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Risk Management in Brazilian Federal Universities: Evaluating the Achievement of Strategic Objectives

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Abstract

Objective: To analyze how risk management is configured to support performance in achieving strategic objectives in Brazilian federal universities.

Method: Data from 35 federal universities were analyzed using fuzzy-set Qualitative Comparative Analysis (fsQCA), which enables a configurational understanding of organizations. Using fsQCA, the study sought to analyze connections between the performance of federal universities and the following conditions: risk management maturity; alignment of the internal control system; extent of use of management control systems; implementation time of the risk management policy; adoption of an implementation plan and/or methodology to guide risk management; and organizational size. The performance dimensions captured the main areas related to the universities' objectives: teaching, research, human resources, and financial resources.

Results: The identified configurations were adapted to contingent factors, such as size, and revealed key factors associated with high performance in achieving strategic objectives. The following factors stood out: the establishment of a formal structure – through the adoption of an implementation plan and/or risk management methodology –, the maturity of risk management, the alignment of internal control systems (adequacy to risk management), and the use of management control systems to monitor performance and risks, as well as in disseminating a risk culture. Evidence suggests that risk management is integrated into the organizational activities of some of the institutions investigated, interacts with existing control systems, and acts as a governance mechanism aimed at achieving strategic objectives.

Contributions: The study offers relevant insights by employing a configurational approach to explore the relationship between risk management and performance in achieving strategic objectives, supporting practical recommendations by highlighting the complexity and non-linearity of implementation processes, as well as their dependence on dynamic interactions with institutional control systems. Furthermore, this study advances the theory by empirically demonstrating equifinality in the risk management arrangements adopted in universities and by offering a model to analyze the complementarity between different control systems.

Keywords: Risk management; internal control systems; management control systems; Brazilian federal universities; strategic objectives.

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1 Introduction

The dynamics of public sector entities underwent a series of transformations in the 1980s with the so-called public management reforms, which introduced new management concepts and a shift from traditional to managerial public administration (Hughes, 2017). This model incorporated practices from the private sector into public organizations at all levels of government as benchmarks for best organizational practices (Secchi, 2009).

Although more pronounced in other sectors, these changes also had repercussions for the management of public universities, due to pressure exerted by oversight bodies, the government, and society for greater efficiency and effectiveness in the use of public resources, the quality of services, and performance-based accountability (Wang, 2010).

In this context, public managers began to deal with multiple objectives, such as creating and maintaining trust and legitimacy, as well as promoting desirable social and economic outcomes (Stoker, 2006), to meet the expectations of citizens and other stakeholders. This contributed to risk management gaining prominence (Huber, 2011), establishing itself as a governance tool capable of supporting managers' choices and improving decision-making in public organizations (Bracci et al., 2021), especially by enabling the identification and assessment of risks that can directly impact service delivery and affect various stakeholders.

Public universities must understand the risks to which they are exposed and the opportunities for value creation, considering their role in the country's economic and social development, not only through the provision of education, but also through the dissemination of knowledge, the training of professionals for the job market, and the encouragement of humanities, scientific, and technological areas (Alvarenga & Ohayon, 2021; Dourado, 2019).

Universities are complex institutions (Wang, 2010) that are exposed to various risks while fulfilling their mission, such as "strategic, operational, financial, compliance, and especially reputational risks" (Pereira et al., 2020, p. 165). There are also risks of a political nature, related to management, leadership, and interaction with students (Khaw & Teoh, 2023). In particular, public universities have been increasingly challenged to balance scarce budgetary resources and maintain their infrastructure to meet the growing demand from students (Medeiros et al., 2020).

Faced with a challenging scenario, Sum & Saad (2017) emphasize the need for risk management to be incorporated into the academic environment, as this approach promotes the proactive and strategic identification of risks, proving to be a tool capable of contributing to the improvement of the performance of Higher Education Institutions (HEIs) and supporting the achievement of their institutional objectives (Al-Subari et al., 2021; Setapa et al., 2020; Sum & Saad, 2017). However, it is important to highlight that the adoption of risk management has been driven mainly by external institutional influences (Alsharari, 2022).

In the Brazilian public sector, it is observed that the implementation of risk management has been motivated by institutional influences and regulatory pressures from the Federal Executive Branch, reflected in Joint Normative Instruction No. 1/2026 of the Ministry of Planning, Development and Management (MPDG) and the Office of the Comptroller General (CGU) (Brazil, 2016), and in Decree No. 9,203/2017, which provides for the governance policy of the federal public administration (Brazil, 2017) (Alsharari, 2022; Araújo & Gomes, 2021; Souza et al., 2020).

Despite existing coercive and normative pressures, the effective adoption of risk management remains a complex and challenging process, as this approach introduces a distinct logic of action in the public sector, characterized by its strategic nature and support for the decision-making process (Souza et al., 2020; Sidorenko & Demidenko, 2017). In this sense, risk management goes beyond the strict perspective of internal control: it encompasses the identification, assessment, and management of risks associated with the organizational strategy and objectives, as well as provides support for a risk-oriented decision-making process, in line with the entity's mission, vision, and core values (COSO, 2017).

In the specific case of Brazilian federal universities, previous studies have identified gaps associated with their implementation process (Araújo & Gomes, 2021; Alves et al., 2017; Araújo & Callado, 2022), such as a lack of proactivity and staff involvement (Araújo & Gomes, 2021); and a lack of employee training, an underdeveloped risk culture, and low commitment from senior management (Alves et al., 2017; Araújo & Callado, 2022).

These weaknesses reinforce the discussion raised by Jemaa (2022), who argues that there may be a dissociation between the policies and formal procedures implemented and the organizational practices actually adopted, indicating the projection of "facade structures," which limit risk management to a mere formal exercise, incapable of achieving the expected results (Jemaa, 2022). In this sense, organizations project an appearance of conformity, while their internal practices remain unchanged (Meyer & Rowan, 1977).

Conversely, when implemented effectively, risk management introduces new types of controls, processes, tools, and techniques focused on risk (Bracci, Tallaki, Gobbo & Papi, 2021), in addition to interacting with existing control systems (Bracci et al., 2021), such as performance measurement systems and strategic planning (Mikes, 2009; Mikes & Kaplan, 2013; Rana et al., 2019). This demonstrates that risk management is not an isolated activity disconnected from an entity's daily operations (Hinna et al., 2018). From this perspective, risk management is recognized as a strategic management control system (Andersen & Sax, 2019; Mikes, 2009; Mikes & Kaplan, 2013), one which complements traditional forms of control and introduces risk-focused processes and practices (Bracci et al., 2021; Soin et al., 2014).

Given the previous discussion, and considering the particularities of each organizational context, as well as the distinct characteristics of the risk management implementation process, the following research problem was defined: **How is risk management configured to support performance in achieving strategic objectives in Brazilian federal universities?**

This study aimed to analyze how risk management is configured to support the performance of Brazilian federal universities in achieving strategic objectives, considering aspects such as the formal structure, the maturity of the practices adopted, and the interactions with internal and managerial controls.

To meet this objective, and given the absence of consolidated standards for measuring performance in universities—due to the diversity and ambiguity of objectives typical of complex institutions (Gomez & Girotto, 2015)—we opted to assess performance from a strategic perspective, considering the extent to which organizational objectives are achieved and how they align with the institutional mission, as suggested by Wang (2010). The analysis encompasses two dimensions: the academic dimension, which includes teaching and research, and the managerial dimension, which involves the management of human and financial resources.

This study is justified by the scarcity of empirical evidence on the effectiveness of risk management (Andersen & Sax, 2019; Pereira et al., 2020), especially in the context of higher education. Furthermore, previous studies (Al-Subari, Ruslan & Zabri, 2020; Al-Subari, Ruslan, Zabri & Akbar, 2021; Khaw & Teoh, 2023; Medeiros et al., 2020; Nunes et al., 2022; Pereira et al., 2020) have not jointly explored the formal structure or the interactions with control systems while focusing on performance in achieving strategic objectives.

In this sense, this study innovates by adopting a configurational approach, which considers that organizations have interrelated structures and practices (Fiss, 2007). Hence, the fuzzy-set Qualitative Comparative Analysis (fsQCA) was adopted. This methodology is well suited for dealing with complex problems and relationships between variables that are not always linear (Betarelli & Ferreira, 2018).

The results of this investigation can provide useful insights for the academic debate, contributing to a broader understanding of the relationship between risk management and organizational performance, a relationship that is neither direct nor linear. Unlike econometric methods, fsQCA offers a configurational understanding of organizations and does not focus on estimating the effects of one variable on another (Carmona et al., 2016; Fiss, 2007).

In terms of practical contributions, this study sheds light on the process of implementing risk management in Brazilian federal universities, helping to explain how this approach permeates the work activities of these organizations and connects to existing control systems, including internal controls (INTOSAI, 2007) and managerial controls (Soin et al., 2014).

2 Literature Review

2.1 Risk management and its adoption by federal higher education institutions

All organizations are exposed to some type of risk in fulfilling their mission, including non-profit organizations such as public universities (Al-Subari et al., 2020). These institutions face "strategic, operational, financial, compliance, and especially reputational risks" (translated from the original) (Pereira et al., 2020, pp. 165-166; Narayan & Kommunuri, 2021). In addition to these, they are subject to political risks and to challenges related to management, leadership, and interaction with students (Khaw & Teoh, 2023).

Changes in the current Brazilian landscape reinforce the importance of adopting good governance practices, as well as risk management. Public universities, in particular, have been challenged to reconcile scarce budgetary resources with the need to maintain and expand their infrastructure, given the growing demand from students (Medeiros et al., 2020). This situation is further aggravated by the unpredictability resulting from budget cuts (Yokoyama, 2018; Soobaroyen et al., 2019). In this context, risk management emerges as a mechanism capable of contributing to the improvement of the decision-making process, promoting more rational actions in the use of public resources (Nunes et al., 2022).

The concept of risk is associated with uncertainty regarding events and outcomes. Thus, risk management is recognized as a governance tool used to support managers' choices and improve decision-making (Bracci et al., 2021), and it was incorporated into the public sector through managerial reform, which shifted the focus of this approach toward the effective delivery of services and accountability (Mahama et al., 2020).

Risk management aims to ensure, even if only reasonably, the achievement of objectives in public sector entities. This is enabled through the recognition of risks that permeate the organizational environment, as well as existing uncertainties and vulnerabilities, along with an understanding of how such risks can affect the entity's performance (Mahama et al., 2020; COSO, 2017).

As risks are identified and assessed, treatment measures can be adopted to mitigate their effects. This process allows for a more appropriate sizing of internal controls, directing efforts toward areas where risks have a higher probability of occurrence and impact. In this way, entities can anticipate risks and prioritize preventive strategic actions more effectively (Andersen & Sax, 2019). Furthermore, strategic risk management allows for the recognition of potential events that may affect the organization—whether negative or positive, such as opportunities for value creation—thereby reducing unwanted surprises and fluctuations in performance and enhancing results (COSO, 2017).

According to COSO (2017), risk management encompasses a set of principles that should guide processes within an organization. Its scope extends beyond the sphere of internal control, incorporating elements such as strategy formulation, governance, communication with stakeholders, and the evaluation of organizational performance, thereby supporting decision-making through a logical and systematic process (Alsharari, 2022).

Risk management, implemented through different techniques, can contribute to identifying uncertainties and understanding the source of risks arising from the internal and external environment (ABNT, 2018), allowing risks to be managed and kept within acceptable limits (organizational risk appetite) (COSO, 2004). Although risks cannot be completely eliminated, they can be reduced through the use of formal risk management tools—such as risk inventories, risk maps and matrices, risk assessment and response reports—and through the use of frameworks, which offer a standardized structure that serves as an implementation guide for risk management (Hinna et al., 2018).

Among the existing frameworks are COSO-ERM (Enterprise Risk Management) and the ISO 31000 standard, which offer a conceptual structure with guidelines and principles applicable to any type of organization for developing more effective risk management processes (Mahama et al., 2020).

In Brazil, risk management is regulated within the scope of the Federal Executive Branch through Joint Normative Instruction No. 1/2026 of the Ministry of Planning, Development and Management (MPDG) and the Office of the Comptroller General (CGU) (Brazil, 2016), in conjunction with Decree No. 9,203/2017 (Brazil, 2017) (Araújo & Gomes, 2021; Souza et al., 2020). These regulations demonstrate the influence of the COSO-ERM framework and the ISO 31000 standard (Souza et al., 2020), which have become established as international reference models (Christopher & Sarens, 2015; Palermo, 2014).

Despite the regulatory framework, the implementation of risk management in the context of Higher Education Institutions (HEIs) faces challenges, such as the deficient application of risk management policies, the lack of involvement of boards and administrators, financial constraints, and a predominantly internal-control and audit focus, to the detriment of the strategic perspective (Khaw & Teoh, 2023; Tamrat & Teferra, 2020; Yokoyama, 2018). These limitations can compromise the effectiveness of risk management. On the other hand, when effectively implemented, this practice can bring several benefits, including improved service delivery through process optimization; increased efficiency and effectiveness of operations supported by adequate internal controls (Christopher & Sarens, 2015; 2018); support for achieving strategic objectives (Al-Subari et al., 2021); error reduction and enhanced compliance; more efficient use of public resources (Alves et al., 2017); and a strengthened decision-making process, making it more evidence-informed (Nunes et al., 2022).

Due to its comprehensive nature, risk management is recognized as a strategic management control system (Andersen & Sax, 2019; Mikes, 2009; Mikes & Kaplan, 2013), as it complements traditional forms of control. Its practices, processes, and tools interact with other management controls (Arena et al., 2017), permeating both the strategic and managerial levels (Soin et al., 2014) and broadening the scope of these systems by introducing new risk-focused control practices (Bracci et al., 2021; Rana et al., 2019). Furthermore, risk management interacts with other existing controls, such as performance measurement, planning, and project management (Mikes, 2009; Mikes & Kaplan, 2013; Rana et al., 2019). However, this interaction does not always occur in an integrated manner, which would represent the ideal configuration (Arena et al., 2017).

The importance of this interaction between risk management practices and other management controls is highlighted by Kominis et al. (2022), who emphasize that interactive controls are relevant for effective risk management because they allow for the reconciliation of top-down and bottom-up assessments, facilitating risk governance. These controls stem from dialogue at all organizational; levels, enabling the reporting of critical changes, uncertainties, and contingencies to decision-makers (Simons, 1995).

Information processing is facilitated by diagnostic controls, which is particularly significant in scenarios of risk and uncertainty, as it speeds up decision-making. The feedback generated by management control systems, through diagnostic controls, also supports the risk identification process. Thus, the levers of the management control system are considered facilitators of effective risk management, primarily by ensuring the necessary flow of information to monitor threats and opportunities (Mahama et al., 2020).

In summary, effective risk management enables organizations to enhance performance related to value generation and preservation (TCU, 2018a), while reducing negative surprises or fluctuations in performance (Pereira et al., 2020; COSO, 2017). Achieving this, however, requires effective implementation, which involves continuous learning and a gradual shift in organizational culture (TCU, 2018b; Sidorenko & Demidenko, 2017). Consequently, the maturity levels of risk management can vary among organizations, as noted by Beasley et al. (2015), depending on their organizational and cultural contexts, as well as the distinct characteristics of the implementation process and use of risk management frameworks (Mikes & Kaplan, 2013).

Characteristics associated with the maturity of risk management in organizations include effective support from senior management; the longevity of the risk management process; the adoption of interactive practices to address strategic risks, such as meetings and discussions for risk assessment and prioritization (Mikes & Kaplan, 2013); the active presence of risk committees; the existence of formal policies and implementation plans that guide the approach throughout the organization (Palermo, 2014); frequent updating of the risk inventory; leadership training; and formal oversight by board committees (Beasley et al., 2015; Mikes & Kaplan, 2013). Furthermore, the role of people in this process is emphasized, as they contribute significantly to the implementation of the guiding framework (Mikes & Kaplan, 2013).

2.2 The phenomenon of decoupling and its implications for risk management in the public sector

Over the past two decades, risk management has expanded from an approach centered primarily on financial risks to a broader managerial concept, establishing itself as a dimension of good governance and an instrument of legitimation. Several organizations have adopted formal risk management frameworks, such as COSO-ERM and the ISO 31000 standard, considered best practices, with the aim of projecting an image of well-managed organizations and demonstrating compliance. However, in the public sector, the implementation of risk management presents specific challenges arising from its particularities, such as conflicting demands, the involvement of multiple actors, and the politicized nature of its actions (Power, 2007; Power et al., 2009; Palermo, 2014).

Although regulatory and professional initiatives propose generic risk management models applicable to different types of organizations, public entities require specific tools that address their inherent complexity (Palermo, 2014). More flexible arrangements, adapted to organizational idiosyncrasies, tend to have greater managerial relevance (Arena et al., 2017).

However, practices such as risk management, often introduced in response to coercive pressures (norms and recommendations from regulatory bodies), mimetic pressures (the adoption of reference models used in other organizations), or normative pressures (influences from professional bodies) (Alsharari, 2022), can become more symbolic than substantive, primarily aimed at gaining legitimacy (DiMaggio & Powell, 1983; Jemaa, 2022). This dynamic reinforces the institutional paradox described by Meyer and Rowan (1977), according to which organizations tend to adopt formal structures to meet environmental pressures and gain legitimacy, even when such structures are not effectively incorporated into organizational practices.

In light of institutional theory, the phenomenon of decoupling occurs when there is a disconnection between the formal structure adopted and the organization's actual practices. In the context of risk management, this manifests itself when plans, policies, and risk matrices are developed solely to meet legal and accountability requirements, without being integrated into organizational processes or having a substantive impact on decision-making (Palermo, 2014). Such dissociation limits the effectiveness of risk management, reducing it to a mere formal exercise incapable of achieving the expected results, and signals the projection of "façade" structures that do not alter work activities, internal practices, and routines, potentially producing inconsistent outcomes (Jemaa, 2022).

For risk management to effectively support the achievement of organizational objectives, its policies and formal procedures must be aligned with the institution's actual practices. When implemented effectively, risk management introduces new practices and processes and simultaneously interacts with existing control systems (Bracci et al., 2021), as it is not an isolated activity or dissociated from other organizational operations (Hinna et al., 2018).

2.3 Performance measurement in federal universities

Performance measurement has become a key component of risk management, as it enables the monitoring of organizational results and provides useful feedback for risk identification (Mahama et al., 2020). Understanding how organizational performance is affected by risks is one of the foundational elements of risk management (COSO, 2017).

Performance measurement is included among diagnostic management controls, allowing the quantification of the efficiency and effectiveness of organizational actions (Neely et al., 1995). These principles gained strength in public entities with the advent of public management reform. This reform, in turn, influenced the dynamics of the educational system by introducing new arrangements and management mechanisms (Araújo & Pinheiro, 2010; Wang, 2010), bringing with it a stronger focus on results and an emphasis on measuring institutional performance.

Understanding the importance of performance measurement within Federal Higher Education Institutions (FHEIs), the Brazilian Federal Court of Accounts (TCU), through Decision No. 408/2002 TCU-Plenary, established the mandatory development of a series of performance indicators and determined that these should be presented in the institutions' management reports, aiming to strengthen accountability and public transparency (Pessôa et al., 2018). Accordingly, indicators were created to measure efficiency, productivity, quality, and effectiveness. However, according to Oliveira & Turrioni (2006), these indicators still do not clearly capture the institutions' actual performance or needs, due to the inherent complexity of evaluating higher education.

In this sense, the structure proposed by Wang (2010) for a more strategic performance measurement in universities is based on two dimensions closely linked to institutional objectives: the academic dimension and the managerial dimension. The academic dimension, which is central to a university's mission, encompasses teaching and research, while the managerial dimension supports these activities by incorporating two essential resources related to institutional capabilities—human and financial resources.

According to Wang (2010), academic performance can be evaluated by teaching-related criteria—such as course variety, faculty quality, student diversity, graduate employability, and retention rates—and by research, including investments, publications, citations, awards, patents, and presence in international rankings. In the managerial sphere, human resource indicators stand out, such as faculty qualifications, human capital, investments in training, and employee satisfaction. In the financial dimension, the evaluation involves the diversity of funding sources, revenues from research and university services, as well as indicators of both short- and long-term financial position.

The previous discussion indicates that performance evaluation in universities requires a multidimensional approach, capable of reflecting the breadth of their objectives and responsibilities, both academic (teaching, research, outreach, innovation, and student support) and managerial (financial, budgetary, and human resources).

Regarding the relationship between organizational performance and risk management, although the latter is recognized as a tool capable of supporting the achievement of strategic objectives and contributing, among other aspects, to improvements in the performance of higher education institutions (Al-Subari et al., 2021; Sum & Saad, 2017), it is important to emphasize that this relationship is complex and indirect. Its effects are difficult to quantify, as the outcomes of the decision-making processes concerning risks and controls may be intangible or become perceptible only in the long term, particularly when associated with reductions in adverse events (ACCA, 2019). Preventive actions, for example, can be adopted to mitigate risks that may or may not materialize in the future, which makes it difficult to immediately measure the impact of risk management. Furthermore, organizational performance is influenced by multiple factors, which reinforces the complexity of this relationship.

The study by Al-Subari et al. (2021) provided significant evidence of the effectiveness of risk management. They demonstrated that an effective risk management process has the potential to support senior university management in making more assertive decisions and improving institutional performance across the academic (teaching and research) and managerial (human and financial resources) dimensions.

On the other hand, Nunes et al. (2022), who analyzed risk management in 63 Brazilian federal universities, found no evidence of a significant influence of risk management on efficient academic management. They argue that this result was associated with limitations in the indicator used to measure risk management, which did not have a direct relationship with the universities' core activities—teaching, research, and outreach activities. According to Andersen and Sax (2019) and Pereira et al. (2020), the relationship between risk management and organizational performance is neither direct nor linear, which may explain the inconclusive or contradictory findings reported in previous empirical studies.

This characteristic, in turn, imposes methodological challenges for measuring this relationship, while also creating room for further investigations that more robustly explore how risk management is linked to organizational performance in public universities.

To address this gap, the present study adopts a differentiated methodological approach through fuzzy-set Qualitative Comparative Analysis (fsQCA). In Brazil, this approach is still in its early stages, but it is promising, especially in the social sciences, which deal with complex problems and with relationships between variables that are not always linear (Betarelli & Ferreira, 2018). fsQCA is a method that does not focus on estimating the effects of one variable on another (Woodside, 2013); instead, it analyzes combinations of conditions (causal configurations), seeking to identify the pathways through which a given outcome occurs (Carmona et al., 2016).

3 Methodological Procedures

3.1 Study design, population, and sample

Given the overall objective established for this investigation—to analyze how risk management is configured to support performance in achieving strategic objectives in Brazilian federal universities—this study aimed to analyze organizational configurations, describe the characteristics of the phenomenon, and establish relationships between the variables.

Hence, evidence of the formal implementation of risk management was examined, as well as the maturity level of the practices adopted and the alignment of internal control systems, considering the interrelationship between these governance mechanisms (internal controls and risk management). Furthermore, the interaction of risk management with other managerial controls was investigated. However, the core of the investigation was to understand the association between risk management and performance in achieving strategic objectives in the context of federal universities.

The qualitative and quantitative approaches were integrated in a complementary manner to enhance the interpretation and validation of the results. Regarding the data collection strategy, a survey and documentary research were employed.

The population comprised 69 federal universities, according to information available on the Ministry of Education's (MEC) website. Of these, five were created in 2018—the Federal University of Jataí (Goiás), the Federal University of Catalão (Goiás), the Federal University of Rondonópolis (Mato Grosso), the Federal University of Agreste de Pernambuco (Pernambuco), and the Federal University of Delta do Parnaíba (Piauí). In 2019, the Federal University of Northern Tocantins (Tocantins) was also created. As newly established institutions, these universities are still in the process of structuring their internal regulations and maturing their management practices; therefore, they were not included in the scope of this investigation. Consequently, only the 63 established federal universities were considered.

As part of the ethical protocol, consent was requested from the institutions to conduct the research, in accordance with the recommendations of the Institutional Review Board. The requests were submitted through the Fala BR Portal, and in some cases, by email, resulting in 46 consent forms. However, the final sample comprised 35 universities from different regions of Brazil that agreed to participate and completed the questionnaire. The institutions included were distributed as follows: 13 from the Northeast; 8 from the Southeast; 6 from the South; 4 from the Central-West; and 4 from the North.

Observing the distribution of universities by geographic region, it is clear that the research sample included institutions from all Brazilian regions. From a size perspective—based on the equivalent number of undergraduate students, an indicator proposed by the TCU (Brazilian Federal Court of Accounts) and frequently used in studies involving federal universities (Araújo, Lins & Diniz, 2022)—the sample demonstrated heterogeneity, as it included institutions of various sizes. The average number of undergraduate students was 17,615, with a minimum of 4,421 and a maximum of 41,862. These figures indicate that size is one of the distinguishing characteristics of the universities investigated.

3.2 Data collection and variables

The research data were collected using an electronic questionnaire validated by eight experts in management control systems and three experts in risk management. These specialists were selected based on the following criteria: a) authors of articles published in indexed journals, holding a doctoral degree; and b) professors who had served on master's or doctoral thesis committees addressing topics related to risk management, also holding a doctoral degree. Subsequently, the questionnaire underwent a pre-test with two internal auditors from a federal university, both with more than 11 years of professional experience in the public sector.

At the end of the validation process, the data collection instrument consisted of 40 items, distributed into three blocks, covering the following aspects: i) demographic and functional information of the respondents; ii) evaluation of the internal control system (ICS) and the maturity of risk management; and iii) evaluation of the extent to which management control systems (MCS) are used.

The items used to assess the ICS were developed based on widely recognized frameworks. The primary reference was the Internal Control – Integrated Framework (ICIF) issued by COSO (2013), which defines internal control according to five integrated components and 17 principles aimed at achieving objectives related to operations, reporting, and compliance. Additionally, some items were also informed by the COSO-ERM framework (COSO, 2017), since, despite their different approaches, the two models share several convergent aspects (COSO, 2013).

Similarly, the items designed to assess the extent to which management control systems (MCS) are used were based on the framework proposed by Simons (1995), widely applied in management research and considered useful for providing a more comprehensive understanding of an organization's risk appetite, drawing on the notions of risk subordinated to the different levers of control (Vasileios & Favotto, 2021). In addition, studies by Widener (2007) and Marcelino (2019) were considered, as they underscore the relevance of this framework.

The empirical validity of the set of variables used in the research was assessed through Confirmatory Factor Analysis (CFA), along with reliability measures such as Ordinal Alpha and the Construct Reliability Coefficient (CR) (Hair, Black, Babin, Anderson & Tatham, 2009).

The questionnaires were developed using Google Forms® and sent by email to the 46 institutions that consented to participate. The target audience consisted of managers responsible for risk management at the strategic and operational levels of governance (Christopher & Sarens, 2015). To identify these actors, the composition of the risk management committees was mapped to determine the main participants within Brazilian federal universities. These committees typically included the institution's highest authorities (rector or vice-rector); pro-rectors or deans; as well as directors, superintendents, coordinators, advisors linked to the rector's office, ombudspersons, and other members, depending on each institution's structure. Data collection was carried out over a three-month period, from June 1, 2023 to August 31, 2023. Table 1 presents the set of variables.

The ICS and MCS constructs were assessed by asking the respondents to report their level of agreement with the items, which were rated on a 5-point Likert scale, ranging from 1 – "strongly disagree" to 5 – "strongly agree". The only exception concerned the evaluation of MCS within the diagnostic controls dimension, where the Likert scale ranged from 1 – "very low extent of use" to 5 – "very high extent of use", reflecting the degree to which top management used performance measures.

Risk Management Maturity was assessed using the scale proposed by Beasley et al. (2015), composed of 3 dimensions: i) the stage of risk management development (5-point Likert scale); ii) the process of risk identification and reporting through formal reports (4-point Likert scale); and iii) the supervision of risk management by the board or senior management (5-point Likert scale). The sum of the scores across these three dimensions yields the Risk Management Maturity score (GR_MAT_T), which can range from 3 to 14 points.

Table 1

Detailed description of the constructs, variables, and items in the questionnaire

Constructs	Dimensions	Variables	Items	References
Internal Control System (ICS)	Control environment	SCI_AC	1 a 5	Coso (2013; 2017)
	Risk identification/assessment	SCI_ID	6 a 12	
	Control activities	SCI_ACO	13 a 15	
	Information and communication	SCI_IC	16 a 19	
	Monitoring	SCI_MO	20 a 22	
Risk Management Maturity (GR_MAT_T)	Risk management development	GR_MAT1	23	Beasley et al. (2015)
	Current implementation stage	GR_MAT2	24	
	Supervision by the board or committee	GR_MAT3	25	
Management Control Systems (MCSs)	Belief system	SCG_SC	26 a 29	Widener (2007); Marcelino (2019); Simons (1995)
	Boundary system	SCG_SL	30 a 33	
	Diagnostic controls	SCG_CD	34 a 37	
	Interactive controls	SCG_CI	38 a 40	

Source: developed by the authors (2023).

In addition to electronic questionnaires, documentary sources were used to gather information on university characteristics, the risk management implementation process, and institutional performance. University websites were reviewed to identify documents such as risk management policies; ordinances establishing risk committees; minutes of committee meetings; risk management implementation plans or guides; management reports; institutional performance indicators; and other documents relevant to the research topic. The collected information was then organized in Microsoft Excel® spreadsheets to construct the framework of research variables.

The proxies used as evidence of risk management implementation are presented in Table 2.

Table 2

Variables used as evidence of risk management implementationco

Variables	Analysis Dimensions	Assessment	References
GR_COMIT	Existence of a risk committee	1 = Yes 0 = No	Sum and Saad (2017); Beasley et al. (2015); Christopher and Sarens (2015); Mikes and Kaplan (2013); Palermo (2014)
GR_POL	Existence of a risk management policy		
GR_PLAN_MET	Adoption of an implementation plan and/or risk management methodology		
GR_TEMP_ IMPL	Duration of Risk Management Policy Implementation	Years	
GR_ATUCO	Committee Activities	No. of meetings/year	

Note: The activities of the risk committees were evaluated based on the meeting minutes published in 2022..

Source: developed by the authors (2023).

Table 3 presents the variables selected for evaluating university performance.

Table 3

Performance indicators selected for the research

Variables	Indicators	Source	References
DESEMP_ENS	Full-time students / Equivalent number of faculty members	Management Reports	Wang (2010); Alvarenga & Ohayon, (2021); Soares et al. (2019).
DESEMP_PES	Score in the Times Higher Education (THE) World University Rankings	THE Portal	
DESEMP_FIN	Own-source Revenues Collected / Total Discretionary Budget	Federal Treasury Information System (Tesouro Gerencial)	
DESEMP_RH	Faculty Qualification Index (IQCD)	Management Reports	

Note: THE score concerns the 2023 ranking.

Source: developed by the authors (2023)..

University performance was assessed considering that performance can be measured to the extent that a university's essential roles—academic and management—remain aligned with its institutional objectives (Wang, 2010). Academic performance is associated with teaching and research, the core activities of universities. Managerial performance, in turn, encompasses human and financial resources, which are key elements of university management (Wang, 2010). Thus, university performance was evaluated from both the academic (teaching and research) and managerial (human resources and financial resources) perspectives.

The teaching dimension was evaluated using the ratio of full-time students to equivalent faculty members (ALU/PROF), as suggested by the TCU (2022). This indicator is associated with productivity (Soares et al., 2019). The research dimension was measured using the score in the 2023 World University Rankings, published by Times Higher Education (THE), an indicator widely used as a reference in Brazilian and international studies. This score is comprehensive and reflects university performance across several categories: teaching, research, citations, industry income, and internationalization (Alvarenga & Ohayon, 2021; Vanz et al., 2018; Wang, 2010).

For the evaluation of human resources performance, the Faculty Qualification Index (IQCD) was used, which captures the qualification of human capital linked to the core activity of the institutions (TCU, 2022). This indicator reflects the effectiveness of human resources policies and practices (Wang, 2010).

Finally, financial performance was evaluated considering the relationship between own-source revenues collected and the total discretionary budget, using information obtained from the Tesouro Gerencial tool for the 2022 fiscal year. This indicator signals the capacity of universities to acquire additional sources of funding for their activities beyond those from the National Treasury. These sources consist of current revenues from research activities, rentals, administrative and educational services, information technology services, etc. Own-source revenues, in this case, can be an important source of funding for institutions, and they can increase them by striving to commercialize research results (Wang, 2010).

3.3 Data Analysis Method

Initially, Confirmatory Factor Analysis (CFA) was used to assess the validity of the constructs (internal control system, risk management maturity, and management control system), that is, the extent to which the observed variables represent their underlying latent constructs. For the application of CFA, the diagonally weighted least squares estimation method was used, because data from Likert scales are ordinal and generally do not exhibit normality.

The measures used to assess the fit of the CFA model were: chi-square (χ2), degrees of freedom (df), Standardized Root Mean Residual (SRMR), Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and Relative Non-Centrality Index (RNI) (Hair et al., 2009). Regarding the CFA procedures, convergent validity was verified by analyzing the standardized factor loadings of the items. According to Hair et al. (2009), standardized factor loadings should exceed 0.50 and are preferable when above 0.70.

In turn, the data were analyzed using Qualitative Comparative Analysis (QCA). QCA is based on set theory and Boolean algebra (Betarelli & Ferreira, 2018), and is considered a case-oriented approach within comparative configurational methods, as it aims to understand the complex configurations of conditions that lead to specific results (Fiss, 2007). Its focus is on understanding how results arise—that is, the causes of effects—by exploring necessary and sufficient conditions (Vis, 2012).

Among the techniques for operationalizing QCA, the fuzzy-set technique (fsQCA) was used in this study, as it allows researchers to explore the extent to which certain management practices are implemented within an entity, based on set membership scores obtained through the calibration process (Fiss, 2017). Thus, the technique offers strong potential for advancing the analysis of the phenomenon under investigation.

To analyze the configurations proposed in this research, the following conditions were considered: maturity of risk management; alignment of the internal control system; extent of use of management control systems; implementation time of the risk management policy; and existence of an implementation plan and/or methodology to guide risk management. In addition to these conditions, an organizational characteristic (size) was included, given the heterogeneity of the sample.

For the operationalization of fuzzy sets, qualitative anchors must be defined. This process is known as variable calibration. Anchoring points were established to calibrate the fuzzy sets: full membership (score 1, indicating a high degree of belonging to the set); no membership (score 0, indicating a low degree of belonging to the set), and the crossover point (score 0.5, indicating maximum ambiguity, that is, being "neither inside nor outside" the set) (Betarelli & Ferreira, 2018).

In the process of calibrating variables—which involves transforming the original scale into a fuzzy-set scale—the researcher must rely on external references (Woodside, 2013). Since the study uses subjective scales (based on perceptions), the use of relative scales for variable calibration is recommended, establishing scores based on percentiles (De Paula, Santos & Couto, 2023). As observed in previous studies, the 10^{th}, 50^{th}, and 90^{th} percentiles were used as references to establish the anchors of "no membership," "maximum ambiguity or crossover point," and "full membership," respectively (De Paula et al., 2023; Felício et al., 2021).

To aid in the interpretation of QCA results, two analytical measures are used: consistency and coverage (Ragin, 2008). These measures help identify conditions—or combinations of conditions—that are necessary or sufficient to achieve a given result. A condition is considered necessary if "all cases in which the result occurs share the presence of the condition" (Legewie, 2013, p. 9). If the condition is absent in at least one case, it is not considered necessary for the result (Betarelli & Ferreira, 2018). In turn, a condition is considered sufficient if, when present, it leads to the result (Schneider & Wagemann, 2010). If, in all cases, both the condition and the result are present (score 1 in both), this criterion is considered satisfied (Betarelli & Ferreira, 2018).

However, since not all cases adhere to a relationship of necessity or sufficiency, and some cases deviate from general patterns (Legewie, 2013), it is important to examine the fit indicators, namely the measures of consistency and coverage. According to Marx et al. (2014, p. 127), "these measures allow researchers to assess the extent to which a model explains the results observed in the cases."

The consistency measure is used to assess the degree of agreement between cases that share a specific combination of conditions and the outcome (Viss, 2012, p. 187; Ragin, 2008). To assess the empirical importance of a consistent condition, the coverage measure is used, which indicates how much that condition (or configuration) contributes to a specific outcome (Marx et al., 2014) or, alternatively, its relevance to the outcome, reflecting the number of cases in which it is valid (Duşa, 2022). A researcher generally concludes that a model is informative when consistency is above 0.75 and coverage is between 0.25 and 0.65 (Ragin, 2008; Woodside, 2013). In this study, the QCA package in R was used to compute the consistency and coverage measures.

Finally, it is worth highlighting that the central tool for data analysis in QCA is the truth table. Since the ultimate goal of fsQCA is to analyze sufficiency relationships, it is through the truth table that one can identify which combinations of causal conditions are consistently associated with the result (Carmona et al., 2016). The truth table can also be logically minimized using the Quine-McCluskey algorithm. This procedure reveals the combinations of causal conditions that are minimally sufficient to achieve the desired result (Ragin, 2008), allowing for the logical reduction of the solution (Fiss, 2007). A solution represents a sufficient pathway for achieving the desired result.

It is up to the researcher to decide which solution to use in the study, among the three existing types: the parsimonious solution, the intermediate solution, or the complex solution. The parsimonious solution considers logical remainders to derive the simplest possible solution. The intermediate solution incorporates the so-called easy counterfactual remainders, which represent redundant conditions for the outcome, as they are peripheral elements. Finally, the complex solution—which is more conservative—considers only combinations that have occurred empirically and therefore makes no statements about unobserved situations (Betarelli & Ferreira, 2018; Carmona et al., 2016). In this study, the complex solution was analyzed, as it is the most conservative and relies exclusively on empirically observed evidence (Betarelli & Ferreira, 2018; Carmona et al., 2016).

4 Presentation and Discussion of Results

4.1 Evidence of the formal implementation of risk management

To identify characteristics of the formal risk management implementation process in federal universities, a survey of information and documents available on their respective websites was conducted. Formalization was verified through the following aspects: i) the existence of a responsible committee; ii) the presence of an institutional risk management policy; iii) the adoption of an implementation plan, guide, or methodology; iv) the implementation time of the risk management policy; and v) the annual frequency of risk management committee meetings.

The analysis revealed that, in 2022, 31 universities had a risk management policy, although only 27 had formalized plans or guidelines. All the institutions investigated had established risk management committees. The average implementation time of the risk management policy was just over two years, ranging between newly established policies (up to 1 year) and those with longer periods in force, consistent with the deadline established in Joint Normative Instruction MP/CGU No. 1/2016.

Regarding the committees' activities, the average was two meetings per year, with wide variation among universities and a lack of published meeting minutes in 13 cases. Overall, the findings indicate that most institutions align with best practices and current regulations, although differences in implementation time and committee activity may reflect varying levels of risk management maturity.

4.2 Confirmatory factor analysis of the constructs

To assess the fit of the constructs listed in Table 1, Confirmatory Factor Analysis (CFA) was used.

The analysis of the factor loadings indicated that some items in the questionnaire were not consistent in measuring the dimensions under analysis. This issue occurred in both the ICS construct and the MCS construct. Nine items were excluded to make the necessary adjustments. It is worth noting that the "Boundary system" dimension, which belonged to the MCS construct, was completely excluded. Furthermore, the "control activities" dimension was grouped with the "monitoring" dimension in the ICS construct.

After adjustments, the scales proved adequate for measuring the constructs. The proposed model presented 31 observable variables (m = 31) and 35 subjects in the sample (n = 35). Based on a comparison of the estimation results obtained with the parameters recommended by Hair et al. (2009), the results indicated good model fit, considering characteristics such as sample size and number of observed variables (χ^2/df = 1.12; CFI = 0.976; TLI = 0.972; RNI = 1.000; RMSEA = 0.058), as shown in Table 4.

Table 4
Model Fit Statistics

Statistics	Model Fit Indicators
χ^2	453,008*
df	406
χ^2/df	1,12
CFI	0,976
TLI	0,972
RNI	1,000
SRMR	0,110
RMSEA	0,058

Note: *Statistical significance: p-value = 0.053. χ2 = chi-square; df = degrees of freedom; χ^2/df = chi-square to degrees-of-freedom ratio; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RNI = Relative Non-Centrality Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation.

Source: Research data (2023).

Analyzing the standardized factor loadings, it was observed that all values exceeded 0.50, and most were greater than 0.70 (26 out of 31 items). The Average Variance Extracted (AVE) was above 0.50 in each of the dimensions analyzed, indicating good convergent validity, as shown in Table 5.

Table 5

Factorial loadings, Ordinal Alpha, CR and AVEE

Constructs	Dimensions	Variables	Factor loading	Alpha Ordinal	Construct Reliability	Average Variance Extracted
INTERNAL CONTROL SYSTEM	Control environment	SCI_AC1	0.644	0,844	0,833	0,570
		SCI_AC2	0,724			
		SCI_AC3	0,734			
		SCI_AC4	0,732			
		SCI_AC5	0,915			
	Risk identification/ assessment	SCI_ID1	0,733	0,826	0,787	0,549
		SCI_ID2	0,837			
		SCI_ID3	0,600			
		SCI_ID4	0,772			
	Control activities and monitoring	SCI_ACMO1	0,625	0,895	0,886	0,664
		SCI_ ACMO2	0,933			
		SCI_ ACMO3	0,773			
		SCI_ ACMO4	0,828			
		SCI_ ACMO5	0,881			
	Information and communication	SCI_IC 1	0,723	0,849	0,831	0,612
		SCI_IC 2	0,798			
		SCI_IC 3	0,819			
		SCI_IC 4	0,785			
RISK MANAGEMENT MATURITY		GR_MAT1	0,672	0,861	0,806	0,645
		GR_MAT2	0,802			
		GR_MAT3	0,916			
MANAGEMENT CONTROL SYSTEM	Belief system	SCG_SC1	0,898	0,834	0,844	0,720
		SCG_SC2	0,638			
		SCG_SC3	0,973			
	Diagnostic control system	SCG_CD1	0926	0,960	0,944	0,886
		SCG_CD2	0,924			
		SCG_CD3	0,946			
		SCG_CD4	0,970			
	Interactive control system	SCG_CI1	0,878	0,931	0,899	0,819
		SCG_CI2	0,938			
		SCG_CI3	0,897			

Source: Research data (2023).

Regarding reliability, it was analyzed whether the Ordinal Alpha and Construct Reliability (CR) presented values greater than 0.70, as recommended by Hair et al. (2009). The tests indicated that the reliability criterion was met, as the Ordinal Alpha was greater than 0.80 in all dimensions, and the Construct Reliability indicator was greater than 0.80 in most dimensions, reaching the threshold only in the risk identification and assessment dimension (0.787).

4.3 fuzzy-set Comparative Qualitative Analysis (fsQCA)

Based on the fsQCA framework, this study examined the relationships between the performance of federal universities and the following conditions: risk management maturity; alignment of the internal control system; extent of use of management control systems; risk management policy implementation time; the adoption of an implementation plan and/or methodology to guide risk management; and organizational size. The performance dimensions analyzed encompassed the main areas aligned with the universities' objectives: teaching, research, human resources, and financial resources (Wang, 2010).

As part of the fsQCA method, the condition and outcome scores were converted into fuzzy data through the calibration process (described in section 3.3). To perform this step, the tabulated spreadsheet data were imported into R, and the calibrate function from the QCA package, developed by Duşa (2018), was used. The calibration of the fsQCA variables was performed based on the following membership anchors: "no membership to the set" (fuzzy value of 0), "crossover point" (fuzzy value of 0.5), and "full membership to the set" (fuzzy value of 1), corresponding to the 10^{th}, 50^{th}, and 90^{th} percentiles, respectively. For example, the Risk Management Maturity variable (GR_MAT_T) was calibrated as follows: raw data ≤ 6, fuzzy value of 0; raw data equal to 9, fuzzy value of 0.5; raw data ≥ 12, fuzzy value of 1. This procedure was adopted for all the other variables in the study. After the calibration process was completed, fuzzy values were obtained for each condition and for the outcome.

The roadmap for the fsQCA analyses followed this order: i) construction of the truth tables; ii) analysis of the combinations of necessary and sufficient conditions for the outcome; iii) performing Boolean minimization; iv) presentation of the results of the conservative solution; and v) interpretation of the results.

4.3.1 Analysis of necessary and sufficient conditions

In QCA, a necessary condition is defined as one that is present in all cases in which the outcome occurs. This means that the condition is indispensable for the outcome to occur (Dusa, 2022).

Based on the analysis of the conditions necessary for the results to be achieved, evidence was found confirming the existence of conditions that, individually, proved important for supporting high performance in universities. The main one was the presence of an implementation plan and/or a risk management methodology, which appeared whenever the result was observed and across all performance dimensions analyzed (teaching, research, human and financial resources). This finding highlights the importance of explicit guidelines that outline how risk management should be developed and how managers should assess the impact of risk events (Beasley et al., 2015). Furthermore, adopting a structured plan contributes to the evaluation of the effectiveness of risk management by supporting the monitoring of its progress and the critical analysis of any deviations (ABNT, 2018).

Size was another condition that proved necessary for the presence of results, particularly in the performance dimensions related to research and financial resources. The results confirmed that size is an influential factor and should be considered in performance analyses of universities, as highlighted by Soares et al. (2019). In this sense, larger institutions tend to produce research with greater impact and, consequently, achieve international visibility. These institutions also demonstrated a greater capacity for generating their own revenue. As Wang (2010) points out, financial resources support an organization's operational capacity; thus, universities with diversified funding sources can use these resources to finance their activities and fulfill their academic purposes.

Furthermore, risk management maturity has also proven to be an important condition for supporting high performance in universities, but only in the teaching dimension, whose indicator is related to productivity. In this sense, Chen et al. (2019) highlight that one of the factors that supports the maturity of risk management is organizational culture. The introduction of a risk culture, through codes of ethics, policies, and appropriate procedures, is important for promoting efficiency objectives and enhancing productivity in universities.

Table 6 presents the conditions necessary for the outcome, with consistency indicators above 0.75 (the threshold parameter).

Table 6

Necessary conditions by performance dimensions

Performance Dimensions	Conditions					
	GR_PLAN_MET		TAM		GR_MAT_T	
	Consistency	Coverage	Consistency	Coverage	Consistency	Coverage
Teaching	0,873	0,557			0,789	0,687
Research	0,837	0,489	0,825	0,738		
Human Resources	0,828	0,596				
Financial Resources	0,819	0,508	0,822	0,781		

Note: GR_PLAN_MET indicates that an implementation plan and/or a methodology was adopted to guide risk management; TAM indicates Size; GR_MAT_T indicates risk management maturity.os.

Source: Research data (2023).

Table 7 identifies the combinations of conditions sufficient for the result, considering the dimensions of teaching and research. A minimum of two cases per configuration was established as a criterion, along with a consistency indicator above 0.75. The configurations that received output "1" are those that achieved the expected result, based on the consistency parameter. The other configurations received output "0".

Table 7

Analysis of the sufficient conditions for high performance in teaching and research.

Conditions	Teaching performance						Research performance		
	Configurations						Configuration		
	64	60	31	40	43	56	64	60	56
GR_MAT_T	1	1	0	1	1	1	1	1	1
MED_SCI	1	1	1	0	0	1	1	1	1
MED_SCG	1	1	1	0	1	0	1	1	0
GR_TEMP_IMPL	1	0	1	1	0	1	1	0	1
GR_PLAN_MET	1	1	1	1	1	1	1	1	1
TAM	1	1	0	1	0	1	1	1	1
No. of cases	**4**	**3**	**2**	**2**	**2**	**2**	**4**	**3**	**2**
Consistency	**0,95**	**0,92**	**0,76**	**0,80**	**0,83**	**0,78**	**0,97**	**0,84**	**0,83**

Note. GR_MAT_T indicates risk management maturity; MED_SCI indicates alignment of the internal control system; MED_SCG indicates the extent to which managerial control systems are used; GR_TEMP_IMPL indicates the length of time the risk management policy has been implemented; GR_PLAN_MET indicates the existence of an implementation plan and/or a methodology to guide risk management; TAM indicates size.

Source: Research data (2023).

In the analysis of results, six configurations appear to be consistent with high performance in teaching (productivity). These configurations, identified by codes 64, 60, 31, 40, 43, and 56, found empirical evidence in 15 universities. Only three configurations were consistent with high performance in research (participation in international rankings). These configurations, identified by codes 64, 60, and 56, found empirical evidence in nine universities.

Configuration 64 showed the highest consistency indicators in the two performance dimensions analyzed (0.95 and 0.97, respectively), representing larger universities with a higher level of maturity in risk management, an aligned internal control system, and greater extent of use of management control systems. Furthermore, these institutions have had a risk management policy implemented for a longer period and have adopted an implementation plan and/or methodology to guide risk management. Empirical evidence was found in four cases.

Configuration 60 also proved to be consistently associated with achieving the desired outcome in both performance dimensions, with empirical evidence in three cases. It differs from the previous configuration by the absence of the condition related to the implementation time of the risk management policy, indicating that this policy was recently instituted in these institutions.

Configuration 40, which has empirical evidence in two cases, is composed of larger universities that have a higher level of maturity in risk management and a risk management policy that has been implemented for a longer time. These are institutions that have adopted an implementation plan and/or methodology to guide risk management, but have a less aligned internal control system and demonstrate a less extensive use of management control systems.

There are also larger universities that presented all the conditions investigated in the research, with the exception of the extent of use of management control systems, as seen in configuration 56, which has empirical evidence in two cases.

When analyzing the different configurations, it was also found that there are smaller universities that do not have mature risk management, but do have an aligned internal control system and all the other conditions investigated in the research (configuration 31). In addition, there are universities where risk management shows maturity, but the internal control system did not demonstrate alignment, and their risk management policies were recently instituted (configuration 43).

Table 8 presents the combinations of conditions sufficient for the outcome, considering the dimensions of human and financial resources.

Table 8

Analysis of the conditions necessary for high-performance results in human and financial resources

Conditions	Human Resources Performance							Financial Resources Performance						
	Configurations							Configurations						
	64	60	63	7	31	43	56	64	60	7	31	40	55	56
GR_MAT_T	1	1	1	0	0	1	1	1	1	0	0	1	1	1
MED_SCI	1	1	1	0	1	0	1	1	1	0	1	0	1	1
MED_SCG	1	1	1	0	1	1	0	1	1	0	1	0	0	0
GR_TEMP_IMPL	1	0	1	1	1	0	1	1	0	1	1	1	1	1
GR_PLAN_MET	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TAM	1	1	0	0	0	0	1	1	1	0	0	1	0	1
No. of cases	**4**	**3**	**3**	**2**	**2**	**2**	**2**	**4**	**3**	**2**	**2**	**2**	**2**	**2**
Consistency	**0,98**	**0,90**	**0,78**	**0,79**	**0,81**	**0,84**	**0,82**	**0,78**	**0,86**	**0,83**	**0,84**	**0,96**	**0,80**	**0,97**

Note. GR_MAT_T indicates risk management maturity; MED_SCI indicates alignment of the internal control system; MED_SCG indicates the extent to which managerial control systems are used; GR_TEMP_IMPL indicates the length of time the risk management policy has been implemented; GR_PLAN_MET indicates the existence of an implementation plan and/or a methodology to guide risk management; TAM indicates size.

Source: Research data (2023).

In the human resources dimension, seven configurations (64, 60, 63, 7, 31, 43, and 56) were found to be consistent with achieving high performance, with empirical evidence from 18 universities. In the financial resources dimension, seven configurations also proved consistent (64, 60, 7, 31, 40, 55, and 56), with evidence from 17 universities. It is worth noting that some of the configurations presented were also evidenced in the previous performance dimensions, indicating that they are consistently associated with various performance outcomes, with the exception of configurations 63, 7, and 55.

Note that configuration 64 in the human resources dimension showed the highest consistency (0.98), as in the teaching and research dimensions, with empirical evidence in four cases. In this configuration, all the conditions investigated in the research were observed. Another configuration that proved consistent was 63 (consistency of 0.78), with empirical evidence in three cases, comprising smaller universities with a higher level of maturity in risk management, that demonstrated alignment in their internal control systems and a greater extent of use of management control systems. In addition, these institutions have a risk management policy implemented for a longer time and have adopted an implementation plan and/or methodology to guide risk management.

Regarding the financial resources dimension, configuration 56 showed the greater consistency (0.97), with empirical evidence in two cases. It is composed of larger institutions, that demonstrated a higher level of maturity in risk management and an aligned internal control system, have a risk management policy implemented for a longer time, and have adopted an implementation plan and/or methodology to guide risk management. On the other hand, they demonstrated a lower extent of use of management control systems.

In general, the findings shed light on the multiple organizational configurations consistently associated with high performance in universities, indicating that risk management has proven adaptable to contingent factors, such as size, and to the particularities of each context (Mikes, 2009). Larger and more complex organizations with an equally complex risk profile are expected to present more extensive and formal risk management practices, as well as more formalized control procedures, to ensure the process functions properly (TCU, 2018). The configurations presented by the smaller universities, in turn, were different, as risk management was formalized but, in most cases, did not demonstrate maturity.

The findings of this research align with the notion of equifinality, according to which different institutional arrangements can lead to similar results, provided that the contingent factors of each organization are considered – as also evidenced by Felício et al. (2021) when analyzing the adoption of management control systems in the public sector. Furthermore, the findings reinforce that management controls do not operate in isolation, as discussed by Malmi and Brown (2008). From this perspective, it would be reductionist to examine individual practices, such as risk management, without considering their interdependence with other controls within a system, as argued by Grabner and Moers (2013).

4.3.2 Synthesis and interpretation of the fsQCA primary results

Given the multiple configurations observed, and aiming to reduce the number of conditions and observe only the most logically concise combinations associated with the desired outcome, a truth table minimization process was performed. Table 9 presents the results of the complex solution and the "recipes" that made the greatest contribution to the outcome, according to the gross coverage indicators.

Panel A of Table 9 presents the recipe adopted by larger institutions, which was consistently associated with high performance in the dimensions of teaching, research, human resources, and financial resources. These universities showed a higher level of risk management maturity, an aligned internal control system, and a greater extent of use of management control systems. Furthermore, they adopted an implementation plan and/or methodology to guide risk management. The implementation time of the risk management policy proved irrelevant to achieving the result, which is why this condition was omitted from the presented recipe. This recipe found empirical evidence in seven cases. The gross coverage indicator revealed that the presented conditions explain more than 30% of the contribution to the result in each of the analyzed performance dimensions.

Table 9
Combinations of conditions associated with high performance (complex solution)

Panel A – Larger universities			
Revenue	**Performance Dimensions**	**Consistency**	**Coverage**
GR_MAT_T*MED_SCI*MED_SCG *GR_PLAN_MET*TAM	Teaching	0,898	0,377
	Research	0,869	0,398
	Human Resources	0,909	0,337
	Financial Resources	0,743	0,320
Panel B – Smaller universities			
Revenue	**Performance Dimensions**	**Consistency**	**Coverage**
GR_MAT_T*~MED_SCI*MED_SCG* ~GR_TEMP_IMPL*GR_PLAN_MET*~TAM	Teaching	0,826	0,151
MED_SCI*MED_SCG*GR_TEMP_IMPL *GR_PLAN_MET*~TAM	Human Resources	0,790	0,240
~GR_MAT_T*MED_SCI*MED_SCG *GR_TEMP_IMPL*GR_PLAN_MET*~TAM	Financial Resources	0,844	0,156

Note. GR_MAT_T indicates risk management maturity; MED_SCI indicates alignment of the internal control system; MED_SCG indicates the extent to which managerial control systems are used; GR_TEMP_IMPL indicates the length of time the risk management policy has been implemented; GR_PLAN_MET indicates the existence of an implementation plan and/or a methodology to guide risk management; TAM indicates size.

Source: Research data (2023).

This analysis aligns with the findings of Huber's (2011) study, which suggests that differences in risk management among universities reflect their individual characteristics, such as size and visibility. Evidence suggests that larger, more visible universities, such as those participating in international rankings, tend to employ a wider range of control mechanisms to mitigate risks associated with governance failures (Huber, 2011), as these can compromise institutional image and reputation – aspects that are among the evaluation criteria for these rankings. In turn, mitigating reputational risks helps attract talent and partnerships, supporting cutting-edge research.

In this sense, the research findings highlight the concern of several universities with the formal implementation of risk management, the development of greater maturity in their practices, and the use of management control systems, as highlighted by Mahama et al. (2020), to monitor organizational results and identify risks so as to adopt corrective and mitigating measures. Additionally, the importance attributed by the institutions to the structuring of adequate internal control systems to deal with risks was also evident (Yokoyama, 2018).

Discussions confirm that size is an important contingent factor in the adoption of control mechanisms, which is consistent with Contingency Theory (Otley, 1980). Because it is associated with complexity, size influences the extent and diversity of risks faced by organizations (Andersen & Sax, 2019). The complexity of processes and risks requires that organizations establish a formal risk management structure, through policies, procedures, and controls that ensure a systematic and consistent process for identifying, assessing, and treating risks, including the use of appropriate internal controls (Subramaniam et al., 2011).

Since QCA is not probabilistic, it is also important to know the paths with lower coverage, as these serve as guidance on the organizational arrangements adopted by institutions (Invernizzi et al., 2020). This is the case for smaller universities, where gross coverage indicators had a limited capacity to explain the outcome. There were also no "recipes" for all the performance dimensions researched, due to the scarcity of empirical evidence.

Panel B of Table 9 indicates that the first recipe is consistently associated with high performance in the teaching dimension and is comprised of smaller universities that demonstrated a higher level of risk management maturity, showed a greater extent of use of management control systems, and adopted a risk management implementation plan and/or methodology. On the other hand, their risk management policies were recently established, and their internal control systems did not prove adequate for risk management.

The second recipe, which is consistently associated with high performance in the human resources dimension, is comprised of smaller universities that have formally implemented risk management through a policy established approximately four years ago, and have adopted an implementation plan and/or risk management methodology. These institutions presented an aligned internal control system and demonstrated a greater extent of use of management control systems. In this configuration, the maturity of risk management proved to be an indifferent condition for achieving the result.

The third recipe, which is consistently associated with high performance in the financial resources dimension, is comprised of smaller universities that formally implemented risk management through a policy established approximately three years ago and adopted an implementation plan and/or risk management methodology. These institutions presented an aligned internal control system and a greater extent of use of management control systems, but did not demonstrate mature risk management.

As observed in the configurations presented by the smaller universities, the level of maturity in risk management did not prove to be a fundamental condition for achieving the results, except in the teaching performance dimension. Other conditions stood out in the remaining dimensions, such as the establishment of a formal risk management structure through a risk management policy implemented, on average, for about three years, and the adoption of an implementation plan and/or risk management methodology. Furthermore, the alignment of the internal control system and the extent of use of management control systems were conditions that stood out in the performance dimensions related to human and financial resources.

Given these results, it is important to emphasize that the context of smaller institutions is unique and often reflects reduced operational capacity, as well as limitations in terms of competencies to implement managerial innovations such as risk management (Klein, 2020). In these cases, the implementation time of risk management proved to be a relevant condition, present in two of the three configurations analyzed. This aspect is fundamental for the consolidation and acceptance of a policy within the organizational culture, as this requires a diffusion movement throughout the institution.

Furthermore, the role of internal control systems, when aligned with risk management, is highlighted, regardless of the maturity level of the latter. According to COSO (2013), even less formal and structured internal control systems, such as those adopted by small institutions, can be effective and offer reasonable assurance for achieving organizational objectives.

Considering universities' size and the complexity of their processes, the results indicate that organizations can follow different paths and adopt distinct control practices to achieve high performance. These factors play a fundamental role in defining the formalization and scope of risk management practices, because, as Sidorenko and Demidenko (2017) state, organizations must adopt risk management structures that are proportionate to their characteristics and appropriate to their context.

5 Final Considerations

5.1 Primary contributions and findings

This study aimed to analyze how risk management is configured to support performance in achieving strategic objectives in Brazilian federal universities. Furthermore, it sought to analyze whether formal risk management policies and procedures were aligned with the institutions' actual practices, since risk management, when effectively implemented, introduces new practices and processes and simultaneously interacts with other existing control systems (internal and managerial controls).

Using a configurational approach, supported by fuzzy-set Comparative Qualitative Analysis (fsQCA), the following conditions were analyzed: risk management maturity; alignment of the internal control system; extent of use of management control systems; implementation time of the risk management policy; adoption of an implementation plan and/or methodology to guide risk management; and size of the organizations. The analysis of these aspects aimed to establish a connection with the performance of federal universities in the dimensions of teaching, research, human resources, and financial resources.

The results revealed different consistent configurations to support federal universities in achieving high performance in their strategic objectives, adapted to contingent factors such as size. The configurations highlighted that the establishment of a formal structure, through the adoption of an implementation plan and/or risk management methodology, the maturity of risk management, the alignment of internal control systems (their suitability for risk management), and the use of management control systems to support risk management (in monitoring performance and risks, as well as in disseminating a risk culture) are conditions associated with achieving high performance in larger universities. It was also observed that there are systematic variations in risk management, reflected both in the level of maturity and in the alignment of internal control systems, among institutions of different sizes.

The findings reinforce the notion of equifinality, according to which different combinations of practices and mechanisms can lead to similar results in terms of organizational performance, while also highlighting the complementarity between governance mechanisms. In the context of federal universities, both institutions with more consolidated risk management structures and those in an initial stage of maturity can achieve high performance in their strategic objectives, provided that they adopt arrangements appropriate to their specific conditions.

This finding is expected to draw the attention of regulators and oversight bodies, which frequently require the adoption of formal risk management structures but do not always consider the particularities and complexities of each organization (Black, 2005). The results reinforce that there is no single recipe applicable to all institutions; risk management needs to be adapted to the context and specificities of each entity.

In this sense, the findings also indicated that risk management already permeates work activities in some of the federal universities investigated, is incorporated into internal practices and routines, and is configured as a governance mechanism capable of supporting the achievement of strategic objectives. At the same time, it became evident that its effectiveness strongly depends on its interaction with other controls – notably internal and managerial control systems – which contribute to enhancing its effects and legitimizing its adoption in the university governance arrangement.

It is important to highlight, however, that the implementation of risk management in public universities occurs within a context marked by institutional pressures stemming from oversight bodies, regulatory requirements, social demands, and, in some cases, the pursuit of legitimacy. This scenario creates incentives for the formal adoption of risk management structures, even though, in certain cases, such practices do not fully translate into substantive changes in internal processes, resulting in decoupling. This problem deserves attention, since the effectiveness of risk management depends on its actual incorporation into the organizational culture and its alignment with existing control mechanisms.

This study is expected to contribute to the academic debate by demonstrating that risk management operates simultaneously with internal and managerial controls, integrating into the governance structure adopted by public universities, with the potential to support these organizations in achieving their objectives and increasing their capacity to generate and preserve value. The results suggest tangible and achievable benefits from adopting risk management practices, while also pointing to the limits of their effectiveness when they are dissociated from organizational culture and consistent governance practices.

Regarding practical contributions, the research results can alert the main actors responsible for risk management in federal universities, so that they can find alternatives to integrate risk management into existing control processes and systems, as well as promote an organizational culture that is aware of risks—relevant aspects for risk management to produce the expected effects.

This study advances the theory by empirically demonstrating the equifinality in risk management arrangements adopted in universities, challenging the "one-size-fits-all" perspective—that is, the idea of a single model applicable to all institutions—and offering a framework for analyzing the complementarity between different control systems. This reinforces the importance of understanding risk management as a contingent and systemic phenomenon, in which multiple paths and interactions can support the achievement of strategic objectives.

Finally, it is worth noting that, although risk management is a relevant practice, it is not the sole determinant of organizational performance, which is a multifaceted phenomenon influenced by several factors beyond the scope of this investigation. Furthermore, the relationship between risk management and organizational performance is complex and often indirect, making it difficult to measure its effects. This aspect helps explain why previous studies have found inconclusive or even contradictory results, as pointed out by Andersen and Sax (2019) and Pereira et al. (2020).

5.2 Limitations and agenda for future research

Although the findings and analysis presented robust evidence, it is important to note that the research is not deductive in nature and therefore does not allow for broad generalizations. The results should be interpreted with caution, as this study has some limitations. The first concerns the sample, which consists exclusively of Brazilian federal universities. While this delimitation enables a deeper understanding of the context of these institutions, it also restricts the generalization of the findings to other types of universities (state, private, or international), which may exhibit different governance and risk management arrangements. Future research could expand the scope of analysis by incorporating different institutional contexts to assess the robustness and comparability of the results.

Another limitation relates to the cross-sectional design and the time lapse between data sources, since the indicators were collected using 2022 as the baseline year, while the questionnaires were administered at the beginning of the following year. This time frame prevented the observation of how risk management evolved over time. Thus, longitudinal studies could provide additional evidence on the dynamics of implementation, consolidation, and maturity of risk management in universities.

Additionally, the use of performance proxies represents another limitation. Although these indicators are relevant and supported by the literature, they do not capture the full complexity inherent in evaluating higher education. Future investigations could incorporate complementary measures, such as innovation, social impact, institutional reputation, or stakeholder satisfaction, to broaden the understanding of the effects of risk management on multiple dimensions of value.

Finally, future research adopting qualitative approaches, such as case studies, is suggested to provide an in-depth understanding of how risk management practices translate into organizational routines, interact with other control mechanisms, and address the problem of decoupling. This perspective can enrich the configurational analysis presented in this study, providing a more comprehensive view of the effectiveness of risk management in complex contexts such as public universities.

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