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**Supervisory support, work values, and commitment to scientific research among
Business doctoral students**

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ABSTRACT

This study aimed to examine the relationship between doctoral supervisors' support and business doctoral students' commitment to scientific research, as mediated by work values. Examining supervisory support through the lens of Basic Psychological Needs Theory (BPNT) provides insights into how contextual factors, such as supervisory support, and personal factors, such as work values, influence commitment to scientific research. By simultaneously integrating these elements, the study highlights the underlying mediating mechanisms and reinforces the supervisor's role as a facilitator of students' academic development. The relevance of this topic lies in understanding supervisory support as a factor that influences doctoral students' commitment to research, thereby contributing to the scientific advancement of the business field. Such support is associated with students' motivation, well-being, and personal and professional development, while also shaping their work values. Supervisory support for autonomy, competence, and relatedness, as proposed by BPNT, provides a reflective framework for graduate programs to develop guidelines that reconcile scientific productivity with students' psychological needs, thereby enhancing supervisory outcomes. Using a quantitative approach, data from 503 business doctoral students were analyzed through partial least squares structural equation modeling (PLS-SEM). The findings indicate that supervisory support constitutes an important contextual factor in strengthening business doctoral students' commitment to scientific research. Competence support has a direct and positive effect on research commitment, whereas relatedness support exerts an indirect effect through intrinsic work values. These findings provide valuable insights for improving supervisory practices and fostering academic environments that better support the development of developing researchers.

Keywords: supervisory support, doctoral education, basic psychological needs, work values, commitment to scientific research.

1. INTRODUCTION

The interaction between doctoral supervisors and doctoral students has been widely discussed in the literature as a significant factor influencing students' satisfaction and success in graduate education (Van Rooij et al., 2021). Students report greater satisfaction when they perceive their supervisors as available through face-to-face interactions, regular meetings, timely responses to emails, and continuous feedback on their research (Van Rooij et al., 2021). Furthermore, supervisory support directly influences students' academic experiences and outcomes (Curtin et al., 2016; De Clercq et al., 2021; Overall et al., 2011).

Despite its importance, the supervisory process and the supervisor–student relationship are often overlooked or treated as secondary issues (Nóbrega, 2018). Graduate programs generally lack specific guidelines for supervising master's and doctoral students. Consequently, supervisory practices are largely shaped by individual faculty members' experiences and initiatives developed throughout their academic careers (Eby et al., 2007). Moreover, supervision is frequently regarded as a purely procedural activity, disregarding the interpersonal relationship established between supervisors and students, which often extends over several years and is crucial to the successful completion of theses, dissertations, and the scholarly outputs derived from them (Nóbrega, 2018).

In Brazil, several studies have examined the supervisor–student relationship in graduate education. Specifically, within the business field, Leite and Martins (2006) investigated how the supervisor–student relationship influences the production of master's dissertations and doctoral theses in accounting graduate programs; Falaster et al. (2017) examined the effect of supervision on the scientific productivity of doctoral students in business administration; Machado et al. (2018) explored the ideal characteristics of supervisors and students in accounting graduate programs; Meurer et al. (2021) investigated how master's graduates perceived the emotions experienced throughout different stages of the supervisory process in accounting; and Martins et al. (2021) analyzed the influence of the supervisor–student relationship on burnout symptoms among graduate students in accounting.

Taken together, these studies highlight the importance of academic supervision in graduate programs within the business field and contribute to a broader understanding of different aspects of the supervisory process. Building on this body of research, the present study adopts Basic Psychological Needs Theory (BPNT) as its theoretical lens to examine the supervisor–student relationship. BPNT provides a robust theoretical framework that has been widely applied to explain human behavior across diverse contexts, including higher education (Guay, 2022).

BPNT explains how the social context influences the satisfaction of individuals' basic psychological needs, proposing that people require supportive environments to satisfy their needs for autonomy, competence, and relatedness (Deci & Ryan, 2000). The theory also posits that social contexts may either support or frustrate these needs, thereby affecting individuals' motivation (Deci & Ryan, 2000; Van der Linden et al., 2018).

In this study, BPNT serves as a conceptual framework for understanding the particularities of the supervisor–student relationship in graduate education. Supervisors are viewed as key agents within the academic social environment who may either support or frustrate doctoral students' basic psychological needs (Devos et al., 2015; Van Rooij et al., 2021). Accordingly, supervisory support is operationalized through three dimensions: autonomy support, competence support, and relatedness support.

Previous research has shown that supervisory support functions as an important nudge for improving graduate students' academic experiences. Overall et al. (2011) demonstrated that supervisors' autonomy and competence support contribute to higher levels of research self-efficacy. Devos et al. (2015) found that autonomy support may lead to greater motivation and engagement, whereas autonomy frustration leads to program attrition. Chemers et al. (2011) reported that supervisory support indirectly predicts commitment to a scientific career, suggesting that the quality of the supervisor–student relationship functions both as an antecedent and as a predictor of students' engagement in research activities.

Nevertheless, an important gap remains regarding how supervisors and students jointly construct a social environment that supports autonomy, competence, and relatedness in graduate education (Janssen et al., 2021). Likewise, little is known about the supervisor's role in fostering active researchers who maintain a sustained interest in and enjoyment of scientific research both during and after doctoral training (Sinclair et al., 2014).

Given that Brazil does not offer a clearly structured scientific career path, the present study refers to this sustained interest in research as commitment to scientific research, understood as commitment to an academic professional activity. Thus, the term *commitment to scientific research* is used to describe students' willingness to contribute to scientific advancement (Chemers et al., 2011) through activities related to conducting,

disseminating, and publishing research in the business field, regardless of whether they ultimately pursue an academic career.

Accordingly, it cannot be assumed that all doctoral students intend to pursue academic careers, nor that supervision alone determines previously established career choices. Rather, supervisory support provided during graduate education may influence the extent to which scientific research becomes integrated into students' professional trajectories as a meaningful work activity.

Another important consideration is that students are influenced by the values of the groups to which they belong (Estrada et al., 2011). In this regard, supervisors are "the primary socialization agents who transmit scientific knowledge and professional values to developing researchers through their representation and integration into the academic community" (Lam & Campos, 2015, p. 832). Academic socialization therefore entails the acquisition of values (Zanelli et al., 2014). Consequently, supervisors may influence their students' work values by communicating the goals and norms of graduate education and the scientific community, thereby shaping their professional orientations toward academic work.

Work values refer to the goals or rewards individuals seek through work and are influenced by personal experiences as well as the cultural context in which individuals are embedded (Porto & Pilati, 2010). Within academic settings, work values have been associated with work engagement (Sortheix et al., 2013), career decision self-efficacy, and academic satisfaction (Doo & Park, 2019). Empirical evidence further indicates that work values influence individuals' career plans and occupational choices while playing a fundamental role in motivation and commitment (Gesthuizen et al., 2019).

Therefore, it is reasonable to expect that work values predict students' professional orientations and that supervisory support may influence both students' work values and their commitment to scientific research. Accordingly, this study addresses the following research question: What is the relationship between supervisory support and business doctoral students' commitment to scientific research, as mediated by work values?

By examining the supervisor–student relationship through the lens of BPNT, this study advances understanding of how supervisory support influences business doctoral students' commitment to scientific research while extending the application of BPNT to the context of Brazilian graduate education. Moreover, it provides insights that may help both experienced and novice faculty members identify the types of support required during doctoral supervision, thereby fostering stronger academic socialization and students' professional development.

From a practical perspective, understanding the forms of support involved in doctoral supervision may assist graduate programs in developing guidelines to improve supervisory outcomes. Furthermore, by conceptualizing work values as a mediating mechanism linking supervisory support to commitment to scientific research, the study makes an important theoretical contribution by integrating contextual and individual factors within a single empirically tested conceptual model.

2. THEORETICAL BACKGROUND

2.1 BPNT

BPNT posits that individuals' motivation should be understood in terms of the fulfillment of three fundamental psychological needs: autonomy, competence, and relatedness (Deci & Ryan, 2000). These needs may be either supported or frustrated by

the social context, thereby influencing both intrinsic motivation and the internalization of extrinsic motivation.

According to BPNT, the satisfaction of basic psychological needs requires a supportive context that provides the resources necessary to meet individuals' developmental needs (Van der Linden et al., 2018). The concept of *basic needs support* refers to the characteristics of social contexts that influence individuals' motivation, well-being, and performance (Deci et al., 2017). From this perspective, the social context encompasses both the structural features of the environment and the people within it.

Within this framework, BPNT is particularly applicable to understanding the supervisor–student relationship. If the satisfaction of basic psychological needs depends on a supportive social context, then supervisory support may constitute an important contextual factor influencing doctoral students' academic development.

In graduate education, autonomy support is reflected in supervisors' encouragement of students' sense of ownership over their academic work. This includes providing opportunities for independent initiative and decision-making regarding their research, acknowledging students' perspectives, and avoiding excessive control over each stage of the research process (Devos et al., 2015; Van Rooij et al., 2021).

Competence support refers to fostering learning by clearly communicating expected outcomes and providing guidance on how to achieve them. It is manifested when supervisors articulate their expectations, offer constructive feedback, and encourage the development of students' academic skills (Zeinstra et al., 2023).

Finally, relatedness support concerns the establishment of interpersonal relationships that foster students' sense of belonging within the graduate environment. It is reflected through supervisors' expressions of care, empathy, understanding, friendship, and attentive listening toward their students (Devos et al., 2015; Zeinstra et al., 2023).

Accordingly, the quality of the supervisor–student relationship can be understood in terms of the extent to which supervisors support students' basic psychological needs for autonomy, competence, and relatedness (Janssen et al., 2021). As argued by Devos et al. (2015, p. 441), employing a sound theoretical framework "provides a deeper understanding of the psychological processes underlying the relationship between supervisory support and student outcomes." Therefore, adopting a robust theoretical foundation is essential for advancing the understanding of doctoral supervision.

2.2 Research Hypotheses and Theoretical Model

Within the context of graduate education, several studies (Devos et al., 2015; Litalien & Guay, 2015; Su, 2019; Van der Linden et al., 2018) have drawn on Basic Psychological Needs Theory (BPNT) to examine the effects of supervisory support on doctoral students' learning experiences. These studies sought to better understand how autonomy support, competence support, and relatedness support are manifested within the doctoral education context.

By examining the three dimensions of support proposed by BPNT, Devos et al. (2015) demonstrated that autonomy support may enhance doctoral students' motivation and engagement, competence support may help them cope with the challenges of doctoral education, and relatedness support may foster a stronger interpersonal connection between supervisors and students, thereby facilitating successful supervisory outcomes.

Litalien and Guay (2015) found that supervisory support indirectly influences persistence in doctoral studies, showing that students who successfully completed their doctoral programs perceived more frequent support for their basic psychological needs. Furthermore, greater perceived supervisory support enhanced doctoral students' sense of

competence in their studies. Similar findings were reported by Van der Linden et al. (2018), who also identified positive effects of supervisory support on students' intentions to persist in their doctoral programs.

Su (2019) found that supervisory support is positively associated with doctoral students' need satisfaction. The study further showed that insufficient supervisory support tends to produce negative effects on learning; however, these effects may be mitigated when students develop self-confidence strategies and seek support from their peers to compensate for unmet needs during the supervisory process.

Although not explicitly grounded in BPNT, previous studies have likewise documented the positive effects of supervisory support on academic and professional outcomes. Chemers et al. (2011) identified positive indirect effects of supervisory support on commitment to a scientific career, whereas Curtin et al. (2016) and German et al. (2019) found that supervisory support positively influences students' interest in pursuing academic careers.

Overall, the existing literature indicates that supervisory support is an important factor shaping the doctoral experience by influencing learning, persistence, and, consequently, students' academic and professional development. Accordingly, the following hypothesis is proposed:

H₁: Supervisory support for (a) autonomy, (b) competence, and (c) relatedness has a positive effect on doctoral students' commitment to scientific research.

Commitment to scientific research refers to an individual's interest in and identification with research activities, which may be expressed across different professional contexts, including those outside formal academic careers. Nevertheless, empirical research has predominantly examined this interest through the lens of intentions to pursue an academic career. Studies by Chemers et al. (2011), Curtin et al. (2016), and German et al. (2019) have shown that supervisory support is associated with doctoral students' greater likelihood of pursuing academic careers.

However, German et al. (2019) found that doctoral students expressed intentions to apply for academic positions regardless of their level of satisfaction with supervisory support. This finding suggests that although supervisory support represents an important contextual factor shaping career choices, such decisions may also be influenced by students' individual expectations and professional aspirations.

Doctoral education represents a transitional period between the educational and professional domains and is therefore regarded as a preparatory stage during which students evaluate the extent to which academic occupations align with their personal and professional aspirations (Curtin et al., 2016). Accordingly, both contextual and individual factors have been identified as important determinants of students' educational and career choices (Atitsogbe & Bernaud, 2022). From a contextual perspective, studies by Chemers et al. (2011), Curtin et al. (2016), and German et al. (2019) suggest that supervisors can influence their students' career trajectories and occupational choices. From an individual perspective, the literature highlights the importance of work values as key determinants of students' career decisions (Sulistiobudi & Hutabarat, 2022).

Work values reflect the aspects of work that individuals consider important and desirable because they function as "secondary action drivers determined by needs, as well as by socialization, cognition, and experience" (Kooij et al., 2011, p. 199). They can therefore be understood as personal resources that facilitate students' transition into their chosen occupations or careers (Sortheix et al., 2013). Agbonlahor et al. (2021) argue that students' career preferences begin to develop during doctoral education and that career

choices may be shaped by a variety of factors. Accordingly, because commitment to scientific research is conceptualized in this study as an academic professional activity, work values are expected to exert an important influence on such commitment.

Furthermore, it is proposed that supervisory support also influences doctoral students' work values. Although work values are personal in nature, they are shaped by individuals' needs and socialization processes and therefore cannot be understood solely as products of individual experience (Zanelli et al., 2014). During doctoral education, students' integration into and socialization within the academic community are largely guided by their supervisors, who play a central role in transmitting professional values and enriching the experiences of those entering the academic community (Lam & Campos, 2015).

Agbonlahor et al. (2021) further argue that doctoral experiences constitute a period of anticipatory socialization, during which students who work more closely with faculty members tend to receive stronger preparation for future academic occupations. Consequently, the supportive contexts experienced throughout doctoral education may influence the development of students' professional goals and shape their subsequent career trajectories.

By providing autonomy, competence, and relatedness support, supervisors tend to expose doctoral students to a realistic understanding of academic life and academic professional activities (Austin, 2002). This process, in turn, contributes to the development and consolidation of students' work values. Accordingly, when examining the relationship between supervisory support and commitment to scientific research, it is reasonable to expect that this relationship is also mediated by students' work values. Specifically, supervisory support may shape doctoral students' work values, which, in turn, significantly influence their commitment to scientific research.

Work values are traditionally classified as intrinsic or extrinsic. Intrinsic work values refer to the goals individuals seek to achieve through their work, such as personal fulfillment, personal growth, and challenging work, whereas extrinsic work values concern external rewards, including job security and financial independence (Porto & Pilati, 2010). Doo and Park (2019) argue that students guided by intrinsic work values are more likely to choose occupations that align with their academic interests and provide personal satisfaction, whereas those guided by extrinsic work values tend to seek occupations that offer external rewards, such as material achievement and social prestige.

Doctoral students enter graduate education in pursuit of both intrinsic and extrinsic rewards (Agbonlahor et al., 2021). Traditionally, academic professional activities have been associated with individuals who are primarily motivated by intrinsic work values (Teichler et al., 2013). Based on this reasoning, the following hypothesis is proposed:

H₂: Supervisory support for (a) autonomy, (b) competence, and (c) relatedness has a positive indirect effect on doctoral students' commitment to scientific research through intrinsic work values.

Academic professional activities, such as commitment to scientific research, are generally regarded as attractive because they involve intellectual challenges, personal fulfillment, and opportunities for professional growth—characteristics traditionally associated with intrinsic work values. However, external rewards, such as financial independence, job security, and social prestige, are also important considerations and are reflected in extrinsic work values.

Although the literature has not traditionally associated extrinsic work values with academic professional activities, it is reasonable to assume that students motivated by

extrinsic work values may also perceive academic activities as attractive when they expect to obtain external rewards from them. For example, a student guided by extrinsic work values may, at some point during doctoral education, demonstrate commitment to scientific research upon recognizing that engagement in research may facilitate career advancement, access to stable academic positions, or opportunities that provide social recognition and financial rewards.

In this regard, Sousa and Colauto (2021) found that extrinsic work values, particularly those related to job security and financial independence, play a central role in the occupational choices of accounting students. These findings may reflect the characteristics of the sample, as graduate students are typically at a stage of professional development in which career advancement, higher earnings, and financial security are particularly salient.

Accordingly, it is proposed that extrinsic work values may also foster students' commitment to scientific research when they perceive such commitment as a means of obtaining external rewards. Therefore, the following hypothesis is proposed:

H3: Extrinsic work values mediate the positive effects of supervisory support for (a) autonomy, (b) competence, and (c) relatedness on doctoral students' commitment to scientific research.

The theoretical model of the study is presented in Figure 1.

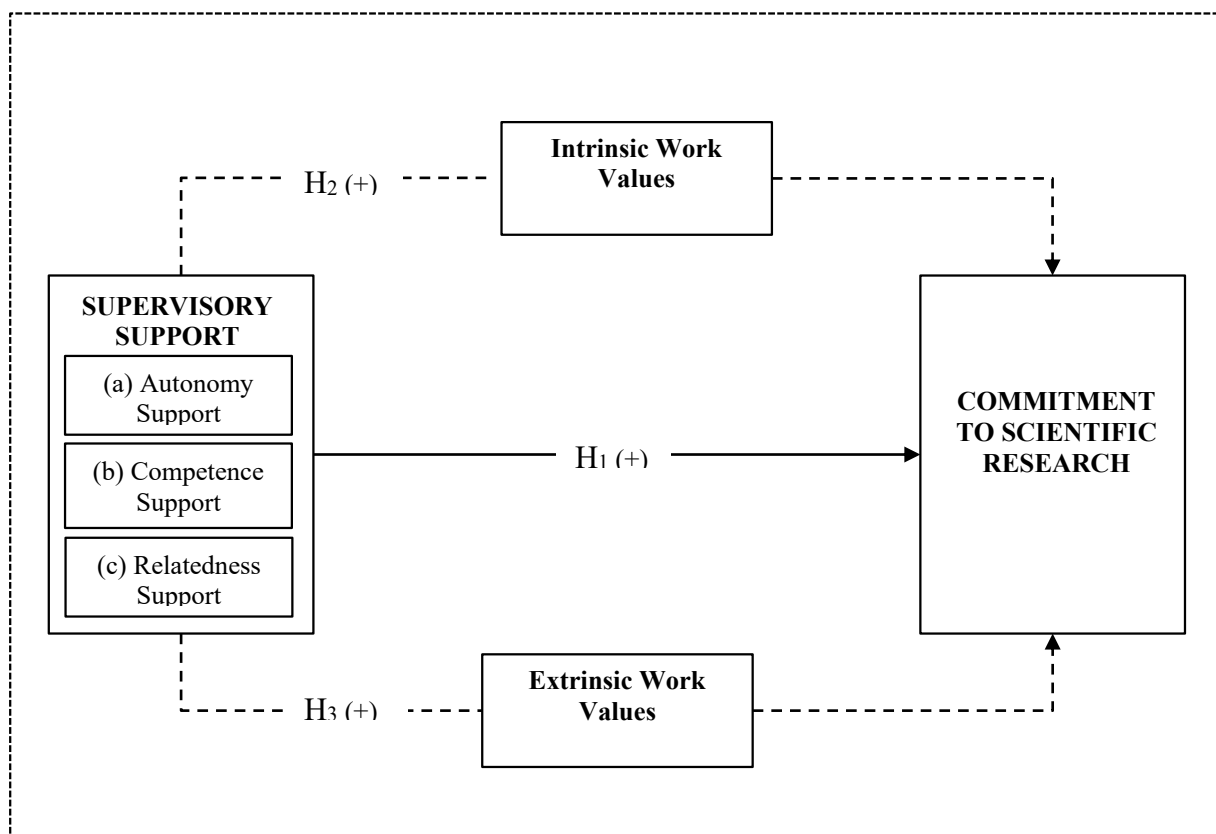


Figure 1 Theoretical model of the study

Source: Prepared by the authors.

3. METHODOLOGY

This study adopted a quantitative, descriptive research approach and used a survey as the data collection strategy. The respondents were doctoral students enrolled in academic PhD programs in Brazil in the fields of business administration, accounting, and economics who were in the thesis development stage. The study was restricted to: (1) business administration, accounting, and economics because these fields constitute the “business” area; and (2) the thesis development stage because it is assumed that interactions between supervisors and doctoral students are more intense during this phase of doctoral education. These delimitations imply limitations regarding the generalizability of the findings to other academic contexts and fields of knowledge.

To identify potential respondents, a search was conducted for academic doctoral programs in the business field (business administration, accounting, and economics) through the website of the Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES). According to CAPES’s 2017–2020 four-year evaluation, these fields comprised 95 doctoral programs and 4,743 enrolled students. For data collection purposes, the questionnaire was initially sent to the coordinators of the 95 programs for dissemination among doctoral students. Subsequently, the email addresses of the 4,743 students were obtained from the Sucupira Platform, enabling direct distribution of the survey.

Because not all enrolled students were developing their theses at the time of data collection, a screening question was included in the questionnaire. Only respondents who indicated that they were in stages related to thesis development were allowed to proceed with the survey. The response options included: beginning of thesis writing, revisions after the qualification examination, revisions after the thesis defense, or submission of scientific manuscripts. An open-ended field was also provided for participants to report other stages, allowing the researchers to assess whether these cases met the study’s inclusion criteria.

Data collection took place from July 13 to August 9, 2023, using an electronic questionnaire administered online through the SurveyMonkey® platform. The study was conducted in accordance with ethical standards for research involving human subjects, ensuring the rights and interests of participants, under the Certificate of Presentation for Ethical Review (CAAE) No. 69452023.8.0000.0214.

The data collection instrument consisted of three sections. The first section collected information regarding respondents’ educational level, field of study, and doctoral stage. The second section assessed supervisory support, work values, and commitment to scientific research using 11-point scales (0 = strongly disagree; 10 = strongly agree) for all items. The third section aimed to identify participants’ sociodemographic characteristics.

To measure supervisory support, an instrument tailored to the Brazilian context was developed. Initially, a literature review was conducted based on studies by Devos et al. (2015), Overall et al. (2011), Van der Linden et al. (2018), and Zeinstra et al. (2023) to construct a reference framework containing the construct dimensions, measurement items, and studies supporting their development (Hair et al., 2019). Subsequently, the instrument underwent a three-stage validation process: (1) theoretical or face validity; (2) semantic validity; and (3) empirical validation (Hair et al., 2019). After validation, the instrument comprised 21 items, as presented in Table 1.

Table 1*Items comprising the dimensions of the Supervisory Support construct*

Construct My supervisor....	
Autonomy Support	Allows me to perform activities at my own pace
	Encourages me to think about original projects
	Provides rationales for the activities assigned to me
	Encourages me to discuss issues that concern me
	Takes my ideas into consideration
	Encourages me to work independently
	Listens to my suggestions regarding how I would like to conduct my research
Competence Support	Makes clear his/her expectations regarding my responsibilities as a doctoral student
	Encourages in-depth discussions about my research
	Helps me plan the different tasks I need to complete
	Is available when needed
	Provides guidance on technical knowledge and academic skills
	Discusses the difficulties I face and provides constructive feedback
	Responds to my questions within a reasonable timeframe
Relatedness Support	Shows enthusiasm when we discuss my research
	Expresses empathy when necessary
	Makes me feel good about myself
	Reassures me when I need it
	Shows concern for me, not only as a researcher but also as a person
	Makes me feel that I can succeed
	Demonstrates respect for my feelings

Source: *Prepared by the authors.*

To measure work values, 11 items from the Revised Work Values Scale developed by Porto and Pilati (2010) were used, corresponding to the dimensions of “security” and “self-determination and stimulation.” These dimensions represent, respectively, extrinsic and intrinsic work values, which are widely used in research on work values. The items comprising the work values construct are presented in Table 2.

Table 2*Items comprising the Work Values construct*

Construct It is important to me...	
Intrinsic Work Values	To have an innovative job
	To have a job that requires originality
	To have a job that allows me to meet new people
	To have a job that allows me to express my knowledge
	To have constant challenges
	To have autonomy in performing my tasks
	To have freedom to decide how to perform my work
Extrinsic Work Values	To support myself financially
	To achieve financial independence
	To achieve financial stability
	To earn money
	To have better living conditions

Source: *Porto and Pilati (2010).*

To measure commitment to scientific research, a portion of the Career Commitment Scale developed by Carson and Bedeian (1994) and validated for the Brazilian context by Magalhães (2013) was used. The scale was adapted to specifically reflect aspects related to scientific research, and nine items were included in this study, as presented in Table 3.

Table 3

Items comprising the Commitment to Scientific Research construct

Statements
Scientific research is an important part of who I am.
Scientific research has great personal meaning for me.
I feel emotionally attached to scientific research.
I strongly identify with the scientific research area in which I am involved.
I have strategies to achieve my goals in scientific research.
I have goals to achieve my objectives in scientific research.
I think about my personal development in scientific research.
My achievements associated with scientific research are rewarding.
My problems in scientific research are compensated for by the benefits it provides.

Source: Adapted by the authors based on Magalhães (2013).

It should be noted that all adaptations made to the instrument were reviewed and validated by two doctoral faculty members with expertise in accounting education and by two doctoral students in the business field, who assessed the clarity of the items and the need for additional adjustments.

For data analysis, descriptive statistics techniques were performed using IBM SPSS Statistics® version 22, and the multivariate technique of partial least squares structural equation modeling (PLS-SEM) was applied using SmartPLS® 3.2.9. The minimum sample size required for the application of PLS-SEM was estimated using G*Power 3.1.9.7®, which indicated a minimum requirement of 138 respondents [parameters used: effect size $f^2 = 0.15$; α error probability = 0.05; power ($1-\beta$ error probability) = 0.95; number of predictors = 5].

4. RESULTS

4.1 Respondent Characteristics

A total of 503 valid responses were obtained, with a predominance of male respondents (51.9%). Most participants were between 26 and 36 years old (55.9%). Regarding their doctoral fields, most respondents were enrolled in business administration programs (63%), followed by economics (21.1%) and accounting (15.9%). Concerning academic characteristics, 68% of participants were enrolled at public universities. Regarding supervision, 67.4% of respondents had never considered changing supervisors, 20.7% had considered this possibility, and 11.9% had to change supervisors. Regarding their doctoral programs, 45.3% of respondents reported having considered withdrawing from the program.

4.2 Measurement Model

In the first stage, the factor loadings of the indicators were assessed, resulting in the removal of three items with loadings below 0.708, as recommended by Hair et al.

(2021). Items with loadings close to the threshold ($\lambda = 0.654$; $\lambda = 0.685$) were retained because their removal did not improve internal consistency or the model's convergent validity (Hair et al., 2021).

In the second stage, internal consistency reliability was assessed using Cronbach's alpha and composite reliability. In the third stage, convergent validity was evaluated through the average variance extracted (AVE) (Hair et al., 2021). Subsequently, discriminant validity was assessed using the Fornell–Larcker criterion, which requires the square root of each construct's AVE to be greater than its correlations with other constructs, and the heterotrait–monotrait ratio (HTMT), considered a more robust approach (Hair et al., 2021). HTMT values should be below 0.90 for conceptually similar constructs and below 0.85 for conceptually distinct constructs.

Table 4 presents the values associated with the measurement models.

Table 4

Measurement Model

	λ	α	CR	AVE	CSR	RS	AS	CS	EWV	IWV
CSR	[0.654;0.842]	0.914	0.929	0.595	0.772	0.258	0.237	0.329	0.196	0.617
RS	[0.878;0.948]	0.926	0.942	0.730	0.245	0.919	0.877	0.865	0.064	0.257
AS	[0.804;0.891]	0.930	0.943	0.705	0.221	0.831	0.855	0.831	0.111	0.196
CS	[0.751;0.883]	0.969	0.974	0.844	0.308	0.826	0.778	0.84	0.064	0.184
EWV	[0.685;0.895]	0.871	0.903	0.652	0.193	0.062	0.105	0.051	0.807	0.243
IWV	[0.744;0.832]	0.831	0.881	0.598	0.543	0.238	0.179	0.173	0.214	0.773

Note: Values on the diagonal and below the diagonal refer to the Fornell–Larcker criterion, whereas values above the diagonal refer to the heterotrait–monotrait ratio (HTMT). AVE = average variance extracted; AS = autonomy support; CS = competence support; CR = composite reliability; CSR = commitment to scientific research; EWV = extrinsic work values; IWV = intrinsic work values; RS = relatedness support; α = Cronbach's alpha; λ = factor loadings.

Source: Prepared by the authors.

According to Table 4, all constructs demonstrated adequate internal consistency reliability, with Cronbach's alpha and composite reliability values above 0.70, as well as satisfactory convergent validity, indicated by average variance extracted (AVE) values above 0.50, as recommended by Hair et al. (2021). Additionally, the square root of the AVE was greater than the shared variance (cross-loadings), and HTMT values remained below the established thresholds, confirming discriminant validity and reinforcing the robustness of the measurement model.

4.3 Structural Model

The assessment of the structural model in partial least squares structural equation modeling (PLS-SEM) considers the significance and relevance of path coefficients, as well as the model's explanatory and predictive power (Hair et al., 2021). This assessment included: (a) collinearity analysis using the variance inflation factor (VIF); (b) significance and relevance of path coefficients; (c) coefficient of determination (R^2); and (d) effect size (f^2). The values of these initial indicators are presented in Table 5.

Table 5*Structural model indicators*

Constructs	R ²	Adjusted R ²	f ²	VIF
Autonomy support			0.001	3.57
Competence support			0.065	3.45
Relatedness support			0.009	4.51
Extrinsic work values	0.014	0.008	0.009	1.06
Intrinsic work values	0.059	0.053	0.359	1.11
Commitment to scientific research	0.359	0.352		

*VIF = variance inflation factor.***Source:** Prepared by the authors.

VIF values above 5 indicate potential collinearity problems among predictor constructs (Hair et al., 2021). The results showed VIF values below this threshold, indicating the absence of collinearity issues. Regarding the model's explanatory power (R²), the construct commitment to scientific research presented a substantial explained variance. In terms of effect size (f²), the construct intrinsic work values demonstrated a large effect on the explanation of commitment to scientific research.

The significance and relevance of the structural path coefficients were assessed through bootstrapping with 5,000 subsamples, using bias-corrected confidence intervals and a two-tailed test.

Table 6 presents the assessment of the structural model.

Table 6*Structural model*

Structural path	β	Standard error	t-Value	p-Value	Hypothesis	Conclusion
Direct effects						
AS → CSR	-0.039	0.096	0.409	0.682	H _{1a}	Not supported
CS → CSR	0.38	0.094	4.035	0	H _{1b}	Supported
RS → CSR	-0.162	0.098	1.654	0.098	H _{1c}	Not supported
Indirect effects						
AS → IWV → CSR	-0.021	0.054	0.392	0.695	H _{2a}	Not supported
CS → IWV → CSR	-0.031	0.042	0.746	0.456	H _{2b}	Not supported
RS → IWV → CSR	0.163	0.054	2.999	0.003	H _{2c}	Supported
AS → EWV → CSR	0.015	0.011	1.416	0.157	H _{3a}	Not supported
CS → EWV → CSR	-0.004	0.007	0.664	0.506	H _{3b}	Not supported
RS → EWV → CSR	-0.004	0.006	0.601	0.548	H _{3c}	Not supported

CSR = commitment to scientific research; AS = autonomy support; CS = competence support; RS = relatedness support; EWV = extrinsic work values; IWV = intrinsic work values; β = structural coefficient.

Source: Prepared by the authors.

4.4 Discussion of Results

When specifically examining whether autonomy support has a positive effect on commitment to scientific research (H_{1a}), the relationship was found to be statistically non-significant ($\beta = -0.039$; $p = 0.682$). Thus, the results indicate that supervisory

autonomy support does not influence the commitment to scientific research among business doctoral students participating in this study.

It is well established that autonomy support provided by supervisors encourages students' active involvement in research activities and in the definition of academic goals, fostering greater ownership and motivation (Van Rooij et al., 2021). Although Overall et al. (2011) found that autonomy support contributes to higher levels of research self-efficacy, the findings of the present study indicate that, when considered independently, it is not sufficient to promote commitment to scientific research.

According to Devos et al. (2015), within the logic of BPNT, if supervisors provide excessive autonomy without adequate guidance, students may feel uncertain and insecure about their choices, which, in turn, may undermine their commitment to scientific research.

In this regard, Overall et al. (2011) highlighted that effective supervision should balance autonomy support and competence support, allowing students to develop their own ideas while improving the skills required to perform the activities expected of them.

Regarding hypothesis H1b, the results revealed that supervisory competence support had a positive and significant effect on commitment to scientific research among business doctoral students ($\beta = 0.380$; $p = 0.000$), supporting the proposed hypothesis. This finding advances previous literature, which had, thus far, identified only the indirect influence of competence support on commitment to a scientific career (Chemers et al., 2011). Furthermore, this result is consistent with other studies that, although not grounded in BPNT, confirmed the positive influence of competence support on the development of scientific identity (Chemers et al., 2011) and career self-efficacy (Curtin et al., 2016).

This study, therefore, provides additional evidence by demonstrating that competence support has a direct and positive influence on doctoral students' commitment to scientific research. This finding reinforces the understanding that, by providing constructive feedback, being available to discuss research techniques and skills, and clearly communicating expectations, supervisors help students feel more competent in their research activities, thereby fostering their commitment to scientific research.

Regarding supervisory relatedness support, this type of support did not have a positive effect on commitment to scientific research (H1c), given the statistically non-significant relationship ($\beta = -0.162$; $p = 0.098$). Relatedness support, when considered independently, was not capable of predicting commitment to scientific research. From the perspective of BPNT, this type of support focuses on the quality of the interpersonal relationship between supervisors and doctoral students. Recognized as relevant for creating a safe and supportive environment, relatedness support tends to function as a "background condition" that promotes students' well-being and healthy development. Therefore, previous studies have associated this type of support with student satisfaction (Overall et al., 2011) and persistence in doctoral programs (Van der Linden et al., 2018).

Overall et al. (2011) argue that supervisors should strongly consider relatedness support because it is a predictor of students' satisfaction and well-being. The authors suggest that greater relatedness support may generate several benefits, such as positive research experiences, greater adaptability when facing difficulties, and the indirect promotion of research self-efficacy, as students perceive supervision as an environment in which they can seek assistance whenever necessary.

The findings related to these hypotheses suggest that, in the context of doctoral education in the business field, commitment to scientific research is less associated with autonomy or interpersonal relationships and more strongly related to the perception of effective development of the competencies required for scientific activities. This result may stem from the specific characteristics of doctoral programs in the business field,

where pressure for productivity, methodological rigor, and tangible outcomes makes competence support more salient than other types of support.

Additionally, studies suggest that the impact of supervisory support on doctoral students' academic experiences is mediated by students' personal variables (De Clercq et al., 2021; Litalien & Guay, 2015), implying that the effects of support may vary according to individual student characteristics. This represents a crucial point for both research and academic practice.

Hypothesis H₂ proposed that “supervisory support for (a) autonomy, (b) competence, and (c) relatedness has positive effects on doctoral students' commitment to scientific research when mediated by intrinsic work values.” However, the results indicated that intrinsic work values did not mediate the relationship between autonomy support and commitment to scientific research ($\beta = -0.021$; $p = 0.695$), nor the relationship between competence support and commitment to scientific research ($\beta = -0.031$; $p = 0.456$). These relationships were not statistically significant, and therefore hypotheses H_{2a} and H_{2b} were not supported.

Conversely, the results revealed that intrinsic work values mediated the relationship between relatedness support and commitment to scientific research ($\beta = 0.163$; $p = 0.003$). Thus, the mediation effect was supported, indicating that supervisory relatedness support has a positive effect on doctoral students' commitment to scientific research when mediated by intrinsic work values (H_{2c}). This finding is relevant because it confirms the importance of relatedness support in the supervision process, as highlighted by Overall et al. (2011). Although no direct relationship was found between relatedness support and commitment to scientific research, this type of support indirectly influences such commitment through intrinsic work values.

According to BPNT, relatedness support involves establishing a friendly, empathetic, and healthy relationship between supervisors and doctoral students, which may foster students' sense of belonging and security. In this sense, relatedness support acts as a predictor of intrinsic motivation toward work, operationalized in this study as intrinsic work values.

Intrinsic work values refer to the pursuit of occupations that are inherently rewarding and enjoyable (Porto & Pilati, 2010). When students develop or hold intrinsic work values, they seek professional occupations that provide personal fulfillment and allow them to learn, explore new ideas, and contribute to knowledge development. This explains the relationship between intrinsic work values and commitment to scientific research, which involves identification with research activities, continuous dedication to inquiry, and contributions to the advancement of a particular field of knowledge.

This means that students who are intrinsically motivated toward work find satisfaction in the research process itself, in the discovery of new knowledge, and in contributing to the advancement of their field. Such intrinsic motivation can represent a valuable source of commitment to scientific research, even when extrinsic rewards, such as funding or recognition, are not immediate or guaranteed.

Regarding extrinsic rewards, hypothesis H₃ investigated whether “supervisory support for (a) autonomy, (b) competence, and (c) relatedness has positive effects on doctoral students' commitment to scientific research when mediated by extrinsic work values.” The results indicated that extrinsic work values did not play a mediating role in any of the relationships examined. Specifically, when analyzing whether autonomy support has a positive effect on doctoral students' commitment to scientific research through the mediation of extrinsic work values (H_{3a}), the results did not show a significant relationship ($\beta = 0.015$; $p = 0.157$). Similarly, extrinsic work values did not mediate the relationship between competence support and commitment to scientific

research (H3b: $\beta = -0.004$; $p = 0.506$), nor the relationship between relatedness support and commitment to scientific research (H3c: $\beta = -0.004$; $p = 0.548$).

The findings indicate that extrinsic work values do not function as a mediating variable in the relationship between supervisory support and commitment to scientific research. This result may be related to the fact that, when students are primarily focused on external rewards, their commitment to scientific research may be affected, since research requires substantial effort, dedication, and interest in the subject matter, aspects that extend beyond immediate external rewards.

For comparison purposes, Sousa and Colauto (2021) found a predominance of extrinsic work values among Brazilian graduate students in accounting, which raises concerns because, in the present study, such values were not associated with commitment to scientific research. Therefore, it is relevant to reflect on how doctoral programs in the business field and their supervisors can foster values that strengthen students' connection with scientific activities, particularly considering that academic doctoral programs are designed to prepare independent researchers committed to advancing their fields.

Overall, the results indicate that, in the context of doctoral education in business in Brazil, commitment to scientific research is more strongly associated with the perception of competence development than with autonomy or relatedness considered separately. From this perspective, doctoral students tend to strengthen their commitment to research as they perceive concrete improvements in their technical skills and in their ability to produce academically recognized outcomes. This finding suggests that doctoral programs should devote greater attention to supervisor training, promoting effective supervision practices and recognizing supervisors' role as facilitators of students' academic and professional development.

The absence of a direct effect of autonomy support may be related to characteristics of the Brazilian academic context, which is still marked by hierarchical structures and more guided educational trajectories. In this setting, high levels of autonomy, when not accompanied by clear guidance, may be perceived by doctoral students as supervisory distance or lack of direction, helping explain the absence of a significant association between this type of support and commitment to scientific research.

Relatedness support did not directly influence commitment to scientific research; however, a positive and significant relationship was observed when intrinsic work values were considered as a mediator. This result indicates that interactions based on trust, emotional support, and empathy contribute to strengthening students' intrinsic work values, which appear to constitute an important foundation for commitment to scientific research. Taken together, these findings suggest that models based on BPNT may assume specific configurations depending on national and disciplinary contexts, requiring supervision approaches that integrate structured technical development, interpersonal support, and strategies aimed at fostering intrinsic work values.

5. CONCLUSIONS

The findings of this study demonstrated that competence support has a direct and positive effect on commitment to scientific research, whereas autonomy support and relatedness support did not present significant direct effects. However, intrinsic work values mediated the relationship between relatedness support and commitment to scientific research, indicating that interpersonal aspects indirectly influence students' commitment to research activities. Extrinsic work values did not act as mediators in any of the relationships examined.

From a theoretical perspective, this study contributes by applying BPNT (Deci & Ryan, 2000) to the supervisor–doctoral student relationship, providing a deeper understanding of how the social context of graduate education may influence students' development. Furthermore, it empirically demonstrates the relevance of competence support, expanding discussions on academic supervision and commitment to scientific research, particularly in the business field. This finding highlights the importance of doctoral programs investing in faculty development to enable supervisors to provide this type of support and strengthen students' academic development.

Analyzing commitment to scientific research as an academic professional occupation allowed this study to consider research as an important and necessary form of work within the academic context. Although supervisory relatedness support did not directly influence commitment to scientific research, it demonstrated a positive and significant effect when mediated by intrinsic work values. Thus, by providing interpersonal support, supervisors influence students' intrinsic work values and, consequently, their commitment to scientific research, highlighting the importance of valuing the interpersonal dimensions of supervision to foster a healthy and motivating academic environment.

Regarding practical and pedagogical contributions, the findings provide insights for faculty members to understand the types of support required throughout the supervision process, aiming to promote students' academic and professional development. Graduate program committees may use this information to develop guidelines that address students' needs, train faculty members, and improve supervision practices, thereby enhancing doctoral students' performance, engagement, and commitment. Additionally, the development of an instrument to measure supervisory support in Brazilian graduate education enables joint analyses with other academic variables, providing further evidence to improve doctoral supervision practices and students' well-being.

Among the limitations of this study, it should be noted that the data reflect only students' perspectives, are self-reported, and were collected through a cross-sectional design. Moreover, the findings are restricted to a sample from the business field, limiting their generalizability. Future research should adopt longitudinal and qualitative approaches, explore the perspectives of supervisors and peers, and investigate the effects of autonomy, competence, and relatedness need frustration throughout the supervision process.

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Conceptualization: equal;
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 Formal analysis: lead;
 Funding acquisition: equal;
 Investigation: lead;
 Methodology: lead;
 Project administration: equal;
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 Software: equal;
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 Validation: equal;
 Visualization: equal;
 Writing – original draft: lead;
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Conceptualization: equal;
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 Investigation: supporting;
 Methodology: supporting;
 Project administration: equal;
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 Visualization: equal;
 Writing – original draft: supporting;
 Writing – review and editing: equal.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The dataset supporting the findings of this study is not publicly available.

GENERATIVE AI DISCLOSURE

The authors declare that no generative artificial intelligence was used in any stage of the production of this manuscript (including research, writing, data analysis, formula generation, or the creation of graphic elements).

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