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CONSELHO REGIONAL DE CONTABILIDADE DE MINAS GERAIS

MANAGEMENT CONTROL SYSTEMS AND INNOVATION MANAGEMENT: AN INVESTIGATION IN COOPERATIVE ORGANIZATIONS

SISTEMAS DE CONTROLE GERENCIAL E GESTÃO DA INOVAÇÃO: UMA INVESTIGAÇÃO EM ORGANIZAÇÕES COOPERATIVAS

ABSTRACT
The objective of this research was to identify whether each of the control systems from Simons' framework (beliefs, boundaries, diagnostic, and interactive) is distinctly related to different types of innovation—incremental and radical—within the context of cooperatives. A total of 94 cooperatives from Goiás (a Brazilian estate) participated in the study, and data analysis was conducted through correlation tests and simple linear regression. The results indicate that, in the sample studied, both boundary and enabling systems foster two forms of innovation: incremental and radical. Evidence was also found that the relationship and emphasis of these phenomena are influenced by the cooperatives' business sectors and geographic clusters. These findings enrich the debate on the actual relationship between the constructs and suggest that such a relationship may vary according to the organizational structure.

Keywords: management control systems, levers of control, innovation, cooperatives.

RESUMO
O objetivo desta pesquisa foi identificar se cada um dos sistemas de controle do framework de Simons (crenças, limites, diagnóstico e interativo) se relaciona de maneira distinta com os diferentes tipos de inovação, incremental e radical, no contexto das cooperativas. Participaram da pesquisa 94 cooperativas goianas e a análise de dados foi realizada por intermédio dos testes de correlação e regressão linear simples. Os resultados apontam que, na amostra estudada, tanto os sistemas delimitadores como os facilitadores promovem duas formas de inovação: incremental e radical. Foram encontradas evidências de que a relação e ênfase desses fenômenos são também influenciadas pelos ramos de atividade e pelo cluster geográfico das cooperativas. Essas evidências enriquecem o debate sobre a real relação entre os constructos e indicam que essa relação pode variar de acordo com a estrutura da organização.

***Palavras-Chave*:** sistemas de controle gerencial, alavancas de controle, inovação, cooperativas.

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1. INTRODUCTION

Management control systems (MCS) are formal routines employed by managers to maintain or alter the patterns of organizational activities (Simons, 1995). In recent decades, a stream of research (Bisbe & Otley, 2004; Bedford, 2015; Bisbe & Malagueño, 2015; Baird, Su, & Munir, 2019) has highlighted that certain models of MCS are relevant for the management and promotion of innovation.

The framework proposed by Simons (1995) presents four management control systems—beliefs, boundaries, diagnostic control, and interactive control—which, although designed to guide and monitor organizational activities, also provide flexibility and support for the development of innovation.

Innovation is the core of organizational creation and survival (Carvalho, Reis, & Cavalcante, 2011; Bisbe & Malagueño, 2015). Innovation initiatives enhance organizations' competitive potential and economic development (Schumpeter, 1997; Carvalho, Reis, & Cavalcante, 2011; Popadiuk, 2015). In this study, the concepts of radical and incremental innovation proposed by Schumpeter (1997) are adopted, referring respectively to the creation of new products, processes, and services, and to the continuous improvement of existing ones. Both forms of innovation play an important strategic role, yet they serve different functions (Lawson & Samson, 2001) and, therefore, demand distinct control mechanisms for their management (Davila, Foster, & Oyon, 2009).

According to March (1991) and Bedford (2015), the certainty, speed, accuracy, and clarity of a diagnostic control system, along with the clear definition of risks and opportunities to be avoided as established by boundary systems, are more effective for incremental innovation. In contrast, belief systems (Widener, 2007; Mundy, 2010) and interactive control systems—focused respectively on disseminating organizational values and beliefs, and on fostering communication between managers and employees (Bisbe & Otley, 2004; Tessier & Otley, 2012; Arjaliès & Mundy, 2013)—create environments conducive to the implementation of radical innovation.

Implementing control systems capable of responding to environmental pressures and the needs of cooperative members (Pletsch & Lavarda, 2016) is essential for cooperatives to survive in a competitive environment that requires constant encouragement of innovation—the creation and continuous improvement of their "products, processes, or services" (Jerônimo, Maraschin, & Silva, 2006; Padilha, Severo, Delgado, & Silva, 2010).

The relationship between belief, boundary, diagnostic, and interactive systems and the types of innovation (incremental and radical) differs in cooperatives due to their democratic structure and collaborative values. Cooperatives such as Land O'Lakes (USA) often adopt incremental innovations, such as improvements in agricultural techniques, aligned with collective consensus (Chaddad & Cook, 2004). Radical innovation, on the other hand, which requires disruptive changes, is more challenging due to risk aversion and democratic decision-making.

Boundary systems in cooperatives, grounded in principles such as those of the International Cooperative Alliance (ICA), may restrict radical innovations, whereas collaborative diagnostic systems facilitate gradual improvements. For example, credit cooperatives such as Desjardins (Canada) employ participatory processes to incrementally enhance financial services (Malo & Vézina, 2004). The organizational culture of cooperatives, which values inclusion and equality, also shapes this dynamic. Legacoop (Italy) promotes incremental innovations but faces challenges in adopting disruptive technologies, such as artificial intelligence, due to the need for consensus (Borzaga & Galera, 2021).

Given the context of cooperative organizations and the framework proposed by Simons (1994), according to which control systems play a decisive role in guiding the organization—whether toward continuous improvement or the creation of new products, processes, and services—the following research question emerges: Is each control system in Simons' framework related to a specific type of innovation, incremental or radical, in cooperatives? Accordingly, the objective of this research is to identify whether each of the control systems in Simons' framework (beliefs, boundaries, diagnostic, and interactive) is distinctly related to different types of innovation, incremental and radical, within the context of cooperatives. In Brazil, cooperativism is present in the agricultural, credit, transportation, labor, goods and services production, health, consumer, and infrastructure sectors (Organização das Cooperativas do Brasil [OCB], 2024). According to OCB data (2024), in 2023 cooperative activity generated revenues of R$ 692 billion, benefiting 23.45 million members and 550.61 thousand employees.

Sell, Pletsch, Lavarda, and Silva (2023) and Pletsch and Lavarda (2016) emphasize the demand for investigations that assess the applicability of the levers of control model in cooperatives, particularly in the Brazilian context. Studies have identified positive correlations between management control systems and an innovation culture (Bicicgo & Cescon, 2022). However, despite the growing interest in the theme of innovation within the context of the Levers of Control over the past decade, the literature remains incipient, and some studies present divergent results. This scenario highlights the need for further investigations, opening new research opportunities on the subject (Agnol, Diehl, & Leite, 2020).

The contributions of this study encompass two perspectives: theoretical and practical. From the theoretical perspective, this research contributes by providing evidence that: (1) the use of control systems is associated with and positively related to both incremental and radical innovation; (2) systems associated with values, principles, and rules have greater potential to promote both incremental and radical innovation initiatives; and (3) the industry sector can alter the intensity of the relationships and their interrelation, as the behavior as complementary or supplementary changes according to the sector of activity.

As a practical contribution, this research provides society with important information about cooperative organizations. These insights, related to management control and innovation systems, offer: (1) researchers, guidance for future studies; (2) professionals and managers, an overview of these phenomena and evidence of the potential and importance of these mechanisms for organizational development; and (3) the OCB/GO, an overview that enabled the provision of initiatives such as lectures, workshops, and short courses for presidents aimed at improving and advancing these mechanisms within cooperatives.

2. THEORETICAL FRAMEWORK

The distinction between enabling and constraining systems is based on Simons' (1995) proposal, which describes the Levers of Control as mechanisms that both stimulate and restrict innovation. Studies such as Mundy (2010) and Bedford (2015) emphasize that control systems can function in an **enabling** manner, fostering radical innovation, or in a **constraining** manner, focusing on efficiency and incremental innovation. Building on this literature, this research adopts this division to analyze the relationship between different types of control systems and innovation.

Organizational innovation can be influenced by different approaches to management control (Garcia, Carraro, & Dimon, 2024; Anjos et al., 2024). While enabling systems encourage creativity and experimentation, constraining systems ensure stability and risk mitigation (Assis et al., 2023; Kaveski & Beuren, 2020). In the context of cooperatives, characterized by democratic governance and greater risk aversion (Mannes & Beuren, 2024), understanding these differences is essential for assessing their influence on incremental and radical innovation.

In this research, control systems are grouped according to Simons (1995):

- **Enabling systems**: foster openness to new ideas and organizational learning, such as belief systems (Widener, 2007; Mundy, 2010) and interactive systems (Bisbe & Otley, 2004).
- **Restrictive systems**: establish boundaries for decision-making and minimize risks, such as diagnostic control (Bedford, 2015) and boundary systems (McCarthy & Gordon, 2011).

Studies indicate that belief and interactive systems encourage experimentation and rapid adaptation, favoring radical innovation (Arjaliès & Mundy, 2013; Bedford, 2015). On the other hand, diagnostic control and boundary systems are more effective for incremental innovation, as they establish strict guidelines for continuous improvement (Chenhall & Moers, 2015; Guo, Paraskevopoulou, & Sánchez, 2019). Based on this distinction, this research formulates hypotheses to assess these relationships in the context of cooperatives.

2.1 Enabling systems and radical innovation actions

Enabling systems—beliefs and interactive control—are positive-force control mechanisms that create room for experimentation and allow employees to be creative in seeking solutions and developing their activities (Simons, 1995).

The belief system aims to encourage employees to embrace the organization's core values in the pursuit of new opportunities (Widener, 2007; Mundy, 2010; Bandiyono & Augustine, 2019). The interactive control system functions as a mechanism for managers to share and communicate with employees about business uncertainties (Stewens, Widener, Moller, & Steinmann, 2019), fostering organizational learning and the emergence of new ideas and strategies (Simons, 1994).

Experimentation, creativity, and the implementation of new ideas are stages of the innovation process (Bisbe & Malagueño, 2015), which are expected to result in a new product, service, production method, organizational structure, or exploration of new markets (Schumpeter, 1997). Combined with uncertainty and the need for rapid adaptation, these are defining characteristics of radical innovation actions (March, 1991; Schumpeter, 1997). Garcia, Carraro, and Dimon (2024) emphasize that the strategic use of interactive control systems can facilitate communication and continuous learning, thereby strengthening radical innovation.

Bisbe and Malagueño (2015) found evidence that in non-conservative companies—those inclined to take risks and proactive in seeking new market opportunities—value systems (beliefs and boundaries) and interactive control were associated with innovation at the level of creativity. In conservative companies, however, these systems were associated only with the processes of idea filtering, improvement of existing products, and review of resource commitment to innovation efforts.

Cruz, Frezatti, and Bido (2015) found evidence in Brazilian companies that both the focus on disseminating organizational core values, established through the belief system, and the dynamics of communication and idea exchange, enabled by the interactive control system, contribute to achieving technological innovation.

Beyond product and service innovations, Baird, Su, and Munir (2019) identified that the extensive use of belief and interactive control levers was positively associated with managerial innovation (new managerial practices, processes, structures, and organizational techniques). The authors further concluded that the levers of control precede innovation processes.

A system that provides managers with information on aspects related to organizational values or preferences constitutes a belief system (Mundy, 2010). In cooperative organizations, beliefs, principles, and values form the fundamental basis for the development of their activities. Delfino, Lan, and Silva (2010) identified that in these organizations, employees' values tend to be aligned with the organization's principles.

In light of the theoretical assertions by Simons (1995) and Widener (2007) that the levers of control are capable of fostering innovation, as well as the empirical evidence (McCarthy & Gordon, 2011; Bedford, 2015) that there is a relationship between the use of control systems and forms of innovation, and considering the strong emphasis of cooperative organizations on their principles and values, it is expected that cooperatives, by emphasizing the use of the belief control system, will communicate their values to employees to build long-term commitment and inspire the pursuit of new opportunities. Therefore, organizations are directed toward the execution of radical innovation actions, and the following hypothesis is proposed:

H1a: The use of the belief control system has a positive relationship with Radical Innovation actions.

The interactive control system enables managers to recognize and integrate opportunities and new ideas into organizational routines (Simons, 1995). Bedford (2015) found evidence that companies focused on radical innovation actions performed better when they emphasized the use of interactive control systems. Stewens, Widener, Moller, and Steinmann (2019) identified that innovation capacity, in both stable environments and especially in turbulent environments requiring rapid adaptability, was driven and facilitated by the use of the interactive control system.

Interactive control allows managers' personal and regular involvement in employees' activities to identify initiatives with greater potential for competitive advantage (Simons, 1995). According to Parolin and Albuquerque (2011), in cooperative organizations there is a constant practice of dialogue that offers broad opportunities for participation in group discussions on organizational decisions. In this context, it is believed that cooperatives emphasizing the use of the interactive control system employ performance measures to facilitate dialogue between managers and employees and to stimulate the emergence of new ideas and strategies; therefore, they focus their activities on radical innovation actions. Thus, it is suggested that:

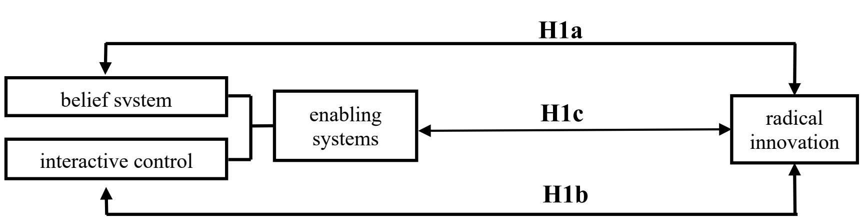
H1b: The use of the interactive control system has a positive relationship with Radical Innovation actions.

To translate opportunities and new ideas into commercially viable outcomes, a coordinated allocation of resources is required (Simons, 1995). In other words, without interactive controls, the new ideas inspired by the belief system may take longer to be effectively realized (Bedford, 2015). According to McCarthy and Gordon (2011), in terms of radical innovation, belief systems and interactive control systems work together to generate relevant and adaptable research and discoveries.

Interactive control systems maintain or adjust radical innovation activities in a specific direction over time (McCarthy & Gordon, 2011), but they are potentially more effective when there is congruence between the organization's values and purposes and those of its members (Widener, 2007). Thus, cooperatives that combine the use of belief systems and interactive control—collectively referred to as enabling controls—are expected to direct and foster Radical Innovation actions, as detailed in the figure below:

H1c: Enabling controls have a positive relationship with Radical Innovation actions.

Figure 1 - Theoretical research model (H1)



2.2 Constraining systems and incremental innovation actions

Constraining systems—boundaries and diagnostic control—are grounded in the establishment of limits for the pursuit of opportunities and in the control and guidance of behavior toward achieving organizational goals (Simons, 1995).

The boundary system defines and reinforces the limits that employees must not cross (McCarthy & Gordon, 2011; Bandiyono & Augustine, 2019). The diagnostic control system provides a monitoring mechanism and motivates employees to align their behavior with organizational goals (Bandiyono & Augustine, 2019).

These systems are concentrated in organizations that pursue low-cost strategies and operate in more stable environments (Chenhall & Moers, 2015). Guo, Paraskevopoulou, and Sánchez (2019) state that constraining systems have a stronger positive association with innovation in low-technology industries, which emphasize efficiency strategies. This latter aspect is consistent with incremental innovation actions, characterized by the continuous improvement of existing products, processes, and services without significant disruptions, but with a focus on efficiency and gradual enhancement.

The structured management of incremental innovation is fundamental for cooperative organizations, as it ensures strategic alignment without compromising operational efficiency (Mannes & Beuren, 2024). Kaveski and Beuren (2020) emphasize that the structure and predictability provided by diagnostic control systems are essential for ensuring the continuity of incremental innovation. The use of constraining controls to manage incremental innovation is consistent with the need to establish clear strategic guidelines, as highlighted by Assis et al. (2023).

Evidence of the relationship between boundary systems and diagnostic controls with incremental innovation was found by Bedford (2015), who identified that companies characterized by incremental innovation actions performed better when they emphasized the use of boundary and diagnostic control systems.

Cruz, Frezatti, and Bido (2015) found a positive association between innovation and the boundary system, but not with the diagnostic control system. Their findings suggest that the boundary system leads to actions that contribute both to improvements in existing products and processes and to the creation of new ones. However, in the study conducted by Baird, Su, and Munir (2019), the tests indicated that innovation impacted organizational performance only through diagnostic and boundary control systems.

Stewens, Widener, Moller, and Steinmann (2019) found that the diagnostic control system is directly and positively associated with product innovation and indirectly associated with the innovation rate in environments of high uncertainty. For the authors, these results imply that the rigidity of diagnostic use does not directly contribute to the creative aspects of innovation when the environment is turbulent. This shift in the type of relationship, resulting from the organization's context or changes occurring within it, is consistent with the argument that constraining control systems are more suited to stable environments with lower levels of risk.

March (1991) indicated that the certainty, speed, accuracy, and clarity of a feedback system are more synergistic with incremental innovation actions than with radical ones. Pletsch and Lavarda (2016) identified, in a cooperative, the practice of using the diagnostic control system to monitor activities and results in order to guide the achievement of desired objectives. In this context, cooperatives that emphasize the use of the diagnostic control system are expected to intensify their activities in incremental innovation actions. Therefore, it is suggested that:

H2a: *The use of the diagnostic control system has a positive relationship with Incremental Innovation actions.*

To reduce the risk of tension or pressure, management control systems are used to specify and enforce organizational rules (Simons, 1995). According to the study conducted by Pletsch and Lavarda (2016) in the cooperative analyzed, the boundary system was used only when there was a need to establish operational and behavioral limits and, once defined, these limits became rules.

Bedford (2015) states that the clear definition of risks and opportunities to be avoided directs employees' efforts and makes them more effective in exploiting existing capabilities. Based on the theoretical definitions and the empirical evidence found by Baird, Su, and Munir (2019) and Stewens et al. (2019), it is expected that cooperatives emphasizing the use of the boundary system will employ codes of conduct, policies, and sanctions to determine risks to be avoided and limits for the pursuit of opportunities, thereby intensifying their activities in incremental innovation actions. Therefore, it is expected that:

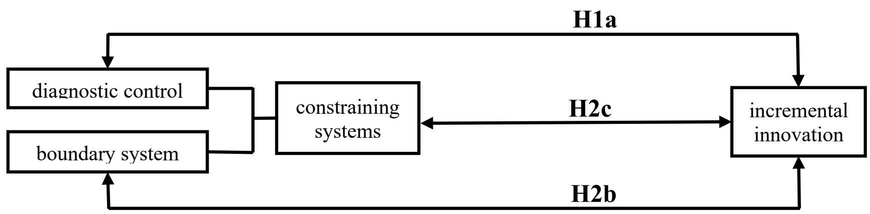
H2b: *The use of the boundary control system has a positive relationship with Incremental Innovation actions.*

Although the diagnostic control system communicates the desired organizational outcomes, it does not specify how these results should be achieved, that is, the boundaries that must be observed (Bedford, 2015). The absence of clearly defined boundaries increases the space for employees to engage in excessive experimentation, which may result in resource waste and heightened risks of operational discontinuity (Simons, 1995).

According to McCarthy and Gordon (2011), the combined use of these levers allows for the identification of deviations from desired results through diagnostic control and, if such deviations persist, boundary systems are then implemented. Boundary and diagnostic control systems create extrinsic motivation by providing formula-based rewards and delimiting the domain for the pursuit of opportunities (Simons, 1995), characterized by a feedback-oriented control approach that generates or enhances incremental innovation activities (McCarthy & Gordon, 2011). The theoretical framework provides the basis for the understanding that the boundary system strengthens the effectiveness of diagnostic controls. Thus, it is expected that cooperatives combining the use of boundary and diagnostic systems—constraining controls—will intensify their activities in Incremental Innovation actions, as illustrated in the figure below:

H2c: *Constraining controls have a positive relationship with Incremental Innovation actions.*

Figure 2 - Theoretical research model (H2)



3 METHODOLOGY

3.1 Sample selection and data collection procedure

The data for this research were collected through a questionnaire and refer to the use of management control systems and innovation actions in cooperatives. The data collection instrument was developed through the adaptation and combination of the instruments by Widener (2007) and Bedford and Malmi (2015) for management control systems, and by Lubatkin et al. (2006) and Bedford, Bisbe, and Sweeney (2018) for innovation, as presented in Table 4. The questionnaire underwent the following construction phases: (1) analysis and selection of instruments from previous empirical studies and adaptation to the population of this research; (2) content validity testing, presented in item 3.4; and (3) submission to and approval by the ethics committee.

The questionnaire was made available by OCB/GO alongside the data collection for the annual census of cooperatives, from March 3 to August 5, 2020. The instrument was divided into two parts: (1) identification of the respondent and the cooperative, and (2) measurement of the studied phenomena. Part 2 consists of 40 variables (see Table 6) measured using a seven-point Likert scale (1=strongly disagree and 7=strongly agree). The scale employed is based on Arantes and Soares (2020).

The research population consisted of 235 cooperatives in Goiás (a Brazilian state) affiliated with OCB/GO. The sample was census-based by voluntary participation and resulted in 134 responses. After excluding incomplete questionnaires and duplicate responses, the final sample comprised 94 cooperatives, distributed across the following sectors:

Table 1 - Research sample

sector of activities	valid responses	frequency (%)
Crop & livestock production	36	38%
Consumer	2	2%
Credit	23	24%
Health	18	19%
Labor, Goods, and Services Production	4	4%
Transportation	11	12%
total	94	100%

3.2 Treatment and measurement of variables

First-order variables were obtained from the mean of the values reported in the responses to the set of variables belonging to the same construct. Second-order variables were determined by summing the means of the first-order variables (see Table 3).

Table 2 - variable equations

		equation
first-order factor	belief system	mean of V16 to V20
	boundary systems	mean of V11 to V15
	interactive control	mean of V6 to V10
	diagnostic control	mean of V1 to V5
	incremental innovation	mean of V31 to V40
	radical innovation	mean of V21 to V30
second-order factor	enabling systems	$\bar{x}$ BELIEF + $\bar{x}$ INTER
	constraining systems	$\bar{x}$ BOUND + $\bar{x}$ DIAG

To test the hypotheses, two types of statistical tests were conducted: Pearson's correlation and simple linear regression. For the Pearson correlation tests, the steps suggested by Dancey & Reidy (2006) were followed, encompassing the assessment of dispersion, direction of the relationship, and evaluation of magnitude. With respect to the regression tests, the necessary conditions for conducting the analyses were evaluated, including verification of the minimum number of observations, assessment of data normality through skewness and kurtosis, confirmation of the absence of outliers, and verification of multicollinearity, as recommended by Dancey & Reidy (2006).

3.3 Instrument evaluation

The validity of the instrument was established by following the guidelines of Hair Jr. et al. (2009). To test content validity, a pretest was conducted with the research group and representatives from OCB/GO. Adjustments suggested by OCB/GO were made regarding terminology. It was not possible to test criterion validity because this is the first time the instrument has been applied; therefore, there are no similar studies available. Thus, according to Hair Jr. et al. (2009), criterion validation was not feasible.

The convergent validity test yielded statistical significance among the factors of the same construct. The correlation indices (Management Control Systems ≥ 0.48 and Innovation ≥ 0.833) indicated that the factors converge toward a common point. The discriminant validity test did not indicate strong correlations among any of the six factors investigated (≤ 0.59).

Data sensitivity was also tested. The distribution test showed that the skewness values (≤ 0.052) and kurtosis values (≤ 2.783) are within the limits indicated by Marco (2007) and Hair Jr. et al. (2009). Reliability testing was conducted using Cronbach's Alpha for both the factors and the constructs. The results of the test are within the limits recommended by Hair Jr. et al. (2009). The internal consistency index for management control systems presented an Alpha of 0.935, and for the innovation constructs, an Alpha of 0.973.

4 DATA ANALYSIS

4.1 Sample profile

The sample of this research presents the following characteristics regarding the respondents' positions: 27 hold the position of cooperative president, 15 hold a director position, 14 serve as managers, 10 are organizational accountants, and 22 hold positions as analysts, consultants, and assistants. Thus, it is possible to identify that at least 58% of the respondents in the sample occupy a management position.

The sample showed a higher concentration of questionnaires answered in the Central Goiás mesoregion (44%) and a lower concentration in the Northwestern Goiás mesoregion (2%). These mesoregions represent, respectively, the largest and smallest concentrations of cooperatives in the state.

4.2 Descriptive statistics

Table 4 presents the descriptive statistics of the variables related to control systems and innovation. It is possible to observe that there is no major discrepancy regarding agreement on the use of control systems, with the variable means ranging between 6.23 and 5.33 and a standard deviation of less than 2. For the innovation variables, the means ranged between 4.95 and 6.14, also with a standard deviation of less than 2.

The variable with the lowest mean was the one that asked respondents whether the cooperative's actions provided opportunities for developing skills entirely new to the sector ($\bar{x}$ =4.95 – item 29). The results of the descriptive statistics are presented below.

Table 3 - Descriptive statistics and sensitivity tests

variable	mean	standard deviation	skewness	kurtosis
Regarding the use of PERFORMANCE MEASURES (revenue, production, results/surpluses, and others) and BUDGETING, do you agree that they are:				
1. Used to identify the critical points for achieving the cooperative's goals and strategies.	6.18	1.34	-2.17	4.93
2. Used to define targets related to the critical performance points.	6.12	1.20	-1.80	3.85
3. Used to monitor progress toward the goals.	6.23	1.02	-1.48	2.36
4. Used as feedback to correct deviations from predefined goals.	6.12	1.16	-1.83	4.43
5. Used to review the main goals and to set new performance targets.	6.16	1.09	-1.65	3.16
Diagnostic control system	**6.16**	**0.979**	**-1.37**	**1.69**
6. They are recurring and frequent "demands" of management activities.	5.99	1.22	-1.68	3.53
7. They are recurring and frequent "demands" of employees' activities.	5.57	1.44	-1.13	1.22
8. They allow discussion of information about ongoing challenges and the development of action plans among managers and employees.	6.12	1.11	-1.31	1.42
9. They make it possible to focus on uncertainties that may undermine the current strategy or offer opportunities for new strategic initiatives.	5.94	1.24	-1.63	3.17
10. They facilitate the sharing of information and encourage dialogue between managers and employees.	6.05	1.20	-1.39	1.69
Interactive control system	**5.93**	**1.01**	**-1.01**	**1.24**
Regarding guidelines for BEHAVIOR, OPPORTUNITY SEEKING, and LIMITS to be observed, do you agree that:				
11. Our cooperative has a "code of conduct" to guide employee behavior.	6.06	1.36	-1.93	3.95
12. The code of conduct is based on belief systems, cooperative system standards, and legal restrictions.	5.94	1.41	-1.73	3.00
13. There are policies or guidelines that establish specific areas or limits to be observed in the pursuit and experimentation of new opportunities.	5.64	1.51	-1.36	1.67
14. Management actively communicates the risks and activities to be avoided by employees.	5.89	1.22	-1.53	3.06
15. Sanctions or penalties are applied to employees who engage in risks and activities not included in the cooperative's policy, regardless of the outcome.	5.33	1.77	-0.96	0.06
Boundary system	**5.77**	**1.12**	**-1.34**	**2.09**
16. The cooperative's values, purpose, mission, and vision are formally documented.	5.98	1.55	-1.76	2.37
17. Management actively communicates the core values to employees.	5.82	1.39	-1.21	0.92
18. To build long-term commitment, management uses formal statements of values.	5.53	1.70	-1.09	0.29
19. Employees are aware of the cooperative's core values.	6.04	1.25	-1.43	1.58
20. The cooperative's values, purpose, mission, and vision inspire our employees in the pursuit of new opportunities.	5.81	1.53	-1.38	1.37
Belief system	**5,84**	**1,29**	**-1.21**	**1.06**
ENABLING SYSTEMS	**11,77**	**1,98**	**-1.02**	**1.31**
CONSTRAINING SYSTEMS	**11,94**	**1,83**	**-1.34**	**2.58**

variable	mean	standard deviation	skewness	kurtosis
Regarding the cooperative's current actions related to the DEVELOPMENT and PROSPECTION OF NEW TECHNOLOGIES, do you agree that:				
21. It searches for technological solutions by "thinking outside the box," that is, beyond the cooperative's limits, exploring technologies different from current ones.	5.34	1.71	-1.05	0.29
22. It explains the cooperative's performance in terms of exploiting innovative technologies, that is, attributing its success to the ability to explore new technologies.	5.21	1.65	-0.92	0.18
23. It focuses on the creation of new products.	5.09	1.86	-0.78	-0.49
24. It focuses on the creation of new services.	5.31	1.62	-0.92	0.22
25. It seeks creative and differentiated ways to meet the needs of its clients.	5.69	1.53	-1.30	1.18
26. It uses new products and/or services to operate in new markets.	5.27	1.68	-1.09	0.56
27. It employs innovation to meet its clients' needs.	5.61	1.55	-1.31	1.34
28. It has acquired entirely new skills that are important for product/service innovation (such as identifying technologies, coordinating and integrating research and development, managing the product development process).	5.16	1.67	-0.74	-0.38
29. It has learned product/service development skills and processes that are entirely new to its sector (such as product design, prototyping of new products, scheduling new product launches).	4.95	1.81	-0.69	-0.47
30. There has been a strengthening of product/service innovation skills in areas where there was no previous experience.	5.01	1.78	-0.68	-0.41
Radical innovation	**5.26**	**1.47**	**-1.02**	**0.61**
Regarding the cooperative's actions related to the IMPROVEMENT and EXPLOITATION OF CURRENTLY USED TECHNOLOGIES, do you agree that:				
31. It seeks to gradually improve the quality of its products and services.	6.14	1.19	-1.85	4.15
32. It seeks to gradually reduce the (production) costs of its products and services.	5.90	1.38	-1.59	2.56
33. It seeks to gradually increase the reliability of its products and services.	6.17	1.23	-2.02	4.62
34. It aims to expand the levels of automation (automated processes) in its operations.	5.78	1.48	-1.55	2.27
35. It frequently researches the satisfaction of its current customers.	5.35	1.76	-1.01	-0.03
36. It develops its product or service offerings by carefully observing the characteristics of its current customers.	5.71	1.47	-1.25	1.24
37. It seeks to strengthen and deepen relationships with its current customers.	6.06	1.22	-1.70	3.45
38. There has been an update of current knowledge and skills for familiar products/ services and technologies.	5.43	1.60	-1.00	0.32
39. There has been an enhancement of skills in product/service development processes in which the company already has significant experience.	5.48	1.62	-1.11	0.58
40. There has been a strengthening of knowledge and skills for projects that improve the efficiency of existing product/service innovation activities.	5.51	1.57	-1.25	1.22
Incremental innovation	**5.75**	**1.21**	**-1.47**	**2.60**

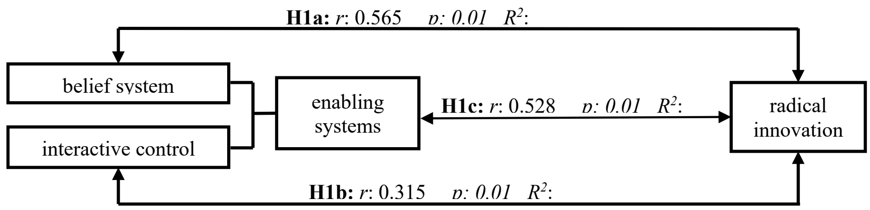
4.3 Hypothesis testings

To test the research hypotheses, the data were analyzed using correlation tests to identify the intensity and direction of the association between the research constructs, and simple linear regression tests to identify the relationship between the constructs.

H1a predicts a positive relationship between the belief system and radical innovation. Figure 3 shows that the association between the constructs is positive and significant (r=0.565, p < 0.01), providing support for confirming the hypothesis. The results also support H1b, which predicts a positive association between interactive control systems and radical innovation (r=0.315, p<0.01).

H1c predicts that the combined use of belief and interactive control systems has a positive association with radical innovation. This hypothesis was also confirmed by the regression test and the correlation test (r=0.528, p<0.01). However, when combined, the explanatory power of the model, taking the belief system as a reference, is reduced, as shown in Figure 3.

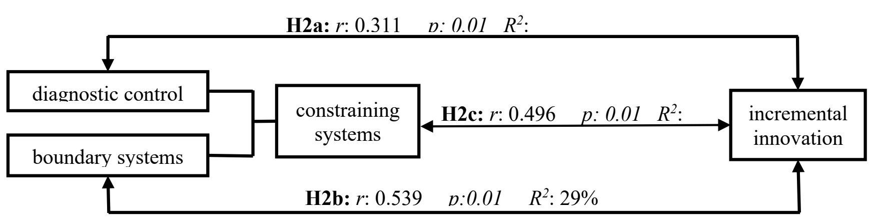
Figure 3 - Result of hypothesis test 1 (H1)



In H2a, a positive association was expected between the diagnostic control system and incremental innovation. The results confirm the hypothesis and indicate that it is positive and significant (r=0.539, p<0.01). H2b predicts a positive association between the boundary system and incremental innovation, and this was confirmed by the test (r=0.311, p<0.01).

Finally, the tests also provided support for confirming that constraining control systems are positively associated with incremental innovation in H2c (r=0.528, p<0.01). However, when combined, the explanatory power of the model, taking the boundary system as a reference, is reduced.

Figure 4 - Result of hypothesis test 2 (H2)



In H2a, a positive association was expected between the diagnostic control system and incremental innovation. The results confirm the hypothesis and indicate that it is positive and significant (r=0.539, p<0.01). H2b predicts a positive association between the boundary system and incremental innovation, and this was confirmed by the test (r=0.311, p<0.01).

Finally, the tests also provided support for confirming that constraining control systems are positively associated with incremental innovation in H2c (r=0.528, p<0.01). However, when combined, the explanatory power of the model, taking the boundary system as a reference, is reduced.

5 DISCUSSION AND ADDITIONAL TESTS

5.1 Discussion of results

The research results provide clear evidence that management control systems do not represent obstacles to innovation in cooperative organizations. Furthermore, they reinforce the role of these systems in this specific context, highlighting their positive influence on both incremental and radical innovation, and confirming what was theoretically expected, in line with the findings of McCarthy and Gordon (2011), Cruz, Frezatti, and Bido (2015), Bisbe and Malagueño (2015), Bedford (2015), Baird, Su, and Munir (2019), and Stewens, Widener, Moller, and Steinmann (2019).

Garcia, Carraro, and Dimon (2024) reinforce this perspective by demonstrating that control systems, when well aligned with the organizational context, can act as catalysts for innovation rather than as barriers. The analysis also suggests that the cooperative context, with its focus on collective well-being, strengthens the role of these systems as enablers of innovation, aligning organizational values and driving continuous improvements.

The objective of the study was to identify whether different types of management control systems—belief, interactive, boundary, and diagnostic—foster different types of innovation—incremental or radical. The evidence obtained confirms H1a, showing that the formal dissemination of cooperatives' beliefs and values inspires employee commitment to the pursuit of new opportunities, making the belief system a driver of radical innovation actions. In the cooperative context, this finding highlights how the sharing of values and goals fosters a culture of innovation, strengthens creativity, and reinforces collective commitment. The cooperative model, by its collaborative essence, amplifies the impact of control systems and underscores the importance of shared values for the implementation of innovative strategies.

According to Cruz, Frezatti, and Bido (2015), the positive association between belief systems and innovation indicates that organizations may be incorporating information on strategic innovation guidelines into their values, beliefs, and purposes. These findings corroborate the results reported by Bisbe and Malagueño (2015) and Cruz, Frezatti, and Bido (2015), showing that companies emphasize belief systems to promote organizational coherence in the face of the uncertainties and complexities of innovation-related actions.

The confirmation of H1b indicates that, in cooperative organizations, frequent dialogue with employees enables the sharing of information and discussions on challenges, thereby supporting the establishment of new plans when necessary. Kaveski and Beuren (2020) suggest that organizational creativity, when supported by an interactive control environment, can result in radical innovation without compromising the company's stability. Thus, the interactive system plays a significant role in the development of creative actions that allow cooperatives to adapt and establish new strategies in innovation contingencies. The participatory involvement of cooperative members intensifies this dynamic, fostering a collaborative environment essential for continuous innovation.

A similar result was found by Cruz, Frezatti, and Bido (2015), who identified that companies seeking to innovate their products and processes must engage in environments that foster discussions among internal members of the business. Likewise, Bisbe and Malagueño (2015) observed that creativity levels in entrepreneurial firms are influenced by interactive control systems. Kaveski and Beuren (2020) indicate that organizational creativity, when supported by an interactive control environment, can result in radical innovation without compromising the company's stability.

Hypotheses H2a and H2b were also confirmed. According to Simons (1995), the boundary system imposes important limits on organizational search activity motivated by belief systems. In this sense, the results of this research suggest that the restrictions imposed by this system do not hinder innovation actions but instead help identify opportunities aligned with intended strategies (Cruz, Frezatti, & Bido, 2015), directing individuals' actions toward the improvement and efficiency of their products, processes, and services. In cooperatives, this approach ensures a balance between innovation and sustainability, guaranteeing that resources are used efficiently without compromising development. Diagnostic control systems are essential tools for ensuring that employees follow the guidelines established by the organization. The positive relationship between these constructs reveals that, by prioritizing local knowledge and skills enhancement, organizations employ such systems in a way that provides space and motivation for experimentation, albeit within defined limits (Bedford, 2015). In cooperatives, this practice reflects a commitment to efficiency and sustainable development, ensuring that incremental innovation processes are conducted collaboratively and aligned with cooperative values. This result also aligns with Bedford's (2015) finding that companies focusing on incremental innovations tend to benefit from emphasizing diagnostic and boundary control systems.

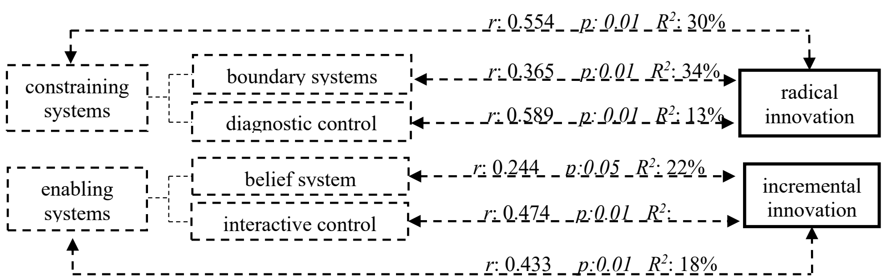
A relevant reflection from the results of this research centers on the intensity of the correlations and relationships among the constructs analyzed. Although Bedford (2015) primarily associated innovation with interactive and diagnostic control systems, the data from this study suggest that, in the organizations analyzed, systems related to principles and values play a more prominent role compared to other types of organizations. As Schneider (2012) points out, cooperative principles are rooted in an ideological perspective that explains the complex situations of economic and social reality, giving meaning to individuals' actions, defining boundaries, and instilling security. While belief systems communicate organizational values to employees, boundary systems establish restrictions based on defined business risks (Simons, 1995). This finding reinforces the role of cooperatives in promoting sustainable innovations, as their democratic management model and collective focus favor a balanced use of control systems to drive both incremental and radical innovations. Therefore, the result aligns with the intrinsic characteristics of this type of organization.

Regarding the hypotheses on the combined use of the levers, both H1c and H2c were confirmed. However, it is observed that the explanatory power of combining the systems is lower than that of the belief system or the boundary system when analyzed individually. Initially, it was expected that the combined use of belief and interactive systems would reduce the time required to transform new ideas into commercially viable outcomes (Simons, 1995). Similarly, it was believed that diagnostic and boundary systems would establish controls to prevent failures and define parameters in the search for opportunities, directing organizational efforts toward improving products, processes, and services (Cruz, Frezatti, & Bido, 2015; Bedford, 2015). In the cooperative context, this analysis suggests that the collaborative and democratic nature may influence the combined use of the levers, prioritizing isolated systems that reinforce collective values and sustainable practices. This scenario points to the need for further research on how cooperatives can integrate control systems to enhance innovation. The result may indicate that such systems function not as complementary, as suggested by Simons (1995), but as supplementary—that is, one system is not necessarily conditioned by another. Mundy (2010) found evidence that these systems acted in a complementary manner; however, he also suggested that they possessed interdependent functions. Bedford (2015, p. 15) associates this interdependence with the fact that such systems are "frequently separated spatially and temporally." In the cooperative context, this dynamic indicates that the flexibility and adaptability of cooperatives may facilitate the supplementary use of control systems, allowing their application according to the demands of innovation and sustainable management. This scenario underscores the potential of cooperatives to balance innovation and effective governance.

5.2 Alternative research models

Complementary tests were conducted and revealed other important insights into the relationship between control systems and innovation in cooperative organizations. Initially, based on strong evidence of the relationship and association of belief systems, values, and boundaries with innovation, tests were carried out to determine whether the trend would hold in the relationships opposite to those hypothesized.

Figure 5 - Non-hypothesized relationships



The results presented in Figure 5 show that the systems classified by Simons (1995) as constraining display a stronger correlation with both radical and incremental innovation. This finding may indicate that even the boundaries imposed by these systems do not inhibit innovation in cooperative organizations. This outcome may be linked to the fact that even the code of conduct in these organizations is based on belief systems and cooperative system standards. According to Cruz, Frezatti, and Bido (2015), belief and value systems may incorporate guidelines for innovation.

These results contrast with those found by Bedford (2015), who identified that the use of interactive control was associated with better performance in companies engaged in radical innovation, but not in incremental innovation. For Bisbe and Malagueño (2015), diagnostic control systems follow models adhering to pre-established plans and a mechanistic approach to decision-making, and therefore could not influence radical innovation actions, which are complex and fraught with uncertainty. A correlation test by industry sector and mesoregion was also conducted (see Table 7) to identify whether the region in which the cooperatives operate and their industry sector could exert any influence on the association between the constructs.

Table 4 - Correlation test by industry sector

	N	BS & RI	IC & RI	EC & RI	BO & II	DC & II	CS & II
industry sector							
Crop & livestock production	36	0.356*	-0.014	0.27	0.357*	0.178	0.352*
Credit	23	0.639**	0.422*	0.582**	0.756**	0.472*	0.731**
Health	18	0.691**	0.602**	0.768**	0.685**	0.503*	0.624**
CLT	17	0.629**	0.546*	0.583*	0.613**	0.482	0.605*
mesoregion							
Central Goiás	41	0.461**	0.156	0.351*	0.626**	0.426**	0.603**
Southern Goiás	37	0.552**	0.592**	0.633**	0.579**	0.462**	0.563**
ENN	16	0.554*	0.297	0.564*	0.547*	0.156	0.451

Note **: Significance at 0.01; *: Significance at 0.05. BS: belief system; IC: interactive control; EC: enabling control; RI: radical innovation; BO: boundary system; DC: diagnostic control; CS: constraining control; II: incremental innovation; CLT: consumption, labor, and transport; ENN: East, North, and Northwest.

In this test, we found evidence that activities with higher levels of regulation, such as credit and health, showed higher correlation indices. The credit and health sectors exhibited correlation indices considered moderate (r>0.400) and strong (r>0.700), while the agribusiness sector showed lower correlation intensity (r<0.600).

According to research conducted by Cruz, Frezatti, and Bido (2015), the sector of activity influences how management control systems affect innovation. In this regard, the results of this study confirm that assertion. They further indicate that in the credit and health sectors, unlike the tests that did not take sector characteristics into account, enabling and constraining systems show stronger correlations with the forms of innovation. This result suggests that the industry sector influences the way the systems behave.

The test by mesoregion indicated that the region where the cooperatives are located also influences the correlation between the phenomena studied. According to the information presented in Table 10, cooperatives located in Southern Goiás show higher correlation indicators among the phenomena.

The correlation results change when organizations are classified by region. According to Schneider (2012), cooperative organizations have a commitment to the localities in which they operate and must reinvest their profits in the regions where they were generated. Thus, these differences by mesoregion, considering the characteristic mentioned above, can be explained by Porter's (1999) cluster theory. According to the author, companies operating in clusters have a material interest in the locality where they conduct business, as they achieve better alignment in the competitive field through greater synergy "in terms of technology, skills, information, marketing, and customer needs that cut across companies and industries" (Porter, 1999, p. 214).

6 CONCLUDING REMARKS

This study, conducted with 94 cooperatives, provides relevant contributions to the understanding of the relationship between control systems and innovation management in the cooperative context. The findings show that the management control system promotes improvements and the exploration of new technologies by aligning control practices with collective values and a commitment to development.

While traditional companies tend to emphasize efficiency and competitiveness (Guo, Paraskevopoulou & Sánchez, 2019), cooperatives use management control systems to foster innovation in a collaborative manner. The research revealed that both constraining and enabling systems positively influence innovation, with this relationship shaped by the cooperatives' industry sectors and geographical locations. Management control systems, from the perspective of Simons' (1994) framework, can therefore behave in either a supplementary or complementary way depending on the industry sector.

Belief and boundary systems demonstrated a central role in encouraging innovation without compromising stability, while democratic involvement strengthens the use of interactive systems, driving idea generation and continuous improvement. Diagnostic control systems ensure operational efficiency and reflect the cooperative commitment to sustainability. Mannes and Beuren (2024) argue that internal communication and effective risk management are essential elements for incremental innovation, ensuring an organizational environment that is stable and conducive to the continuous enhancement of processes.

The conclusions of this study must be interpreted in light of its potential limitations. First, due to the cross-sectional nature of the study, it is not possible to precisely infer causal relationships, as the results represent necessary but not sufficient conditions for fostering innovation—that is, there is an association between the use of control systems and innovation actions, but this does not mean that control systems alone will produce such actions. Second, despite the pretesting of the research instrument and the demonstration of statistical validity and reliability, the data may contain bias, as they are based on the perceptual judgments of managers. Furthermore, the data reflect the opinion of only one representative per cooperative. Finally, the analysis is based on data from the state of Goiás and its cooperatives, limiting the results to organizations within this specific context and setting.

Future research could examine additional control attributes for achieving innovation, such as leadership style, organizational structures, and processes, and investigate this relationship by considering other control system models. It could also expand the study by examining employees' perceptions or even assessing whether the results hold when these systems act upon cooperative members, given that they occupy a dual role: both as owners and, at the same time, as labor and input providers.

In addition, qualitative studies are suggested to explore how management control systems foster innovation. Such research could investigate why industry sectors modify the way control systems operate and how this impacts the promotion of innovation.

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