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UNIVERSITY GOVERNANCE AND ITS RELATIONSHIP WITH SCIENTIFIC PRODUCTIVITY: PROPOSAL AND VALIDATION OF A MODEL FOR UNIVERSITIES IN CHILE[1]

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ABSTRACT: Universities have a social responsibility to generate and transmit accumulated knowledge while responding to emerging problems in each historical moment. Given this, the present study formulates the following objectives: 1) to propose a governance model for Chilean universities that promotes scientific productivity and 2) to validate the model from the perspective of academics dedicated to research. To achieve this, interviews were conducted with 30 key informants using a semi-structured instrument. Through a qualitative approach and discourse analysis, employing the ZMET technique, key interactions were identified between structural variables. The findings reveal a consensus on the factors linking university governance with research, highlighting the importance of culture and its relationship with scientific performance. This study provides an understanding of how the interaction between formal and informal factors within universities impacts research, contributing to the development of effective policies and practices to foster scientific research.

Keywords: *University governance, scientific research, discourse analysis, ZMET technique, model.*

INTRODUCTION

Universities are responsible for creating and managing knowledge (Frank and Meyer, 2007). This social function of universities arises from the need to transmit accumulated knowledge and generate responses to emerging problems at each historical moment (Araya-Castillo and Gorrochategui, 2024).

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For this reason, from a management-centered approach, it is necessary to know how these entities face and distribute their administrative, financial and academic aspects (Thieme et al., 2012; Araya-Castillo and Rivera-Arroyo, 2021; Araya-Castillo, 2024); in the same way that it is essential to understand how each unit is formed and relates to the other entities involved in the decision-making processes.

In this sense, the government of universities and/or their governance could become a decisive actor in the management of necessary public policies or, in any case, a lucid detector of the difficulties of such processes and, obviously, a factor in their correction (Ganga-Contreras et al., 2015; Nisar, 2015; Acosta-Silva et al., 2021).

This is so because understanding the complex dynamics between university governance (Balbachevsky, 2017; Ganga-Contreras et al., 2018; Pack, 2020) and scientific research (Araya-Castillo and Escobar-Farfán, 2015; Hue et al., 2022; Serrano de Moreno et al., 2024) is fundamental to address contemporary challenges in higher education (Ganga-Contreras et al., 2018; Fatmawati et al., 2024; Ramírez-Cardona and Calderón-Hernández, 2024), in that it is essential to have modern, flexible universities with mechanisms that enable them to provide the human capital necessary for the development of society (Araya-Castillo and Gorrochategui, 2024).

Consequently, considering that the generation of knowledge is a common good (Ganga-Contreras et al., 2024) and given that governance allows a better resource allocation (Acosta-Silva et al., 2021), the following general question arises: How is the governance of research systems and its impact on scientific productivity in Chilean universities? To answer this question, this study aims the propose and validate a model that emphasizes the relationship between university governance and scientific productivity results.

METHODOLOGY

The general approach of the work adopts a type of conclusive descriptive research with cross-sectional or sectional cut (Malhotra, 2004), which seeks to categorize the elements

(categories or variables) of university governance systems in their interaction with the performance obtained in terms of scientific production.

This study distinguishes two interrelated stages of implementation: 1) the proposal of a governance model that promotes scientific productivity; and 2) its validation from the perspective of academics engaged in research.

The research focuses on the Chilean university sector, characterized by a significant expansion of its enrollment (Alarcón and Dzimińska, 2023), a high level of competitiveness (Brunner and Alarcón, 2023) and complexity (Araya-Castillo et al., 2018), as well as by a demanding regulatory framework (Pérez Carvajal and Catalán Cueto, 2022; Alarcón et al., 2025).

However, the strategic analysis of higher education transcends the case of Chile, as it constitutes a highly relevant issue for Latin America (Araya-Castillo, 2024). In this context, universities are expected to play a key role in economic growth, national competitiveness, optimization of productive processes, and promotion of individual welfare. Likewise, their contribution is fundamental for the reduction of inequality gaps and social mobility (Gallegos Macías et al., 2022; Castillo et al., 2023; Araya-Castillo, 2024).

In the construction of the theoretical model, expert validation is guaranteed (Deng and Dart, 1994), since its elaboration considers the meetings held with 5 academics (men and women) from Chilean universities with a long trajectory in research. With the proposed model, this research adopts a qualitative approach with descriptive scope (Gioia et al., 2013; Gioia, 2021) to validate the relationship between university governance and scientific productivity from the perspective of academics engaged in research. The discourse analysis methodology (Araya-Castillo et al., 2022) is employed with the support of the ZMET tool of metaphor elicitation (Catchings-Castello, 2000; Zaltman, 1996, 2014), suitable to delve into the symbolic construction of university governance and its impact on research.

The questions are formulated about the elements that make up university governance in relation to the decisions that regulate, condition, or provide support to the academics' research

work. In addition, these indirect questions reduce the social desirability of the answers obtained in the structured interviews.

Interviews were conducted with 30 key informants, using a semi-structured projective instrument to identify consensus in their perceptions of the factors that influence the relationship between university governance and scientific production. With this sample size, the saturation of the category is reached (Denzin and Lincoln, 2000), since from interview 27 onwards, the responses of the interviewees on the topic under study are repeated.

The field study will be conducted between December 2024 and January 2025. The sample, which is purposive and selected by convenience (Malhotra, 2004), is composed of academics whose main dedication is research or who combine this activity with management functions in executive positions, such as vice-rectorships, deanships, and school directorships. This group includes both men and women with different levels of seniority in academia, representing the diversity of the university sector in Chile. This diversity is manifested in their research areas, which cover multiple disciplines, as well as in their performance in public and private universities of different sizes, located both in the capital and in different regions of the country. This heterogeneous sample allows a comprehensive exploration of the individual and contextual factors that influence their experiences and perceptions, enriching the analysis of the relationship between university governance and scientific production.

The interviews are transcribed and undergo a thematic coding process guided by the theoretical model presented in Figure 1. The application of the semi-structured metaphor elicitation interview follows a flexible process, adapted to the key informants, where the questions are adjusted according to the answers and the flow of the conversation. The interview is conducted using the Google Meet platform, recording audio and using a dialectical approach to stimulate detailed responses about the study phenomenon. The interviews have an average duration of 30 to 45 minutes. After the interviews are conducted and recorded, the participants' responses are transcribed into text and analyzed using the qualitative software Atlas.ti through coding and saturation tools.

Through this deductive coding, key segments are identified in each variable of the model, ensuring their presence in all interviews to validate their existence and relevance (Gioia et al., 2013; Kull, 2020; Gioia, 2021). In this process, qualitative data, founded on narratives associated with metaphorical images, are analyzed to identify common patterns among participants, which are constituted by emerging themes that are grouped into broader concepts or codes that form the conclusions of the study. The analysis technique employed is the emergent coding of relevant segments to construct categories that group common meanings among participants (Araya-Castillo et al., 2022; Letzkus-Palavecino et al., 2022; Álvarez-Maldonado et al., 2023).

In addition, a technique based on Atlas.ti software is used, which consists of measuring the cooccurrences between the different codes identified in the discourses, to examine the interrelationships between the different themes, analyzing the overlapping of contents and the frequency with which certain codes appear together in the discourse of the interviewees (Coulter and Zaitman, 1994; Zaltman, 2014; Gioia, 2021). To strengthen this analysis, a chi-square test is applied on the co-occurrence matrix, which allows us to evaluate the dependence or independence between the variables of the model.

This process, which combines thematic analysis through deductive coding, the study of co-occurrences, and the chi-square statistical test, provides an empirical validation of the proposed theoretical model (Zaltman, 1996; Gioia et al., 2013; Kull, 2020). Table 1 details the steps of the research.

Table 1

Research steps

Step	Description
Definition of the Purpose	To explore the relationship between university governance and scientific productivity from the perspective of academics engaged in research.

Theoretical model proposal	Meetings were held with 5 academics with research experience to propose a theoretical model on the influence of university governance on scientific productivity.
Data collection	Application of semi-structured interviews with 30 key informants with a projective approach to identify consensus on influential factors.
Methodological approach	Qualitative research with descriptive scope based on discourse analysis using the ZMET technique.
Data coding	Transcription and thematic coding are guided by the theoretical model, ensuring the identification of key segments in each variable.
Co-occurrence analysis	Identification of interrelationships between topics based on the overlapping of contents and the frequency of joint appearance in the speeches.
Statistical test	Application of the chi-square test on the cooccurrence matrix to evaluate the dependence or independence between variables.
Model validation	Combination of thematic analysis, co-occurrence, and chi-square to empirically support the proposed model.
Results and interpretation	Identification of key factors based on evidence on the relationship between university governance and scientific productivity.

Note. Own elaboration.

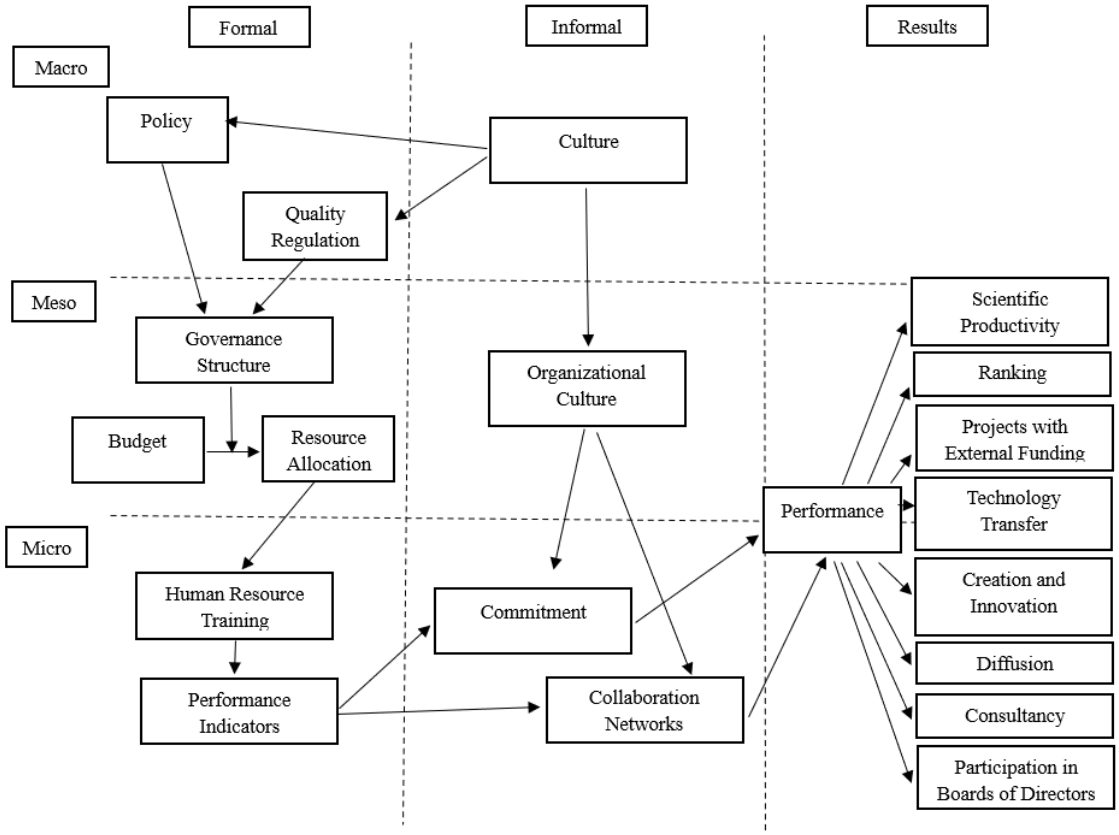
RESULTS

Each part of the research has a result; the first consists of the proposal of a theoretical model, while the second corresponds to its validation. Regarding the former, the theoretical model that explains the relationship between university governance and scientific productivity considers the influence of institutional factors at different organizational levels (Figure 1). This model is based on institutionalist theory, which holds that organizational structures and practices are shaped by norms, regulations and pressures from the institutional environment (Selznick, 1948; Meyer and Rowan, 1977; Zucker, 1977, 1983, 1988). Under this

perspective, universities not only respond to internal efficiency criteria, but also to external demands coming from social transformations, regulatory agencies, government policies and expectations of the productive sector and the academic environment (Araya-Castillo and Rivera-Arroyo, 2021; Jiménez-Bucarey et al., 2023; Ganga-Contreras and Araya-Castillo, 2024). Figure 1 schematizes the model.

Figure 1

University governance model and its relation to scientific production



Note. Own elaboration.

In the proposed model, the macro level includes the set of norms, values, beliefs, and principles that are shared by society and that shape the national culture, which in turn impacts educational policy and quality regulations that condition the structure and priorities of universities. At the meso level, the organizational culture of these higher education

institutions and their internal governance practices, such as budgetary and resource allocation decisions, are analyzed. At the micro level, we examine how these internal governance conditions are influenced by performance indicators and by the training and commitment of researchers, and the cooperation networks they can generate. In summary, the model proposes three interconnected levels, covering elements of the general normative-social context, the internal organization of higher education institutions, and the behavior of researchers and the evaluation of the performance of scientific production.

The results of the second part of the paper support the theoretical model proposed in Figure 1, and the relevance of the different variables that compose it, which are presented and validated by means of qualitative empirical material. Table 2 specifies the category of each variable, its frequency of occurrence in the key informants' discourses, and includes a textual example to illustrate its meaning.

Table 2

Coding of participants' speech.

Code	Frequency
Culture	101
Policy	15
Quality Regulation	8
Governance Structure	8
Budget	44
Resource Allocation	33
Human Resource Training	19
Performance Indicators	34
Organizational Culture	27
Commitment	11
Collaboration Networks	17
Performance	29

Note. Own elaboration using Atlas.ti

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The first variable, called “culture” is considered by the key informants as one of the variables that has the greatest impact on the scientific research process. It is defined as a set of practices, values, and beliefs that are present at the country level and have a direct impact on the production of knowledge. Participant 8 points out that “the diversity of cultures has to do with respecting or encouraging the development of different cultures and their beliefs, their religiosity, their way of conceiving the world”. This view highlights how culture influences the research environment, not only as an object of study but also as a determining factor in research processes.

On the other hand, “culture” is also linked to the adaptation of universities and academics to the evolution of issues of interest, literature development, and regulatory framework. Participant 13 explains how research has evolved, especially in the social sciences: “now you can't not do research... if we think about research 20, 25, 30 years ago, for those of us who have been doing it for a while, especially in our areas of the social sciences, which do not have a traditional research culture, unlike other areas such as the exact sciences, etc., where there is a more deeply rooted culture”.

In addition, “culture” has a direct impact on research management and institutional policies. According to participant 13, “the fact of establishing concrete actions through structured policies, forms of governance that allow women to access certain benefits... we are doing very concrete actions at the institutional level”. This statement underlines the importance of integrating the national “culture” about gender equality and its relation to the evolution of scientific practices, highlighting the need to adjust policies so that research reflects a greater diversity of voices and contexts.

The second variable is called “policy” and with regard to scientific research, it is defined as a set of institutional and structural actions, norms, and strategies designed to guide and promote research in various contexts. Educational “policy” in research implies doing, as pointed out by participant 13, who emphasizes that “generating strategy policies, structures, regulations, etc, are fundamental steps to advance research” It is not only a matter of defining the framework for action, but also of implementing concrete actions that give shape and direction to research processes.

In this sense, participant 8 highlights the relevance of collective construction and consensus in the decision-making process. She mentions that "they [the actors] have also looked in the mirror in institutional construction", suggesting that educational "policy" should not be imposed in a unidirectional manner, but should be centered on critical reflection and the participation of all the actors involved in the research. About norms and clarity in procedures, participant 25 emphasizes the importance of having "clarity of purpose and specificity in the procedure" within the educational policy. According to her, "it is essential to have clear norms and guidelines so that research follows a defined path".

The third variable is called "quality regulation" and is defined as a set of norms, processes, and mechanisms designed to ensure that the products of research, such as the knowledge generated, are relevant, useful, ethically responsible, and of a high scientific standard. Participant 20 notes that "institutional criteria for quality in scientific research vary according to the institutions and the markets in which they compete". According to this participant, quality is a determining factor in the regulation and evaluation process, highlighting the difference between those institutions that prioritize quality over quantity.

On the other hand, participant 22 points out that "the quality of research must be aligned with a practical sense and not just an individualistic pretension to generate new knowledge". For him, the quality of research must have a tangible and relevant social impact, always seeking to improve people's well-being and quality of life. In this sense, "quality regulation" not only ensures that projects are carried out with high academic standards, but also includes the practical and social benefits that research results can generate.

The fourth variable is called "governance structure" and is defined as the set of systems, rules, and processes that regulate decision-making, management, and relationships within universities, to ensure that research is conducted in an efficient, inclusive, and sustainable manner. Participant 9 emphasizes that "corporate governance and management are central concepts within research, especially when approached from a corporate social responsibility perspective" According to him, the governance structure in the university context implies how institutions are organized and regulated to achieve good performance, within a framework of research administration and management. Which implies, according to

participant 17, that the governance structure must be connected to regulatory models that ensure efficient and ethical functioning within institutions.

On the other hand, participant 13 stresses that "forms of governance have had to adapt to the changes that have been emerging", suggesting that the governance structure must be flexible and able to evolve in response to new realities, such as technological transformations, anti-harassment regulations, and gender inclusion needs. In addition, it mentions that within governance structures, stakeholder participation and diversity management are relevant to create a more inclusive and equitable environment in scientific research. It also highlights the need to implement "concrete actions through policies of structure, forms of governance, both locally (such as the Chilean State) and globally, to encourage the participation of women in science".

The fifth variable is called "budget" and refers to the financial and material resources needed to carry out a research project. Participants emphasized that research budgets are closely linked to the available infrastructure, the allocation of funds, and the management of resources within institutions. Participant 5, for example, comments that "institutional resources are allocated in a prioritized manner" reflecting how the available budget influences decisions on which projects receive support. In addition, participant 29 notes that "resources are always scarce" underscoring the importance of efficiency in their use, as scarcity forces careful management of each allocation.

In this sense, limitations and obstacles arising from a lack of resources are a recurring concern. Participant 2 describes that "the resource allocation for research that has not won funding is very limited and this can lead to research that is very narrow in scope". This lack of resources imposes clear limits on the potential of projects. Thus, participants emphasize the dependence on external funding to ensure research success.

The sixth variable is called "resource allocation" and refers to the distribution of resources needed to carry out research projects within a university. These resources include funding, infrastructure, institutional support, and access to software, libraries, or databases. Thus, the availability of infrastructure and material resources is fundamental. According to participant

10, “we have many, many resources through virtual libraries that allow us databases... fundamental from the point of view of research, in different areas of knowledge”.

In addition, resource management challenges are a major concern. Participant 5 emphasizes that “institutional resources that are allocated in a prioritized manner...are going to be subject to different eventual course changes due to obstacles that may appear along the way” This comment underscores that, in addition to resource availability, effective resource management is crucial, as resources must be adjusted to the needs and challenges that arise during the research process.

The seventh variable is called “human resources training” and in relation to scientific research, it is understood as an integral process that develops the competencies, capacities, and attitudes necessary for academics to contribute effectively to the advancement of knowledge. This implies that the development of research skills is fundamental for the generation of knowledge in the various disciplines, since, as participant 14 points out, “a lot, a lot of research is done and... curiously, psychologists also have a lot of research”, which also reflects the importance of research as a central axis of the training process.

Likewise, the need for academics to maintain a balanced approach between teaching and research is highlighted, recognizing that few manage to dedicate themselves exclusively to research. As participant 18 emphasizes, indicating that “all academics must have the ability to balance, since few can dedicate themselves exclusively to research”. And, in this process, reflection and analysis are also vital, since, as participant 26 points out, “the capacity for analysis and over-analysis, for important reflection” is crucial for the research process, emphasizing the relevance of strengthening or developing critical and reflective skills to address complex problems and generate relevant knowledge.

The eighth variable is called “performance indicators” and, in the context of scientific research, is defined as the metrics used to evaluate and measure the progress, results, and impact of the projects carried out. These indicators are essential both for guiding research processes and for institutional decision-making and adaptation to new demands in scientific production. Participant 13 explains that the indicators make it possible to obtain a “panoramic view of what is happening in research”, since they not only consider the immediate results,

but also the impact and decisions to be made in the future. According to him, “today, when we talk about governance and scientific production, we are thinking about how we organize ourselves, how we participate, what the results are we are obtaining, what is the impact”.

Participant 12 emphasizes that performance indicators are closely related to effort and dedication. From his perspective, for research results to be as expected, it is important that academics dedicate time and attention to the indicators and that they seek support from other researchers. For this reason, participant 1 points out that indicators are essential to achieve objectives and goals within a collaborative context. He mentions that “the objective is a clear element [within a project], it represents a goal where [researchers] arrive... in short, an objective or a goal to which we want to aspire also in terms of optimizing indicators”.

The ninth variable is called “organizational culture” and is defined as a set of shared values, attitudes, and practices within an institution that influence how research is conducted and how both institutional and personal efforts are articulated. Participant 13 notes that within universities, an action-oriented “organizational culture” is fostered, seeking to promote women's access to scientific careers. She complements this with her statement that “research projects should respond to the demands of what scientific production should be, where it should be directed and that it should be applied, that it should be adequate, pertinent and respond to particular needs”.

In turn, participant 1 emphasizes that research must be aligned with “an institutional guideline”, which is related to what was stated by participant 24, who highlights the importance of the “transition of the researcher within the institutional structure”, referring to how the “organizational culture” impacts the decisions and paths that researchers must follow to access resources and support within the institution. This process of transitioning highlights how institutional dynamics impact the trajectories of researchers, directly influencing the opportunities they have to advance their research projects.

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Similarly, participant 15 highlights the autonomy in the research process and how the fulfillment of objectives provides satisfaction. In this process, it is necessary to manage emotional tension and personal sacrifices, where participant 22 highlights that commitment is not only related to the result, since "it requires a high tolerance to frustration... personal effort, family commitment, etc.". Participant 25 emphasizes that research is a gradual process that involves the path towards the goal, mentioning that "we must be able to meet our objectives and finally reach a happy conclusion to our research".

The eleventh variable is called "collaborative networks" and is defined as a set of interconnected and cooperative relationships between individuals and institutions, where resources, knowledge, skills, and common objectives are shared to advance the production and dissemination of knowledge. This collaboration is manifested in group work contexts and in broader interactions that are generated among diverse institutions and academic disciplines. Participant 9 refers to the importance of collaboration in the research arena, although she recognizes the individual nature of many processes. Participant 4 reinforces this point of view by pointing out that a paradigm shift was generated in the vision of the researcher: "I judge that before the researcher was a solitary person", highlighting how collaborative networks have transformed the nature of research work, turning it into a more collective and shared effort.

Likewise, participant 22 explains how collaborative networks allow more experienced researchers to guide younger researchers, noting that "there is a collaborative network that allows those with more experience to teach the guidelines and routes for action". This, in the opinion of participant 1, highlights how critical collaboration is in the generation and dissemination of knowledge, indicating that "it is not possible today to understand the process of knowledge generation and dissemination without a basic foundation of collaboration".

Finally, the twelfth variable is called "performance" and refers to the results achieved through research, according to the different metrics of scientific production. These research results

can simultaneously contribute to researchers and universities in terms of scientific publications, dissemination in the press, exposure at research meetings, and the awarding of external competitive funds. They can have a direct impact on researchers in terms of consultancies and participation in directories; benefit universities through the position they can achieve in national and international quality rankings; and favor the country as a whole when technology transfer and innovation projects contribute to finding solutions to problems that afflict society.

It stands out that research performance is seen as a sequential and structured process, where one goes from the formulation of ideas and objectives to the execution of projects and obtaining results. This idea is expressed by participant 6, who says, “I already have the idea, then I apply the instrument, the interview in the selected population, then I achieve the results, and finally I am happy because I have finished the research”. Participant 13 broadens this perspective of performance by including an integral vision of the research process. According to this participant, when conducting research, one must have “a panoramic view of what is happening”, since researchers should have the ability to adapt to the changing demands of the context.

In this way, visual metaphors are used to deepen the understanding of how academics think and feel about the influence that university governance has on scientific production, exploring the underlying perceptions, attitudes, and emotions about the phenomenon under study. This methodological approach is based on the premise that human thought is fundamentally unconscious and is better expressed through images and metaphors than through direct, rational words.

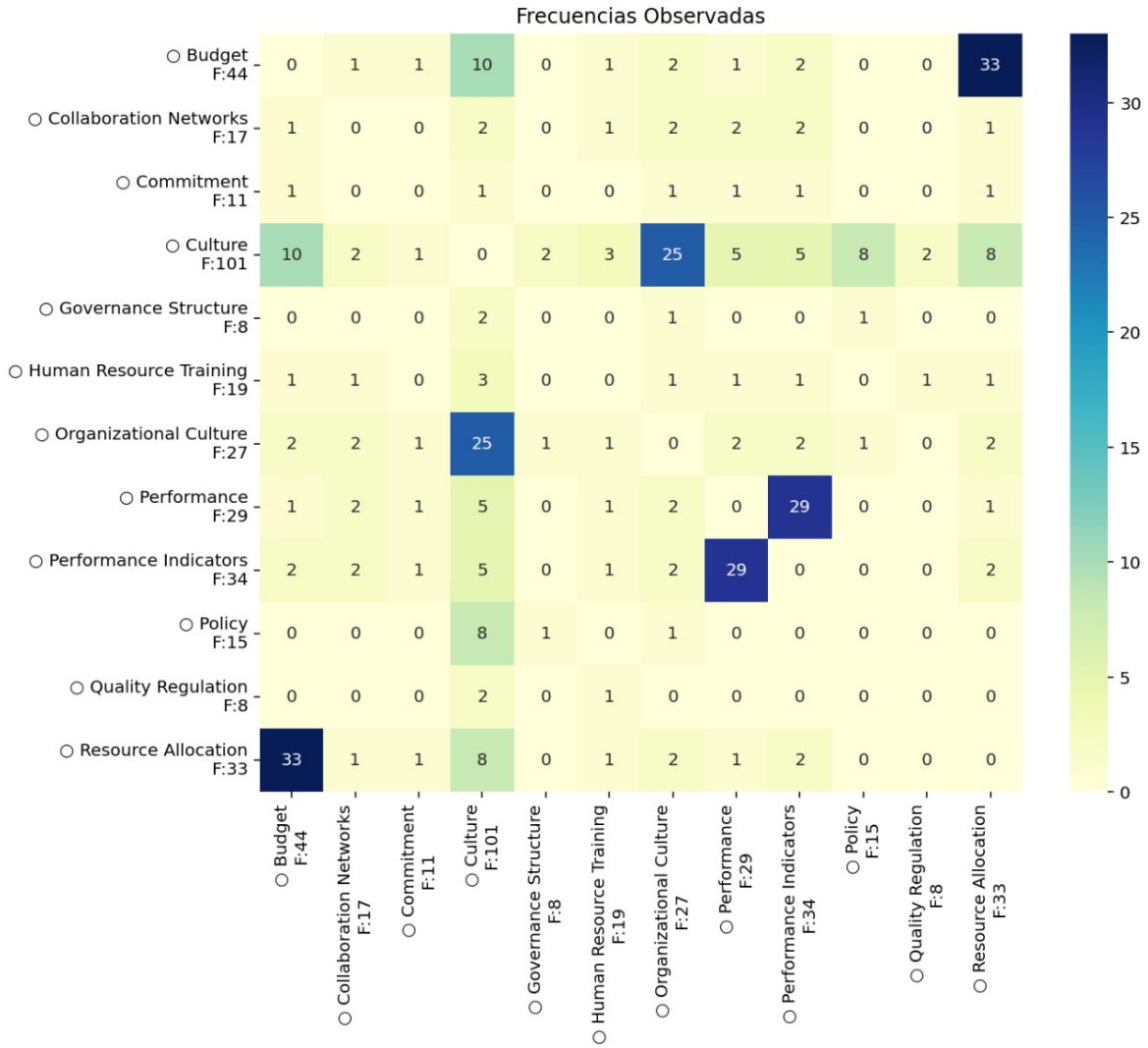
DISCUSSION OF RESULTS

The categories coded in the speeches generate a frequency per category and a frequency of cooccurrence detailed in Figure 2. This frequency of cooccurrence makes it possible to demonstrate the links between the different categories of the model in Figure 1, giving

consistency to the model's relationships. To demonstrate this link between categories, the chi-square test is applied, where the results obtained indicate the existence (or not) of a significant association between the variables evaluated.

Figure 2

Cooccurrence matrix



Note. Own elaboration using Python.

The chi-square value obtained was 660.8185, suggesting a substantial difference between the observed and expected frequencies under the hypothesis of independence. The associated p-value is extremely low (p = 2.7821x10-75), and much lower than the commonly used

threshold of 0.05, which provides conclusive evidence to reject the null hypothesis, suggesting that there is a significant relationship between the variables evaluated.

With the above, it is concluded that the variables (categories) that make up the model in Figure 1 are not independent of each other, but are interrelated, giving rise to the frequency of co-occurrences. This implies that when key informants from the academic sector express their perception of how university governance influences scientific production, they do not necessarily do so for one variable in particular, since an opinion can refer to more than one variable. This occurs when participant 29 expresses that "the frustration is very great... however, one has to make sense of it as one obtains research results". In this expression, the participant refers to the variables "commitment" (when he points out that one must give meaning to what one does) and "performance" (when he points out that research results are obtained).

The cooccurrence matrix in Figure 2 shows the observed frequencies between different categories, where a high level of cooccurrences between variables could reflect relevant interactions within the proposed model (Smircich, 1983; Ertimur and Coskuner-Balli, 2015), and conversely, a low level of cooccurrences suggests a low interaction of these variables in the analysis (Lawrence and Lorsch, 1967; Pfeffer, 1993).

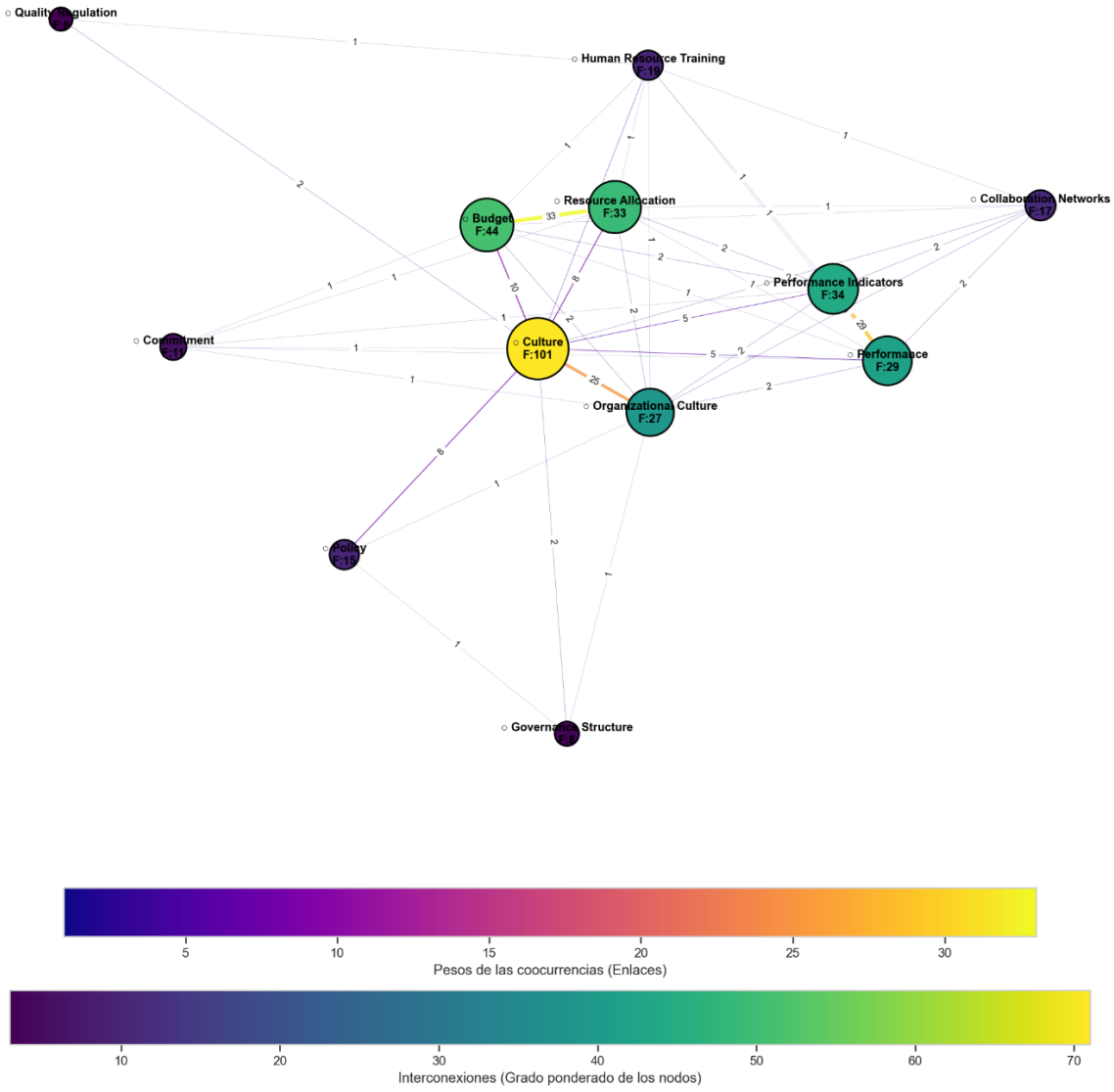
In this context, some relationships stand out. "Resource allocation" with a co-occurrence of 33 is closely linked to "budget" suggesting that the management and distribution of financial resources within the university organization is highly dependent on decisions made in budget planning. It is also observed that "culture" with a co-occurrence of 25 is strongly linked to "organizational culture", which shows that the values and norms shared in society influence the behavior of academics and the practices generated within universities. And it can be seen that "performance" is related on 29 occasions with "performance indicators", and therefore it is justified that the measurement of scientific productivity is adequate to the extent that it responds to formal criteria of compliance.

As a consequence, the results obtained allow establishing a cognitive consensus of academics regarding their perceptions of the relationship between university governance and scientific productivity, identifying relevant factors in these perceptions (Gioia, 2021). Thus, the

network graph in Figure 3 provides a view of the mental model of researchers involved in Chile's higher education sector, showing the relationships and connections between different topics.

Figure 3

Cooccurrence network



Note. Own elaboration using Python.

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Continuing with the analysis, the model in Figure 1 is transformed into a process map in Figure 4, oriented by the network graph in Figure 3. In the center of this network, "culture" (frequency of 101) emerges as the most important node, which highlights its relevance in guiding the patterns of behavior that are shared and accepted by those who make up society. Therefore, it follows that the "culture" of the country, which represents the beginning of the process (green circle), influences how academics perceive scientific research and the role they play in the generation of knowledge.

In this sense, "culture" impacts the "organizational culture" (frequency of 27) of the universities, which is directly related to the "commitment" (frequency of 11) of the academics and their "collaboration networks" (frequency of 17), and consequently to the "performance" (frequency of 29) that they can achieve in scientific productivity. This reflects how the "organizational culture" of a university can be a strategic asset of its research processes.

Likewise, "culture" also influences the educational policy (frequency of 15) of the university sector in Chile and the regulations of "quality regulation" (frequency of 8) that control the functioning of these institutions. Thus, "culture" generates the bases that regulate the activities and competitive dynamics of the universities, which is reflected in the "governance structure" (frequency of 8) that they establish to comply with their strategic planning and educational project.

This "governance structure" determines how university decision-makers plan and manage the "budget" (frequency of 44) and the "resource allocation" (frequency of 33). This is relevant because the financial sustainability of the universities determines whether they are in a position to invest in "human resources training" (frequency of 19), which is manifested in the hiring of academics with research preparation and experience, and/or in the career development of researchers with growth projections.

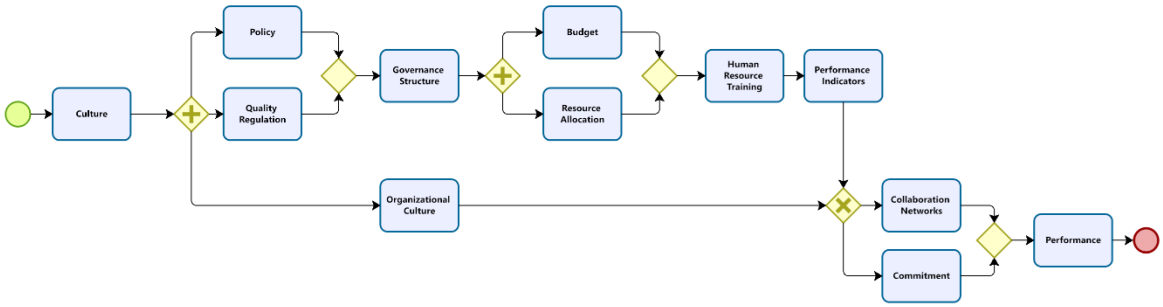
In turn, "human resources training" establishes the conditions for the configuration of "performance indicators" (frequency of 34), since the institutional objectives and goals, which are materialized in productivity metrics (e.g., number of publications and external projects awarded), must be aligned with what the team of academics is capable of achieving

based on their personal conditions (e.g., research training and experience) and structural restrictions (e.g., teaching load and management roles).

However, in order to generate compliance with the "performance indicators", formality is not enough, but rather, as previously mentioned, it is important to establish internal policies that encourage and reward the "commitment" of academics and what they can contribute to or receive from the "collaboration networks". This is crucial for universities to fulfill their social function of generating and transferring knowledge, and thus achieve the expected "performance", which is the main goal of the whole process (red circle).

Figure 4

Cognitive consensus process map



Note. Own elaboration using Bizagi.

CONCLUSIONS

This research validates the model proposed in Figure 1. It provides evidence of the interdependence generated among the variables (categories) analyzed. Within these variables, it is "culture" that acts as a central node in the network of relationships generated within universities when academics carry out research projects in the different disciplines of knowledge. In this process, "organizational culture", "budget", "resource allocation", "performance indicators" and "performance" also show a high level of co-occurrence. Meanwhile, "policy", "quality regulation", "governance structure", "human resources

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training", "commitment" and "collaboration networks" are presented with more peripheral interactions, but the connection they have with the other categories highlights the importance they have for the research developed to be of quality, promote inclusion, be done with efficiency in the use of resources, contribute to the solution of different problems of society, and comply with ethical standards.

However, despite the rigorous methodology used, there are some limitations. The analysis focuses on a convenience sample of academic researchers, which may restrict the generalizability of the results to other academic institutions in Chile's higher education sector or other geographical contexts. The heterogeneity of educational institutions could influence the dynamics of the relationships between categories, suggesting that the results may not be uniformly applicable across educational settings. In addition, using cooccurrence frequencies and the chi-square test does not fully capture the causal nature of the relationships. Although cooccurrence suggests significant links, it does not allow us to delve deeper into causality or the underlying mechanisms that explain these links.

Therefore, some future lines of research are derived. To explore the causal mechanisms underlying the observed relationships between the categories, research designs that combine quantitative and qualitative tools could be used. In this scenario, the role that other variables may play in moderating or mediating the relationship between university governance and scientific productivity could be analyzed, such as the size and age of the universities, the disciplines they teach, the breadth of their graduate programs, and whether they are part of a consortium. Also, longitudinal research could be carried out to obtain a more dynamic view of the evolution of the relationships generated between variables over time, to identify challenges to university governance.

However, the research has theoretical and practical significance. It is one of the first studies to propose and validate a model that relates university governance to scientific productivity. This topic is of social relevance in the current context of higher education, where universities have acquired a central role as engines of economic competitiveness. Their contribution is manifested both in the formation of highly qualified human capital and in the generation of increasingly sophisticated scientific and technological knowledge. In this sense,

understanding the interactions between the different categories allows us to obtain a deeper vision of the factors that influence the development of the research process and its results, which can serve as a basis for the formulation of public policies on research, as well as for the design of institutional strategies that strengthen the performance of the universities themselves.

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