate further under what contexts they are confirmed or not the proposed relationships between the four factors and project performance.

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