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Brain Drain: Proposal for a Management Model of the Capes Full Doctoral Program in Light of the Resource-Based View

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ABSTRACT

Globalization and network society, with processes that surpass national borders, mark the innate of the south 21. These factors defy higher education institutions to internationalize to form high human resources, highlighting the state's need to prioritize and encourage academic mobility. In Brazil, the Coordination of Improvement of Staff of a Superior (CAPES) It is the main agency of internationalization of internationalization, allowing scholars to perform their poses in full sensu abroad through the Full Doctorate Program. However, this can lead to brain drain when researchers do not return to their country of origin, causing losses. This dissertation investigates strategies for managing the CAPES Full Doctorate Program in light of the Resource-Based View (RBV), considering brain drain. The objective of the study is to propose a Program management model in accordance with the RBV theory, which considers Human Resources as sources of sustainable competitive advantage. The research is qualitative in nature, exploring in approach and based on a single case study. Data collection included documentary survey on the Ministry of Education - MEC/CAPES portal, data from the Sucupira Platform (GeoCAPES), semi-structured interviews with managers from the Directorate of International Relations (DRI) CAPES, students and graduates of the Program, and semi-structured questionnaires with students, allowing data triangulation according to Yin (2001). The analysis followed the Content Analysis technique proposed by Bardin (2011). The main results indicate that, despite the return commitment established with CAPES in the Grant and Scholarship Acceptance Term, some participating researchers do not return to Brazil due to lack of resources, infrastructure, political instability, better salaries or scholarships abroad, participation in research groups at renowned universities and negotiations with CAPES (Novação). Data analysis led to the Proposal of a Management Model that replaces the interstice with the researcher's contribution through an Alternative Academic Activities Plan, with an impact and relevance equivalent to the investment made. For the effectiveness of the proposed Model, it is suggested for future studies to calibrate Academic Activities with ad hoc consultants. This work contributes to the Sustainable Development Goals (SDGs 4, 8, 16 and 17), demonstrating its social impact.

Keywords: Internationalization of postgraduate studies, Brain drain, Full Doctorate, CAPES, RBV

[1] Corresponding author. Email addresses: asarasantos@icloud.com.We, authors of the current research paper, certify that the paper is an outcome of our independent and original work. We have duly acknowledged all the sources from which the ideas and extracts have been taken and we are responsible for any errors that may be discovered. We thank the editor of CYRUS Global Business Perspectives (CGBP), and anonymous reviewers for their careful reading of our manuscript and their many insightful comments and suggestions.

INTRODUCTION

The 21st century is characterized by globalization, which drives the internationalization of postgraduate education as a key strategy for scientific advancement and technological innovation (Moskal & Schweisfurth, 2018; Tight, 2019). Academic mobility has been widely adopted worldwide to promote scientific progress and researcher qualification (Altbach & Knight, 2007). In Brazil, the Coordination for the Improvement of Higher Education Personnel (CAPES) leads this process through the Full Doctoral Program Abroad, which requires substantial financial investment and faces challenges related to the retention of the intellectual capital it develops (Neves & Barbosa, 2020).

Brain drain, characterized by the permanent migration of researchers abroad after completing their training, is a critical issue as it can undermine national scientific development (Bruno et al., 2024). While academic mobility offers benefits such as international collaborations and research advancements, the lack of effective mechanisms to facilitate the return of these professionals to Brazil can lead to significant economic and scientific losses (Yang, 2020; Labanauskas, 2019). Studies indicate that this phenomenon occurs when there are limited job and research opportunities in the country of origin (Siekierski et al., 2019; Azevedo & Dutra, 2021). Despite the relevance of this issue, a theoretical gap remains concerning effective management models to balance postgraduate internationalization and human capital retention. Thus, this study aims to propose a management model for the CAPES Full Doctoral Program, based on the Resource-Based View (RBV) (Barney, 1991), by analyzing the factors that influence the decision to stay abroad or return to Brazil.

This research adopts a qualitative, exploratory approach, incorporating semi-structured interviews with CAPES directors, students, and graduates of the Full Doctoral Program. Data analysis follows the content analysis method (Bardin, 2011), allowing for the identification of strategies to optimize program management and minimize the negative impacts of brain drain while providing insights to establish the proposed management model. The results indicate that creating incentives for return, such as improved working conditions, research opportunities, and academic networking, is essential for talent retention (Horta, 2020; Khan, 2021). However, many frontier research projects in Brazil cannot continue if researchers return to the country. Therefore, it is suggested that remote contribution mechanisms, such as an Academic Activities Plan, be implemented for researchers who remain abroad, facilitating academic collaborations and mentoring initiatives (Oliinyk et al., 2021). The core premise of the Academic Activities Plan is to engage researchers in intellectual activities with an impact and relevance equivalent to the investment made (scholarship funding received), thereby ensuring that research findings contribute to Brazil or the country of origin.

This study contributes theoretically to discussions on postgraduate internationalization, academic mobility, and brain drain. In practice, it provides guidelines to enhance the management of programs that promote academic mobility, mitigating brain drain by ensuring that research results

are absorbed by the country of origin. This research aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 16 (Peace, Justice, and Strong Institutions), and SDG 17 (Partnerships for the Goals), underscoring its relevance in strengthening higher education and scientific innovation in Brazil.

THEORETICAL BACKGROUND

The Resource-Based View (RBV)

The Resource-Based View (RBV) originated in the works of Selznick (1957) and Penrose (1959), later developed by Barney (1991) and expanded by Peteraf (1993). Penrose (1959) introduced the concept of resource-based firm growth, which was subsequently explored by Wernerfelt (1984) and Barney (1991). Over time, the approach evolved into what is now known as RBV, emphasizing how firms leverage internal resources for competitive advantage (Newbert, 2008). Porter (1980) developed strategic analysis models, such as the Five Forces framework, to explain competitive advantage, but RBV shifted focus to internal firm capabilities as the primary source of sustained performance (Penrose, 1959; Ansoff, 1968).

Barney (1991) introduced RBV as a framework for understanding how organizations achieve sustainable competitive advantages through valuable, rare, inimitable, and non-substitutable resources. This model was reinforced by Peteraf (1993) and Peteraf & Barney (2003), further establishing RBV as a dominant theory in strategic management. The theory posits that competitive advantage arises not just from external positioning but also from the firm's ability to develop and manage unique internal resources. Additionally, Barney (1995) emphasized that individual strategic practices might be limited in impact, but when integrated into an organization's resource system, they contribute significantly to sustainable competitive advantage (Gerhart & Feng, 2021).

RBV classifies firm resources into tangible and intangible categories, including physical assets, human capital, and organizational structures (Mintzberg, 1979). The VRIO framework (Value, Rarity, Imitability, and Organization) is central to evaluating resource competitiveness (Barney, 1991). Scholars such as Wernerfelt (1984) and Dierickx & Cool (2002) expanded the framework, emphasizing the heterogeneity of resources and their role in sustaining long-term competitive advantage. Furthermore, Peteraf (1993) categorized resources into four key conditions: heterogeneity, ex-ante and ex-post competition limits, and imperfect mobility, highlighting how firms must strategically manage their resources to maintain a competitive edge. Freeman, Dmytriyev, & Phillips (2021) suggested integrating RBV with Stakeholder Theory to enhance its applicability by incorporating sustainability and cooperative behaviors, reinforcing the theory's relevance for understanding human capital retention and innovation-driven economies, The RBV aligns with this research by considering the researchers in the Full Doctoral Program as important internal resources, characterized by their unique attributes of V – Value, R – Rarity, I –

Inimitability due to their skills, competencies, and talents, and O – Organization in a strategic manner to generate value for institutions, companies, or, in a broader perspective, for the country in a sustainable way.

Stricto Sensu Graduate Education in Brazil

Between 1930 and 1960, Brazil's industrialization and modernization process led to the expansion of public universities focused on research, such as the University of São Paulo (1934) and the University of Brasília (1961), which contributed to the emergence of the first master's and doctoral programs (Oliveira et al., 2010). The 1931 Brazilian Universities Statute structured the university system, emphasizing research and the role of tenured professors in system expansion (BRASIL, 1931). However, Brazil lacked a qualified academic workforce, leading to international academic missions and the reception of exiled scholars from Europe before World War II (Oliveira et al., 2010). The creation of CAPES in 1951 marked the beginning of the Brazilian stricto sensu postgraduate system, which was later regulated in 1965 by the Sucupira Report, defining the organization and purpose of postgraduate education in the country (da Cruz, 2015; Hostins, 2006; Marenco, 2015; Borges & Barreto, 2012).

Stricto sensu postgraduate education refers to academic and research-oriented programs beyond undergraduate studies, awarding master's and doctoral degrees (CAPES, 2023). Unlike lato sensu programs, which focus on professional specialization and training, stricto sensu courses emphasize scientific research as an essential part of higher education (CAPES, 2023). The growth of these programs accelerated during the Brazilian military regime (1964-1985), which sought to develop a highly qualified workforce and foster scientific research for national development (Oliveira, 2015). The formal institutionalization of postgraduate education occurred in 1965 with the creation of CAPES and the National Council for Scientific and Technological Development (CNPq), leading to the establishment of 27 master's and 11 doctoral programs (Marenco, 2015). The 1968 University Reform further consolidated this system, modernizing higher education and expanding postgraduate programs nationwide (Borges & Barreto, 2012).

In the 1970s, postgraduate education saw significant progress, driven by academics committed to research excellence (Silva & Carvalho, 2007). The establishment of the National Postgraduate System (SNPG) in 1975 marked a milestone in higher education policy, reinforcing long-term commitments to academic development (Silva & Carvalho, 2007; Neves, 2020). Over time, the postgraduate model evolved from a linear to a non-linear structure, incorporating professional master's programs to meet social and technological demands (Moreira & Velho, 2008; Dias & Serafin, 2009). CAPES oversees program accreditation, evaluation, and funding, ensuring continuous quality improvement (Marenco, 2015). Despite challenges, Brazil’s postgraduate system has significantly contributed to knowledge generation, forming professionals across various sectors. Most research output in Brazil originates from universities and public research

institutes, highlighting CAPES's crucial role in guiding and promoting postgraduate education (CAPES, 2010; Oliveira, 2015).

CAPES

APES was established in 1951 as a commission to promote the "National Campaign for the Improvement of Higher Education Personnel" and was later incorporated into the Ministry of Education in 1964. Since its foundation, it has aimed to train specialists to drive national development and democratize access to advanced qualifications (Borges & Barreto, 2012; Marenco, 2015). The agency has played a crucial role in the internationalization of Brazilian postgraduate education, investing in international scientific cooperation, awarding scholarships, and attracting foreign visiting professors (CAPES, 2023). Over time, CAPES expanded its functions, becoming responsible for fostering and evaluating stricto sensu postgraduate programs in Brazil, significantly contributing to the expansion of academic research and higher education.

Currently, CAPES operates in several areas, including the evaluation and accreditation of postgraduate programs, funding scholarships in Brazil and abroad, and promoting initial and continuing teacher education for basic education (CAPES, 2023). Additionally, the agency plays a strategic role in shaping public policies for postgraduate education, ensuring that master's and doctoral degrees have national validity (Maccari, Martins & de Almeida, 2015). The Sucupira Platform centralizes data on regulated courses, and CAPES has conducted periodic evaluations since 1976, providing subsidies for policy formulation and allocating resources for scholarships and research support.

The impact of CAPES on the development of Brazilian science is evident, especially in the context of the global scientific production ranking. Brazil ranks among the top 15 countries in the number of academic publications, although it faces challenges in research internationalization and talent retention (Scimago Journal & Country Rank, 2023). The agency also engages in strategic planning to address challenges such as increasing the number of master's and doctoral graduates, reducing regional disparities in postgraduate education availability, and integrating research with the productive sector. The National Postgraduate Plan (PNPG) guides these policies, setting goals and strategies to strengthen the training of highly qualified human resources and scientific innovation in Brazil (CAPES, 2023).

CAPES Doctoral Programs

The internationalization of Brazilian postgraduate education has driven programs such as the Full Doctorate Abroad and the Sandwich Doctorate, promoted by CAPES to expand global academic cooperation and strengthen scientific research. While the Full Doctorate allows for complete training abroad, the Sandwich Doctorate, established in 2011, enables doctoral students to conduct part of their studies at foreign universities, reducing costs and preventing brain drain. In recent years, the sandwich model has become a strategic alternative to enhance international collaboration

and train researchers without significantly increasing educational investments (CAPES, 2023; Velho, 2001).

In this context, it is important to highlight that, although the sandwich model is financially viable due to its lower demand for financial resources, the Full Doctorate, being entirely conducted abroad, allows for a longer research period in cutting-edge fields. This extended timeframe enhances research outcomes and increases their potential contributions to the country of origin (Brazil).

Internationalization of Postgraduate Education in Brazil

The internationalization of postgraduate education in Brazil has become a fundamental aspect of educational and scientific research activities. This process is driven by the need for access to international experiences, the formation of global networks, and the establishment of international scientific collaborations (Spagnolo, 2011; Wit, 2013; Ramos, 2018). Key strategies for internationalization include academic mobility, attracting foreign students, and offering courses in foreign languages. Despite advancements in implementing internationalization strategies, Brazil still faces challenges in fully integrating this process. Barriers such as language proficiency and bureaucratic regulations in public administration hinder the attraction of foreign professors and impact academic mobility (Barbosa & Neves, 2020). Programs rated six and seven in CAPES's Triennial Evaluation, recognized for excellence, continuously adopt internationalization practices, including academic mobility initiatives and attracting visiting researchers. The presence of faculty trained abroad plays a crucial role in this process by fostering scientific partnerships, collaborative projects, and academic exchanges (Ramos, 2018; Hollnagel et al., 2020).

To enhance institutional internationalization, CAPES published the Guide for Accelerating Institutional Internationalization, developed by the Directorate of International Relations (DRI, 2020). This guide aims to strengthen postgraduate education in Brazil by providing directives based on international experiences and partnerships, targeting managers and academics interested in internationalizing their institutions. It outlines four maturity levels in the internationalization process - awareness and commitment, implementation, consolidation, and full internationalization - and establishes evaluation criteria such as teaching reputation, research reputation, scientific influence, international presence, and global collaboration (Hollnagel et al., 2020). Additionally, the National Education Plan (2014–2024) sets specific goals for postgraduate internationalization, focusing on academic mobility and global partnerships. However, internationalization carries the risk of brain drain, where individuals who participate in mobility programs choose not to return to their home country, posing a challenge for many nations. Addressing this phenomenon requires policies and strategies that promote talent retention and create a favorable environment for scientific and technological development (PNE CAPES, 2014).

Brain Drain

The brain drain phenomenon is often analyzed in the context of internationalization policies that encourage short-term mobility or brain circulation. This process, involving the movement of skilled professionals between countries and institutions, fosters knowledge dissemination and national development, benefiting both the sending and receiving countries (Tung, 2008; Marcinkeviciene, 2009). However, in contrast to these policies, the permanent migration of highly skilled individuals in search of better opportunities, known as brain drain, can negatively impact the higher education and research sectors in the country of origin, especially in a global economy increasingly reliant on knowledge (Beine, Docquier & Rapoport, 2001; Khan, 2021).

Brain drain occurs when qualified individuals leave their home country for better working conditions, salaries, educational opportunities, and living standards, resulting in human capital transfer (de Morais & de Queiroz, 2017). Classical literature attributes highly skilled migration to economic and political imbalances in the globalized world, examining its positive and negative effects on sending and receiving countries (Matthews & Zander, 2000; Petroff, 2016). A key challenge is the complexity of return migration, as extended periods abroad can lead to cultural and professional detachment, making reintegration difficult (Harvey, 1989; Williams et al., 2004). Moreover, inadequate social and professional networks in the home country may further hinder returning scientists from effectively rejoining their academic communities.

To address this issue, alternative strategies such as the "diaspora option" propose maintaining permanent scientific and professional networks between migrants and their home countries without requiring physical return (Brown, 2000; Horvat, 2004; Ciumasu, 2007; Petroff, 2016). Countries can benefit from their expatriates through physical return programs or by engaging them in scientific and economic activities remotely (Meyer & Brown, 1999; Labrianidis & Karampekios, 2022). Tsalaportas (2020) highlights the need for flexible governmental policies to attract and retain talent, including fostering remote collaborations. His study on Southern European countries, particularly Greece, shows that brain drain leads to reduced local talent pools and economic stagnation, reinforcing the need for policies that enable expatriates to contribute without returning physically.

The concept of "virtual return" further expands the transnationalism framework, viewing highly skilled migrants as valuable resources who can maintain cross-border professional and academic connections through digital engagement (Portes, 2001; Levitt & Schiller, 2004; Tejada et al., 2013; Labrianidis & Karampekios, 2022). Kousis, Chatzidaki & Kafetsios (2022) affirm that many highly qualified expatriates prefer maintaining professional or research ties over physical return, making institutions that adopt the "brain network" model crucial bridges for global knowledge exchange. Applying the Resource-Based View (RBV) theory, brain drain can be reinterpreted as a strategic challenge: a nation's ability to manage and leverage its highly skilled emigrants determines its competitive advantage, emphasizing the need for policies that optimize talent retention and utilization (Barney, 1990).

METHOD AND RESEARCH DESIGN

This research involves a phenomenological study within a qualitative approach to understand brain drain based on the meanings attributed by those directly involved. Grounded in the interpretation of social reality through the experiences of individuals, phenomenology avoids biases and analyzes specific aspects from the participants' perspectives (Perovano, 2016; Mortari, 2023). The study follows an inductive approach, allowing theories and models to emerge from data collected through multiple methods, small samples, and in-depth qualitative techniques (Triviños, 1897; Gray, 2016). This methodology enables the capture of perceptions from researchers involved in the CAPES Full Doctorate Program, providing an in-depth understanding of the factors influencing their decision to remain abroad (brain drain) or return to Brazil.

Unlike ethnographic research, phenomenological research investigates human experience through unstructured interviews, ensuring reliability through validation by the interviewees themselves (Gray, 2016; Bicudo & Aparecida, 2020). In Brazil, where literature on brain drain remains limited (Torres, 2016), this approach proves appropriate as it allows for the analysis of interactions and documents without imposing predetermined concepts (Bohnsack, 2004; Deslauriers & Kérisit, 2023). Thus, the qualitative research facilitated the structuring of a management model aligned with the study's objectives, contributing to the formulation of strategies that reduce talent loss and strengthen the internationalization of Brazil

The methodological design combines a descriptive, exploratory, and explanatory study, employing documentary analysis and in-depth semi-structured interviews to collect relevant information (Creswell, 2007). The selection of a single-case study, combined with methodological triangulation—based on theory, document analysis, and interviews—allows for an in-depth investigation of specific aspects within their real-world context, ensuring data reliability (Keohane, 1994; Gorard, 2013). Evidence was gathered from institutional documents, administrative records, and testimonies from CAPES area directors, students, and alumni of the CAPES Full Doctorate Program (Yin, 1994, 2001). The research highlights the importance of strategic management in mitigating the effects of brain drain by developing a model based on the Resource-Based View (RBV), which values knowledge and academic networks as essential factors for the internationalization of graduate education and talent retention (Teece, Pisano & Shuen, 1997), or the absorption of research outcomes, as framed by this study.

Collection procedure and data

Data collection was conducted through documentary research and semi-structured interviews with managers, students, and alumni of the CAPES Full Doctorate Program. Documentary sources included the Ministry of Education (MEC) portal, the Sucupira Platform, and official public notices, as well as scientific publications indexed in databases such as Google Scholar, Web of Science, and Scopus (Yin, 2015; Creswell, 2021). The interviews followed a semi-structured script

and were conducted with two CAPES managers and twenty current and former scholarship recipients, selected through convenience sampling, with recruitment via email and support from the Lattes Platform. To expand data collection, an online questionnaire was developed using the QuestionPro platform (Malhotra, 1996; Minayo, 2001).

Data analysis followed Bardin's (1977) Content Analysis methodology, allowing the identification of emerging patterns. The interviews were transcribed using Whisper AI software, ensuring fidelity to the original content and eliminating language biases. Atlas Ti® software was used for data coding, organizing responses into predefined categories based on the theoretical framework, facilitating a deductive approach in interpreting the findings (Krippendorff, 2004). Methodological triangulation combined documentary sources, interviews, and administrative records to ensure result validity and mitigate biases through theoretical constructs and standardized protocols (Yin, 2011; Creswell, 2013).

Finally, the research findings highlight the challenges in talent retention and the need for more flexible institutional policies to mitigate the negative impacts of brain drain. The study proposes a management model based on the Resource-Based View (RBV), emphasizing the strategic role of knowledge and academic networks in strengthening postgraduate internationalization and creating mechanisms that encourage researchers to remain in Brazil or contribute remotely to the country (Teece, Pisano & Shuen, 1997).

ANALYSIS AND INTERPRETATION OF RESULTS

The document analysis and interviews aimed to address the central research question: what strategies can be employed to manage the CAPES Full Doctorate Program in light of the Resource-Based View (RBV), considering the phenomenon of brain drain. The study proposes contributions to the program's management based on RBV principles and the following analytical axes: (1) Selection; (2) Student monitoring; (3) Graduate follow-up; (4) Professional integration and absorption of research outcomes for researchers returning to Brazil; (5) Alternative strategies for those who remain abroad; and (6) Suggestions for improving program management. The analysis and interpretation of the results are structured into two dimensions: the characterization of the research subjects, based on data collected from CAPES, and the analysis of the research unit, considering the findings obtained through interviews.

CHARACTERIZATION OF THE RESEARCH SUBJECT

This case study analyzed CAPES and its Full PhD Program, which funds doctoral studies abroad, representing a high investment and a risk of brain drain. The choice is justified by CAPES's significant role in the internationalization and promotion of research in Brazil.

Research unit

The selection of participants - including managers from the Directorate of International Relations (DRI) at CAPES, students, and alumni of the CAPES Full Doctorate Program - was conducted using convenience sampling (Malhotra, 1996). Two managers, four students, and nine alumni were interviewed, in addition to seven alumni who responded to an online questionnaire via the QuestionPro® platform. Documentary analysis complemented the data collection process, utilizing sources such as the MEC/CAPES portal and the Sucupira Platform.

Data analysis followed the content analysis methodology proposed by Bardin (2011). The categorization was based on predefined variables and emerging categories, including selection, student and alumni monitoring, research result absorption, and suggestions for improving the program's management. Methodological triangulation was employed to validate the findings, integrating interviews, documentary analysis, and theoretical constructs (Yin, 2015; Creswell, 2021). The Atlas Ti® software facilitated data coding, while Whisper AI ensured the accuracy of transcriptions.

The results highlight structural challenges in talent retention and emphasize the need for more flexible policies to enhance the internationalization of postgraduate education and the absorption of research outcomes, regardless of whether researchers return physically to Brazil.

CAPES Full Doctorate Program

The CAPES Full Doctorate Program aims to qualify Brazilian researchers in prestigious foreign institutions, fostering the internationalization of science and strengthening national academic production. However, the low proportion of PhDs in Brazil reflects structural challenges in postgraduate education, exacerbated by the decline in scholarship opportunities and the difficulty of integrating these professionals into the job market or effectively leveraging their research outcomes at the national level (Azevedo & Dutra, 2021; Madeira & Marenco, 2016; Maués & Bastos, 2017). Figure 2 illustrates the decline in scholarship opportunities Full Doctoral - extracted from GeoCAPES (2022).

The increasing presence of PhDs in the private sector outside academia highlights the need for policies that expand demand for these professionals in the country, particularly in the face of economic crises and the impacts of the COVID-19 pandemic (Colombo, 2023). Furthermore, the emphasis on internationalization may prioritize quantitative metrics without considering the country’s capacity to retain talent or absorb research outcomes, reinforcing the need for strategies to mitigate brain drain (Maués & Bastos, 2017). Figure 1: job market - number of doctoral students titled per year and percentage by occupational situation.

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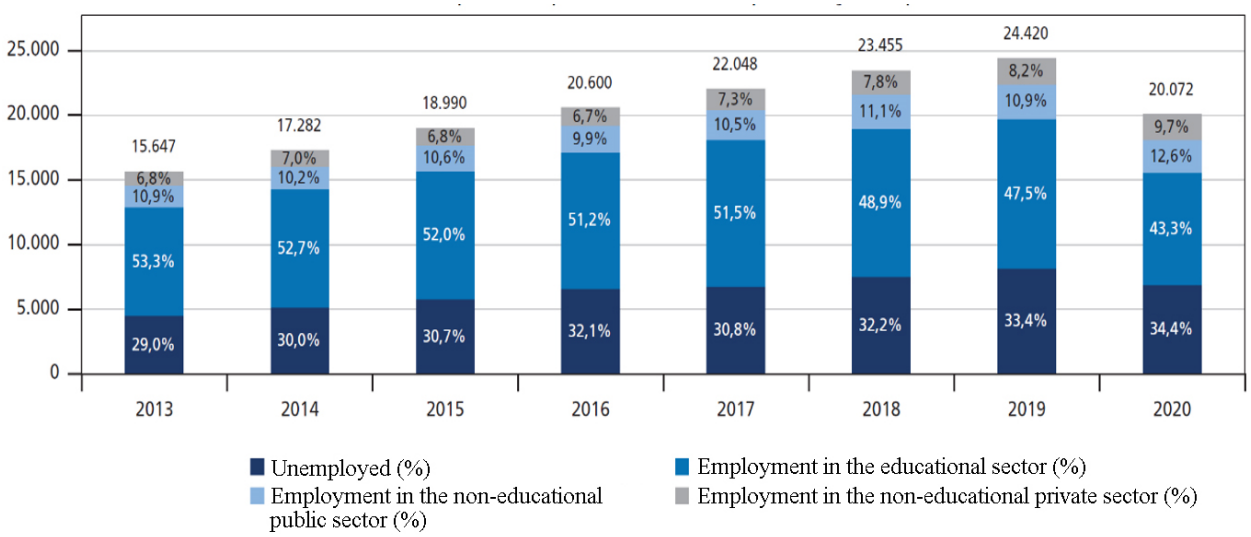

Figure 1. Job market - number of doctoral students titled per year and percentage by occupational situation. Notice. (1) The educational sector contemplates all employees of teaching institutions, and also those who occupied a position of teaching professional in other organization. The private sector in the educational sector includes employees of business entities or non-profit entities, including pillful or mixed economy companies. (2) the links to access to Capes (2023) and Ministry of Labor and Employment (2023) data are not available, as these are confidential databases, which are in the IPEA confidentiality room. Source: Prepared by Colombo (2023) based on Capes (2023) and Ministry of Labor and Employment (2023).

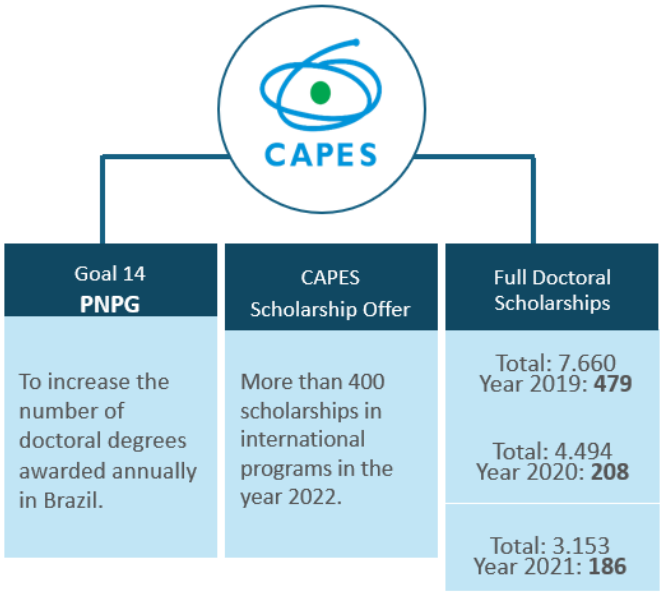

Figure 2. The decline in scholarship opportunities Full Doctoral - extracted from GeoCAPES (2022).

Alternatives such as the "diaspora option" and "virtual return" enable researchers to remain academically connected to Brazil, contributing remotely to national science (Tsalaportas, 2020; Labrianidis & Karampekios, 2022). Establishing academic networks that promote continuous scientific cooperation between researchers in Brazil and abroad can maximize the benefits of

academic mobility without compromising talent retention (Williams & Baláž, 2008; Brown, 2000). The concept of a "brain network" suggests that instead of focusing exclusively on the physical return of PhDs, Brazil should develop mechanisms to harness their knowledge and foster strategic international collaborations (Horvat, 2004; Carr et al., 2005). Thus, aligning academic mobility with innovation policies and scientific competitiveness can strengthen the internationalization of postgraduate education and enhance the impact of national research.

SUGGESTIONS FOR THE MANAGEMENT OF THE CAPES FULL DOCTORATE PROGRAM

Through interviews with directors, students, and alumni of the CAPES Full Doctorate Program, the study identified suggestions to enhance program management, highlighting structural challenges faced by scholarship holders and graduates. Among the recommendations, the following were proposed: **partnerships with academic journals and publishers** to facilitate publications during doctoral studies abroad and the **update of the Talentos software**, developed by CAPES, to promote greater integration among researchers and expand employment opportunities in Brazil (CAPES, 2021). Additionally, the **establishment of institutional partnerships** with private Brazilian universities to facilitate the professional integration of returning graduates and **postdoctoral opportunities** was widely emphasized. Interviewees also addressed the need for **clearer definitions of scientific outputs required in the negotiation of student debt (Novation)** for defaulting scholars or those who did not return to Brazil upon completing their mandatory interstice period. The goal is to establish **more transparent criteria for assessing the equivalence of scientific outputs concerning the investment received** (scholarship) and their relevance to the research field, ensuring a meaningful contribution to the country.

Another critical issue identified was the **lack of clarity and rigidity in the debt negotiation criteria with CAPES**. Reports indicate that researchers face challenges in obtaining approval for their debt renegotiation proposals due to **unannounced requirements in the official guidelines**, including **bank statements proving financial resources equivalent to the scholarship received** a condition that often renders negotiations unfeasible and exacerbates the brain drain phenomenon (Yin, 2015; Creswell, 2021). **Extending the interstice period and expanding the virtual return option** were suggested as strategic alternatives to leverage researchers' expertise and absorb the **research results at a national level** without requiring their physical return to Brazil. Furthermore, **the formation of academic and scientific networks**, the **creation of a CAPES Scientific Symposium**, and **partnerships with international laboratories** were recommended to support the selection of research institutions.

Other recommendations include **improving researcher support services and providing emotional assistance to scholarship holders**, as many interviewees reported experiencing **isolation, adaptation difficulties in foreign countries, and emotional distress. The**

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misalignment between the international academic calendar and CAPES' schedule was also highlighted as a challenge, often forcing scholarship holders to submit reports before completing critical stages of their research abroad. Finally, interviewees expressed concerns about a **perceived reduction in funding for the CAPES Full Doctorate Program**, favoring the **CAPES-Fulbright program** a funding modality in partnership with foreign universities. This shift raises concerns about **the long-term sustainability of full doctoral funding abroad** and **its potential impact on talent retention in Brazil**. According to interviewees, such partnerships **fail to address or mitigate brain drain**, as researchers abroad are exposed to **more attractive professional and financial opportunities** than those currently available in Brazil.

PROPOSAL FOR A MANAGEMENT MODEL FOR THE CAPES FULL DOCTORATE PROGRAM

The proposed model was developed based on the research problem, general and specific objectives, and findings from the interviews, analyzed through the lens of the Resource-Based View. Figure 3 illustrates a Proposal for a Management Model for the Capes Full Doctorate Program.

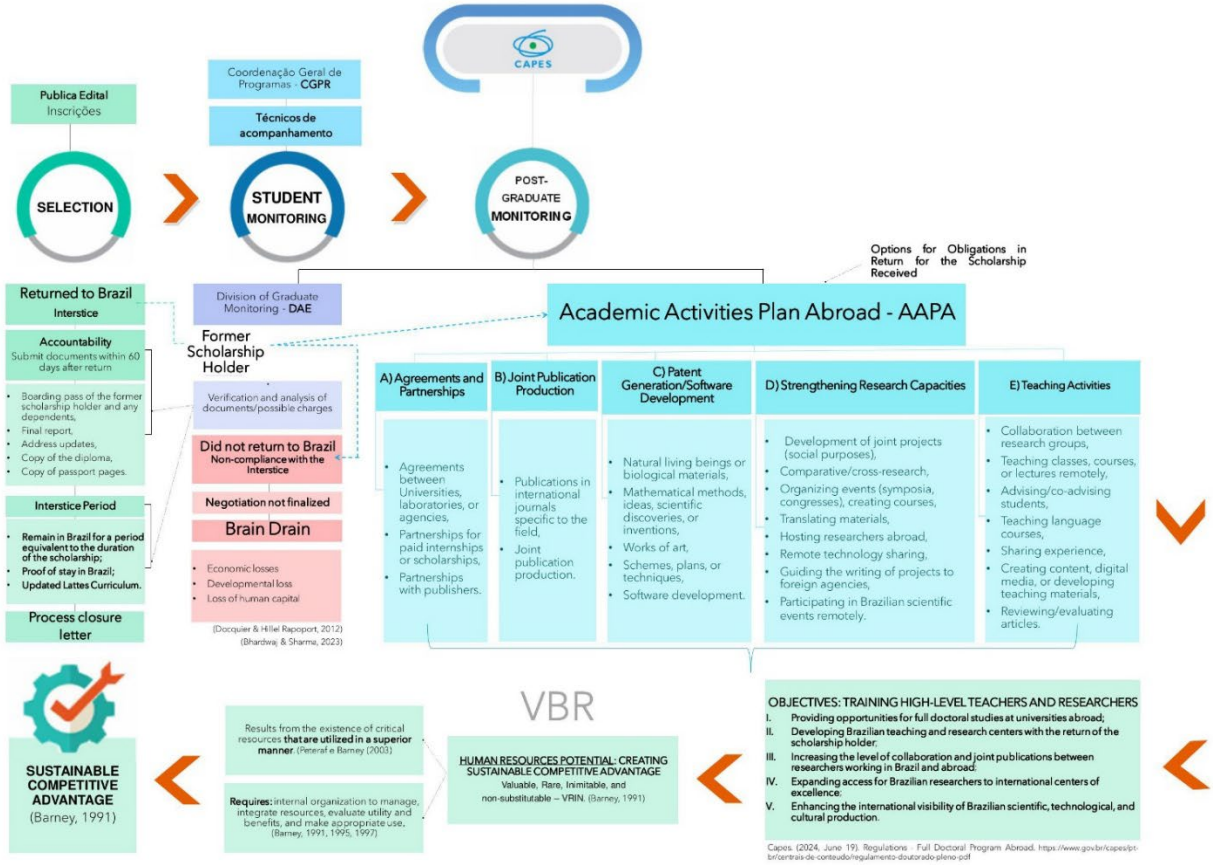

Figure 3. Proposal for a Management Model for the Capes Full Doctorate Program

In the Proposed Model presented in this research, the Student Monitoring and Graduate Monitoring phases incorporate additional policies. As discussed below:

- **Student Monitoring:** currently, this process involves the verification and analysis of documents, and any requirements related to financial accountability and the fulfillment of the interstice period (the researcher's return to the country after completing their research). Once all documentation is submitted (within 60 days after the grantee's return to the country) and the interstice is fulfilled, a Closure Letter is issued. It is during the phase in which the researcher is still conducting their research abroad that, upon deciding not to return to the country, they may submit a Novação proposal, meaning they can negotiate an alternative arrangement to contribute remotely instead of fulfilling the interstice requirement.

However, when a student decides not to return to the country after the scholarship period ends or fails to comply with the required interstice, they are classified as non-compliant and are not eligible to submit a Novation proposal - thus characterizing the brain drain phenomenon addressed in this research.

Follow-up of the egress: the proposed model suggests that, during the Alumni Monitoring phase, researchers who choose not to return after completing their studies should still have the option to submit a Novation proposal. To be effective, this proposal must be based on an Academic Activities Plan Abroad, outlining predefined scientific contributions and deliverables aligned with Brazil's frontier research areas. This approach would enable and validate remote contributions as an equivalent means of fulfilling the investment received through the scholarship. Figure 4 illustrates the Academic Activities Plan Abroad.

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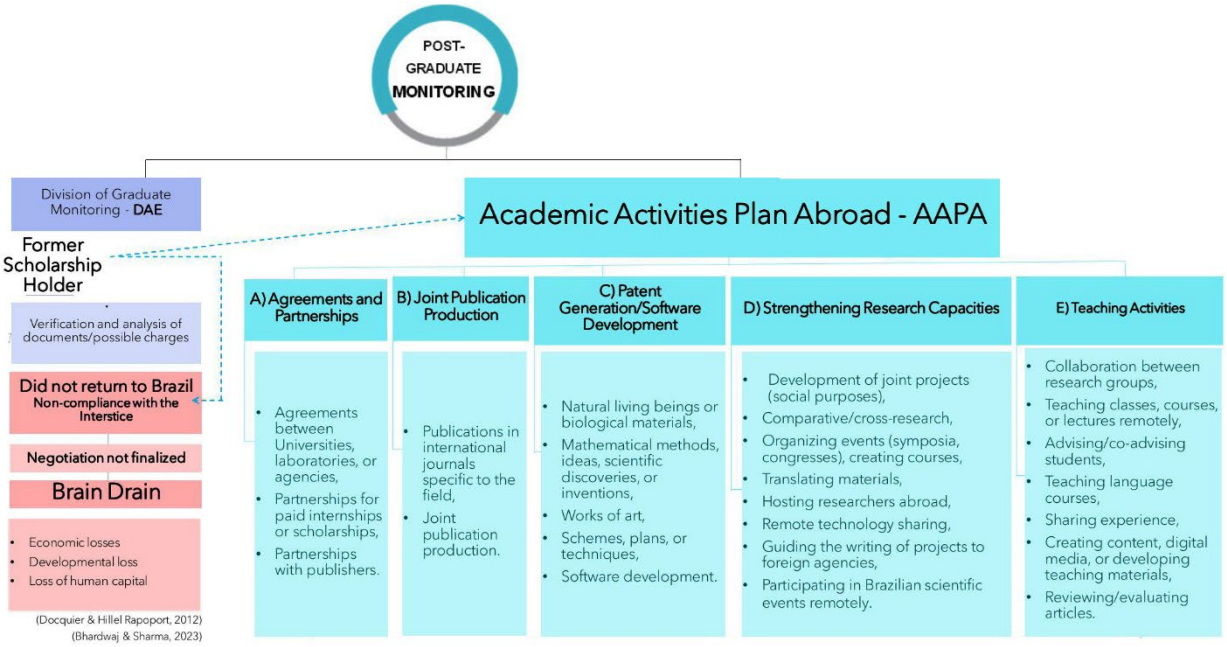

Figure 4: Academic Activities Plan Abroad

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDIES

This qualitative, descriptive, and exploratory phenomenological study employed a single-case study approach, with data collection based on document analysis, in-depth interviews, and questionnaires. Given the inherent limitations of this methodology, a rigorous research design and Bardin's (1977) content analysis were adopted to minimize biases and structure emerging categories. The Emphatic Phase included a convenience sample comprising two CAPES directors, four students and sixteen former students of the Capes Complete Doctorate Program, a full to exploitation studies that do not require statistical representativeness (Chizzotti, 1991; Malhotra, 1996). The study aimed to answer the central research question regarding strategies for managing the program through the lens of the Resource-Based View in the context of brain drain, presenting conclusions aligned with its objectives.

Specific Objective 1: Identify practices, tools, and procedures related to the selection and monitoring of students and alumni of the CAPES Full Doctorate Program:

The selection of CAPES Full Doctorate Program scholarship recipients follows continuously improved guidelines to ensure the selection of candidates with academic excellence and linguistic proficiency, capable of conducting research in frontier areas of knowledge. The selection process consists of three main stages: (1) evaluation of academic merit and project feasibility, prioritizing proposals that cannot be developed in Brazil; (2) interviews with candidates approved in the initial phase; and (3) prioritization based on the excellence of the host institution. The evaluation is conducted by ad hoc consultants or specialized committees. Additionally, candidates must address questions regarding the socioeconomic impact of their research and its application in Brazil upon their return. However, scholarship recipients and alumni reported challenges, such as the lack of

infrastructure to develop their research in Brazil and communication issues with CAPES, including delays in issuing authorizations for academic travel abroad.

The monitoring of scholarship recipients is carried out by the General Coordination of Programs (CGR) and the General Coordination of Scholarships and Projects (CGBP), which utilize systems such as SCBA and Sac-Exterior, along with the Linha Direta communication channel. Designated technical staff oversee resource management and facilitate periodic evaluations of academic performance. However, many scholarship recipients reported difficulties in communicating with CAPES, experiencing automated responses and a lack of support in critical situations, leading to the perception of ineffective monitoring. This lack of support in crucial moments highlights the need for improvements in interactions between responsible technical staff and scholarship recipients to ensure greater security and efficiency in program management.

Specific Objective 2: Identify the subjective factors associated with the decision to remain abroad or return to Brazil:

The interviewees who remained abroad cited key factors such as obtaining complementary scholarships for postdoctoral studies or continued research in prestigious universities and research groups, better working conditions, and sustained research funding, along with competitive salaries and security. The opportunity for networking in centers of excellence and greater professional recognition were also decisive aspects. Conversely, those who returned to Brazil highlighted reasons such as proximity to family, new academic opportunities, public sector job competitions, and the requirement to fulfill the mandatory interstice period. The general perception is that, in some countries, research is recognized as a formal professional activity, with employment contracts, benefits, and financial stability, whereas in Brazil, uncertainties arise due to political issues such as funding cuts and limited opportunities for PhD holders in the job market. Figure 5 illustrate the Funding cuts - relationship between CAPES budget and the number of enrolled postgraduate students in Brazil (2013 a 2022).

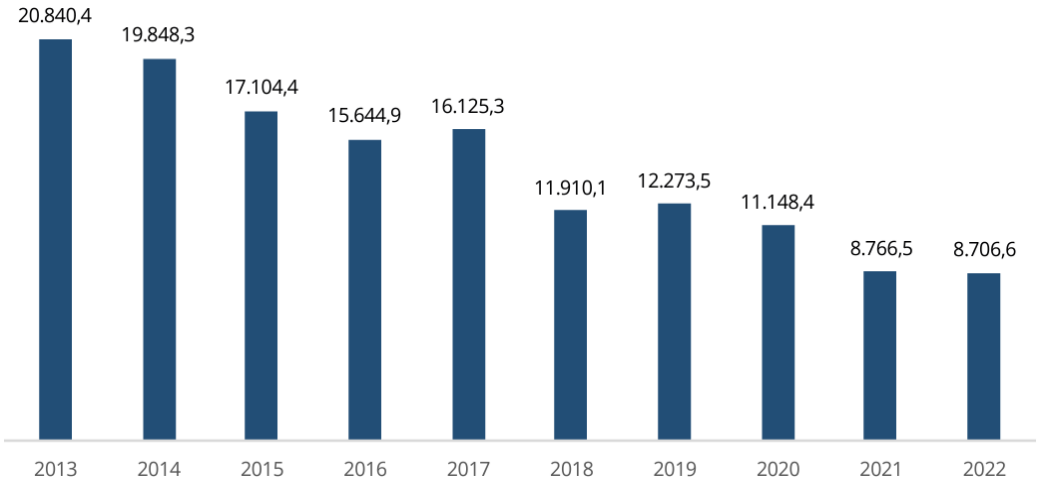

Figure 5 illustrate the Funding cuts - relationship between CAPES budget and the number of enrolled postgraduate students in Brazil (2013 a 2022). *Note: Source*: DPB/CAPES/PNPG (2024-2028).

Specific Objective 3: Analyze the strategies adopted by CAPES to manage the Full Doctorate Program considering student attrition.

CAPES has a dedicated department to monitor graduates of the Full Doctorate Program and identify cases of non-compliance, such as failure to submit required reports and not returning to Brazil after the mandatory interstice period. In such cases, CAPES actively searches for the scholarship recipient and, if no response is obtained, contacts the designated legal representative. If these attempts are unsuccessful, non-repayment of the debt may result in the initiation of a Special Account Audit (TCE), judicial collection, and registration of the debt in the federal government's active debt registry (CAPES, Public Call, Art. 7). This study brings a different perspective to the discussion, arguing that a researcher's decision to remain abroad is not necessarily detrimental. Some frontier research areas cannot be effectively developed in Brazil, making the establishment of a remote contribution strategy a viable alternative. In these cases, the researcher's continued presence abroad becomes strategically beneficial through remote academic contributions.

During their studies, students can submit up to two debt renegotiation (novation) proposals, which, if approved, allow them to replace their physical return with academic contributions. However, graduates who choose to remain abroad—whether due to new scholarships or employment opportunities—are currently ineligible for debt renegotiation under the existing framework. This is because, to qualify for renegotiation, the scholarship holder must not be in default, meaning the request must be made while the researcher is still conducting their studies. Interviewees also reported challenges in quantifying their academic contributions in a way that equates to the value of the scholarship received, highlighting the need for adjustments in the management model of the CAPES Full Doctorate Program. These changes would enable clearer and more feasible alternatives for compensating the investment made in their training.

Specific Objective 4: Identify criteria and instruments that can be used in the proposed management model for the CAPES Full Doctorate Program.

The interviews highlighted the significance of the Full Doctorate Program and its potential to drive advancements in frontier areas in Brazil, raising the question of whether the physical return of graduates is truly the only way to capitalize on this investment. Based on the Resource-Based View (Penrose, 1959; Wernerfelt, 1984; Barney, 1991), which emphasizes the strategic alignment of human resources, it is suggested that scholarship recipients in centers of excellence abroad who have not returned or do not intend to return to Brazil can serve as strategic links for the development of frontier knowledge areas in the country. Talent retention is crucial for institutional competitiveness, as highly qualified individuals possess rare and difficult-to-replace expertise (Barney, 1991).

In this context, remote contribution emerges as a strategy to maintain engagement with these talents while ensuring mutual benefits for both the researchers and the country. Thus, to maximize the benefits of this investment and mitigate the economic and intellectual losses associated with brain drain, it is essential to complement student and graduate follow-up strategies by enabling remote contributions to Brazil.

Impact of Research on Society

This research has a significant social impact by proposing strategies to mitigate brain drain in the CAPES Full Doctorate Program, promoting the retention of highly qualified human capital in Brazil without requiring the physical return of researchers. The proposed management model, based on the Resource-Based View (RBV), strengthens the country's capacity for innovation and competitiveness by incorporating the results of research conducted abroad. This model has the potential to influence public policies aimed at talent retention or reintegration while enhancing the scientific contributions of Brazilian researchers across various sectors, regardless of their location.

The research's impact extends to multiple social domains, including community well-being by fostering innovative solutions that benefit the population; the formulation of more effective public policies for retaining and utilizing the knowledge generated by PhD holders abroad; and the strengthening of businesses and industries through collaboration with qualified researchers, driving innovation and market competitiveness. Additionally, this initiative can enhance the quality of higher education through academic partnerships and projects, benefiting both public and private institutions. Consequently, the research directly contributes to Brazil's economic and social development.

Previous Studies

Previous studies on brain drain in Brazil emphasize the loss of human capital and its negative impacts on innovation and economic development, yet few propose practical and systematic

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solutions to mitigate this issue. Carvalho (2015) and Silva (2018) analyzed the causes and consequences of the phenomenon, while Almeida (2020) suggested talent retention strategies without developing a specific management model. This research advances the field by presenting a management model for the CAPES Full Doctorate Program based on the Resource-Based View (RBV), offering an operationalizable approach to aligning human resources with institutional strategies and maximizing their contribution to the country. In addition to addressing the challenges of brain drain, the study proposes a consolidated theoretical and practical solution aligned with the Sustainable Development Goals (SDGs 4, 8, 16, and 17), reinforcing its positive social impact in Brazil.

LIMITATIONS OF THE RESEARCH AND SUGGESTIONS FOR FUTURE RESEARCH

The main limitations of this research include restricted access to the contact information of CAPES Full Doctorate Program students, the potential low participation or withdrawal of respondents from the online survey and semi-structured interviews, and the risk of response or recall bias, which may affect the accuracy of the information provided. Additionally, the findings cannot be generalized to the entire population of researchers funded by CAPES abroad, and the use of the Resource-Based View (RBV) as a theoretical lens may limit the analysis, as other complementary theoretical approaches could also be explored.

Based on the interviews and the establishment of the proposed Management Model, future studies are recommended to validate the model through peer review with **ad hoc** consultants. This validation process should refine the model by aligning it with scientific contribution products quantifying each item according to its relevance for different fields of knowledge. Figure 6 illustrate the recommendations for Future Research: Model Calibration.

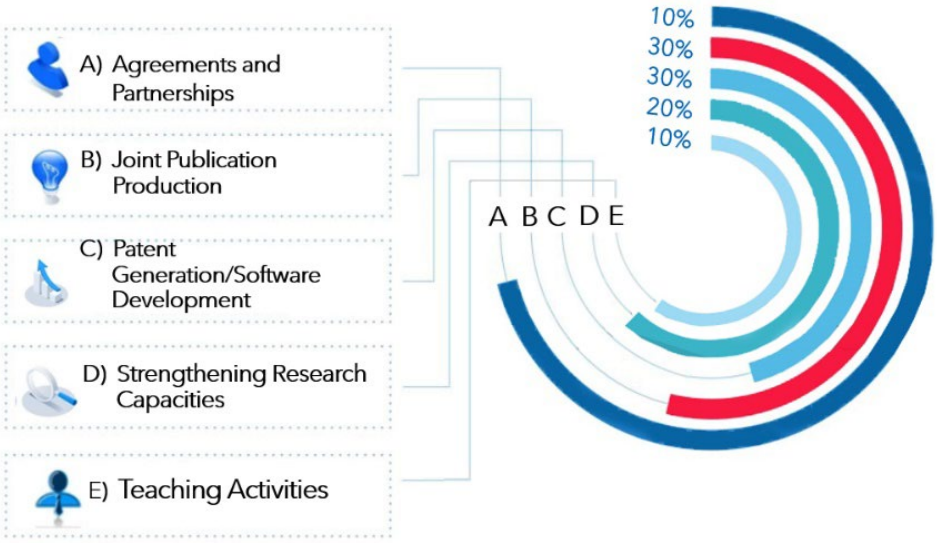

Figure 6: Recommendations for Future Research: Model Calibration

For future research, it is recommended that the proposed Model be calibrated with the support of ad hoc consultants. These consultants are specialists in various fields of knowledge, invited to conduct technical evaluations and analyses for institutional processes. At CAPES, they play a crucial role in assessing postgraduate programs, granting scholarships and financial aid, and approving research funding projects. Their expertise is essential for refining the Model by assigning weighted values to each scientific contribution, considering its relevance to different fields and establishing a clear financial equivalence between each contribution and the funding received by the researcher through scholarships.

Once the scientific outputs are established and validated, researchers who do not fulfill the interstice requirement (return to Brazil) may select specific contributions from a predefined set of activities or propose alternative ones, ensuring both relevance and financial equivalence to settle their obligations. The proposal formulated by the graduate would still undergo a merit evaluation, aligning with CAPES' existing policies for scholarship selection and student monitoring. However, key improvements in this negotiation process include: (1) greater clarity regarding the financial equivalence of contributions in relation to the debt, (2) enhanced transparency on the relevance of contributions to the research field, and (3) the possibility for researchers to formalize their Innovation proposal an improved version of the current Novation process either during their studies abroad or even in a situation of default, meaning after completing their doctorate and exceeding the return period.

For future research, it is recommended to: (1) identify and classify scientific contributions made by Brazilian researchers abroad, assessing their relevance by field of knowledge and their potential impact on the national scientific system; (2) develop an equivalence model that links scientific outputs produced abroad to the public investments received, ensuring their contribution to the sustainability of Brazilian science; and (3) validate the applicability of an innovative strategic model that enables the absorption of remote scientific contributions into the national research system, optimizing resources in scenarios of brain drain. These recommendations align with the Resource-Based View (Barney, 1991; Wernerfelt, 1984) and Dynamic Capabilities Theory (Teece, 1997), the latter being particularly relevant to organizational process innovation by emphasizing institutions' ability to transform and renew operations in response to change, thereby fostering continuous innovation.

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