10

A national evaluation push towards increased societal impact

> *It is only by analysing the processes that induce social impact that we have a chance of recognising potential research impacts and the contributions made by research that might otherwise not be evident.*
>
> — **Jack Spaapen & Leonie van Drooge**

The Brazilian National System of Graduate Education (SNPG) constitutes the locus of the majority of scientific and technological research within the country (SBPC and ABC, 2020b). This system, described at length in a previous study (Brasil, 2020), exhibits two primary features pertinent to the current investigation: i) The SNPG emerged as a consequence of consistent public policy implemented over various regimes and governments for many decades, with an applied perspective at its core, emphasising the role of science in driving the country's development; ii) An obligatory evaluation system has been established since the 1970s, impacting the operation, funding, and autonomy of graduate programs (PPG) in the SNPG, which operate only after being accredited by the Brazilian Agency for Support and Evaluation of Graduate Education (CAPES), with reaccreditation required in four-year evaluation cycles.

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Despite the SNPG's developmental impetus, by the 1990s, policymakers perceived a growing disconnect between the system and societal needs, deeming it excessively academic. In an attempt to enhance science engagement, professional graduate programs were introduced in the country (Brasil, 2020). These programs were not novel, having been sparsely implemented in countries like Canada, the United States, Australia, and the United Kingdom throughout the 20th century (Maxwell and Kupczyk-Romanczuk, 2009; Taylor, 2008). In Brazil, they started operating in 1998, but only at the master's level (CAPES, 1998). After nearly 20 years of what has been considered a successful experience, the modality was authorised for the doctoral level in 2017 (CAPES, 2017b).

Several studies have documented the successes and failures of professional master's in Brazil (Barata, 2020; Brasil, 2018; Brasil, 2020; Paixão et al., 2014). However, many of the main critics of the modality say that the programs have mostly become "different but equal", a phenomenon Maxwell and Kupczyk-Romanczuk (2009) believe to be an issue for most of the first generation of professional programs around the world. Until the 1980s or 1990s, despite having a different mission, they offered the same types of coursework and thesis model seen in academic programs, and producing equivalent outputs: primarily scientific papers, conference proceedings, and books.

Prior research has revealed distinctions between academic and professional program outputs in Brazil, with the latter showing some increase in technical and technological production (Brasil, 2018). However, this difference remains negligible in several disciplines. Consequently, this study aims to explore recent efforts to foster a more applied output profile for professional programs in Brazil, including the creation of two working groups tasked with devising classification and evaluation systems for technical and technological production (Winter et al., 2019) and to examine the socioeconomic relevance and impact of research (Martinelli et al., 2019). The results of these initiatives could have the potential to steer the Brazilian science system to generate more diverse and impactful research outputs, as new official methods and principles to assess and value a broader universe of products would be introduced.

This investigation seeks to assess the actual and potential ramifications of these initiatives by addressing the following research questions: Have the policies promoting technical and technological production been implemented in graduate programs and if so, how? Were the proposals of the working groups accepted and adapted by the 49 evaluation areas that constitute the SNPG? Can discernible effects of the policies implemented be observed?

To address these questions, a mixture of qualitative and quantitative methodologies was employed. The initial step involved analysing the policy decisions made in Brazil to improve research engagement with societal needs, achieved by examining relevant legislation and policy documents. Subsequently, a literature and policy review was conducted to gauge the success of the country's initiatives in recent decades. By identifying any weaknesses, the study proceeds to scrutinise the reports of the working groups and a series of over 100 documents incorporating their recommendations in relation to disciplinary attributes. Lastly, the investigation culminates in a large-scale analysis of all production outputs from Brazilian PPGs between 2013 and 2020, with the aim of detecting any trends attributable to the proposed policies.

The results of this research will not only improve the understanding of the policy landscape in Brazil, but will also provide valuable insights into the effectiveness of such policies in fostering a more applied production profile for applied research programs. Additionally, the findings will contribute to an ongoing dialogue among researchers, policymakers, and stakeholders in the field of research evaluation, facilitating the identification of best practises and potential areas of improvement.

10.1 On the evaluation of societal impact

In recent decades, universities have become increasingly orientated towards economic and industrial needs. Moed (2006) identified such trends in the university system of most of the member states of the Organisation for Economic Co-operation and Development (OECD). The study also highlighted changes in the funding of Research & Development with fewer resources from the government, partially compensated by an increase in funding from the private sector. Since universities are expected to show increased economic relevance and to make more substantial contributions to national innovation systems, government funding for academic research became more mission-orientated and contract-based. According to Leydesdorff et al. (2017), this represents a shift towards an entrepreneurial university capable of translating academic research into outputs other than traditional scientific research and teaching. The consequence is the existence of growing expectations that universities will become engines of regional, national, and international innovation.

In the Brazilian context, the complex funding models and the overall structure of the National System of Graduate Education (SNPG) inadvertently hindered the promotion of applied research, as argued by Brasil (2020). Consequently, efforts to foster research with increased contributions to innovation systems and increased emphasis on social issues depended on the alternative approach to implement the professional modality of graduate courses in the country (CAPES, 1998). Initially available solely at the master's level, these courses aimed to generate not only high-quality scientific research but also applied knowledge readily accessible to the productive sector. Since the inception of this modality in Brazil, both the academic quality and the professional dimensions of the anticipated outputs have been subject to evaluation by CAPES, in a manner similar to the academic evaluation conducted in the country since the 1970s.

According to Spaapen and Drooge (2011), the assessment of societal impact of research is much more complex than that of scientific impact, as reliable and accepted indicators are widely available only for the latter. Different types of output are expected from more applied research programs, as a variety of potential audiences have different needs and expectations from the research. Furthermore, the lack of databases such as WoS and Scopus is a problem, and there are also time and linkage issues: impact usually takes longer than citations to manifest, and it is harder to link to specific research efforts.

In Brazil, the challenge of assessing societal impact became evident in every evaluation cycle in this century, when even newly created professional graduate programs, which in theory produced a wider variety of outputs, had a large share of their evaluation based on more traditional scientific production (Paixão et al., 2014). This was not a problem in design, as diversity in output types has always been a strongly presented goal, from the first reports and legislation around professional courses (CAPES, 1995a; CAPES, 1995b; CAPES, 1998) to more recent evolutions of the modality (BRASIL. Ministério da Educação, 2009; MEC, 2017; CAPES, 2017c). One of the most comprehensive ordinances on the topic to date stated that the evaluation process would consider intellectual and technical production, including technological publications; patents and other intellectual property assets; software development; technical reports; manuals and protocols; and many others that were flexible to the reality of each discipline (BRASIL. Ministério da Educação, 2009). More recently, the professional modality was extended to the doctoral level through legislation that reinforced the purpose of programs to transfer knowledge to society, according to specific demands orientated towards national or regional development (MEC, 2017).

Unfortunately, actual evaluation practises did not appear to be capable of reflecting the proposed comprehensive assessment. Despite the adequate design, the analysis of the evaluation documents shows that, in practise, there was little distinction between the procedures and indicators applied to assess professional and academic research in the first decade of their division. Paixão et al. (2014) proposed that the biggest flaw in the evaluation was the lack of value given to technical and technological products and the fact that only researchers were involved in the process, which lacked the participation of societal stakeholders. To reach that conclusion, the authors conducted an extensive survey with 229 participants involved in professional PPG, including program directors (GPD), disciplinary representatives appointed to lead evaluations in the national evaluation system, and expert schollars. One of their most relevant conclusions is that conducting evaluations mostly based on strict academic metrics forces graduate programs that are professional in name to become academic in practise.

According to Fink (2006), academic programs are expected to be process driven, motivated by discovery, and targeted at fresh researchers seeking academic training. Knowledge dissemination is a central goal, and bibliometric evaluations often steer publishing practises toward impactful peer-reviewed journals, mainly in English (Hammarfelt and de Rijcke, 2014). For professional courses, at least in the Brazilian setting, the focus is on experienced practitioners seeking additional qualifications and seeking to address societal demands through the scientific method and state-of-the-art knowledge (CAPES, 2017c). With that in mind, one may conclude that evaluating these programs with the same metrics and rules as academic ones limits the potential of outcome-driven research.

10.2 Towards valuing broader research outputs

The national evaluation that occurred in Brazil in 2013 took the first step of proposing specific sets of criteria for the evaluation of professional programs.

At that time, the distinction was still superficial (Paixão et al., 2014). The following evaluation, which took place in 2017 went a step further, as separate assessment committees were nominated for the first time, even allowing limited participation of stakeholders from non-academic backgrounds (CAPES, 2017b). However, even as the quadrennial evaluation occurred, it became clear that the initiative was not yet enough, as the data on nontraditional output from research programs were not suitably structured, and the appropriate assessment criteria were also imperfect.

By the time the quadrennial evaluation was completed, CAPES had already started a debate with Brazilian academics to reflect on the advances of the assessment methods up to that point and plan further improvements for the new cycle (SBPC and ABC, 2020b). Among the pressing issues was the evaluation of societal impact and the assessment of technical and technological production, which were addressed by appointing two working groups to propose alternatives for the ongoing evaluation cycle and the next. Members of both groups were nominated from disciplinary representatives involved in the evaluation system, covering the Humanities and Social Sciences; Exact and Earth and Natural Sciences; and Life Sciences. Evaluation officers from CAPES also integrated the groups (Martinelli et al., 2019; Winter et al., 2019).

The group on technical and technological products focused their work on classification, validation, detail for data collection, and strategies for product valuation. The impact group took a more qualitative approach to identify how different outputs from a research program may impact society. Considering not only scientific, technical, or technological products but also graduates from master's and doctoral programs, the group proposed a template of an impact declaration capable of bringing a qualitative dimension to the listed output of a research program. Taking into account the lack of consensus on the concept of impact in the literature, the study adopted the definition of HEFCE (2015) which defines impact as a measure of how much the output of graduate programs can produce positive effects on society.

Both groups produced very rich and detailed reports that resulted in well-structured recommendations for an improved evaluation. Their efforts were the target of only minor adjustments from discussions between CAPES and disciplinary representatives involved in the national evaluation, leading to action plans to implement the proposals over two evaluation cycles.

Among the recommendations of the working group that led to immediate action was the classification of technical and technological products that could be valued by evaluation committees in different fields. Before the proposal, a total of 62 types of products had been mapped in previous efforts. According to Winter et al. (2019), the classification was too broad, including a series of individual researcher activities that did not relate or represent the activities of the research unit. A new list of 21 types of products was proposed after a survey was conducted with representatives from all fields within the national evaluation system. Table 10.1 shows the product list proposed by the working group, including examples of subtypes suggested by the report or disciplinary documents made available by CAPES (2020d).

Table 10.1.: Types of technical and technological production to be adopted by the Brazilian evaluation system from 2020

	Product type	**Subtype (examples)**
1	Bibliographic product	Article published in technical magazine / Newspaper or magazine article / Art review or critique / Text in exhibition catalogue, playbill, or similar.
2	Intellectual property asset	Patent deposited, granted or licenced / Industrial design / Branding / Integrated circuit topography
3	Social technology	Product, process, method or technique developed as a solution to the demands of segments of society, relevant to the achievement of measurable returns of socio- and / or economic character
4	Professional training course	Training activities developed, organised or carried out at different levels.
5	Publishing product	Edited or organised book, catalogue, collection, encyclopaedia, artistic catalogue, proceedings, etc. Website production.
6	Development of teaching material	
7	Software development	Designing or collaborating on the development of software, systems, apps, games.
8	Event organising	Organising relevant events, seminars, symposiums and others (national or international coverage)
9	Regulatory standard or framework	Developing of regulatory norm, framework, or studies, / Preparation of draught rules or regulatory framework changes / Studies presented at public hearing / Arbitral awards, case studies, case law studies and procedural documents

Continue...

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	Product type	Subtype (examples)
10	Conclusive technical report	Conclusive technical report per se, as well as development of management processes, market research, simulations, scenarios, applied games, business models, managerial tools, etc.
11	Manual or Protocol	Development or adaptation of experimental technological protocol / application (e.g., SOP - Standard Operating Procedure) / Elaboration of technical operation manual.
12	Translation	Published translation or technical review.
13	Collection	Curatorship of exhibitions / Collections produced / Curated biological collections
14	Technical-scientific database	Developed from productive sector demand, which may or may not lead to transfer of information to the partner. Database developed by research unit, with deposit in an open access environment.
15	Cultivar	
16	Communication product	Organising, presenting, participating in radio or television programs, as well as similar media.
17	Chart, map or similar	
18	Protected products or proceedings	Declared impact of technical or technological production / Declared interest of the business sector in production under protection / Development of technology transfer instruments.
19	Taxonomy, ontology and thesaurus	
20	Innovative company or social organisation	Start-up companies originated from research unit. Companies associated/owned by research unit.
21	Non-patentable process, technology or product	

Source: Translated and adapted by the author from Winter et al. (2019) with additional information from disciplinary documents made available by CAPES (2020d).

The 49 disciplinary committees of the national evaluation system were invited to select around ten of the 21 types of technical and technological products shown in Table 10.1 as the most significant in their fields. From the choice made, each committee prepared evaluation guidelines containing instructions for all graduate programs in the country, some even highlighting a selection of different sets of products of relevance for academic and professional programs. All documents were made publicly available on CAPES (2020d), including customised assessment forms with respective indicators and scoring methods. Information on Figure 10.1 reflects the selection of the product for each evaluation area, highlighting the broad areas into which they are classified.

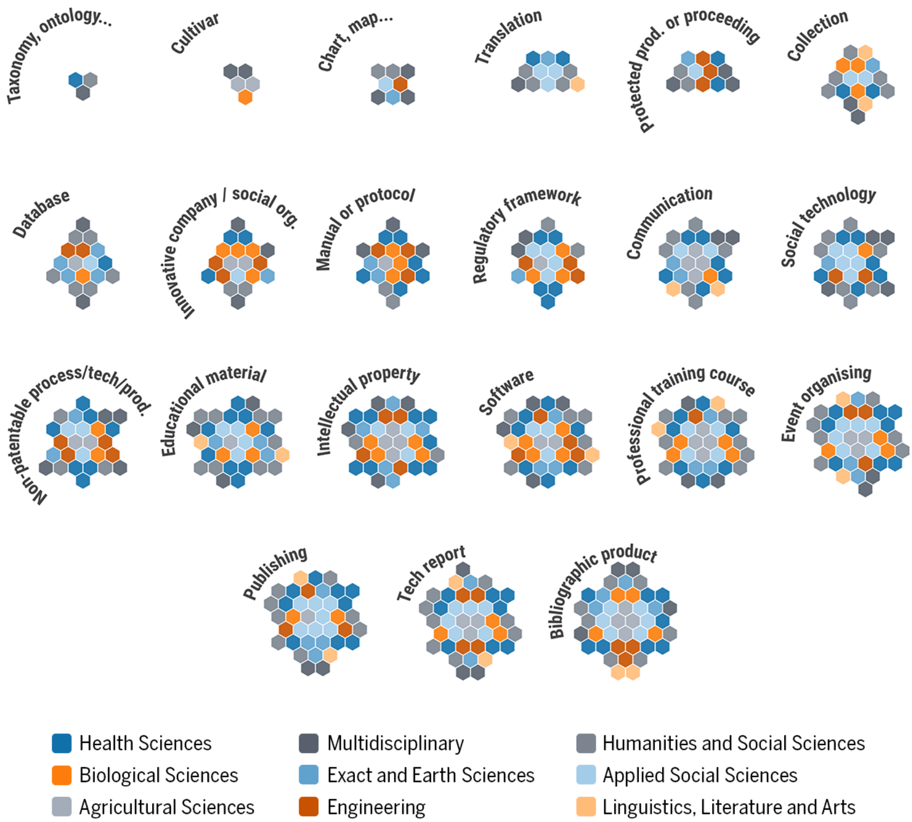

Figure 10.1.: Selection of product types per disciplinary committee, coloured according to CAPES' broad area classification

Figure 10.1, which can be interactively explored at https://andrebrasil.github.io/viz/techprod.html, displays a general overview of the areas that have reported each of the 21 types of products of Table 10.1 as relevant to their evaluation. The overview displayed aligns with expectations, with some products valued in most areas and others restricted to a few. For example, bibliographic and publishing products were valued by most of the committees. On the other hand, cultivars are significant for only five of them (e.g., agricultural sciences and biotechnology). These variations are very representative of the framework Brazilian evaluation is trying to achieve; one in which disciplines are free to determine what matters most for them, so it can recognised and rewarded, thus stimulating growth where desireable.

Further exploration of the interactive figure associated with Figure 10.1 reveals a varying range of selected products in different evaluation areas, with the majority opting to stay around the recommended number and considering something between 8 and 12 products. A notable exception is Astronomy/-Physics, which chose only four products as relevant to their evaluation. In contrast, 11 evaluation areas selected over 12 products. Among them is the expected Interdisciplinary, for which all products were deemed relevant. Political Science and International Relations was also very broad, encompassing 19 products (only cultivar and intellectual property assets were left out).

Regarding the evaluation methods adopted by the areas, it is interesting to see that 19 of them stated that they would employ only qualitative methods in their analysis. This means that they are not concerned with the amount of products listed as outputs from each of the graduate programs under evaluation. They would focus their efforts to qualitatively assess a portfolio of products selected by the PPG as representative of their work as a whole. The remaining 30 evaluation areas informed that they would adopt a mixed methods approach, also performing the portfolio assessment together with a quantitative analysis of the products from each program. Interestingly enough, no area chose a purely quantitative approach to their evaluation, meaning that all of them could value the academic quality and practical applicability of the research outputs.

10.3 Observable changes in the system

The 2018 initiative to rethink Brazil's national evaluation system began immediately after the publication of the 2017 quadrennial evaluation results, which analysed data from graduate programs spanning 2013-2016. The subsequent evaluation would encompass the 2017-2020 period, suggesting that any reform efforts would occur late in the four-year cycle. However, considering the high stakes nature of the Brazilian evaluation discussed by Brasil (2022), higher education institutions and their graduate programs closely monitored the debate to anticipate any changes in the upcoming evaluation. In the case of the assessment of technical and technological production, even though the report of the working group and the subsequent design of criteria within the evaluation areas would materialise only in 2019, the mere appointment of a working group showed that the issue would gain relevance in the evaluations to come. Thus, while substantial effects of valueying alternative types of scholarly output may only be seen in the 2021-2024 cycle and beyond, the proactive engagement of the SNPG already generates anticipation for some increase in the proportion of technical and technological products within the 2022 evaluation.

To verify whether an increase in technical and technological production has already manifested in the 2017-2020 period, all data sets on graduate program output available on the CAPES open data platform were collected (CAPES, 2021a), and the results of the analysis can be seen in Figure 10.2, which can be explored in detail using the interactive dashboard available at http://andrebrasil.github.io/techprod.html

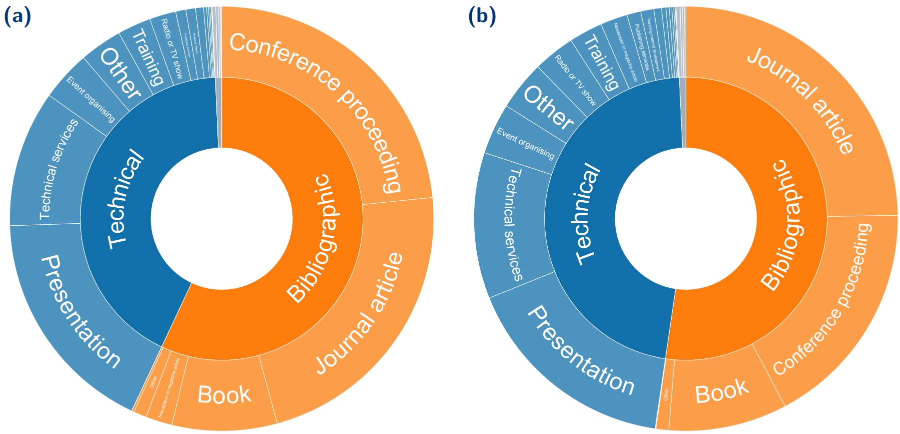

Figure 10.2.: Bibliographic, technical, and artistic production of graduate programs in Brazil, in: (a) 2013-2016; and (b) 2017-2020.

Figure 10.2a shows that nearly 57% of the graduate program output in the 2013-2016 period consisted of bibliographic products, especially books, journal articles, and conference proceedings. Technical and technological products accounted for around 42% of the total output, and artistic production appears as a thin grey slice at the top of the figure. The expected profile change started to materialise in 2017-2020, and Figure 10.2b shows that the share of bibliographic products decreased to around 52% of the total output in the period, with a corresponding increase in technical and technological production. The sunburst charts also reveal some changes in proportion for the subtypes of products, for instance with journal articles and conference proceedings exchanging places. Figure 10.3 shows the percentage variations of the different subtypes available in the database for bibliographic and technical & technological products.

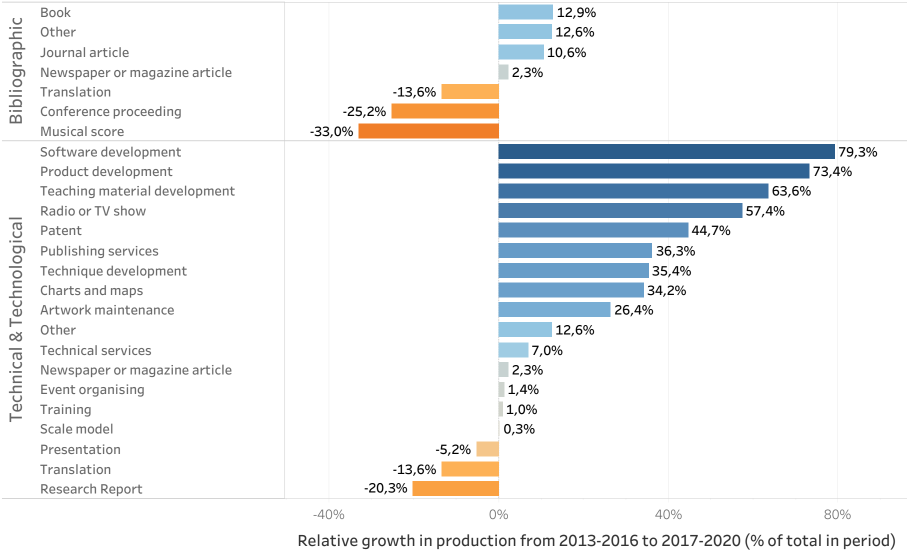

Figure 10.3.: Percent variation in the share of product subtypes in relation to total graduate program output: from 2013-2016 to 2017-2019

As the comparison shown in Figure 10.3 considers two evaluation cycles, the possible influence of the COVID-19 pandemic is not extreme in the most recent production profile of graduate programs, but can be observed in the slight reduction in the percentage of presentations and the more significant drop in conference proceedings. Relevant increases in the representation of products such as patents and the development of software, products, and techniques suggest that an evaluation process that values a broader range of scientific outputs may encourage greater diversity in these outputs. However, careful scrutiny reveals a challenge in accurately analysing the current status of product subtypes: the production database has not been updated to reflect the product classification adopted for the 2017-2020 evaluation, as detailed in Table 10.1.

Changes leading to an increased valuation of technical and technological products, as well as to a new selection and classification of desired products, occurred toward the end of a four-year evaluation cycle. Therefore, the complexity of changing the data collection system to reflect the new situation would be high, especially considering that graduate programs report their production on an annual basis. The impossibility of updating the system led to challenges for data analysis of the products and also made the quantitative assessment proposed by the 30 evaluation areas adopting mixed methods weaker. If products are not recorded as expected, with the appropriate metadata for each product type, the evaluation committees cannot count on the information for their analyses. They either do a parallel data collection, not recorded in official evaluation databases, or their assessment changes to a mostly qualitative one.

Limitations in the data may restrict further advances in the analysis of subtypes, but it is possible to investigate changes in the overall production in each evaluation area. For this, Figure 10.4 shows the percentage of artistic, technical and technological production per area, with the academic and professional modalities of PPG separated to identify possible differences in the production profile. For each case, data can be seen for 2013-2016 and 2017-2020.

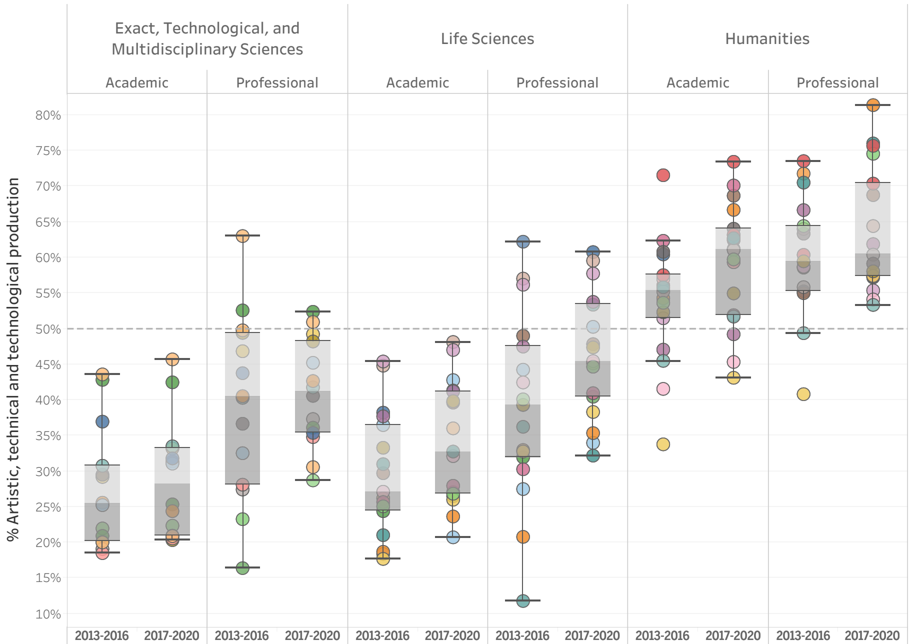

Figure 10.4.: Percent of artistic, technical and technological production per evaluation area from 2013-2016 to 2017-2020, grouped by PPG modality

Each of the circles shown in Figure 10.4 represents the percentage of artistic, technical and technological production in an evaluation area. This percentage can be as low as 12%, considering production from professional graduate programs in the area of Biological Sciences III, and as high as 81%, in the PPG of the same modality in Religion and Theology. The dashboard available at https://andrebrasil.github.io/viz/techprod.html allows each circle to be identified and explored in more detail. However, the collection of 49 evaluation areas reveals a series of interesting production behaviours within their broad area groups. For instance, there is a striking difference in behaviour across broad areas, with a very high percentage of artistic, technical and technological production in the Humanities. Even in more academic programs, the share of bibliographic production is below 50% in most areas.

Productivity variations between academic and professional programs are also evident, with the first more focused in the bibliographic production, more inward orientated as it is mostly destined to academic audiences. Professional programs would, as expected, be more outward orientated, with a higher percentage of artistic, technical and technological production, mostly destined to non-academic audiences. Whether or not that profile difference is under or above the desired, and if a more balanced behaviour should be an aim across the distinct evaluation areas, are questions for future research.

Finally, what is evident in most groups is the growth in outward proportion from 2013-2016 to 2017-2020. As expected, the variation is a bit more evident in the academic PPG, as the professional ones already had this sort of production a little more established in their primary objectives. However, even if little variation can be seen in the median of professional programs in "Exact..." and "Humanities", the overall variation in the area distribution is quite significant.

10.4 Looking for impact

Despite the late adoption of the new approach that values technical and technological production in the Brazilian evaluation system, the National System of Graduate Education (SNPG) has already shown promising results. Although it is difficult to attribute the increase in outward production from graduate programs directly to the evaluation push, the numbers are growing significantly and may become even more impressive by the end of the 2021-2024 cycle. However, the future of impact evaluation, the focus of the second working group approached in this study, remains uncertain.

It is nearly impossible to find consensus on a single definition of the impact of research on society. That was one of the preliminary conclusions of Martinelli et al. (2019), who recognised impact evaluation as a more recent concern for researchers, and also a new focus in Brazil after the introduction of citation metrics in the graduate evaluation system. To serve as a guiding concept for Brazilian evaluation, the definition of impact proposed by the Research Excellence Framework (REF) was adopted, declaring impact to be a measure of the positive effects generated by graduate program outputs for a community (HEFCE, 2015).

According to Martinelli et al. (2019) graduate programs traditionally aimed to generate knowledge to address future problems, rather than immediate demands solvable through existing knowledge. Thus, scientific impact takes precedence, as the generation of new knowledge forms the basis for academic or business groups to develop future solutions to humanity's challenges. That has been the focus of Brazilian evaluation for decades, but researchers are increasingly expected to provide solutions to everyday problems facing the population. Since there is no tradition and little practise in assessing the economic and societal impact of projects and products, many researchers assume their role is to provide foundational knowledge and technology for public or private organisations to implement practical solutions, rather than developing directly applicable products and activities.

With this in mind, the Impact Working Group proposed that the first efforts to map impact in Brazilian evaluation should start with the assessment of the technical and technological products catalogued by Winter et al. (2019). This type of output helps translate scientific impact into potential impact, meaning researchers would show stakeholders how the research conducted could be applied to yield significant results and generate societal impact. The primary indicators the group suggested for application in impact evaluation include causality, impact type, anticipated duration, beneficiary sector, link to institutional strategic planning, application type, availability, beneficiary sector, and territorial scope. This comprehensive approach aims to accurately assess the various aspects of the impact of research within the Brazilian evaluation system.

Three relevant points derive from the indicator list. The first is that the working group proposed the indicators as the basis for an assessment form to be added to the information system cataloguing technical and technological production. As the definition of new product types came too late in the evaluation cycle to be implemented in time, the same happened for the proposed form. Thus, any application of indicators may have been used to inspire qualitative evaluation within areas, but no consistent documentation of that has been found in published evaluation reports (CAPES, 2020d). The next two points relate to the future of impact evaluation, as seen by the WG: time and autonomy.

Scientific impact can be converted to potential impact by the effort of researchers in translating to stakeholders. However, real impact occurs only after the target audience uses research products or services effectively. Accordingly, impact evaluation must consider a temporal scale (short-, medium-, and long-term), since some research benefits may only materialise after many years. With this perspective in mind, Martinelli et al. (2019) recommends a cumulative consideration of up to 12 years of graduate programme output to capture the real effect of research output.

Finnaly, with respect to autonomy, one of the proposed indicators looks at the relation of the research product with institutional strategic planning. For one, that intends to separate intentional from accidental impact, and an eventual distinction of value among these is a matter of complex discussion in itself. However, that also relates to the working group's ideas on the future of impact evaluation, one that relies on a self-assessment strategy where institutions can evaluate their impact based on their mission, objetives, actions, and output.

10.5 Conclusions

This study has presented an analysis of initiatives to further the impact of Brazil's National System of Graduate Education (SNPG). Covering from the historical design of the system and the implementation of a professional modality of graduate program, to recent efforts of an evaluation push to promote growth in technical and technological production, many practical steps have been taken towards the desired impact, several only possible due to the normative aspect of the SNPG, as well as the evaluation system in place.

One of the strengths of the SNPG in promoting any type of change is its high-stakes evaluation. It has direct effects on funding, determines accreditation and the continued existence of graduate programs, the base research unit in the country. Evaluation is compulsory, top-down, centralised, and comparative; thus, any new priority for evaluation can be implemented with a potential steering effect rarely seen elsewhere. Since one of the important recommendations after the 2017 national evaluation was that more attention should be paid to the impact of graduate programs, two working groups have embodied the efforts in that direction. At the end of 2019, they made recommendations to improve the classification and evaluation of technical and technological products and to develop a qualitative approach to assess the impact of these various research program outputs.

As the most recent national evaluation in Brazil assessed the performance of graduate programs from 2017 to 2020, the results of the working groups were a bit late to be fully implemented. However, the first steps taken have signalled academia that a more holistic approach to evaluation has arrived and that it values not only the more traditional bibliographic production but also technical and technological outputs and their relation with impact. Since the 49 evaluation areas in the Brazilian system have incorporated the new perspective in their guidance documents, the process has already started to foster a shift in the orientation of graduate programs, represented by a significant change in their publishing profiles to include a higher proportion of technical and technological products.

It is evident that a surge in the reporting of specific types of products does not necessarily indicate a corresponding increase in production. During the past two decades, the emphasis on bibliographic production within the evaluation system implemented by CAPES has left indelible marks, resulting in pervasive mindsets among faculty, students, and staff that insufficiently document other activities. These deeply embedded perspectives are now undergoing a reversal. For instance, the number of reported patents experienced a relative growth of approximately 45% between the 2013-2016 and 2017-2020 cycles. Although this increase in reporting may be attributable to the 2019 evaluation push, that does not imply that additional patents were produced as a direct consequence. It is more plausible that patents were among the numerous product categories underreported in the annual data collection from graduate programs, given their less pronounced impact in evaluations compared to the new model. However, as researchers become aware that their work will receive due recognition, reporting is expected to improve, consequently inspiring the production of more diverse research outputs.

In conclusion, the shift toward a novel evaluation model presents both challenges and opportunities for Brazilian graduate programs. Although the path to a more impact-orientated evaluation methodology is laden with complexities and uncertainties, it is imperative to recognise the constraints imposed by the previous focus on bibliographic production and to adopt a holistic approach that takes into account the whole of the programs' performance and research products. The potential benefits of implementing such a system are considerable, encompassing enhanced engagement with non-academic audiences and increased emphasis on the societal and economic advantages of research. By persistently refining and advancing the evaluation system and by cultivating a collaborative and transparent environment within the academic community, Brazil's national evaluation has the capacity to exert a pivotal influence on the future trajectory of graduate education and research, thereby ensuring that the country's science system may impact society in broader ways.

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