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## Advancing the evaluation of graduate education: towards a multidimensional model in Brazil

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# Introduction

“Without evaluation, there is no quality at the graduate education level, which is where scientific research is conducted in Brazil.

— Renato Janine Ribeiro

Evaluation plays a crucial role in ensuring the quality and advancement of the Brazilian science system. It provides a framework for institutions, policymakers, and stakeholders to thoroughly assess the effectiveness, impact, and overall performance of the country's graduate education<sup>1</sup> system, which serves as the bedrock for research in Brazil. The evaluation system also exerts a tangible influence on the allocation of funding, institutional reputation, and continued accreditation of graduate programs. Consequently, evaluation practises wield considerable power in shaping the course of research and graduate education in the country (Balachevsky and Schwartzman, 2010; R. J. Ribeiro, 2022b).

The duty of conducting the national evaluation system was entrusted to the Brazilian Agency for Support and Evaluation of Graduate Education (CAPES) in the 1970s. As an agency dedicated to fostering excellence in research and graduate education, CAPES is committed to continually improving its evaluation practises, propelling the progression of academic standards (Verhine and Dantas, 2009). It is within this ever-evolving landscape that the genesis of this dissertation can be found, and its starting point was triggered by the publication of the Leiden Manifesto for research metrics (Hicks et al., 2015).

<sup>1</sup> In this dissertation, “graduate education” refers to studies following a bachelor's degree, specifically master's and doctoral programs. In many parts of the world, the term “postgraduate” is often used interchangeably with “graduate”.

Upon the publication of the Leiden Manifesto, its comprehensive principles, emphasising transparency, diversity, and contextuality in evaluation practises, captivated the attention of CAPES' president. Consequently, the publication was widely shared with the directors of more than 4000 graduate programs nationwide. Recognising the need to align the CAPES evaluation system with the principles outlined in the manifesto, the agency also embarked on a self-reflection exercise, with subsequent working groups being established to examine various dimensions of the existing framework, which encompassed subjects such as journal classifications and societal impact.

CAPES has often been mindful of contributions made by prominent institutions engaged in research evaluation, indicator development, scientometrics, and science policy. While the Centre for Science and Technology Studies (CWTS) naturally fell within this scope, the publication of the manifesto further reinforced the agency's attention towards the diverse developments emanating from Leiden. Consequently, CAPES decided to designate a representative to attend the 21<sup>st</sup> International Conference on Science, Technology, and Innovation Indicators (STI 2016), intending to establish connections with the authors of the manifesto and other researchers whose work served as valuable evidence for our policy decision-making. Given my active participation as a policy officer involved in national evaluation efforts, the responsibility of representing the agency in this capacity was assigned to me. This unique opportunity, coupled with the insights gained from examining Brazilian evaluation through the lens of the Leiden Manifesto, served as a driving force that propelled me on the research journey that culminated in the development of this dissertation.

## 1.1 Motivation and Problem Statement

According to [Farmer \(2010\)](#), policymakers rarely reach out to academic experts before formulating or promoting policies. When they do, the purpose is often to find justification for positions they already hold, rather than looking for objective analyses. Confirmation bias can also be an issue, as the sheer volume of information available makes it inevitable that they rely on trusted sources, often aligned with their ideas ([Andrews, 2017](#)). Therefore, time can be the greatest challenge in digesting evidence. Legislators, politicians, and policymakers rarely have the time or support personnel necessary to synthesise data

to inform decisions (Gaieck et al., 2020). This is notably true if the time frame in policymaking is considered. Results often need to materialise faster than the time required to carry out any semblance of proper research (Colglazier, 2016).

Then comes the capacity issue. Policymakers should be encouraged to be more science-literate, being able to appreciate not only the role of evidence in their decision-making process, but also to develop methods to separate high- and low-quality sources. The lack of preparation to consume science can be partially solved with the presence of properly qualified personnel, but understanding evidence is an essential quality for policymakers (Cairney and Oliver, 2017). These limitations do not mean that science is not privileged in policymaking. Montana and Wilsdon (2021) state the opposite, pronouncing science to be often prominent but not as central to the discussion as researchers might think. The importance of science is often not self-evident, and influential scientists are those who leave the sidelines and make themselves heard (Gaieck et al., 2020).

In light of these arguments, CAPES could be seen as a deviation from the norm of public institutions. Its leadership, including the agency's president and a substantial portion of its directors, has been routinely comprised of renowned scientists; exactly those leaving the sidelines to get involved in managerial processes. These leaders are equipped to interpret and use scientific evidence to enhance their work. Moreover, they are supported by a team of highly qualified public servants, most of whom boast higher degrees, often up to the doctoral level, thus solidifying the bridge between policy and academia.

In such an environment, trust in science is generally high. However, there is a clear limitation: there seems to be a continuous shortage of time to properly base decisions in research. Reflecting on my own experience and that of my colleagues and leaders, public policy management often hijacks calendars. This most likely leads to our entrapment into an unending cycle of urgencies that pose a critical challenge to translating research into policy action, and vice versa. In the case of CAPES, time constraints also affect the production of knowledge from the evaluation process, as leaders and their teams rarely have time to publish detailed accounts of their plans, motivations, and developments.

The absence of accessible primary sources profoundly influences academic research on evaluation in Brazil. Without access to the intricate workings behind the proverbial curtain, researchers must rely on fragmented, superficial, or even

obsolete accounts. As a consequence, part of the research on Brazilian evaluation may be contaminated with inaccuracies, raising the barrier seen by [Farmer \(2010\)](#) between policymakers and academic experts who are not directly involved in evaluation. Furthermore, the extensive literature consulted for this work shows the remarkable scarcity of products in English on Brazilian evaluation.<sup>2</sup> The language barrier prevents international researchers from developing an interest in the Brazilian system, thus limiting the scope of collaboration.

The underlying rationale of this research project can be succinctly summarised into two key points. These serve as the foundation of this scholarly endeavour and also establish a cohesive narrative that connects the intricacies of the research process with the overarching academic aspirations.

- i) This research aims to contribute to a more comprehensive and extensive literature on the Brazilian national evaluation system. This includes an in-depth exploration of its historical trajectory, contemporary challenges, and current status, effectively offering a holistic picture of the evaluation landscape within Brazil. Furthermore, the project also prioritises international accessibility; this research aims to establish itself as a key reference on Brazilian evaluation practises for a global audience. Although the findings will be predominantly distributed in English, an effort will also be made to facilitate access for the Brazilian community by producing multilingual versions of selected research results.
- ii) The literature indicates that influence on policy will rarely emerge from outputs such as journal publications, as these are designed to get scientists' attention. Influence comes from policy briefs, reports, participation, advice, and more ([Donnelly et al., 2018](#); [Gluckman, 2014](#)). Thus, the ambition of this doctoral research extends beyond the confines of this dissertation to the creation of practical recommendations for evaluation managers within Brazil. This requires providing additional output, such as policy briefs and establishing an accessible online platform featuring interactive dashboards that encapsulate data on Brazilian science, international collaboration, and other relevant statistics. The ultimate objective is to create an information-rich interface that supports informed decision making and could contribute to improving the evaluation process.<sup>3</sup>

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<sup>2</sup> See Appendix B ([Additional Resources](#)) to access an interactive dashboard designed to explore the literature investigated for this dissertation, including information on document type and language.

<sup>3</sup> Information on the online platform and the policy-brief output are also available in Appendix B.

## 1.2 Conceptual framework

Two discernible challenges emerged as the project matured from the defined motivations and the preliminary research phase. The first concerns the scope of the project. Instead of focussing on the dissection of a specific component of the evaluation process, this work aspired to provide a diagnostic view of the entire evaluation. The primary rationale for this decision is the observation that many specialised studies tend to ignore that the Brazilian evaluation system may be conceptualised as a “short blanket” predicament, a situation where addressing one issue uncovers another. Numerous studies have fallen into this trap, suggesting solutions that yield significant impacts but inadvertently neglect or exacerbate other problems. In attempting to reform or refine the system, it is crucial to adopt the holistic approach to account for the complex interconnectedness of various facets of the system. Any proposed modification must take into account not only the anticipated benefits, but also potential adverse repercussions that could arise elsewhere within the system.

The other challenge encountered during the first year of research was the quest for a suitable conceptual framework to guide the investigation, as the existing ones seemed incongruous with the unique characteristics of the research object. As explored in [Part I](#) and [Part II](#) of the dissertation, research exists within the realm of graduate education in Brazil, unlike most global scenarios where graduate education is a component of a broader research environment.

Given the focus on the evaluation of graduate education, the core disciplines essential for this investigation would inevitably be at the intersection of higher education studies and research evaluation. However, understanding the Brazilian evaluation system requires a distinct tilt toward the latter. As further explored in [Chapter 3](#), at a certain point, the assessment of scientific production represented up to 80% of the total evaluation result in Brazil. The weight of graduate education in the country’s science is so significant that Renato Janine Ribeiro, president of the Brazilian Society for the Advancement of Science (SBPC) at the time of this publication, recently stated that “without evaluation, there is no quality at the graduate education level, which is where scientific research is conducted in Brazil” ([J. Marques, 2021](#)).

Therefore, this study predominantly anchors itself in the discourse of research evaluation while only tangentially addressing the quality assurance elements

characteristic of higher education research. Drawing on the experience of this researcher within the Brazilian evaluation landscape, the lessons of the latter would resonate more with the evaluation of higher education conducted by the National Institute of Educational Studies and Research (INEP) than with that overseen by CAPES, which is the central focus of this research. Given the unique characteristics of the SNPG, emphasising research evaluation becomes logical and imperative.

However, the study often crosses disciplinary boundaries, integrating insights from a myriad of literature within the Research on Research (RoR) domain. For example, scientometrics is prominently showcased in several chapters, not to advance its methodologies, but to harness its state-of-the-art tools to augment our understanding of evaluation practises in Brazil. The history of science also emerges recurrently throughout the dissertation, providing a nuanced account of contextual factors, contingencies, and complexities that shape the evaluation process in the country. By delving into the past, valuable insights are obtained to effectively navigate the intricate landscape of the evaluation of research and graduate education today, while also helping to face the challenges encountered to advance the evaluation process.

Although academic frameworks and interdisciplinary perspectives are instrumental in shaping the narrative and analytical thrust of this work, they alone cannot fully encapsulate the multifaceted nature of the research object. Recognising this limitation, the study extends beyond theoretical paradigms, immersing itself deeply in the empirical realm. This approach resonates with the ideas of [Montana and Wilsdon \(2021\)](#) about bridging disciplinary divides to allow the consolidation of findings and the professionalisation of scholarship in the field of evidence and policy. Thus, grounded empirical perspectives, anchored in tangible data, real-world observations, and first-hand experiences, become paramount in this research.

Given that both the research subject and the delineation of this study's objectives are profoundly influenced by my professional interests and experiences, a shift towards an empirical methodology was anticipated. As articulated by [Colglazier \(2016\)](#), researchers ought to actively engage with policymakers to understand their specific needs, thereby ensuring that their voices resonate when offering evidence or expert advice. As a policy officer, having the privilege to momentarily step back from the day-to-day intricacies of evaluation to under-

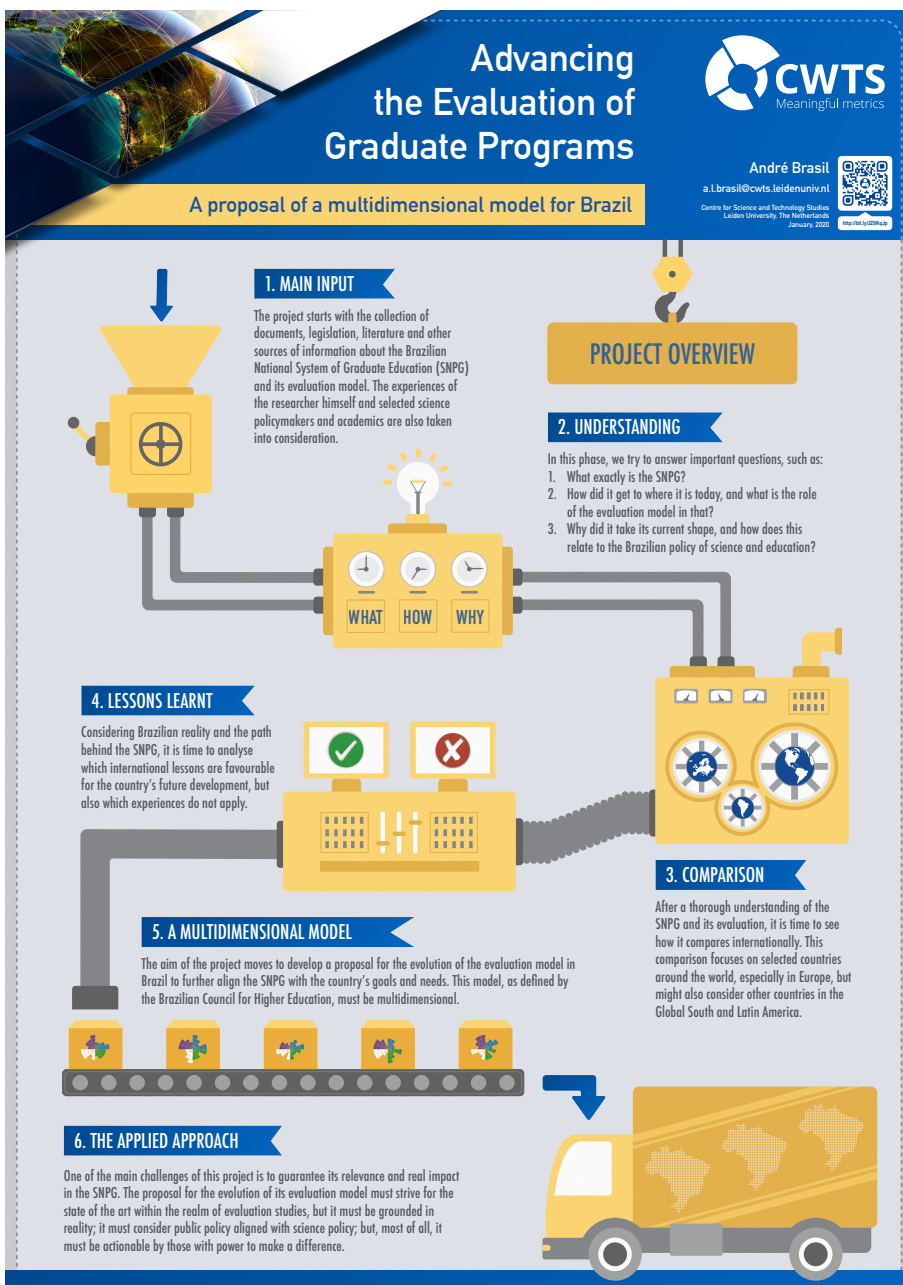
take independent research during my doctoral pursuit, I find myself uniquely poised to traverse both realms. This positions me to bridge the gap between the practical aspects of policymaking – with its empirical understanding of inherent challenges – and an immersive experience in rigorous academic research.

From this unique vantage point, achieving synergy between my professional insights and the academic rigour essential for a research journey has emerged as a central objective of this study. When executed effectively, this synergy can facilitate a bidirectional learning process. Consequently, this dissertation can not only represent my scholarly evolution but also serve as a conduit for a necessary knowledge transfer from the Global South to the North, thus infusing the academic discourse with fresh and often uncharted perspectives.

Given the challenges encountered and the consequent structural decisions made, the foundational framework of this research project was established near the end of the first year of work. The resulting proposal was presented at a seminar organised by CWTS in early 2020, as shown in [Figure 1.1](#), and can be summarised as follows:

1. Main input – This initial stage entails meticulously collecting various data sources and literature about the Brazilian National System of Graduate Education (SNPG) and its evaluation model;
2. Understanding – The subsequent phase involves developing an in-depth understanding of the SNPG's structure, evolution, and alignment with Brazilian science and evaluation policies;
3. Comparison – The project then moves towards an international comparison analysis with the aim of understanding how the Brazilian system differs and whether inspiration can be extracted from other systems.
4. Lessons learnt – From the analysis of Brazilian and international experiences, the project takes a deeper look into the many facets of Brazilian evaluation in the search for understanding and evolution.
5. A multidimensional model – The project's focus shifts towards an idea for evolution of the evaluation model in Brazil, aimed at further aligning the SNPG with the country's goals within a multidimensional framework.
6. The applied approach – The project faces the challenge of ensuring its relevance and impact on the SNPG, through the production of diverse research outputs which are actionable by influential decision makers.





**Figure 1.1.:** The PhD project that evolved from the initial research proposal, as presented in a seminar organised by CWTS in January 2020.

Based on the proposed stages, the architectural design of the project and the essential concepts used within its structure will be described in more detail in the forthcoming section on the dissertation structure. However, before this discussion, it is necessary to recognise the implications of a crisis that has been quite damaging to Brazilian science and the country's higher education. The events that have occurred over the past few years have undoubtedly had an impact on all aspects of the system, including evaluation practises and the landscape of graduate education.

### 1.3 Enter a challenging period

As my project evolved to reflect the first year of research and engagement with the international community, a significant crisis engulfed the Brazilian science system. The advent of such a crisis was, unfortunately, somewhat anticipated. A tell-tale sign came from CAPES high management at the time Jair Bolsonaro was elected president of Brazil. Since my doctoral project was set to begin during the same week as his inauguration, I was advised not to delay my departure to the Netherlands. The rationale was that the new leadership could potentially suspend my official leave and cancel my research grant, a less feasible disruption if I were already overseas. This advice perhaps reflected a sense of uncertainty about what would happen.

As anticipated, concerns turned into reality when a crisis began to unfold in the initial months of Bolsonaro's administration. This government demonstrated a dismissive stance towards the importance of science and explicitly undermined the value of higher education. To illustrate, soon after the minister of education stated that the university should be reserved for the intellectual elite of the country ([Passarelli, 2019](#)), the Ministry drastically cut university budgets by around 30%. At first, the initiative targeted higher education institutions (HEI) that the new government considered bedlam promoters, such as the federal universities of Brasilia, Bahia and Fluminense. The justification was that the HEI did not deserve the funding they were receiving, as they were more interested in creating trouble than pursuing academic excellence ([Agostini, 2019](#)). Interestingly, the Leiden Ranking lists these three universities in the top 20 most productive Brazilian institutions and in the top 15 if ranked by the percentage of publications among the 10% most cited ([CWTS, 2022](#)).

The cuts incited widespread protests from the academic community, particularly since some institutions were specifically targeted in what was considered a political attack (Dias, 2019). Eventually, the budget cuts spread to all federal universities and research institutes. The humanities suffered the worst of these cuts (P. Martins, 2019), inciting further protests nationally and internationally, with academics around the world publishing manifestos on the grave implications of these measures (Furlaneto, 2019).

Brazilian researchers responded to these setbacks by showcasing their ongoing studies on social media, showing that they persisted despite the lack of appreciation of the government (P. Martins, 2019). However, these demonstrations were met with disdain. Bolsonaro even dismissed protesters who took to the streets as “imbeciles”, supposedly manipulated by what he considered the left-wing core of Brazilian universities (Dias, 2019). Soon after, a subsequent minister of education publicly stated his opposition to using taxpayer money to fund sociologists, anthropologists, or philosophers. The official position of the government was that only the professions they considered useful, such as medicine or engineering, should be funded (Rezende, 2020).

In line with the attack on higher education in Brazil, Bolsonaro’s allies in parliament proposed changes to the Brazilian Constitution so that free public universities would start charging tuition to finance their operations. One of the key arguments of the proposal was that universities from 20 of 28 countries in a 2018 study by the Organisation for Economic Co-operation and Development (OECD) charged tuition (Paternelli Jr, 2019). This mentality of “what works for them should also work for us” reflects a lack of understanding of the higher education system and the socioeconomic reality of the country, as education serves as a critical pathway to upward social mobility in Brazil (Giolo et al., 2020). Though one might advocate for a tuition-based system to tackle Brazil’s asymmetries, certain governmental factions seem to be driven by ill-informed or misguided motives. For example, yet another minister of education under Bolsonaro’s rule, endorsing the notion that universities only benefit society if restricted to a few, erroneously asserted that Brazil should emulate Germany, where supposedly only a select few attend university.(M. Ribeiro, 2021).

The lack of knowledge also extended to the science system. As part of the movement to end free higher education in the country, Bolsonaro claimed that very few universities conducted research in Brazil and that most of them were

private institutions. The academic community quickly counterbalanced this misinformation, pointing out that more than 95% of Brazilian scientific production comes from public universities (Clarivate Analytics, 2019; Moura, 2019). Subsequent discussions revealed that more than 400 Brazilian higher education institutions were engaged in research and that 30 of the most productive universities were public (SBPC and ABC, 2020a).

However, the crisis continued, also affecting research and graduate education. In the case of CAPES, the agency was subjected to budget cuts (Rossini, 2021); high turnover of its high-level management, often followed by protests from the academic community about leadership profiles (SBPC, 2021a; SBPC, 2021b); legal interference that delayed the national evaluation and restricts the transparency of the process and its results (Davidovich and Ribeiro, 2021; Justiça Federal, 2021); and more. Together with the impact of the COVID-19 pandemic, the crisis had immense effects on evaluation, as discussed in more detail in select chapters of this dissertation.

## 1.4 Dissertation structure and key concepts

In essence, this study's primary goal is not to dissect the crisis that hit science and higher education in recent years. Given the complexity of the situation, dedicated studies will be needed to fully understand it. However, the general lack of knowledge observed on the reality of research and graduate education – as well as of international models often cited as solutions for Brazilian problems – has reinforced the importance of parts of this study related to understanding and comparison. The approach used to organise the dissertation and the research behind it, all in face of the crisis, are presented ahead.

### Part I: The what, the why and the how

The economic arena served as the genesis of the path dependence concept, with economic historians trying to understand how less-than-optimal technological solutions seem to linger, not giving way to advancement (Torfing, 2009). An example that reached a paradigmatic status has been described by David (1985), who analysed the development and continued usage of the QWERTY

keyboard layout. Introduced in the 19<sup>th</sup> century, the design prevented jams in mechanical typewriters by placing frequently used letters further apart. The layout prevailed despite the fact that more efficient mechanical alternatives were developed, such as the 1930s DSK keyboard. Likewise, even the advent of computer keyboards has been unable to replace the entrenched QWERTY standard with a more efficient design.

According to David (1985, p. 333), this phenomenon is not a consequence of consumers being “prisoners of custom, conspiracy, or state control. But while they are, as we now say, perfectly free to choose, their behaviour, nevertheless, is held fast in the grip of events long forgotten and shaped by circumstances in which neither they nor their interests figured”. While this narrative encompasses all quintessential elements of path dependence, it represents something that maybe should have changed, but it hasn’t because of the path behind it.

However, the Common Law legal system, which originated in England in the Middle Ages and spread to other countries, is an example of positive path dependency. As described in Hathaway (2003), this system is based on the previous courts’ decisions and can evolve the legal principles over time. The system depends on the path and leads to predictability and coherence of the legal results, with the courts bound by their own decisions and those of the superior courts. This helps to preserve the rule of law, providing a reliable framework for individuals and companies. In this case, path dependency increases social order and the stability of economic activity.

Taking into account the negative and positive dimensions of path dependence, historical sociologists have argued that its understanding has important implications for social research. Path dependence characterises historical sequences in which random events trigger chain events or institutional patterns showing deterministic properties (Mahoney, 2000). Furthermore, the construct of path dependence in the field of policy discourse highlights the extent to which existing policy choices are dominated or influenced by the institutional pathways that result from past decisions. This makes the prospect of public policy reform contingent on institutionalised legacy, shaping our interpretation of problems and objectives, delimiting the spectrum of feasible options, and influencing the cost-benefit analysis of policy changes (Torfing, 2009).

In the spirit of the path dependency approach, the first part of this dissertation aims to establish a contextual framework for understanding the Brazilian Na-

tional System of Graduate Education (SNPG) and the national evaluation that comes with it. The two chapters included trace their historical evolution to the present state, providing an understanding of why they developed the way they did and how decisions and external influences along the way helped shape what they have become.

The papers included in this first part display the two dominant types of path dependence sequences described by [Mahoney \(2000\)](#). First, chains of causally connected events can be seen, each of them being a direct or indirect reaction to the antecedents. Like in the case of the QWERTY layout, policies around the SNPG and its evaluation were designed to address particular issues, and it is important to understand what they were and if they remain relevant. Second, reactive sequences may lead to the formation and long-term reproduction of a given institutional pattern, also known as self-reinforcing sequences.

Considering the perspective of policy effectiveness and how the Brazilian system can evolve to address current and fluctuating contexts and conditions through inherent adaptability ([Bali et al., 2018](#)), [Part I](#) is all about understanding the path behind the SNPG and its evaluation, so that policymakers understand the intricacies of the system's development and then can answer the question: "is there a reason for us to keep doing what we are doing?"

## **Chapter 2 – Building a national system of research and graduate education**

This chapter provides a comprehensive review of the Brazilian science system, a unique product of robust public policy initiatives that have bridged research and education for decades. Emphasising the dominant role of the Brazilian National System of Graduate Education (SNPG) within Brazilian science, this study delves into the genesis and evolution of the system, which was shaped by decisive policy decisions over the years. Furthermore, it critically evaluates the justifications behind these decisions, tracing their connections to broader public policy frameworks in Brazil. The study also underscores the top-down structure of the Brazilian science system, marked by influential government agencies that promote change through regulation, assessment, and funding. Using primary sources such as original legislation and policy documents, together with interviews and academic literature, the chapter also delineates the present state of the system, namely its size, organisation, geographical distribution, and demographic characteristics of its faculty and student body. The information obtained is valuable not only for Brazilian academics and policymakers, but

also for the international community, offering a unique model for science and high-level education from both its successes and failures.

### **Chapter 3 – The dynamics of a national evaluation system**

This chapter presents a detailed exploration of the Brazilian evaluation system of research and graduate education over the past five decades, detailing its historical evolution, socio-political influences, and current challenges. Central to this investigation is an understanding of the system's transformation from a rudimentary funding distribution instrument to a quality assurance mechanism, and then to its present multifaceted construct, deeply embedded within the national science landscape. The study also underscores the transformative power of the evaluation system in promoting transparency, fairness, and academic quality, which remain critical to allocating funding and conferring legitimacy on graduate programs. However, the chapter acknowledges the need for evaluation to evolve, and it analyses systematic improvements that have been promoted over time, often triggered by a combination of external pressures and internal critique. Looking ahead, the chapter advocates for a multipronged approach for evaluation reform, incorporating self-assessment strategies, stimulating institutional autonomy, and promoting an evaluation model capable of capturing and valuing the diversity in science vital for addressing the country's challenges and asymmetries.

## **Part II: The Brazilian evaluation system in perspective**

Political scientists often use the concept of path dependency to explain why deliberate policy reforms could fail, especially when institutional inertia affects the outcome (Torfing, 2009). However, the concept also explains how reaction sequences and institutional patterns can promote coherent policy strategies and facilitate the evolution of complex systems over time (Mahoney, 2000). An illustration of this dynamic was seen in Part I with the SNPG and its integral evaluation system. Throughout their history, they have been regarded as stable state initiatives rather than fleeting government ones, allowing their continued development to become sources of pride for Brazilian society (Balbachevsky and Schwartzman, 2010; Nader and Davidovich, 2021).

The Brazilian evaluation system owes part of its success and role in advancing the country's science to having developed concurrently with the growth of the

SNPG. This is not a task without challenges, particularly when it comes to blending different aspects of a complex national evaluation with the reality of the research system. However, the interconnectedness of development pathways usually influences how countries deal with their national evaluation systems, leading to a natural tendency to rely on their own established protocols rather than trying to implement models from elsewhere (Ochsner et al., 2020).

However, evaluations have become of substantial importance for national governments, often steering universities and research systems. This influence may, on occasion, encourage them to draw on international models that have demonstrated success (Capano et al., 2016). This is apparent in Brazil, where there are ongoing suggestions to refine the evaluation system based on international experiences. Although countries aiming for similar results with their evaluation procedures can benefit from mutual experiences, it is essential to carefully consider potential lessons, given the uniqueness of science systems and the different paths behind them (Ochsner et al., 2020).

The second part of this dissertation puts the Brazilian science system and its evaluation in an international perspective. First, the investigation looks at how Brazilian evaluation compares to the long-standing Dutch evaluation system, a frequently cited source of inspiration, to identify any lessons that could be learnt (Barbosa, 2020; Verhine et al., 2019). Subsequently, the scope is expanded to look at the relationship between research and graduate education in Brazil, partly with the objective of confirm its uniqueness and the need for its evaluation to reflect this singularity. Comparative studies like these can enhance our comprehension of challenges across different systems, with focused comparisons particularly attuned to the specifics of individual countries while respecting their historical trajectories. Therefore, any potential differences among systems should be taken into account before trying to replicate strategies that are successful elsewhere.

#### **Chapter 4 – Research evaluation in Brazil and the Netherlands**

This chapter presents a comprehensive comparative analysis of research evaluation systems in Brazil and the Netherlands. The investigation explores the differences and similarities between the two systems, focussing on the unique characteristics, challenges, and impacts of their design on the adopted evaluation models. The study underscores the fundamental incompatibility of these systems due to their unique historical, geographical, and policy underpinnings.



On the one hand, the Brazilian system is a high-stakes, performance-based model. Although this system has played a significant part in the advancement of the country's science system, its structure tends to influence researchers' behaviours, inadvertently promoting research homogenisation and potentially limiting innovative exploration. On the other hand, the Dutch system, following the Strategy Evaluation Protocol, adopts a formative, low-stakes approach that emphasises research quality and societal relevance. This model empowers higher education institutions to conduct evaluations and use the results as they see fit, thus fostering diverse and differentiated research. Although both systems have many qualities that can inform and inspire the evaluation strategies of the other, in the context of path dependency, it becomes evident that no “copy–paste” approach can be taken to act on such inspirations.

## **Chapter 5 – The impact of graduate education on academic publishing**

The first part of this dissertation relied on a detailed analysis of legislation, policy documents, and associated literature to gain a complete understanding of the Brazilian National System of Graduate Education (SNPG). Investigating the system from its conception to its present configuration indicates that it was purposefully designed around graduate education, but bibliometric evidence of that reality is often elusive. As such, this chapter combines data from the Web of Science with publication lists gathered from Brazilian Current Research Information Systems (CRIS) to determine the degree of graduate education's influence on academic publishing in Brazil. Moreover, by incorporating additional publication data and international sources on PhD graduates, it was also possible to compare international rates of publications per degree awarded. Although still preliminary, this investigation seeks to explore methods to better understand the differences between the SNPG and other science systems.

## **Part III: Strengths and weaknesses in Brazilian evaluation**

The Brazilian evaluation system, as discussed in [Part I](#) and [Part II](#) of this dissertation, is quite complex. It employs a multifaceted methodology, harmonising various evaluative instruments and strategies, and the challenges to bring all that together in a single dissertation are significant. Many of the chapters in this resulting text have the potential to develop into full dissertations themselves, attesting to the scope and complexity of the subjects. However, as mentioned

earlier in this [Introduction](#), a holistic diagnostic view of the entire evaluation process has been recognised as a vital gap that justifies this effort for a more ambitious exploration.

Nonetheless, the limitations of individual doctoral research would make it impossible to cover every facet and dimension of the Brazilian evaluation system. Given its complexity, the third part of the dissertation represents the choices made during the research process. That means some representative aspects of the evaluation system under analysis were chosen for a detailed examination, each exemplifying different approaches. One such topic is the classification of scholarly publications through the Qualis system adopted by CAPES. As detailed in [Chapter 3](#), the evaluation of scientific contributions carries significant weight in the final evaluation results, so the system is explored in depth in [Chapter 7](#).

The object of the five chapters included in [Part III](#) will be discussed in detail below, but they all draw upon the principle of path dependence. In that sense, the effort behind the previous chapters is replicated after zooming in on each key facet of the evaluation, once again aiming to understand not only their current status, but also their origins, narrative, evolution, missteps, and triumphs. This approach is designed to contextualise reality, allowing the reader to recognise the value of the system in place while also being able to see the need for change and relevant obstacles in tune with current conditions.

## **Chapter 6 – Rethinking a national classification of research and graduate education**

This chapter presents an analysis of the Brazilian classification of research and graduate education. In Brazil, evaluations are organised comparatively within areas, meaning that the performance of graduate programs that integrate each area is assessed in their specific context. The evaluation results derive from the dynamic panorama of the areas, with criteria and indicators adjusted accordingly. To conduct this examination, the dynamics of the design, expansion, and organisation of evaluation areas are explored. Then, an international comparison is conducted, considering other classification systems of research and education, specifically the OECD Fields of Research and Development (FORD) and the UNESCO International Standard Classification of Education (ISCED). Finally, the study explores whether a review of the classification may be needed and introduces scientometric approaches that could support the areas in their potential reorganisation.

## **Chapter 7 – Between Bibliometrics and Peer Review**

This chapter focusses on the evolution and challenges of the Brazilian Qualis system, which employs journals as a means of assessing the quality of scholarly work spanning diverse disciplines. The study starts with an analytical review of the historical trajectory of the system, highlighting its implications as an integral part of the evaluation process of research and graduate education in Brazil. The Qualis system is fundamentally hybrid, balancing quantitative and qualitative methodologies by using a suite of indicators as a reference, but extending the analysis through a peer-review mechanism. Despite not being free of imperfections, Qualis has shown significant progress in its nearly 25 years of existence and continues to evolve. While some advocate for its dissolution in favour of international metrics, the chapter recognises the system's vital role in fostering a balanced and fair academic environment in Brazil and warns against overreliance on metrics, which may not accurately reflect the challenges faced by Brazilian researchers or the significance of locally-relevant research. Instead, the chapter proposes enhancing the Qualis system towards a more inclusive, equitable, and comprehensive evaluation framework.

## **Chapter 8 – Beyond the Web of Science**

The Brazilian evaluation system of research and graduate education is under review. For scientific publishing, policymakers and evaluators consider a more standardised assessment, trading some current qualitative aspects for expanded use of journal-based indicators from international databases such as the Web of Science. This chapter aims to provide evidence for a better-informed discussion, analysing the complete data set of Brazilian articles published from 2013-2018 regarding: i) coverage by the WoS and regionally relevant databases (e.g., Latinex, SciELO); ii) incidence of the local language in the country's publications, and the impact it has on coverage by regional and international databases; iii) disciplinary variations and disparities in thematic coverage across languages and databases. The results show that half of the Brazilian article output is not found in the WoS, and the normalised distribution of indexed publications across disciplines is hugely unbalanced. Publications not in WoS are predominantly in Portuguese, with a significant share indexed by regional databases, often addressing topics not covered in WoS. The main conclusion is that Brazilian science goes beyond WoS, and evaluators should strive for a sound and comprehensive assessment to capture its complexity, rather than trading it for restraining, short-sighted simplicity.

## **Chapter 9 – The unseen costs of article processing charges**

This chapter takes a slight detour from the core dimensions of Brazilian evaluation, given that elements of open science are projected to be integrated only in upcoming evaluation cycles. However, numerous factors related to openness are already relevant following a specific type of scholarly output identified in [Chapter 8](#): scientific production not indexed by international databases, often in the local language, addressing issues of local relevance. As discussed, Qualis has the potential to capture quality in outputs indexed by regional databases such as SciELO, RedALyC, and Latindex, which are important platforms that feature mostly diamond open access journals, where papers are free to read without the authors having to pay for Article Processing Charges (APCs). Therefore, this chapter initially explores the relationship between APC investment and impact at the national level, uncovering that Brazil appears to invest little and achieve a below average impact. Building on this revelation, the study introduces an economic context, advocating the use of indices such as the Purchasing Power Parity (PPP) exchange rate for international comparisons. The review also scrutinises the vast array of publications deemed by Qualis to be valuable, but that often get excluded from consideration when using major databases for comparison. As the results of this chapter show, countries like Brazil are not able to make the same level of financial investment seen in the Global North, thus developing alternative publication paths that are more coherent with their economic reality, but also capable of resulting in high-quality work, even in local language. Evaluation should be able to capture and value such outputs.

## **Chapter 10 – A national evaluation push towards increased societal impact**

The final chapter of this part of the dissertation explores one of the advances proposed to improve Brazilian evaluation that had the opportunity to be partially implemented in the most recent cycle. For decades, evaluations have tried to improve the impact of Brazilian science, often deemed excessively academic, far from society in its ivory tower. Initiatives such as the establishment of professional graduate programs, addressed in [Chapter 2](#), have been rolled out over the years in an attempt to rectify the situation. Other initiatives focused on the diversification of valued research outputs, leading to the creation of distinct Qualis for books, events, and artistic production, as mentioned in [Chapter 7](#). A recent initiative also saw the advent of a Qualis for technical and technological production. This chapter examines the development and preliminary

implementation of this new type of Qualis. The primary objective is not only to identify how products such as patents, cultivars, and policy briefs can be valued, but also to show how evaluation has the potential to steer a country's science system to generate more diverse and impactful research outputs.

## Part IV: Towards a multidimensional model

According to [Barata \(2020\)](#), the evaluation of the Brazilian National System of Graduate Education is at a crossroads in terms of the next steps of its natural evolutionary process. Over the years, the system has managed to improve significantly, as evidenced in the first parts of this dissertation. However, the exponential growth of the SNPG poses challenges to the capacity of the existing evaluation model, and further evolution may only be possible with an extensive redesign of the process.

A recurring issue with the ongoing evaluation is the growing reliance on quantitative indicators, which represent a significant risk to the evolution of the SNPG. An overly quantitative evaluation tends to foster a homogeneous science system that stifles creativity and innovation, as graduate programs are led to focus predominantly on the pursuit of metrics. This trend is, in part, the result of the high-stakes evaluation conducted in Brazil, as discussed in [Chapter 4](#). The implication is that an evaluation which impacts from accreditation to funding ultimately tends to rely on quantitative measures as a more defensible means of justification for its outcomes.

From the evident fragilities of a quantitative-centric approach, the conversation must pivot towards alternatives that can accommodate the sprawling complexity and diversity of Brazil's academic landscape. The critical shift is to approach evaluation from a multidimensional perspective, so that the inherent complexities of the system can be more effectively managed. This recommendation seems to be almost a consensus in multiple analyses of the Brazilian evaluation, as seen in [Barbosa \(2020\)](#), [PNPG Committee \(2020\)](#), and [Verhine et al. \(2019\)](#).

In the final part of this dissertation, the goal is to bring together the various studies conducted into actionable advice toward a multidimensional model. The opening chapter of [Part IV](#) examines an attempt made by CAPES to implement multidimensionality through the inspiration of uMultirank.

## Chapter 11 – Multidimensionality through self-evaluation

Although many academics question the value of university rankings, some experts have recognised U-Multirank as one of the few that gets closer to meeting community expectations of fairness and responsibility (Gadd et al., 2021; Hazelkorn and Gibson, 2017). Despite this, when CAPES leadership explored the idea of adopting this model as a replacement for the current evaluation system, many within the agency were concerned. This initiative was in line with the concerns already mentioned about the search for primarily quantitative or international evaluation solutions disconnected from the path behind the Brazilian system. With growing concerns on the value of rankings, adopting one to replace five decades of evolution in the country's evaluation is not adequate. This chapter explores the abandoned initiative to adopt the uMultirank model as a multidimensional strategy in Brazil. Highlighting the dangers of seeking an easy solution to evaluation problems, the research suggests self-assessment as an alternative strategy for multidimensionality and alleviating the burden on Brazilian evaluation. As discussed throughout this dissertation, the current system is no longer capable of dealing with the size of the SNPG unless it can count on HEI as partners, exercising their much needed institutional autonomy.

## Chapter 12 – Conclusions & Reflection

A concluding chapter then sets out to compile the learnings from this academic journey, offering recommendations for advancement that match the trajectory of the SNPG and its evaluation. To tackle this task, the chapter begins with an analysis conducted by the CAPES evaluation directorate on how much the Brazilian system was aligned with the principles of the Leiden manifesto. This analysis was part of the agency's efforts to support the discussions about the future of evaluation held during the 2015 seminars with graduate program directors, as outlined at the beginning of this [Introduction](#). In the conclusion, the original analysis will be presented and each of the principles of the manifesto will be revisited in light of the research conducted for this dissertation.

## Appendices

As depicted in [Figure 1.1](#), this doctoral research project has an applied approach. This facet is crucial in that it seeks to ensure its relevance and impact on evaluation, facilitating the transmission of research findings to policymakers involved

in the process. It is within this pragmatic context that two appendices are included, providing an inventory of deliverables intrinsically tied to the essence of this dissertation.

### **Appendix A – Expanding GeoCapes usefulness for research**

Throughout the trajectory of this doctoral project, significant effort was invested in understanding Brazilian databases on research and graduate education. In many instances, lengthy and intricate algorithms had to be created for data cleansing and to enrich data sets like the one offered by CAPES' Georeferenced Information System (GeoCapes). This system offers around 25 years of aggregated data on graduate programs, faculty, student body, funding, and more. Rather than sharing the algorithms designed to deal with GeoCapes limitations, it seemed beneficial to the research community to devise an R package instead, integrating algorithms as functions for producing data output and visualisations. The package is bilingual, allowing Brazilian researchers' to use data in their native language and in English, thus aiding in international publications. Additionally, this package targets the international research community, offering English access to data typically inaccessible to non-Portuguese speakers. Consequently, a paper was produced to support the package, also in English and Portuguese versions, the first being included in the Appendix A.

### **Appendix B – Additional Resources**

Several chapters in this dissertation include recommendations for the evolution of evaluation instruments and for the Brazilian system as a whole. However, this [Introduction](#) has noted that the consumption of such results may not always be straightforward. Factors such as time availability, the need for specialised knowledge to comprehend certain outputs or linguistic barriers can present obstacles. To this end, a set of policy briefs has been produced in Portuguese, tailored for submission to CAPES to support the understanding and implementation of this dissertation's findings. In addition, digital resources are included, exemplified by a dedicated website comprising a plethora of interactive dashboards with information about Brazilian science that can serve as evidence for Brazilian evaluation policy. Another noteworthy output of this research comes from the extensive literature review that was conducted, which could not be fully incorporated into the chapters that make up the dissertation. Consequently, an interactive dashboard was developed to allow the exploration of such references in a user-friendly tool that can support researchers interested in the topic of graduate evaluation, in Brazil and beyond.

## 1.5 Methods and data

Given the detailed nature of the research object previously outlined, it becomes clear why this study necessitates the adoption of a multi- and interdisciplinary approach. The methodological framework, in turn, must incorporate both qualitative and quantitative methods. Only through a mixed-method approach can we gain an encompassing insight into the complex dynamics of research practises and the broader scientific landscape in Brazil.

In this vein, the dissertation is anchored in two primary analytical approaches. First, documents such as policies, laws, evaluation tools, and other procedural materials are analysed, often with a focus on constructive criticism. The primary aim here is to allow for a comprehensive examination of the SNPG, its evaluation, and its primary instruments, originating from an understanding of its developmental process, its motivations, and the political and administrative decisions that shaped the research object.

Secondly, a variety of empirical data sources are consulted, especially those concerning publications and graduate education information drawn from Brazilian Science & Technology databases as well as from international providers, bibliographic and otherwise. Echoing Carl Sagan's sentiment that "you have to know the past to understand the present," the data analysis not only yields evidence supporting the understanding derived from the document review but also sheds light on the current state of the research object. With a grasp of the Brazilian evaluation framework today, through the synthesis of both analytical approaches – informed by current regulations and empirical evidence – we can project crucial perspectives on the potential trajectories of the country's evaluation. By merging a reflexive stance with continued support from the literature, this study then introduced propositions for some necessary adjustments for a better future.

The reflexivity cited is consistently threaded throughout the dissertation, illuminating the interactions between the insights I acquired as a participant in the Brazilian evaluation system and the empirical data. Therefore, this methodology incorporates a participant-observer perspective, recognising the inherent value of my experiences and observations. These are deemed valuable additions to the understanding of the dataset, enhancing the depth and context of the analyses. Yet, the looming threat of potential biases from such an approach



was constantly acknowledged. I was consistently diligent in ensuring that my interpretations remained tied to both experiential and empirical evidence. Maintaining a stark demarcation between my existing professional knowledge and what I learnt during this doctoral journey proved to be a nuanced endeavour at times. Reflecting on the results, I acknowledge that I haven't always achieved the perfect balance. However, in such instances, I consistently leaned towards giving greater weight to the evidence, ensuring the scientific rigour expected of this work was maintained.

Regarding the literature and other documents mentioned, a total of 1462 research items were consulted in the construction of this dissertation. Among them are 635 journal articles, 154 books, 127 book chapters, and 117 pieces of legislation – including laws, decrees, and ordinances – along with numerous other documents, such as official reports, policy briefs, and informative bulletins. All this material was collected with great care given to the quality of metadata for each document, and they were organised using the ReadCube Papers application.

Clearly, it was not feasible to cite all the academic literature and other documents consulted throughout the dissertation. Thus, a selection of the most pertinent documents had to be made. This process largely prioritised primary sources whenever available, especially when it comes to legislation and official documents. At the end of each chapter, a dedicated list of references is provided, while the end of the book features a complete [reference list](#) of cited works, as well as an [author index](#), listing the pages where they are cited. [Appendix B](#) provides details on an interactive online dashboard created from the complete set of references, cited or not. Users can explore the list of works with access to the links available for each record. One can also select the various dissertation chapters to filter the cited works. The dashboard also allows multiple filtering options by author, type of publication, and language. It is noteworthy that about a third of the works used for this research are in Portuguese. One of the objectives of this study was to bring this extensive collection of documents to an international arena, at a level of detail which I believe to be unprecedented.

[Appendix B](#) also includes details on a dedicated dashboard for the collected legislation. The most relevant documents that have influenced the construction of Brazilian graduate education and its evaluation are presented on a timeline where each reference contains a link to the full official text.

Two other types of references also make up the research conducted for this study. One of them consists of news articles, interviews, public letters, manifestos, and similar documents that supported all the accounts presented on the political crisis faced in Brazil, as well as the economic and managerial challenges that affected Science & Technology in the country. Once again, the choice was always to use primary sources, including recorded public statements from various actors mentioned throughout this work.

Among the cited interviews are recent records to support the mentioned accounts, but historical documents are also included. For example, the text “CAPES 60 years: Six decades of evolution in graduate education” incorporates transcriptions of interviews with former CAPES presidents, directors and coordinators, as well as evaluators, graduate education experts, etc. Interviews, testimonies, and online seminars also served as sources for capturing the opinions of relevant actors, for example, events organised by the Brazilian Society for the Advancement of Science and Brazilian Academy of Sciences (SBPC and ABC, 2020a), and lecture transcriptions such as one from a seminal speech by Schwartzman (1989). Speaking of opinions, some articles in this category were also used, written by CAPES leaders and other important actors in the construction of Brazilian graduate education. Among them, it is worth mentioning works by Barata (2020), Castro and Soares (1983), and Sucupira (1980).

The last type of additional reference consists of the databases used. The number of sources is relatively extensive, but the most important ones are listed below.

- i) **Data from Brazilian graduate education** – Most of these data were obtained from CAPES itself. Information has been collected by the agency for several decades, using dedicated platforms whose design and evolution processes are described in detail in Appendix A. The main system used by CAPES is the Sucupira Platform (CAPES, 2021c), where data on graduate programs, research projects, faculty, student body, intellectual production, and much more are available. Much of the platform’s data are open for online consultation, but obtaining large volumes of data is only possible with administrative access. Although I have the necessary access through my affiliation with the agency, whenever possible, preference was given to using data extracted from the CAPES Open Data platform (CAPES, 2021a), where it is possible to download the microdata collected via the Sucupira Platform after processing, cleaning, and validation by

the agency. With this choice, the reproducibility of the studies presented here is facilitated. Finally, data from the GeoCapes platform (CAPES, 2021e), where partially aggregated official data are presented, were also used at times.

- ii) **Additional Data from the Brazilian Scenario** – A variety of other national data sources were used to supplement the information obtained from CAPES. Among them, one can mention the educational census conducted by INEP, whose microdata are available on the institution's platform. Geographic data were sourced from Brazilian Institute of Geography and Statistics (IBGE), and economic data were collected from the Atlas of Human Development.
- iii) **International Data on Science and Education** – The Brazilian data was supplemented with a range of international data sources, including the Organisation for Economic Co-operation and Development (OECD), the European Commission's Eurostat, National Science Foundation (NSF), ministries of education, science, and technology (The Netherlands, Japan, China), among others. Each of these platforms features a dedicated Application Programming Interface (API) or query systems that allow for the export of data in comma-separated values (CSV) format. This kind of information, for instance, enabled a comparison of publication rates per doctoral graduate in Brazil and various other countries, as presented in Chapter 5.
- iv) **International Bibliographic Databases** – The most extensively used bibliographic database in this dissertation was the Web of Science Core Collection, particularly the in-house version available on the CWTS servers (Clarivate Analytics, 2022). Although this database has coverage issues regarding Brazilian production, as discussed in Chapter 8, there are still some advantages to its use, especially due to the quality of the metadata and the refined affiliation mapping developed over the years. To a lesser extent, consultations were made to the Scopus and Dimensions databases, and data from the recent OpenAlex integrate the information portal about Brazilian science — BrScience — presented in Appendix B. All these databases are available in a relational format on the CWTS server.
- v) **Regional Bibliographic Databases** – Among the supplementary databases used are Scientific Electronic Library Online (SciELO), Network of Scien-

tific Journals of Latin America and the Caribbean (RedALyC), and Regional Cooperative Online Information System for Scholarly Journals from Latin America, the Caribbean, Spain and Portugal (Latindex). In most cases, information had to be sourced directly from the websites or the Application Programming Interface (API) provided by these bases, offering a broader overview of journals used for publication not only in Brazil but throughout Latin America.

- vi) **Open Science Databases** – To enrich many of the studies conducted, databases such as the Directory of Open Access Journals (DOAJ) and Unpaywall were also used, enabling, for instance, the analysis of the percentage of open access publications and associated Article Processing Charges (APCs) presented in [Chapter 9](#). The DOAJ database was sourced directly from the organization's website, while Unpaywall was available on the CWTS server.

Regarding analytical methods, Atlas.ti was the primary tool for coding interviews and document analysis. For example, [Chapter 10](#) includes a mapping of valued technical and technological products, as well as the main criteria and indicators adopted for the evaluation of these products in each of the 49 distinct evaluation areas in Brazil. About 100 documents needed to be coded to survey the reported information, and Atlas.ti was used to execute the strategies for document analysis.

To conduct the scientometric analyses here included, together with other quantitative studies, SQL was the language used for database queries and the calculation of various indicators presented in the different chapters. The integration of data not available from relational databases, and further data processing and analysis, was conducted using R Studio. Several algorithms created for this research are available in the project's GitHub repository. Among them, for example, are algorithms capable of integrating multiple data files obtained from the CAPES Open Data platform. Many other algorithms, developed especially to deal with the different databases of the GeoCapes system, were integrated into an R package freely available on Comprehensive R Archive Network (CRAN).

Finally, the various charts and figures presented throughout the dissertation were partly developed using R and Flourish Studios. However, most of the visualizations were created using Tableau Desktop, allowing for the publication of interactive online dashboards that are referenced throughout this work.

In conclusion, by combining the adoption of a multi- and interdisciplinary approach with mixed research methods, this study seeks to integrate theoretical principles, academic literature, and empirical observation. This combination aims to not only understand the context of the evaluation of research and graduate education in Brazil but also to propose general principles to guide future actions for its advancement.

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