Governance and performance of Information Technology projects in Colombia

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Abstract
In this research, the performance of Information Technology (IT) projects was analyzed, evaluating if they meet the schedule, budget, objective, and customer satisfaction. A study by the Standish Group reported that for the period 2015-2020 only 35% of the projects were successful [1]. An exploratory methodology based on bibliometric analysis was used and it allowed to know global trends related to governance and project performance. Also, a quantitative methodology was implemented for structuring the model of factors and variables. With the information obtained from the Colombian universities, a factorial analysis was carried out and a statistical model of linear equations was built that characterized the behavior of corporate governance, IT governance and project performance. As a result, a governance alignment model was created, which will help to improve decision-making, deliver value, and increase the efficiency of IT project management.

Keywords: project management; corporate governance; IT governance; project performance; factorial analysis; multivariate model.

Gobernanza y desempeño de proyectos de Tecnologías de la Información en Colombia

Resumen
En esta investigación se analizó el desempeño de proyectos de Tecnologías de Información (TI), evaluando si cumplen con el cronograma, presupuesto, objetivo y satisfacción del cliente. Un estudio de Standish Group reportó que para el período 2015-2020 solo 35% de los proyectos fueron exitosos [1]. Se utilizó una metodología exploratoria basada en análisis bibliométrico, que permitió conocer tendencias mundiales relacionadas con la gobernanza y desempeño de proyectos, y una metodología cuantitativa para la estructuración del modelo de factores y variables. Con la información obtenida de las universidades colombianas se realizó un análisis factorial y se construyó un modelo estadístico de ecuaciones lineales que caracterizó el comportamiento de la gobernanza corporativa, gobernanza de TI y desempeño de proyectos. Como resultado, se creó un modelo de alineación de la gobernanza, que contribuirá a mejorar la toma de decisiones, entregar valor y aumentar la eficiencia de la gestión de proyectos de TI.

Palabras clave: gestión de proyectos; gobernanza corporativa; gobernanza de TI; desempeño del proyecto; análisis factorial; modelo multivariado.

1 Introduction

One of the lines of research in project management that has had extensive analysis and development has been project performance, due to the enormous impact that its proper management has on obtaining the programmed objectives, based on the guidelines established in the organization's strategic plan. Precisely in this field of knowledge, researchers from various sectors have studied the performance of projects using defined criteria and disseminating their results worldwide. This research focused on Information Technology (IT) projects and questioned the causes why these projects fail in organizations.

The Colombian Association of Systems Engineers [2]

determined that the most relevant causes of failure of IT projects are related to the lack of planning, the poor definition of requirements, the lack of commitment from senior management and the lack of clarity in determining the objective of the project.

Researchers [3] found that lack of user support and participation, inadequate project scope definition, lack of executive management commitment, and poor project leadership were the most important causes of project failure.

In the CHAOS report [4], it was determined that IT projects failed due to lack of user input, frequent changes in specifications, and lack of support from top management.

In the McKinsey study [5] the failure of IT projects was attributed to flaws in the project requirements and an incorrect definition of the objectives and vision of the company.

In the Pulse of the Profession, published by the Project Management Institute (PMI) [6], emphasis was placed on changes in organizational priorities, changes in project goals, inaccurate collection of requirements, and lack of definition of the risks and opportunities of the environment, as the significant causes of failure of IT projects.

Finally, a study carried out in Mexico on the implementation of IT [7] highlighted as significant causes of failure of IT projects: the incorrect definition of the project, the use of inadequate technology, incomplete training, and resistance to change of the workers.

Given these facts, unfavorable conditions were demonstrated in the management of IT projects, which led to the generation of new management models within the organization. In this direction, we resorted to the investigation of new fundamentals related to corporate governance, IT governance and project performance, as well as the effective alignment of these factors that contribute significantly to the achievement of the objectives of the institutions.

The general objective of this work was to develop an alignment model of corporate governance, IT governance and the performance of IT projects, with application in Colombian universities, using a factor analysis. With the development of this research, it is intended to generate a new work scheme for organizations, improving their productivity and profitability and optimizing the efficiency of IT project management.

In this regard, the specific objectives of the research consisted of carrying out a bibliometric analysis using the Scopus and Web of Science (WoS) databases, which makes it possible to identify trends in the international arena on corporate governance, the governance of IT and project performance; to analyze the management of IT projects of the planning offices of the Colombian universities, using statistical software applications and, finally, to propose an alignment model for the governance of IT projects.

2 Methodology

The research has a correlational type, based on a set of variables that are grouped into the factors that determine the alignment of governance and the performance of IT projects. In addition, the research has a non-experimental type, based on the collection of information from primary and secondary sources, based on the use of qualitative and quantitative techniques, through the design of an instrument that was applied to all universities in Colombia.

First, the theoretical foundation was developed, through a bibliometric analysis, using the Scopus and WoS databases, identifying global trends on corporate governance, IT governance and project performance. Secondly, an instrument was designed and validated for the information collection and the field work was carried out, sending the forms to the heads of planning or IT directors of the Colombian universities. This work was carried out for five months, encountering communication and response difficulties due to the Covid-19 pandemic that strongly impacted university management since March 2020. Despite this global phenomenon, information was collected from 64 officials of the universities. Thirdly, the information was analyzed using the statistical program R and, finally, the results obtained were documented.

3 Factorial analysis

In order to develop the governance and performance alignment model for IT projects, a set of factors were specified, which are described below.

3.1 Corporate governance factor

Governance provides a framework for ethical decision-making and managerial action within an organization that is based on transparency, accountability, and defined roles [8]. On the other hand, the Project Management Institute (PMI) defined governance as the framework for directing and empowering an organization through its established policies, practices, and other relevant documentation [9].

Furthermore, the Organization for Economic Cooperation and Development (OECD) stated that corporate governance consists of a set of relationships between the management of a company, its board of directors, its shareholders, and other interested parties. Corporate governance also provides the structure by which the objectives of the company are established, the means to achieve these objectives are determined and performance is monitored [10].

In accordance with empirical evidence, the authors define corporate governance as the framework that regulates the processes for defining the organization's strategic objectives, provides resources and controls the appropriate use of these resources, through people, policies, and processes, to meet the objectives of the organization and meet the expectations of the interested parties.

At this point, the three variables that impact the corporate governance factor were established: strategic objectives, provision of resources and control of progress. Two questions were designed for each of the variables and they were included in the data collection form.

3.2 IT governance factor

Korac-Kakabadse and Kakabadse described IT governance as a subset of corporate governance that focuses on the relationships and processes for developing, directing, and controlling IT resources for the purpose of meeting

organizational objectives through contributions of value [11]. According to this definition, corporate governance can be referred to as an organizational strategy and IT governance as an operational strategy in which both must be aligned with each other. On the other hand, Symons referred to IT governance as the process of making decisions about IT investments: how decisions are made, who makes the decisions, who is responsible, and how to measure and monitor the results of decisions [12].

The IT Governance Institute defined IT governance as an integral part of corporate governance that is a responsibility of the board of directors and executive management; IT governance involved the leadership, the organization structures, and the processes necessary to ensure that the organization's IT is maintained and aligned with the organization's strategies and objectives [13]. With this definition, the importance of strategic alignment between the organization's strategies and IT implementation is also reflected.

Based on empirical evidence, the authors defined IT governance as the framework that supports top management decision-making, responsible for shaping IT strategy, delivering business value, managing IT risk, and managing performance, which focuses on the processes of obtaining, planning, directing, and controlling IT resources, in such a way that IT strategies align with business strategies.

Based on this background information, the four variables that contribute to the IT governance factor were established: IT strategy, value delivery, risk management, and performance management. For each of these variables, two questions were created that were used in the data collection instrument.

3.3 Project performance factor

In the specialized literature it is frequently observed that project performance is closely associated with project success. Project success is generally measured by achieving the results of scope, schedule, and costs, which became known as the triple constraint or the iron triangle [14,15].

However, sometimes these components are insufficient: PMI states that practitioners and academics have determined that project success must also be measured by considering the achievement of project objectives, satisfaction of stakeholder requirements, and compliance with governance criteria [16].

In the research by Díez-Silva et al., an empirical work was developed, in which information was collected from project managers in several sectors of Colombia and a new group of metrics was found in the categories of project performance measurement, such as conflict management, communication, level of effort, work performed, changes and organization, among others [17].

In this research, according to empirical evidence, the authors define project performance as the measurement of scope results, schedule, costs, achievement of project objectives, satisfaction of stakeholder requirements, and compliance with governance criteria, through a set of criteria established in a timely manner.

This leads to the establishment of eleven variables: scope, schedule, costs, quality, risks, resources, acquisitions, communications, stakeholder satisfaction, governance criteria, and integration. In the information gathering form, a question was included for each of the above variables.

4 Governance alignment model

A model can be used with the purpose of establishing the conditions under which the different components of a system can interact to achieve an expected result. The term model was defined as the representation of a fact or phenomenon proposed as an ideal to be followed; it aims to show the general characteristics of the structure of that phenomenon, explain its elements, mechanisms, and processes, how they interrelate and the theoretical aspects that support it, to facilitate its understanding [18].

Researchers have shown that the lack of alignment between IT governance and corporate governance is one of the main reasons why companies do not exploit the full potential of their IT investments [19]. Based on the analyses carried out in the previous paragraphs, the factors that constitute the Governance Alignment Model (GAM) are taken up again, which are shown in Fig. 1.

The choice of factors and variables was based on the judgment of experts and was complemented with the information obtained from the bibliometric analysis.

This IT Project Governance Alignment Model is generic and can be applied in any economic sector and in any region or country, making the necessary adjustments. In compliance with the general objective of this research, the application of the model is limited to the Colombian Universities.

In order to perform the statistical analysis of the information collected in the IT departments of the Colombian universities, the statistical program R was used. A factorial analysis was carried out, the correlation between the variables was analyzed and the final mathematical model was elaborated.

5 Results and discussion

Based on the information collected, the indices were calculated for each of the variables and the results shown in Fig. 2 were obtained.
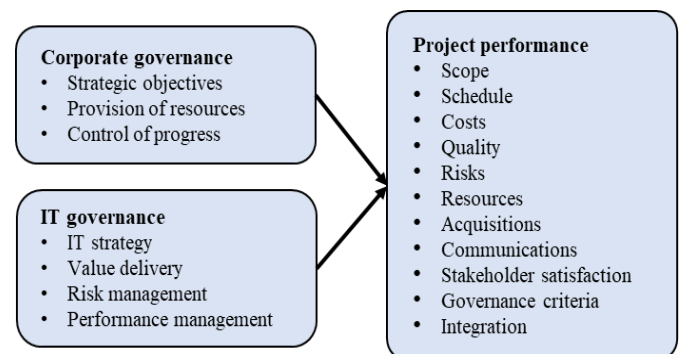

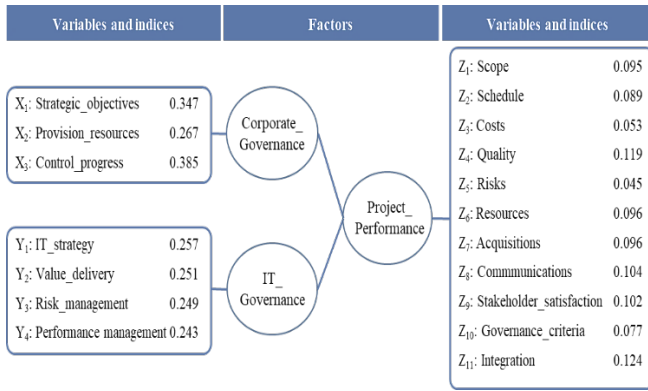Figure 1. Governance Alignment Model (GAM).
Source: Own elaboration.

Figure 2. Factors, variables, and indices of the model.
Source: Own elaboration.

Figure 3. Corporate governance factor.
Source: Own elaboration.

The indices were calculated using the Principal Components function in the R program and correspond to the weight of each variable, which allowed to generate an evaluation of each of the factors through a mathematical equation.

For the corporate governance factor, the indices were calculated and their evaluation was obtained, using eq. (1).

$$Corporate\_gov = 0.347 * X1 + 0.267 * X2 + 0.385 * X3 \qquad (1)$$

In the average of Colombian universities, it was found that the Strategic_objectives variable obtained an evaluation of 8.05, the Provision_resources variable an evaluation of 7.26 and the Control_progress variable an evaluation of 7.58.

Solving these values in eq. (1) gives an overall assessment of the corporate governance factor of 7.66. In this result, it was highlighted in favor that the Superior Council (or the highest administrative body of the University) defines and prioritizes the strategic objectives of the University, while it was evidenced that an aspect to improve consists of increasing the resources and infrastructure available to meet the strategic objectives of the University.

Three ranges were constructed to establish a range of low corporate governance (result of the evaluation between 1 and 4), medium corporate governance (result of the evaluation between 4 and 8) and high corporate governance (result of the evaluation between 8 and 10). In other words, on average, Colombian universities reported high governance in the Strategic_objectives variable, while the Provision_resources and Control_progress variables were in the medium range of corporate governance. The general result of the corporate governance factor indicates that it was in the medium corporate governance range, with ample possibilities for improvement that will be reported to each university, according to a particular analysis. These results are shown in Fig. 3.

In IT Governance, the indices are calculated using the Principal Components function in the R program and correspond to the weight of each variable, which allows generating their mathematical evaluation, using eq. (2).

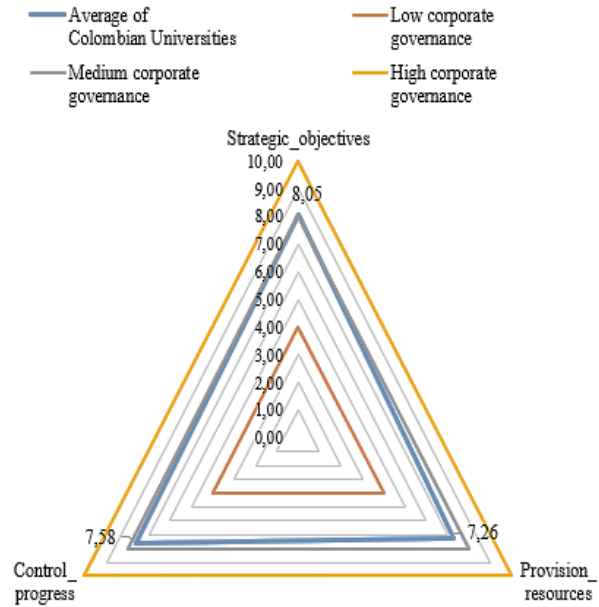$$IT\_gov = 0.251 * Y1 + 0.257 * Y2 + 0.243 * Y3 + 0.249 * Y4 \qquad (2)$$

In the average of Colombian universities, it was found that the IT_Strategy variable received an evaluation of 6.93, the Delivery_value variable an evaluation of 6.97, the Risk_management variable an evaluation of 7.09, and the Performance_management variable an evaluation of 6.48.

Solving for these values in eq. (2) gives an overall assessment of the corporate IT governance factor of 6.87. In this result, it was highlighted as a positive aspect that end users are satisfied with the quality of the service, while there is an opportunity for improvement to the extent that the Superior Council (or the highest administrative body of the University) achieves a vision on how and how much the University invests in IT compared to its competitors.

Analogous to the analysis of corporate governance, three ranges were constructed that allow for the construction of a band of low IT governance (result of the evaluation between 1 and 4), medium IT governance (result of the evaluation between 4 and 8) and high IT governance (result of the evaluation between 8 and 10). In other words, on average, Colombian universities reported average IT governance in all variables. Consequently, the overall result of the IT governance factor was also located in the medium IT governance range, with ample possibilities for improvement that will be discussed with each of the universities, carrying out their own analysis. These results are shown in Fig. 4.

The project performance indices are calculated using the Principal Components function, which generates its mathematical evaluation, using eq. (3).

$$Project\_perf = 0.095 * Z1 + 0.089 * Z2 + 0.053 * Z3 + 0.119 * Z4 + 0.045 * Z5 + 0.096 * Z6 + 0.096 * Z7 + 0.104 * Z8 + 0.102 * Z9 + 0.077 * Z10 + 0.124 * Z11 \qquad (3)$$
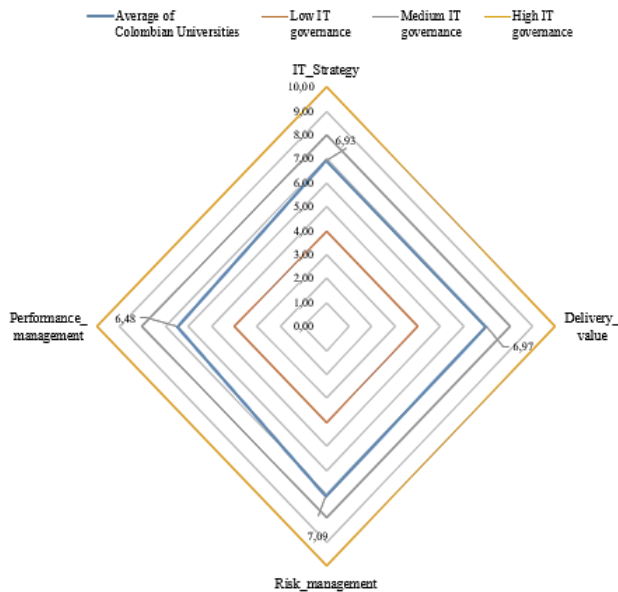
Figure 4. IT governance factor.
Source: Own elaboration.

Figure 5. Project performance factor.
Source: Own elaboration.

In the average of Colombian universities, the Scope variable received an evaluation of 8.03, the Schedule variable an evaluation of 7.08, the Costs variable an evaluation of 7.98, the Quality variable an evaluation of 8.25, the Risks variable an evaluation of 6.69, the Resources variable an evaluation of 7.45, the Acquisitions variable an evaluation of 7.75, the Communications variable an evaluation of 7.34, the Stakeholder_satisfaction variable an evaluation of 8.08, the Governance_criteria variable an evaluation of 8.16 and the Integration variable an evaluation of 7.81

Solving these values in eq. (3) gives an overall evaluation of the project performance factor of 7.74. In the analysis of the variables, the behavior of Quality in the project is highlighted, which is related to the degree to which a set of characteristics satisfies the requirements. This situation reflects the willingness of the universities to promote the application of quality standards and systems in the institutions. On the other hand, the evaluation that obtained the lowest result corresponds to the risks, which reflect uncertain events that may have a positive or negative effect on the objectives of the project. In this sense, the interest of the universities to update the inventory of relevant IT risks and to prepare risk response plans that contribute significantly to increase the evaluation of this variable was evidenced.

The project performance factor is framed in three ranges that allow building a range of low project performance (result of the evaluation between 1 and 4), medium project performance (result of the evaluation between 4 and 8) and high project performance (result of the evaluation between 8 and 10). This shows that the Scope, Quality, Stakeholder_satisfaction, and Governance Criteria variables were in the high-performance range of the project, while the Schedule, Costs, Risks, Resources, Acquisitions, Communications, and Integration variables remained in the medium performance band of the project.
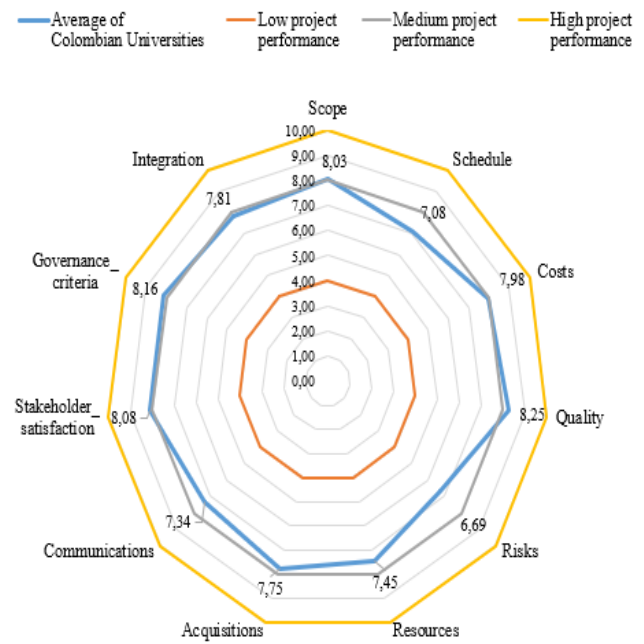
Therefore, the overall result of the project performance factor was situated in the medium performance range of the project with great opportunities for improvement that will be shared with the universities, individually. These results are presented in Fig. 5.

6   Conclusions

As a result of the bibliometric analysis, trends were found related to the causes of project success, the creation of project management models and the solution of various problems in the managerial field, improving the efficiency of project management, and achieving an increase in productivity and profitability of institutions.

Information on the relevant variables was collected from the experience of 64 IT directors from Colombian universities.

At the end of this research, it was possible to develop an IT Project Governance Alignment Model, that will optimize performance indicators in the management of IT projects, which will improve the strategic position and operational performance of Colombian universities and will contribute, in turn, to the optimization of education in the country and the generation of value in the institutions.

Finally, as a future line of research, it is proposed to implement the Governance Alignment Model in the health sector in Colombia. In the State Health Companies (EES) several components can be dimensioned: the process component (service provision), the organizational component (guarantee) and the technological component (health technology); according to López-Sevillano and Aparicio-Pico, their financial sustainability is analyzed from each one of the EES [20].

In addition, the relationship between IT project management, corporate governance, IT governance and project performance must be deepened, significantly impacting the fulfillment of the objectives of the institution, the optimization in the use of resources and an increase in the generation of value for the organizations.

Acknowledgement

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