



Article

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## The relationship between structure, composition and processes of boards and the performance of Brazilian federal public institutions of higher education

A relação entre estrutura, composição e processos dos conselhos superiores e o desempenho das instituições públicas federais de ensino superior brasileiras

La relación entre estructura, composición y procesos de los consejos superiores y el desempeño de las instituciones públicas federales de educación superior brasileñas

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**Abstract:** The objective of this research is to identify the relationship between the structure, composition and processes of governing boards of the Brazilian federal public higher education institutions and the performance of these institutions. The variables used in this research are: for the structure, size and number of committees linked to the Boards; for composition, the proportion of external members; for processes, the number of meetings; and for performance, the General Index of Courses (IGC). To carry out the inferences, initially a survey was implemented with public agents of federal public higher education institutions to identify the key covariates in the relationship between governance and performance. Then, the data was collected from diverse documentary sources. The resulting panel brings data from the period 2010 to 2019 per institution per year, and the inferences are made using the systemic GMM technique. The results demonstrate that there is a statistically significant relationship between the structure, composition and processes of governing boards of the Brazilian federal public higher education institutions and their performance. Analyzed together, the results indicate that smaller boards, more committees linked to the boards, lower proportions of external members and more meetings are associated with better performances. The relationship between the size of the board of directors and performance and the relationship between the number of board meetings and the performance of institutions also showed a statistically significant non-linear relationship.

**Keywords:** organizational performance assessment; federal public institutions of higher education; governance of higher education institutions.

**Resumo:** O objetivo desta pesquisa é identificar a relação entre a estrutura, composição e os processos dos conselhos superiores das instituições públicas federais de ensino superior brasileiras e o desempenho dessas instituições. As variáveis utilizadas nesta pesquisa são: para a estrutura, o tamanho e o número de comitês vinculados aos Conselhos; para a composição, a proporção de membros externos; para os processos, o número de reuniões; e para o desempenho, o Índice Geral de Cursos (IGC). Para a realização das inferências, inicialmente realiza-se um levantamento junto a agentes públicos

das instituições públicas federais de ensino superior com o intuito de identificar as covariáveis-chave na relação entre governança e desempenho. Em seguida, os dados são coletados em fontes documentais diversas. O painel resultante traz dados do período de 2010 a 2019, por instituição, por ano, e as inferências são realizadas a partir da técnica do GMM sistêmico. Os resultados demonstram que existe uma relação estatisticamente significativa entre a estrutura, a composição e os processos dos conselhos superiores das instituições públicas federais de ensino superior brasileiras e o seu desempenho. Analisados conjuntamente, os resultados apontam que conselhos menores, mais comitês vinculados aos conselhos, menores proporções de membros externos e mais reuniões estão associados a melhores desempenhos para as instituições públicas federais de ensino superior. A relação entre o tamanho do conselho superior e o desempenho, e a relação entre o número de reuniões do conselho superior e o desempenho das instituições também apresentaram uma relação não linear estatisticamente significativa.

**Palavras-chave:** avaliação de desempenho organizacional; instituições públicas federais de ensino superior; governança de instituições de ensino superior.

**Resumen:** El objetivo de esta investigación es identificar la relación entre la estructura, composición y procesos de los consejos superiores de las instituciones públicas federales de educación superior brasileñas y el desempeño de estas instituciones. Las variables utilizadas en esta investigación son: para la estructura, tamaño y número de comités vinculados a los Consejos; para la composición, la proporción de miembros externos; para procesos, el número de reuniones; y por desempeño, el Índice General de Cursos – IGC. Para realizar las inferencias, inicialmente se realizó una encuesta a agentes públicos de instituciones públicas federales de educación superior con el fin de identificar las covariables clave en la relación entre gobernabilidad y desempeño. Luego, los datos son recolectados de diferentes fuentes documentales. El panel resultante trae datos del período 2010 a 2019 por institución por año, y las inferencias se realizan utilizando la técnica sistémica GMM. Los resultados muestran que existe una relación estadísticamente significativa entre la estructura, composición y procesos de los consejos superiores de las instituciones públicas federales de educación superior en Brasil y su desempeño. Analizados en conjunto, los resultados indican que consejos más pequeños, más comités vinculados a los consejos, menor proporción de miembros externos y más reuniones se asocian con mejores desempeños para las instituciones públicas federales de educación superior. La relación entre el tamaño del consejo y el desempeño y la relación entre el número de reuniones del consejo y el desempeño de las instituciones también mostró una relación no lineal estadísticamente significativa.

**Palavras chave:** evaluación del desempeño organizacional; instituciones públicas federales de educación superior; gobernanza de las instituciones de educación superior.

## 1 Introduction

The relationship between governance and organizational performance is a recurring theme in the literature (Bhagat; Bolton, 2019). For higher education institutions, governance can be conceptualized as the set of formal and informal arrangements that enable these institutions to define strategies, establish priorities, make decisions, and develop corresponding actions, as well as adapt their configurations to changes in the external environment. It encompasses structures, relationships, and processes through which higher education policies are developed, implemented, and reviewed within these institutions (OECD, 2003; Santiago *et al.*, 2008). Higher education institutions generally have a collegiate body with deliberative, normative, and consultative purposes, characterized here as the Superior Council, which is the highest jurisdiction of these institutions in matters of teaching, research, extension, and administration (Bastos *et al.*, 2016).

Concerning the evaluation of organizational performance, the phenomenon can be defined as the process of assessing organizational efficiency and effectiveness for different purposes. One of these purposes is its use as a managerial tool, making it a tool for directing the activities of organizational managers. It can also be characterized as an instrument of social control, as society, armed with the information resulting from performance evaluation, can analyze how efficiently a given organization fulfills its objectives and demand improvements if the results are not satisfactory (Corrêa, 1986).

The analysis of the relationship between the structure (Arora; Sharma, 2016), the composition (Brown; Caylor, 2004), and the processes (Vafeas, 1999) of governing boards in organizational performance is common in studies investigating the relationship between governance and performance. Most research exploring this topic generally focuses on publicly traded private companies (Bhagat; Bolton, 2019), while others seek to analyze the theme in the public sector (Park, 2019). Some studies have aimed to analyze the relationship between governance and the performance of higher education institutions (Song, 2020).

Despite the valuable contributions of these studies, in Brazil, the literature on the governance of higher education institutions is still incipient (Wandercil; Calderón; Ganga-Contreras, 2021). In particular, the role of boards in the governance of Brazilian public higher education institutions is also scarcely analyzed (Bastos *et al.*, 2016), and it should be considered that the governance of higher education institutions and performance related to their quality are closely related (Hénard; Mitterle, 2010). Therefore, the aim of this research is to identify the relationship between the structure, composition, and processes of the superior councils of Brazilian federal public higher education institutions and the performance of these institutions.

This research is conducted within the universe of federal public higher education institutions whose academic organization is characterized as Federal Center for Technological Education (CEFET), Federal Institute of Education, Science and Technology (IF), or Federal University (UF). In addition to academic organization, only institutions with evaluations in the General Course Index (IGC) from 2011 to 2019 were selected. Considering all institutions with the highlighted types of academic organization, there are 109 institutions. However, six institutions were excluded because, being recently created (all established from 2018 onwards), they did not have IGC results up to 2019.

For this research, four variables related to the Superior Council of these institutions were defined to characterize their governance, namely: for structure, the size of the superior council, measured by the number of council members, and the number of committees linked to the respective Councils are used; for composition, the proportion of external members on the Superior Council is considered; and for processes, the number of Council meetings is used. For performance, the General Course Index (IGC) was considered, an indicator measured annually by the National Institute for Educational Studies and Research Anísio Teixeira (INEP) for all institutions in the federal higher education system, aimed at measuring the quality of these institutions (MEC, 2023).

By shedding light on the relationship between the structure, composition, and processes of superior councils and the performance of federal public higher education institutions, this research may contribute to discussions within academic communities regarding potential reforms of these collegiate bodies, as well as of structuring institutional documents, such as statutes and regulations. In line with the recommendations of oversight bodies, such as the Office of the Comptroller General (CGU) and the Federal Court of Accounts (TCU) (Bastos *et al.*, 2016), changes in the structure, composition, and processes of superior councils could enhance the performance of these councils.

## 2 Literature review

### 2.1 Governance of higher education institutions

The governance of higher education institutions presents different definitions for different authors, characterizing it as a plural and polysemic concept (Silva *et al.*, 2023). For this study, it is characterized as the set of formal and informal arrangements that enable these institutions to define strategies, establish priorities, make decisions, and develop corresponding actions, as well as adapt their configurations to changes in the external environment (Santiago *et al.*, 2008). It encompasses structures,



relationships, and processes through which higher education policies are developed, implemented, and reviewed within these institutions (OECD, 2003).

Higher education institutions generally have a collegiate body with deliberative, normative, and consultative purposes, being the highest jurisdiction of these institutions in matters of teaching, research, extension, and administration (Bastos *et al.*, 2016), characterized here as the superior council. The ability to perform these functions depends greatly on the structure, composition, and processes of the Superior Councils (Santiago *et al.*, 2008). In their structure, variables such as size and the committees linked to the Council are observed; in their composition, attributes of the members, such as their independence, are considered; and regarding the Council's processes, meetings play a prominent role (Carter; Lorsch, 2004).

Superior Councils should be large enough to reflect a wide range of perspectives (Santiago *et al.*, 2008). However, excessively large councils generally lead to delays in problem formulation, solution seeking, proposal development, and decision making (Delbecq; Bryson; Van De Ven, 2013).

Committees can be a mechanism to avoid overloading the responsibilities of Superior Councils (Bastos *et al.*, 2016). Committees may be established to perform specific functions, such as audit committees, which oversee the finances of the higher education institution, and committees for appointing new members to the Superior Council (Santiago *et al.*, 2008). In the context of Brazilian federal public higher education institutions, it is common for committees linked to the Superior Council to be established when other superior governance collegiate bodies with similar competencies do not exist (Bastos *et al.*, 2016).

To perform their functions, council members must be independent of the stakeholders of higher education institutions, especially their staff and students. Independence is necessary so that the Councils are not dominated by the interests of certain faculties or departments and to minimize the risk of coalitions forming among stakeholders with the intent of misguiding strategic decisions (Santiago *et al.*, 2008). In this sense, ideally, the majority of council members should be external to the institution (Hénard; Mitterle, 2010).

Finally, the meetings of the Superior Councils of higher education institutions are an important instrument for the development of the expected actions of these collegiate bodies, and they should have a suitable frequency to fulfill their purpose (Committee of University Chairmen, 2001). Having presented the aspects related to the governance of higher education institutions - especially their councils - the next section will analyze Performance Evaluation.

## 3 Performance evaluation

Performance Evaluation is a process of assessing the value of something, considering its efficiency and/or effectiveness. Performance Evaluation, therefore, requires objective parameters that specify productivity within a given period and represent an average time for task execution (Vieira, E.; Vieira, M., 2003). Increasingly, the performance of higher education institutions, especially public ones, has been measured and evaluated using quantitative indicators (Carnegie; Tuck, 2010). Studies that analyzed the performance evaluation of Brazilian higher education institutions used quality indicators of courses, programs, and the institutions themselves, resulting from quality assessment processes and systems developed by specialized organizations (Lugoboni, 2017; Maccari, 2008).

The quality of Brazilian higher education institutions is preliminarily measured by the IGC (General Course Index), which consists of a single, synthetic, and comparative indicator of institutional performance. It is assessed annually by INEP for all higher education institutions, using the weighted averages of the Preliminary Course Concepts (CPCs) and the CAPES Concepts when the institution has evaluated *stricto sensu* postgraduate programs (MEC, 2023; Repensando [...], 2018). In the calculation, the weighting factor is the number of students enrolled in each course or program. The weighted average of the concepts obtained by the courses and programs of a higher education institution is a possible measure of the institution's overall quality, thus aiming to objectify its evaluation (Verhine, 2015). Therefore, the IGC is widely perceived as a public sign of quality. Despite its possible limitations (Repensando [...], 2018), the IGC is the official indicator of the performance of higher education institutions in the country (MEC, 2023), consisting of a unique available variable that allows the comparison of all higher education institutions (Lugoboni, 2017).

### 3.1 Possible relationships between governance and performance

The governance of higher education institutions and their performance related to quality are closely related (Hénard; Mitterle, 2010). Given the increasing use of indicators for evaluating the performance of higher education institutions, including those with a quality measurement bias (Carnegie; Tuck, 2010), this study aims to identify the relationship between the structure, composition, and processes of the superior councils of Brazilian federal public higher education institutions and the performance of these institutions. To this end, it seeks to analyze the relationship between the following variables of the Superior Councils: a) size; b) number of linked committees; c) proportion of external members; and d) number of meetings with the performance of federal public higher education institutions.

Larger Superior Councils could be positively associated with the performance of federal higher education institutions, for example, by ensuring greater representation of stakeholders or by ensuring a stronger relationship with resource providers for the institution. However, they could also be negatively associated, leading to slower decision-making processes and reducing the supervisory role of management exercised by council members. Thus, for the relationship between the number of council members of the superior councils of federal public higher education institutions and their performance, the following hypothesis is proposed:

H1: There is a statistically significant relationship, positive or negative, between the size of the Superior Councils of Brazilian federal higher education institutions and their performance.

The relationship between the number of committees linked to the council and organizational performance can have different directions. For example, on one hand, a larger number of committees would mean that the council has delegated specific issues to them for discussion and referral, thereby speeding up the decision-making process, which would bring better results for the organization. On the other hand, a large number of committees could be associated with overlapping in the deliberation process, which could cause decisions to take longer and thus have a negative impact on performance. Therefore, for the relationship between the number of committees linked to the superior councils of federal public higher education institutions and their performance, the following hypothesis is proposed:

H2: There is a statistically significant relationship, positive or negative, between the number of committees linked to the Superior Councils of Brazilian federal higher education institutions and their performance.

Regarding the proportion of external members on the superior council, on one hand, a higher proportion may be related to better organizational performance, as it could lead the councils to make decisions aimed at ensuring the institution's long-term survival rather than favoring the interests of a particular stakeholder. On the other hand, a higher proportion of external members could mean that individuals without day-to-day knowledge of the institution, as well as without the time and/or willingness for effective participation, would make decisions that could ultimately harm organizational performance. Therefore, for the relationship between the proportion of external members on the superior councils of federal public higher education institutions and their performance, the following hypothesis is proposed:

H3: There is a statistically significant relationship, positive or negative, between the proportion of external members on the Superior Councils of Brazilian federal higher education institutions and their performance.

Decision-making usually occurs during council meetings, whose frequency should be sufficient for organizational strategic direction, according to the Brazilian Institute of Corporate Governance (IBGC, 2015). In this regard, the number of council meetings and organizational performance may present distinct relationships. On one hand, a high number of meetings could lead the council to unduly interfere in the institution's management, which is the responsibility of its executive administration, negatively impacting organizational performance. On the other hand, a high number of meetings would indicate an active council, where members are adequately informed to make decisions, which would positively reflect on the institution's results. Therefore, for the relationship between the number of meetings of the superior councils of federal public higher education institutions and their performance, the following hypothesis is proposed:

H4: There is a statistically significant relationship, positive or negative, between the number of meetings of the Superior Councils of Brazilian federal higher education institutions and their performance.

## 4 Research method

The universe of this research is composed of federal public higher education institutions whose academic organization is characterized as CEFET, IF, or UF. In addition to academic organization, only institutions with evaluations in the IGC from 2011 to 2019 were selected. Considering all institutions with the highlighted types of academic organization, there are 109 institutions. However, six institutions were excluded because they were created after 2018 and did not have IGC results up to 2019. Thus, the universe of these 103 institutions is justified as they are subject to the same evaluation mechanisms by the State, which is why state and municipal public institutions were not included. Private institutions are also not included due to the unavailability of information regarding the structure, composition, and processes of their superior councils.

The identification of key covariates in this research was conducted through surveys with 65 public agents from these institutions involved in institutional evaluation processes (of undergraduate courses, postgraduate programs, and/or higher



education institutions), as well as those involved in the institution's annual accountability to the TCU. The surveys were conducted through questionnaires developed based on the control variables existing in the literature analyzed concerning the relationship between councils (both governing councils of public institutions and superior councils of higher education institutions) and institutional performance, considering the hypotheses of this research. The control variables identified in the literature were: the state where the institution is located; the region of the country where the institution is located; the existence of a medical school (or course) at the institution; the existence of doctoral programs at the institution (Knott; Payne, 2004); the institution's time of existence; the institution's budget (Park, 2019); the institution's size (Bastos *et al.*, 2016; Park, 2019); and, specifically for the analysis of the relationship between committees linked to the superior council and the institution's performance, the frequency of superior council meetings (Hénard; Mitterle, 2010). In addition to questions related to control variables, other questions were included in the questionnaires to characterize the respondents.

In the questionnaires, respondents were asked to indicate whether they agreed or disagreed with the simultaneous interference of the variables identified in the literature regarding the relationship between the superior council of IFES (Federal Institutions of Higher Education) and its performance. It was decided to use only two response categories, "Agree" and "Disagree," for questions related to the intervening variables in the relationship between the structure, composition, and processes of the superior councils and the institutions' performance. It should be considered that not all key covariates in the relationship between size, proportion of external members, number of linked councils, and frequency of meetings of the superior councils of Brazilian federal public higher education institutions and their performance could be present in the analyzed literature sample. Thus, a questionnaire was applied to a pilot group of 24 respondents who, in addition to indicating whether they agreed or disagreed with the simultaneous interference of the identified variables in the relationship between the superior council of IFES and its performance, could point out other intervening variables to be considered in this relationship. The new variables presented were applied in a new questionnaire, this time to the entire group of respondents. To analyze the reliability of the survey responses, comparisons were made using the Chi-square Test through the statistical software STATA 15.0. No relevant dependencies between the variables were identified. The questionnaires and the Chi-square Test results can be made available upon request to the authors.

The data related to the continuous IGC were collected from INEP's open data portal (2023) and refer to the period from 2011 to 2019. This period was chosen because, on one hand, the results of subsequent years may have been influenced by measures taken to address the COVID-19 pandemic, and on the other hand, although data on the dependent variable is available for periods prior to 2011, it would be

difficult to compile data on the explanatory and control variables as specified below. The IGC data are structured so that each institution has one result per year; however, for some institutions, especially the IFs that began their activities in 2009, the first available results date from years after 2011.

The data related to the explanatory variables (number of council members on the superior council, proportion of external members, number of committees linked to the superior council, and annual number of meetings) cover the period from 2010 to 2018, also having individualized values per institution per year. This period was chosen considering the availability of data, again highlighting the case of the IFs, which began their activities in 2009 and comprise about 39% of the sample, and the availability of information in the institutions that, in many cases, had difficulty providing access to information from earlier periods. For the definition of this period, the propositions of the chosen method were also considered, in which the explanatory variables will lag one period behind those of performance. This is because the influence of the governance aspects analyzed here may require time to manifest in institutional results. Also considering the reflection of previous performances on the current performance of institutions, variables related to the institutions' performances for the period  $t-1$  were included.

The data for the explanatory variables were collected from documentation available on the institutions' websites, such as Statutes, General Regulations, Superior Council Regulations, lists of members, and minutes of superior council meetings. In cases where the data were not publicly available, they were requested from the institutions through requests made on the Integrated Ombudsman and Access to Information Platform (Fala.BR). In total, 128 requests were made through the aforementioned platform, in addition to others made by email. Below, in Table 1, descriptive statistics are presented for the dependent and explanatory variables, considering the set of observations for the 103 institutions analyzed in this study over the period from 2011 to 2019 for the IGC and from 2010 to 2018 for the explanatory variables.

Table 1 - Descriptive statistics for the dependent and explanatory variables

Variables	No. of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Continuous IGC	839	3,17	0,53	1,67	4,34
No. of members of the superior board	896	45,17	24,27	10	172
Proportion of external board members	896	0,15	0,16	0	0,57

No. of committees linked to the board of governors	901	1,04	1,75	0	6
No. of board meetings	884	10,14	5,74	0	38

Source: Own elaboration

Finally, based on the key covariates specified in the conducted survey, the following data were collected—per institution, per year—to be used as control variables: Institution size (in number of equivalent professors); Institution budget; Number of academic units; Number of administrative units; Number of off-campus sites; Frequency of superior council meetings. For these variables, various documents were consulted, especially the institutions' annual Management Reports, constituting about a thousand documents examined. Below, the descriptive statistics for the control variables, which comprise a panel with annual observations per institution for the period between 2010 and 2018, are presented in Table 2.

Table 2 - Descriptive statistics of key covariates

Variables	No. of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Institution size (in equivalent teachers)	1.009	1072,56	756,25	23	4610
Institution's budget (in R\$)	1.011	341 M	298 M	2,127 M	2,207 B
No. of academic unit	1.009	8,30	9,24	1	44
No. of Administrative Units	1.013	5,98	1,25	3	11
No. of off-site campuses	1.012	6,51	5,98	0	34

Observation: M – Millions of Reais; B: Billions of Reais.

Source: Own elaboration.

Given the above, the models used to make inferences for each of the hypotheses of this research are presented below.

## a) Model for Hypothesis 1

$$\begin{aligned}
 IGC_{it} = & \alpha_0 + \lambda IGC_{i,t-1} + \beta \text{Size of the Board}_{i,t-1} + \delta \text{Budget Log}_{i,t-1} + \omega \text{Institution Size}_{i,t-1} \\
 & + \zeta \text{Campuses}_{i,t-1} + \eta \text{Academic Units}_{i,t-1} + \xi \text{Administrative Units}_{i,t-1} \\
 & + \varphi \text{Year Dummies}_t + u_{it}
 \end{aligned}$$

b) Model for Hypothesis 2

$$IGC_{it} = \alpha_0 + \lambda IGC_{i,t-1} + \beta \text{ Linked Committees}_{i,t-1} + \zeta \text{ Meetings}_{i,t-1} + \delta \text{ Budget Log}_{i,t-1} + \omega \text{ Institution Size}_{i,t-1} + \varphi \text{ Year Dummies}_t + u_{it}$$

c) Model for Hypothesis 3

$$IGC_{it} = \alpha_0 + \lambda IGC_{i,t-1} + \beta \text{ Proportion of External Members}_{i,t-1} + \omega \text{ Institution Size}_{i,t-1} + \varphi \text{ Year Dummies}_t + u_{it}$$

d) Model for Hypothesis 4

$$IGC_{it} = \alpha_0 + \lambda IGC_{i,t-1} + \beta \text{ Meetings}_{i,t-1} + \delta \text{ Budget Log}_{i,t-1} + \omega \text{ Institution Size}_{i,t-1} + \varphi \text{ Year Dummies}_t + u_{it}$$

The presented models considered the responses of public agents in the surveys and supported the inferences for the set of institutions in the analyzed universe. In addition to individual linear inferences, the models were adapted to identify the existence of a relationship between governance and performance based on quadratic relationship inferences, as observed in the literature (Ntim; Osei, 2011). Furthermore, considering that the effect of individual fluctuations in the explanatory variables might not be observed in the dependent variable, inferences were made with dummy variables referring to the lower and upper quartiles of the values of the explanatory variables.

Finally, given the substantial difference in the values of the variables between the groups of institutions by type of academic organization, IFs and CEFETs on one side, and UFs on the other, inferences were made using specific data for the institutions in each group. For the inferences, the System GMM technique was used.

## 5 Results and analysis

The superior councils of federal public higher education institutions have very particular characteristics regarding the aspects analyzed in this research, distinguishing them from the boards of directors of publicly traded private companies, from what is observed in the literature regarding the superior councils of higher education institutions in other countries, as well as from the recommendations in the literature regarding the characteristics, composition, and processes of superior councils. Given the entire period analyzed in this research, from 2010 to 2018, the average size of the Superior Councils of Brazilian federal public higher education institutions was about 45 council members; the set of analyzed institutions had, on average, about one committee linked to the Superior Councils; the average proportion of external



members in the Superior Councils was about 15%; and the Superior Councils of these institutions held an average of 10 meetings per year.

However, there are differences among the institutions analyzed in this research. The IFs and CEFETs have a bias towards professional and technological education, aiming to integrate young people into the workforce by offering courses at other levels besides higher education, such as technical-professional courses integrated or not with high school education. In this sense, although all the institutions analyzed here are involved in higher education, the results were also analyzed by groups of institutions: on one side, IFs and CEFETs; on the other, Federal Universities. Regarding the size of the Superior Councils, the IFs and CEFETs group has an average of approximately 28 council members, while the Federal Universities have an average of about 56 council members; IFs and CEFETs had an average of approximately 0.6 committees per institution, while the group of Federal Universities had about 1.3 committees per institution; the average proportion of external members in the Superior Councils is 33% for the group of institutions characterized as IFs and CEFETs, and only about 4% for the Federal Universities; and approximately 7 annual meetings are held by the Superior Councils of the IFs and CEFETs group, compared to about 12 meetings per year by the group of analyzed Federal Universities. Next, we proceed to the analysis of the inference results.

## 5.1 Relationship between superior council size and performance

As observed in Table 1 below, it can be stated that there is a statistically significant relationship between the size of the superior councils and the performance of Brazilian federal public higher education institutions. Specifically for Federal Universities, the quadratic relationships, consistent with what is observed in the literature (Coles; Daniel; Naveen, 2008), demonstrate a U-shaped relationship, where an increase in the number of members on the superior councils is associated with a decrease in performance up to a certain point, after which performance begins to increase.

Table 1 – Inferences for the relationship between the size of the superior council and the performance of Federal Institutes of Education, Science and Technology, Federal Centers for Technological Education, and Federal Universities

	Relationship between Board Size and Institutional Performance							
	Linear Variation		Quadratic Variation		Smaller Advice		Larger Advice	
	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs
Board size (previous year)	0,00265	-0,00118	-0,01478	-0,00507*				
Square of Board Size (Previous Year)			0,00021*	0,00003*				

Dummy for Smaller Boards (Previous Year)					0,21422***	0,12741***		
Dummy for Larger Boards (Previous Year)							-0,01745	-0,00279
Log of Institution Budget (Previous Year)	-0,14935	0,08475**	-0,05322	0,09304**	0,23796	0,08928*	-0,03640	0,11173**
Institution size (previous year)	0,00025	0,00003	0,00026*	0,00003	0,00013	-0,00002	0,00025	-0,00005
Number of Campuses (Previous Year)	0,00310	-0,03592***	-0,00315	-0,03762***	0,00309	-0,01093	0,00215	-0,00999
Number of Academic Units (Previous Year)	-0,03400	-0,00017	-0,03772	0,00034	-0,09061*	0,00648	(omitted)	-0,01152
Number of Administrative Units (Previous Year)	(omitted)	0,01486	(omitted)	0,00736	(omitted)	0,00526	-0,04546	-0,00041
Year_2	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Year_3	(omitted)	-0,03550	(omitted)	-0,02918	(omitted)	-0,05207	(omitted)	-0,05160*
Year_4	(omitted)	-0,04202*	(omitted)	-0,03667	(omitted)	-0,05014*	(omitted)	-0,05451*
Year_5	(omitted)	-0,05713**	(omitted)	-0,05447**	(omitted)	-0,06587**	(omitted)	-0,06962***
Year_6	0,07435*	-0,06649***	0,06698*	-0,06586***	-0,01332	-0,05383**	0,03224	-0,05786**
Year_7	0,13474**	-0,03652*	0,11575**	-0,02746	-0,03924	-0,02411	0,07703	-0,02735
Year_8	0,15200**	-0,01512	0,13067**	-0,00859	-0,05196	-0,00274	0,08469	-0,00723
Year_9	0,12832*	-0,02786	0,09644	-0,02607	-0,09848	-0,03059	0,05146	-0,02782
Year_10	0,19221**	(omitted)	0,15190*	(omitted)	-0,07194	(omitted)	0,10794	(omitted)
IGC (Previous Year)	0,64539***	0,63144***	0,60164***	0,64301***	0,53751***	0,79195***	0,55559***	0,77926***
Constant	3,46117	-0,30435	2,12722	-0,34315	-3,30456	-1,0775	1,70447	-1,20741

\*  $p < 0,05$ ; \*\*  $p < 0,01$ ; \*\*\*  $p < 0,001$

Source: Own elaboration

The results demonstrate the existence of a statistically significant relationship between the number of council members on the superior councils of federal public higher education institutions and the performance of these institutions. Considering a linear relationship, and in line with findings from other studies (Chambers; Cornforth, 2010), there is an association between smaller superior councils and better performance for the institutions.

In turn, the analysis of the quadratic relationship between the variables also presented statistically significant results, as observed by other authors (Coles; Daniel; Naveen, 2008). Based on a sensitivity analysis conducted with the results, it is identified that the increase in the number of members is associated only with a positive variation in the performance of IFs and CEFETs. For UFs, however, the inference indicates that the increase in the number of superior council members is associated with a decrease in institutional performance up to a certain point, specifically 180 members, after which the association becomes positive. Considering that the maximum number of council members observed in the institutions analyzed during the period does not reach the

level of 180 council members, it is found that the result stems from extrapolation, and, in practice, for UFs during the analyzed period, the increase in the number of superior council members is associated with a reduction in their performance. These results are consistent even after robustness tests, which are available upon request from the authors.

## 5.2 Relationship between committees linked to the superior council and performance

The linked committees can prevent the overload of responsibilities on the Superior Councils, as they conduct analyses and make recommendations beforehand, contributing to the development of the activities of the superior councils (Bastos *et al.*, 2016). In this sense, as observed in Table 2, the results indicate a positive association for both groups of institutions, with a more prominent relationship for the group of institutions composed of IFs and CEFETs.

Table 2 – Inferences for the relationship between committees linked to the superior council and the performance of Federal Institutes of Education, Science and Technology, Federal Centers for Technological Education, and Federal Universities

	Relationship between Committees Linked to the Board and Institutional Performance							
	Linear Variation		Quadratic Variation		Smaller Advice		Larger Advice	
	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs
Number of Committees Linked to the Board (Previous Year)	0,03342**	0,02383	0,06927	-0,04977				
Square of Number of Committees Linked to the Board (Previous Year)			-0,00744	0,01775				
Dummy for Absence of Committees Linked to the Board (Previous Year)					-0,09749*	-0,04882		
Dummy for Larger Number of Committees Linked to the Board (Previous Year)							0,11972**	0,05801
Total Number of Board Meetings (Previous Year)	0,00155	0,00468***	0,00208	0,00419**	-0,00215	0,00445***	0,00092	0,00414**
Institution Size (Previous Year)	0,00023*	-0,00006	0,00021*	-0,00003	0,00020*	-0,00003	0,00024**	-0,00004
Log of Institution Budget (Previous Year)	-0,06362	0,12036***	-0,02483	0,08846**	-0,05570	0,10676***	-0,07839	0,14075***
Year_2	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Year_3	(omitted)	0,02534	(omitted)	0,01613	(omitted)	0,03421	(omitted)	0,02970
Year_4	(omitted)	0,02225	(omitted)	0,01483	(omitted)	0,02056	(omitted)	0,02159

Year_5	(omitted)	(omitted)	(omitted)	0,00301	(omitted)	(omitted)	(omitted)	(omitted)
Year_6	0,03629	-0,00256	0,02542	-0,00349	0,04589	0,00656	0,03680	-0,00728
Year_7	0,09021*	0,03175	0,07349	0,03212	0,09585*	0,03168	0,09690*	0,02200
Year_8	0,09505	0,04418*	0,07549	0,04582**	0,10457*	0,04671**	0,10491*	0,035600*
Year_9	0,07624	0,01951	0,05112	0,02919	0,07972	0,02467	0,08455	0,01322
Year_10	0,13913*	0,05177**	0,11569	0,06002**	0,14464*	0,05576**	0,14787*	0,04336*
IGC (Previous Year)	0,52789***	0,74741***	0,50615***	0,73598***	0,58685***	0,72075***	0,53544***	0,68095***
Constant	2,22609	-1,51465*	1,57081	-0,87070	2,0584	-1,13164*	2,47919	-1,67741**

\*  $p < 0,05$ ; \*\*  $p < 0,01$ ; \*\*\*  $p < 0,001$

Source: Own elaboration

The results observed for the group of IFs and CEFETs indicate that there is a positive association between the number of committees and the performance of the institutions. The absence of committees, which represents the lowest quartile of the observed value for this variable, is related to lower performance compared to other institutions in that group, and a higher number of committees is associated with better performance. The same does not apply to the group of UFs, for whom there is no relationship between the number of committees and performance. Thus, one possible interpretation of these results is that more committees for institutions that have fewer of them, namely IFs and CEFETs, can benefit the performance of the Superior Councils, already present in the UFs. The results remain consistent after conducting robustness tests, which are available upon request from the authors.

### 5.3 Relationship between the proportion of external members on the superior council and performance

As shown in Table 3, the results indicate a statistically significant relationship between the proportion of external members on the superior councils and the performance of Brazilian federal public higher education institutions, indicating a negative relationship between the variables, especially for the group of IFs and CEFETs.

Table 3 – Inferences for the relationship between the proportion of external members on the superior council and the performance of Federal Institutes of Education, Science and Technology, Federal Centers for Technological Education, and Federal Universities

Relationship between the Proportion of External Board Members and Institutional Performance								
	Linear Variation		Quadratic Variation		Smaller Advice		Larger Advice	
	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs
Proportion of External Members (Previous Year)	-0,12290	1,37334	-1,49764*	6,90835***				



Square of Proportion of External Members (Previous Year)			1,82507	-58,77544***				
Dummy for Smaller Proportions of External Members on the Boards (Previous Year)					0,13081*	-0,03784		
Dummy for Larger Proportions of External Members on the Boards (Previous Year)							0,02521	0,03136
Institution Size (Previous Year)	0,00017*	6,49E-06	0,00016*	0,00003	0,00024***	0,00005	0,00025**	0,00008*
Year_2	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Year_3	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Year_4	(omitted)	0,00108	(omitted)	0,00151	(omitted)	-0,01476	(omitted)	0,00040
Year_5	(omitted)	0,00270	(omitted)	-0,00225	(omitted)	-0,00788	(omitted)	-0,00391
Year_6	0,05191	0,01251	0,05100	0,00629	0,02330	0,00800	0,03069	0,00678
Year_7	0,09098**	0,06145**	0,09100**	0,04934**	0,05563*	0,04131*	0,06120	0,03893*
Year_8	0,09040**	0,07443***	0,08987**	0,06285***	0,05139	0,06593***	0,05630	0,06201**
Year_9	0,06037	0,06338**	0,05837*	0,05844**	0,02439	0,05062**	0,02934	0,04799**
Year_10	0,10435**	0,09261***	0,09869**	0,08683***	0,07269*	0,08153***	0,07369*	0,07549***
IGC (Previous Year)	0,64156***	0,81072***	0,61878***	0,73416***	0,52141***	0,84133***	0,65840***	0,77708***
Constant	0,82201***	0,56114***	1,12638***	0,71537***	1,05243***	0,47614***	0,69129***	0,63839***

\*  $p < 0,05$ ; \*\*  $p < 0,01$ ; \*\*\*  $p < 0,001$

Source: Own elaboration

Considering a linear relationship between the variables, in line with the literature on the subject (Ntim; Soobaroyen; Broad, 2017), it was generally observed that an increase in the proportion of external members is associated with a reduction in performance. The results from the linear inference models indicate that a lower proportion of external members on the superior council is related to better performance only for the group of institutions characterized as IFs and CEFETs, with no statistically significant linear relationship for the group of Federal Universities. One possible interpretation of these results is that external members, due to their limited knowledge of the institutions' daily operations, goals, and challenges, might make decisions that do not lead to the best outcomes. In this regard, IFs and CEFETs proportionally have more external members on their superior councils than UF, which may partially explain the difference in the results.

The results also showed statistical significance for a quadratic relationship. Based on a sensitivity analysis conducted with the results, an increase in the proportion of external members would be associated with a reduction in the institutions' performance. Despite the statistical significance, such results, especially for the group of Federal Universities, seem to have an excessively high magnitude given the small proportion of external members they have. It is certain that the proportion of external members is only a proxy for the independence of the superior council, and to some

extent, it may reflect underlying aspects of the configuration of the superior councils. However, it seems unlikely that external members exert enough influence for a small percentage variation to be associated with performance to the observed magnitude.

## 5.4 Relationship between the number of superior council meetings and performance

The results presented in Table 4 show that there is a statistically significant relationship between the number of superior council meetings and the performance of Brazilian federal public higher education institutions. When considering the linear relationship, the variables are positively related, especially for the group of Federal Universities. When considering the quadratic relationship, there are mixed relationships, both positive and U-shaped, where an increase in the number of meetings is associated with a decrease in institutional performance up to a certain point, after which the association is with an increase in performance.

Table 4 – Inferences for the relationship between the number of superior council meetings and the performance of Federal Institutes of Education, Science and Technology, Federal Centers for Technological Education, and Federal Universities

	Relationship between the Number of Board Meetings and Institutional Performance							
	Linear Variation		Quadratic Variation		Smaller Advice		Larger Advice	
	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs	IFs e CEFETs	UFs
Total Number of Board Meetings (Previous Year)	-0,00002	0,00477***	-0,03600**	-0,00404				
Square of Number of Board Meetings (Previous Year)			0,00234***	0,00023**				
Dummy for Fewer Number of Board Meetings (Previous Year)					0,03554	-0,00708		
Dummy for More Number of Board Meetings (Previous Year)							-0,00757	0,05126**
Institution Size (Previous Year)	-0,15386	-0,00004	0,00028**	-0,00004	-0,17419	-4,28E-06	-0,02162	-0,00002
Log of Institution Budget (Previous Year)	0,00037***	0,16030***	-0,09949	0,13842***	0,00033**	0,09231**	0,00024*	0,07487*
Year_2	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)	(omitted)
Year_3	(omitted)	0,03872*	(omitted)	0,03556	(omitted)	-0,03181	(omitted)	-0,05085*
Year_4	(omitted)	0,02834	(omitted)	0,02634	(omitted)	-0,04566*	(omitted)	-0,05576*
Year_5	(omitted)	(omitted)	(omitted)	-0,00445	(omitted)	-0,06142**	(omitted)	-0,06875***
Year_6	0,05510	-0,00700	0,03523	-0,01245	0,06675	-0,05415**	0,03472	-0,05822**
Year_7	0,11582**	0,01946	0,09804**	0,01196	0,13075**	-0,02236	0,07181	-0,02335
Year_8	0,13052*	0,03098	0,10710*	0,02968	0,15015*	-0,00503	0,06497	-0,01065

Year_9	0,11235	0,01281	0,08913	0,01262	0,14447*	-0,02395	0,03794	-0,02806
Year_10	0,17736**	0,04064*	0,14337**	0,03858*	0,19599**	(omitted)	0,09189	(omitted)
IGC (Previous Year)	0,57964***	0,64600***	0,58956***	0,67005***	0,63258***	0,69690***	0,65760***	0,80985***
Constant	3,71213*	-1,93938**	2,85337	-1,53386**	3,96877	-0,72291	1,11231	-0,74413

\*  $p < 0,05$ ; \*\*  $p < 0,01$ ; \*\*\*  $p < 0,001$

Source: Own elaboration

Considering a linear relationship, and in line with what was observed by authors who analyzed similar themes (Arora; Sharma, 2016), an increase in the number of superior council meetings at Federal Universities is associated with an increase in the performance of these institutions. Federal Universities with higher numbers of superior council meetings have better performance. In this sense, a higher number of superior council meetings would mean greater activity of this collegiate body, as well as provide council members with more opportunities for interaction and articulation, which would result in better decisions, leading to better performance for these institutions. The difference in this relationship between the group of IFs and CEFETs and the group of Federal Universities is partly associated with the difference in the average size of the superior council.

The analysis of the non-linear relationship between the variables also yielded statistically significant results, as observed in other studies (Ntim; Osei, 2011). For the Federal Universities, the relationship between the variables is positive, indicating that an increase in the number of meetings is associated with better performance. For IFs and CEFETs, after sensitivity tests, the results indicate that an increase in the number of meetings is associated, up to a certain point (16 annual meetings), with a decrease in performance. Beyond this limit, the relationship becomes positive. The results remain consistent even after robustness tests, which are available upon request from the authors.

## 6 Conclusion

This research aimed to identify the relationship between the structure, composition, and processes of the superior councils of Brazilian federal public higher education institutions and their performance. To this end, it examined the relationship between the size of the superior councils, the number of committees linked to the superior councils, the proportion of external members, and the number of meetings of these councils and the performance of the institutions.

The results demonstrate that there is a statistically significant relationship between the structure, composition, and processes of the superior councils of Brazilian federal public higher education institutions and their performance. Analyzed together,

the results indicate that smaller councils, more committees linked to the councils, lower proportions of external members, and more meetings are associated with better performance for federal public higher education institutions.

The relationship between the aspects of the superior council and the performance of the institutions also presented a non-linear relationship. In line with what was observed in the literature (Coles; Daniel; Naveen, 2008), the results demonstrate, in addition to a positive relationship for IFs and CEFETs, a U-shaped relationship between the size of the superior council and the performance of UFs, where an increase in the number of members on the superior councils is associated with a decrease in performance up to 180 council members, after which performance starts to increase. Also consistent with what was observed in the literature (Ntim; Osei, 2011), when considering a quadratic relationship between the number of superior council meetings and the performance of the institutions, mixed relationships are observed, both positive and U-shaped, where an increase in the number of meetings is associated with a decrease in the performance of IFs and CEFETs up to 16 annual meetings, after which the association is with an increase in performance.

It is recognized that the Superior Councils of federal public higher education institutions have other functions, both declared and latent, beyond decision-making and strategic direction of these institutions. It can be argued that some of these roles have the potential to influence the size, number of linked committees, proportion of external members, and/or number of meetings of the Superior Councils without necessarily being related to institutional performance. However, in a context where higher education faces increasing challenges, higher education institutions, especially those funded with public resources, cannot be taken for granted. Therefore, they will increasingly need to demonstrate to society that the resources invested in them bring positive returns to society as a whole.

## 6.1 Research limitations

The limitations of this research relate both to the method used and the availability of data. Regarding the method, if the variables used in the inferences are correlated with unobservable variables over the period, the results may be inconsistent. However, given that the period is relatively short, it is assumed that any unobservable variables correlated with the model variables are constant during the analyzed period. As for the sources consulted, despite being official, inconsistencies were found in the same data listed in different documents. However, whenever feasible, the information was verified, and in cases where inconsistencies persisted, the institution was consulted for clarification.



## 6.2 Recommendations for future research

Considering the specific context of Brazilian federal public higher education institutions, it is relevant to conduct studies that analyze the governance models of these institutions, considering other governance structures beyond their superior councils. Another possibility is to analyze the relationship between the superior councils of these public institutions and their performance using other indicators that reflect different aspects that may characterize the performance of these institutions, such as administrative efficiency, research, and extension.

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## Author Contributions

**Vinícius Silva Flausino** – Formulation of research objectives, literature review, data collection, data analysis, and writing of the text.

**Hamilton Luiz Corrêa** – Research advisor regarding objectives, methodological procedures, literature review, and text revision.

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