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Measuring change in institutional diversity in higher education in Brazil

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In this study, we draw on the previous literature that emphasises the relationship between institutional types of higher education and different institutional logics to investigate the impact of the expansion of tertiary-level education in Brazil in the last decade on the institutional functioning of higher education organisations. Using Latent Profile Analysis and data from all Brazilian higher education institutions in 2010 and 2019, we identified nine distinct institutional profiles. By adopting a multi-functional approach and considering a wider range of institutional dimensions, we highlight the complex configuration of the Brazilian system beyond the formal classifications or legal status of the institutions. The results show a greater diversity of institutional types in 2019 than in 2010, although enrollments are more concentrated in a few institutions. Findings also revealed that changes occurred mainly in private institutions of different sizes. Our findings add nuance to the discussion about institutional diversification in an expanding system like the Brazilian one, challenging prior studies and formal classification..

Keywords: higher education; diversification; expansion; latent profile analysis, typology

Introduction

The expansion of most higher education systems has been accompanied by increasing pressures to diversify their offer to meet the increasing numbers and diversity of students and the varying demands of stakeholders. As a result of this process, the way in which higher education is structured has become the object of public policies concerned with reorganizing the system, making higher education institutions (HEIs) fulfill a more diverse set of objectives (Teixeira, Biscaia, and Cardoso 2013). However, relatively few studies have yet sought to assess the extent to which institutional diversification has reconfigured the functioning of higher

education in emerging countries, many of which became a mass system only recently (Zha, 2009; Schwartzman 2021). This gap is particularly relevant for research on higher education since, in contrast to high-participation systems, where massification has occurred mainly through the public sector (Cantwell 2018), the latter tend to follow disparate strategies, including a greater reliance on the private sector or distance education, and the implementation of public policies aiming at addressing higher aggregate levels of inequality.

In this study, we draw on the previous literature that emphasises the relationship between institutional types of higher education and different institutional logics (Huisman et al., 2015; Fumasoli et al., 2020), to investigate how the expansion of tertiary-level education in Brazil in the last decade has impacted the institutional functioning of higher education organisations. Although the Brazilian system has followed the global trend of expanding while diversifying, the path it has been following poses challenges to research on institutional diversification. Prior studies find that the centrality of the for-profit sector and distance education as means of massifying the system can lead to an intense concentration of the educational offer (Tagliari 2023). Others point to the separation of the primary functions of teaching and research into separate institutions and the polarisation of the private sector between a small number of large private teaching companies at one extreme, and about 2,000 small isolated colleges at the other (Schwartzman 2021). However, it remains open how the system can be characterised when considering a more comprehensive set of institutional dimensions and, more importantly, what are the patterns of stability and change at the institutional level observed in recent decades.

Perimeters of higher education and boundaries between forms are often related to national policies and are likely to change over time (Huisman et al. 2015), and we have some reason to believe that this is the case for the Brazilian system. The public policies implemented in the last decades in higher education, mainly by the federal government, expanded the

coverage of the federal subsystem at the same time that they induced and sanctioned expansion and investment strategies by for-profit private groups, lading to concentration and oligopolization of the higher education market (Carvalhaes, Medeiros, and Tagliari 2021). The constitution of a for-profit subsystem with a service capacity on a scale similar to that existing in the federal one (Vieira and De Macedo 2022) raises a series of questions about the extent to which this process is associated with hierarchies of status and positional advantage among different institutional types.

This study contributes to the literature on the conceptualization and measurement of institutional diversity by seeking to answer two research questions. First, to what extent do we observe different types of institutions due to differences in their organisational functioning? Second, how have the changes in the functioning of the system in the last decade reconfigured the classification of these groups, if at all? Following previous literature (Barringer and Pryor 2022), this study considers change only after exploring potential variation in initial institutional functioning, which may itself shape change processes. We examine these research questions using nationwide administrative data from the 2010 and 2019 rounds of the Brazilian Higher Education Census and tables on enrollment and academic production of postgraduate courses from the Coordination for the Improvement of Higher Education Personnel (CAPES), comprising the more than 2,300 HEIs operating in Brazil. By including key variables relating to the core functions of HEIs (teaching, research, third mission) and other theorised components of institutional diversity, these data allow us to characterise the institutions and assess stability and changes among them in a more nuanced way than previous studies. In order to do so, we use latent profile analysis (LPA) to identify latent groups of HEIs based on their similarities regarding predicted institutional dimensions.

The remaining sections of the article are structured as follows. The next section discusses previous studies, describes relevant aspects of the Brazilian higher education system

and presents our hypotheses. Subsequently, we discuss the data sources used for this paper and the analytical strategy we adopted. The findings section presents and discusses the results. The last section discusses the implications of the findings for research on diversity in higher education and public policies aimed at expanding and evaluating higher education systems.

Theoretical background

Institutional diversity

The sociological literature on higher education has been increasingly focused on the diversity among institutions, particularly in countries where higher education systems are no longer characterised as elite systems (Croxford and Raffe 2015; Harris and Ellis 2020; Huisman et al. 2015). Some studies suggest that the level of diversity within the education systems is associated with their ability to expand and include different social groups while responding to the needs of the labour market. However, organisational theory posits that the diversification of higher education may decrease as institutions tend to emulate successful organisational models within the system (Fumasoli et al. 2020; Teixeira et al. 2012). Scholars informed by institutional theory have expressed concerns about the possibility that processes of academic "drift," in which lower-level institutions attempt to emulate elite institutions, could reduce the level of diversity in the systems (Huisman et al. 2015). These authors expected that a decrease in institutional diversity would lead to instability in higher education systems, compromising their ability to respond to increasingly complex expectations and pressures from different social groups. Our study addresses these issues for the case of Brazil and evaluates which theoretical approach applies in the national context. Based on previous studies, which indicate enrollment concentration and oligopolization in the higher education market, we expect a decline in institutional diversity within the Brazilian system.

Another point of debate is the ways of approaching institutional diversity. As argued by Huisman et al. (2015), the first step for any analysis of institutional diversity is to identify categories and evaluate the robustness of diversity measures concerning category definitions. In particular, the authors caution against the use of pre-existing classifications of institutions, even though they may generate consensus around relevant categories, as they likely conceal a significant internal variety within higher education systems. Brazil has a formally binary system (private and public sector) and although we will take this into account, we expect to find a typology that goes beyond the previously established formal structures. In this article, we start from the definition of institutional diversity as a description of attributes of the higher education system, whose elements can be divided into categories of institutional types (Stirling 2007; Harris 2013). We also adopt a comprehensive perspective on diversity, following the tradition of studies that emphasise a multifunctional approach to higher education (Birnbaum 1983; Huisman et al. 2015; Morphew 2009; Teixeira et al. 2013; Van Vught 2009). This includes organisational dimensions (such as size), educational dimensions (such as academic degree programs at the undergraduate level), research dimensions and third-mission dimensions.

Typologies of higher education institutions

The present study aims to expand and replicate the efforts of different works within this conceptualization of institutional diversity, some of which illustrate the contributions that can be offered to understanding the dynamics of diversification in the Brazilian higher education system. Since the classic work of Birnbaum (1983), scholars have built large-scale studies seeking to identify institutional profiles and their variation over time. In general, these works identify stabilities in institutional structures over time. The results of the studies depend to a large extent on the types of measures and the universe of institutions analysed (Huisman et al.

2017). Some measures, however, are frequent in these studies. The size of institutions, the type of control or funding sources, and the academic organisation are examples of common variables in these studies (Barringer and Pryor 2022; Huisman et al. 2017; Stanley and Reynolds 1994). In addition, measures related to the inclusion of minorities also appear in studies that seek to analyse the relationship between institutional typologies and social inequalities. These variables are relevant for the Brazilian context, especially considering the massive growth of some institutions and distance learning offer. We expect these characteristics to be more relevant in distinguishing groups of institutions in more recent periods.

Despite the increased interest of scholars in higher education regarding institutional diversity, we find few efforts of institutional classification based on the diversification of higher education in Brazil. These works focused on conceptual discussions on changes in the private sector (Sampaio 2014) or reflections on legislative and regulatory changes in the system (Neves 2003). Analyses with objectives similar to the construction of typologies were based on the description of a few variables (Schwartzman, Filho, and Coelho 2021) or resulted in such an extensive set of institutional types that they impose significant difficulties for analytical work (Steiner 2006).

This article builds on the contributions provided by the previous literature to propose a more analytically robust classification of Brazilian Higher Education Institutions (HEIs), based on different relevant sociological approaches for analysing institutional diversification. For this purpose, we focus on conceptual dimensions that largely coincide with those employed in international studies with a similar scope. In dialogue with recent works that map the increasing differentiation of the Brazilian education system, we believe that our findings point to patterns of institutional diversification with important implications for the debate on public policies for the country's higher education.

Higher education in Brazil

The expansion of the Brazilian higher education system in recent decades followed a pattern also found in other countries: its structure underwent profound transformation as it diversified, including the emergence of new institutional models and types of education, improvement of academic standards, and an increasing heterogeneity in the socioeconomic composition of students and professors.

The Brazilian higher education system has developed into a complex system of 2,587 institutions (Inep 2020), divided into public institutions (under the control of the federal, state, and municipal governments) and private institutions (non-profit and for-profit), which have varying levels of autonomy depending on their academic organization (universities, university centers, or colleges). The private sector, mainly composed of small and medium-sized colleges, accounts for 87% of the institutions and focuses on humanities courses. Technologically demanding and high-cost courses are generally offered by public institutions, which are predominantly large research universities. The public sector is tuition-free, while the private sector charges fees.

Private higher education institutions (HEIs) concentrate 75% of the 8.0 million students, with the majority (41.5%) attending for-profit institutions. Although enrollments in public HEIs have shown significant growth in recent decades, the expansion of the private sector has been more pronounced: while the former grew by 80% between 1980 and 2000 and 120% between 2000 and 2014, the rates for the latter were 104% and 225%. In the 1990s, the expansion of the private sector occurred through the creation of small and medium-sized institutions, but since the 2000s, there has been a strong movement of acquisitions and mergers, led by large business groups with significant foreign capital participation (Carvalhaes et al. 2021; Corbucci, Kubota, and Meira 2016; Sampaio 2011; 2015).

The Brazilian higher education system offers various courses in different areas of study and three types of degrees: Bachelor's degree, Teaching programmes, and Technological degree. These credentials are linked, in that order, to opportunities in the job market, decreasing economic rewards, and social esteem. The proportion of enrollments by degree types reflects this scale of prestige and remuneration. Two-thirds of students preferred the first type throughout the 2000s. Enrollments in teaching programmes have been slightly decreasing, while the opposite occurs with technological courses, which have grown by up to 14% and show remarkable growth, multiplying their share of total enrollments by six (14%). The areas of study are also associated with different income levels (Santos et al. 2020).

The structure of higher education in the country presents two important characteristics significantly associated with the socioeconomic profile of students: a high proportion of courses and enrollments in the evening shift and the presence of distance education. Evening higher education courses are mostly attended by older students who usually work full-time, while daytime courses are preferred by the middle and upper classes. Distance education courses, which were almost nonexistent at the end of the century, have been growing in proportion, reaching 20% of total enrollments in 2019.

Research design and methods

Data sources

In order to examine the questions set out above, we provide a case study of institutional diversity based on nationwide administrative data from 2010 and 2019 rounds of the Brazilian Higher Education Census (HEC) and tables on enrollment and academic production of postgraduate courses from the Coordination for the Improvement of Higher Education Personnel (CAPES). Despite having several limitations, these data sets offer a unique opportunity to describe the level of diversity in a mass higher education system such as the

Brazilian one. The Higher Education Census is the most comprehensive data source on higher education institutions that offer undergraduate and sequential specific training courses[1], as well as students and professors. CAPES data contain information about *stricto sensu* graduate students in Brazil, such as the student's nationality, enrollment year, degree level, status in the graduate program, the Graduate Program and the Institution where the student is enrolled, among others.

The advantages of the combined HEC/CAPES data are that it: (1) covers an extensive period of time (almost one decade) allowing us to assess stability and changes among clusters of institutions in a period of transformations of the system, (2) includes key variables relating to the core functions of HEIs (teaching, research, third mission) and other theorized components of institutional diversity, and (3) covers all institutions of higher education in the Brazilian system. The HEC/CAPES includes information on the population of 2,377 and 2,608 HEIs operating in Brazil in 2010 and 2019, respectively.

Operationalizing and measuring diversity

Following previous research (Morphew 2009; Daraio et al. 2011; Huisman et al. 2015), we adopt a generic approach for selecting the relevant dimensions and making decisions about their operationalization and measurement. In line with most research on institutional diversification in higher education and addressing limitations of similar studies on the Brazilian system (Schwartzman, Filho and Coelho 2021), we focus on key dimensions related to central missions of HEIs, such as teaching, research, and third-mission, but also selected variables that represent components of governance, teaching process or quality of academic staff, students' characteristics and internationalization. This theoretically informed choice stands in contrast

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[1]The sequential courses are a modality of higher education that has a shorter duration - maximum two years and are intended for a more specific training, conferring technical qualification.

with some case studies that built typologies based on a restricted set of variables, such as the sector and the size of the institutions (Schwartzman, Filho, and Coelho 2021), in some cases referring to classifications of higher education systems quite different from the Brazilian one (Steiner 2005; 2006).

For the purpose of this article, we have selected a set of 37 variables (see Appendix Table A), which reflected our theoretical understanding of six dimensions that are deemed particularly relevant for organizational functioning: (1) Governance, (2) Educational profile, (3) Research involvement, (4) Socioeconomic composition, (6) International orientation and (7) Third mission. There appears to be some consensus that structural features such as size, infrastructure and type of management matter for most institutions' activities, while governance, in particular the private-public dimension, should relate in one way or another to the core functions of HEIs (Huisman et al. 2015). The dimension of socioeconomic composition of enrollments is particularly relevant for the Brazilian higher education system in the period under analysis, due to the implementation of a series of policies aimed at expanding access to groups traditionally excluded from it. In 2010, changes to the Student Financial Fund (FIES), the federal student loans program aimed at students enrolled in private institutions, made it more accessible to low-income students. In 2012, the quota law was approved, guaranteeing the reservation of 50% of vacancies in federal universities for blacks, browns, indigenous peoples, people with disabilities and public school students. Together, these policies accounted for much of the substantial increase in the participation of low-income students, working students and racial minorities in higher education over the past decade.

Governance was meant to be measured by five components: size (staff, student, teachers and courses numbers), operating time, (years of operation of the first course), location (proportion of enrollments in courses offered in capitals) and management (proportion of professors who work in management). We built indicators related to components of faculty and

students to measure each one of the other dimensions. For educational profile, we have calculated the proportion of enrolments by course shift, type of degree, type of offer and field of study, and those who were participating in or receiving scholarship for teaching or non-mandatory internship activities; the faculty component included the proportion of full-time professors or professors with a doctoral degree.

As regards the dimension of research involvement, the student component was composed of the proportion of enrollments in *stricto sensu* (master and doctoral degrees) graduate programs, undergraduate enrollments with a research scholarship and working in research; for the faculty side we selected proportions of professors working in research, with a research scholarship, working in postgraduate courses, and the number of publications in journals indexed in Scopus. In order to capture different aspects of socioeconomic composition, we have chosen proportions of enrollments by gender, race, disability indicator, type of high school, and those benefiting from student support programs and between 18 and 24 years old; proportions of female, black, and with disabilities professors, as well as proportion of courses offering accessibility conditions for PCD complete the list.

Finally, the dimensions of international orientation and third mission had two and three indicators, respectively: (1) proportion of foreign visiting professors and students in international academic mobility; and (2) proportion of professors working in third mission activities and proportions of students with a third mission scholarship or in third mission activities.

Analytic strategy

Our main empirical analysis proceeds in two steps. After we selected the variables for each theorised dimension, we used exploratory factorial analysis (EFA) in order to check their

consistency. In the second step, we use latent profile analysis (LPA) to identify latent groups of HEIs based on their similarities regarding the indices predicted by the AFE.

We chose to keep in EFA only those variables that contributed satisfactorily to the estimated factors (loading higher than 0.4 (Morin et al. 2020, 1052) or that could be considered adequate for the factor analysis (MSA > 0.60 [Garson 2023]). According to these criteria, 19 variables remained in the final model (Table 1). The EFA results, using the parallel analysis method (Humphreys and Montanelli, 1975), showed the existence of seven factors, which together explain 68% of the data variance and which adequately fit the data, with a Bartlett's test of sphericity significant ($p < 0.001$), KMO = 0.77, RMSEA = 0.067.

The variables contributing most to the first factor are numbers of enrolments, staff, professors and courses, followed by the proportions of enrolments enrollment in master's and doctoral programs and of full time professors, which is why we might call it the "Governance". Both proportions of enrolments in teaching programs and courses in the area of Education loaded strongly on the second factor, labeled "Teaching programmes". Based on the contribution of the proportions of female enrolments and professors to the third factor, in the opposite direction to the loading of the proportion of enrollments in the typically male area of Engineering, we chose to label it "Feminization". The fourth factor, "Academic orientation", was associated mostly with the proportion of enrollments in four-year baccalaureate courses and, in the opposite direction, enrollments in two-year technological courses. The proportion of enrollments in full time courses and, in the opposite direction, evening courses contributed strongly for the "Evening courses" factor. Considering the strong contribution of the proportion of enrollments in distance learning courses and the moderate contribution of the proportion of enrollments of 18 to 24 year-olds, which is consistent with the fact that those are attended mostly by working students, we chose to label the sixth factor "Virtualization". Although the last factor relied only moderately on the proportions of professors with a doctoral degree and

full-time professors, which were moderately crossloaded on the first factor, we label it "Faculty composition".

INSERT TABLE 1 HERE

The seven predicted factors were used in a series of latent profile analyses to evaluate the organisational structures of HEIs and the ways in which they changed (or not) over time. LPA uses observed quantitative data to estimate latent profiles, or groups of cases, based on their similarities and differences on the observed data (Barringer and Pryor 2022; Hagenaars and McCutcheon 2002; Goodman 2002). This technique has been used in higher education research as they allow researchers to incorporate multiple measures of multidimensional concepts, such as governance or academic orientation, to analyse differences and patterns across cases within a population and determine the extent to which sub-populations are present (Barringer and Pryor 2022; Barringer, Taylor, and Slaughter 2019). Additional benefits of LPA relative to other clustering methods, which justify its use here, include: (1) it allows for better model estimation by providing multiple measures of model fit that can improve model specification relative to other clustering techniques; (2) enables evaluation of the significance of variables used to estimate latent profiles (Barringer and Pryor 2022; Janmaat and Green, 2002).

We carried out a series of LPA models to evaluate different model specifications and different numbers of latent profiles using the tidyLPA package in R (Rosenberg et al. 2018.). We incorporated both editions of HEC/Capes data in order to estimate a single model that incorporated information from both years and included a "year dummy" (coded 1 for 2019) as a predictor of membership in the latent profiles, to account for the potential for time to influence class membership. Using a combination of two criteria, the change in log-likelihood and the Bayesian Information Criterion (BIC) (Weller et al. 2020; Schmidt et al. 2021), we determined

a nine-profile model using the factors' indices outlined above to be the best-fitting across all data in both years of our analysis. Table 2 shows the fit statistics of these models, which indicate that the model with nine clusters has both the lowest BIC and the highest log-likelihood.

INSERT TABLE 2 HERE

Results

The clustering identified nine distinct groups of institutions based on the observed variables. We also identified patterns of stability and change at the institutional level. Some clusters remained almost unchanged, while others disappeared and new ones appeared. In the following, we describe the group of institutions found and then we describe patterns of change and stability over the two periods analysed.

Typology of higher education institutions

The typology found through LPA contains nine clusters of institutions. The descriptive statistics for each of the nine clusters is presented in Table 3. Additionally, we describe the composition of each cluster according to the formal organisational structure of Brazilian higher education institutions. Institutions in the country are classified according to type of control (public federal, public municipal, public state, private non-profit, and private for-profit) and by academic organisation (universities, university centre, or colleges).

The results indicated that institutional differentiation occurs mainly in the private sector (nonprofit and for-profit institutions) while public institutions were concentrated in a few clusters (mainly in cluster 7). There is also a concentration of institutions organised in universities in cluster 7, which is the typical academic organisation of institutions under state and federal control. In addition, other general characteristics are worth highlighting.

Most of the institutions are characterised by offering bachelor's degrees, evening courses and in-person classes. However, small variations in these characteristics are capable of producing notable differences in how institutions are located across clusters. For example, the greater proportion of enrollments in Teaching programmes is associated with greater female presence among students and faculty. On the other hand, the greater proportion of enrollments in Technological degrees is linked to a greater male presence. These profound differences between two institutional types also interact with common characteristics between them, such as the size of the institutions, the age of the students, and the faculty composition.

Below, we describe each of the nine clusters found, starting with those with the largest institutions and ending with those with the smallest. We used size as the primary criterion to describe the groups because it was the most significant factor in differentiating them.

INSERT TABLE 3 HERE

Large private institutions with a high level of virtualization

Cluster 8 is composed of HEIs with the highest average enrollment (31,610), although it represents the smallest number of institutions (2,14% of HEIs across both time points). This group contains private institutions almost exclusively (53% for-profit and 42% non-profit) and predominantly organised as colleges (52%). These institutions are characterised by a balanced offering of different types of degrees (Bachelor's degree, Teaching programmes, and Technological degrees). The most distinguishing feature of this group from all others is the emphasis on distance learning (72%). Regarding the faculty composition, there is a low participation of professors with Ph.D and in full-time positions. Examples of institutions in this group include Paulista University (UNIP), University of Northern Paraná (UNOPAR), Estácio de Sá University, and Anhanguera University of São Paulo.

Public and private confessional universities, with low virtualization and full-time professors with doctoral degrees

Cluster 7 has the second highest average enrollment (13,385) and it represents 5% of all HEIs. Institutions in this group are also characterised by a diverse offering of degrees (Bachelor's degree, Teaching programmes, and Technological degrees). Group 7 is characterised by in-person courses, mainly offered in the evening or on a full-time basis, and it has a higher proportion of Ph.D qualified professors. The main form of organisation is as universities (77,8%) and they are mostly managed by the federal government (64%). Institutions in this group include University of São Paulo (USP), Federal University of Rio de Janeiro (UFRJ), Mackenzie University and Pontifical Catholic University of Rio de Janeiro (PUC-RJ).

Medium-sized and diversified for-profit colleges and (?) public? university centres

Cluster 6 is characterised by medium-sized institutions (average enrollment of 3,569 students) and accounts for 19% of HEIs (the second most common type of institution). Institutions in this group focus on academic training (Bachelor's degree) with in-person classes typically offered in the evening. In terms of the faculty composition, there is a low participation of professors with Ph.D. However, compared to similar institutions in Cluster 1, these HEIs have more qualified professors. For-profit institutions account for 61% of HEIs in this group, and those organised as colleges account for 66%. Examples of institutions belonging to this cluster are Federal University of ABC, PUC of Minas Gerais, Higher Education Institute of Brasilia (IESB), and Salvador University.

Medium-sized private colleges and university centres with a predominance of evening courses

Cluster 1 is the most prevalent profile of institutions, accounting for 38% of HEIs across both years. This cluster is also characterised by medium-sized institutions (average enrollment of

2,327 students). They share a common feature with group 6, which is an emphasis on academic training (Bachelor's degree) with in-person classes typically offered in the evening. Faculty composition in this group has fewer qualified professors than those from medium-sized institutions from Cluster 6. Non-profit institutions organised as colleges constitute the most common type of organisation in this group, accounting for 52% and 87% respectively. HEIs in this group include Unisinos, PUC of Goiás, University Center of Belo Horizonte (UniBH), and Anchieta College.

Academically and research-oriented small-scale public and private institutions
Cluster 3 is characterised by small institutions with an average enrollment of 932 students, representing 3,4% of the institutions. Those institutions are characterised by the highest percentage of enrollment on academic training (95% at Bachelor's degree) and the lowest percentage of enrollment in evening courses (5%). These courses are typically offered in-person and full time regime. Group 3 stands out for having a greater participation of Ph.D professors working full-time and a greater proportion of enrollments in a *stricto sensu* graduate program. Non-profit institutions organised as colleges constitute the most common type of organisation in this group, accounting for 44% and 91% respectively. HEIs in this cluster include institutes and colleges with focus in specific fields, such as business (Ibmec), military education (Aeronautical Technology Institute - ITA and Military Institute of Engineering - IME), health and medicine (Einstein's Teaching and Research Institute), Law (Rio de Janeiro Law School and São Paulo Law School), and agricultural sciences (FAZU).

Small-sized, vocationally oriented private and public institutions
Cluster 5 represents 10% of all institutions and is characterised by small institutions with an average enrollment of 508 students. Institutions in this group predominantly offer evening

courses with in-person classes and have a low proportion of full-time Ph.D professors. This group heavily focuses on vocational training (94% in Technological degree) and is almost exclusively organised as colleges (99%). HEIs in this group includes mainly for-profit (39%) and non-profit (32%) private organisations (e.g. SENAI and SENAC), but it also includes state institutions of technology (e.g. São Paulo Technology College - FATEC, Rio de Janeiro Technology College - FATERJ).

Small private colleges focused on mostly evening teaching programs

The average enrollment among institutions in this cluster is 347 students and they represent almost 10% of all institutions. These small HEIs are highly focused on evening and in-person courses. The institutions in this group have the highest proportion of enrollment in Teaching programmes (88%) and the highest proportion of women among their students (76%). Group 9 is almost exclusively organised as colleges (98%) in the private sector (41% for-profit and 47% non-profit). HEIs in this group include institutes and colleges heavily specialised in teacher training, such as the Faculty of Educational Sciences (FACE), Higher Institute of Education of Rio de Janeiro, and Higher Institute of Education Anísio Teixeira.

Small and diversified private colleges, academically oriented focused on evening courses

Cluster 4 has the second smallest average enrollment of students (330) and represents 13% of the institutions in our sample. This cluster has the highest proportion of enrollment in evening courses (89%). Moreover, these institutions have a focus on academic training (Bachelor's degree) typically offered in-person. Similar to Cluster 9, Cluster 4 is almost exclusively organised as colleges (99%) in the private sector, with 55% being for-profit and 49% non-profit. Institutions in this group include colleges such as College of Suzano, College of Rondônia, College of Sinop, and College of Pará de Minas.

Small for-profit private colleges that are academically oriented and focus on predominantly female courses

Cluster 2 has the smallest average enrollment of students (322) and is the second least common profile, representing just 2,6% of institutions. Institutions in this group are characterised by offering courses in the evening with in-person classes. Cluster 2 has the second highest proportion of women among their students (71%). This group differs from Cluster 9 in terms of the type of degree, focusing largely on academic training (Bachelor's degree). Cluster 2 has the highest concentration of for-profit institutions (74%) and is almost exclusively organised into colleges (99%). Institutions in this group include College of Uninassau Aliança, Faculty of Education and Health Sciences, and College of Amazonas.

Stability and change in institutional typologies

We evaluate patterns of stability and change by looking at the relative prominence of clusters of institutions over time, the movement of institutions between them and the emergence of new ones. The public and confessional universities, with low virtualization and full-time qualified professors are the most stable cluster, with 98.1% of institutions remaining in the same group in 2019 (Figure 1). Next in descending order of stability, we observe the academically and research-oriented small-scale public and private institutions (77.8%) and small-sized, vocationally oriented private and public institutions (69.1%). Although all clusters have institutions performing differentiated shifts (i.e., movement of institutions from one profile into multiple other profiles), which indicates patterns of diversification across different segments in the system as a whole, two clusters stand out: small private colleges focused on mostly evening teaching programs (48.0%) and large private institutions with a high level of virtualization (34.6%) (see Appendix B). The movement of the latter is consistent with well-

documented segmentation strategy among the private conglomerates that dominate Brazil's lucrative higher education sector (Corbucci, Kubota, and Meira 2016; Caleffi and Mathias 2017; Seki 2021; Tagliari 2022).

Three clusters emerged over the period from 2010 to 2019, which concentrate 68.7% of institutions at the end of the decade (Table 4): (1) small for-profit private colleges, academically oriented and focused on Health and Education courses; (2) small and diversified private colleges, academically oriented focused on evening courses; (3) medium-sized and diversified for-profit colleges and university centres. These clusters alone received 55.3% of the 728 HEIs created over the period, mostly private ones (95.2%), and were the destination of most institutions (91.9%) from the one cluster that ceased to exist, represented by the medium-sized private colleges and university centres with a predominance of evening courses (Figure 1). Combined with the previous findings on the stability of public institutions, these results support the hypothesis that the multidimensionality of institutional logics is observed mainly in the private sector. Since private HEIs' funding depends largely on tuition fees, they are typically under greater pressure to be responsive to the diverse needs of students (Teixeira et al. 2013; Barbosa et al. 2023). That these institutions adopt measures such as increasing the offer of low-cost, distance and evening courses is related to the predominance of working, low income students in the population that attends higher education in Brazil.

INSERT TABLE 4 HERE

The creation of a significant number of higher education institutions in the last decade attests to the expansion of the system and ongoing reconfiguration processes. The creation of a significant number of higher education institutions in the last decade corroborates the expansion of the system and ongoing reconfiguration processes. The first of these processes is the predominance of private for-profit institutions focused on teaching, through which the massification of the system has occurred in Brazil, in contrast to the high participation systems

of higher education (Cantwell, Marginson, and Smolentseva 2018). In 2019, most institutions created were organised as private colleges (92.7%), for-profit (69.6%) and were small in size (401 enrollments on average).

The second is the socio-spatial reconfiguration of the system promoted by the expansion of private institutions, characterised by the interiorization of higher education and the expansion of its offer in previously unserved municipalities (Vieira and De Macedo 2022). Just over two thirds (66.7%) of the institutions created since 2010 were located in non-capital municipalities, 34.4% of which did not have previously established institutions. Equally important, the educational offer of these institutions is characterised by a low average degree of virtualization (about 1% of enrollments in distance learning courses), which reinforces that these are small institutions aimed at the local population.

Finally, the Brazilian system has increased its coverage, mainly due to the entry of a massive number of working students, whether in evening in person courses or distance education, typically less expensive. The new institutions, of small size and installed in non-capital municipalities, possibly do not have the infrastructure capacity to respond to the demand for distance education. However, the adoption of institutional strategies to serve this population of older students is clearly stated: 81.3% of enrollments on average were in evening courses in 2019 and were mostly composed of students from public high schools (79.8%) and over 24 years old (53.4%).

INSERT FIGURE 1 HERE

Discussion and conclusions

The current paper has shown that following a multi-functional, generic approach to understanding the degree of institutional diversity in a higher education system allows for a more nuanced capture of its current dynamics and changing patterns over time. This can be especially true for those systems that, although formally binary, such as the Brazilian one, or

even unitary, have taken large steps towards greater differentiation within sectors or organisational forms. Overall, our findings suggest that, although institutional types can and do change in different meaningful ways, these changes assume a very particular form in Brazil: the shifts between clusters are concentrated in groups of private HEIs, such as large for-profit institutions and small private colleges focused on teaching, a significant proportion of which were created or merged in the last decade. On the other hand, changes are relatively uncommon among research-oriented private and public institutions, which are generally stable over time and perhaps more likely to continue as bundled institutions.

These findings support some of our expectations. First, that the size of institutions is among the most relevant dimensions to describe the current state and changes in the system. This goes against previous studies indicating that the strongest factor in defining clusters of HEIs would be the sector (public or private). On the contrary, especially the growing concentration of educational provision in a few private for-profit groups and the polarization between these groups and a multitude of small and medium-sized institutions have substantially affected the estimation of HEI clusters. Second, that integrated research institutions and universities constitute a separate and substantially elitist group, with a greater degree of stability than the others and losing ground to for-profit conglomerates. Third, that the exponential growth of distance education, especially since 2017, constituted a dimension capable of distinguishing groups of institutions, with public and confessional universities at one extreme and large for-profit institutions at the other. However, contrary to what is often assumed, distance education is almost irrelevant for the other groups, which are characterised by a low degree of virtualization. Fourth, the feminization of higher education has been characterised by the massive presence of women in low-prestige (such as Education) or care-related courses (e.g. Health), in such a way that it distinguishes specific groups of institutions, especially small private ones.

Our findings also confirm the strong academic orientation of most Brazilian HEIs, expressed in the preference for bachelor's degrees, typically characterised by a greater investment in abstract training, to the detriment of practical knowledge. Perhaps the mark of academicism, particularly in the large public research universities, is among the factors contributing the most to maintaining the elitist character of the training traditionally generally offered in the Brazilian system. The institutional types that are most malleable to change are also those that are more oriented towards so-called 'vocational' education, which could be more properly defined as more attentive to the labour market and social change. This would indicate that the changes captured in our analysis are driven not only by the commercial contest for students but also by social and political disputes over what is intended for higher education in the country.

As to implications for the wider literature on diversity in higher education and public policies, our findings add some nuance to the discussion about institutional diversification in an expanding system like the Brazilian one, challenging prior studies and formal classification. The results show a greater level of diversity of institutional types than should be expected according to analyses concerned with the growing concentration of educational provision. In general terms, we found that the two phenomena can occur at the same time: more diversity of institutional types coexisting with a concentration of enrollments in one of these types. Our analytical strategy contributed decisively to this: by adopting a multi-functional approach and considering a wider range of institutional dimensions, we were able to capture the complex configuration of the Brazilian system in a more nuanced way. This points to the importance of having policies aimed at expanding and evaluating the system based on how the organisations are effectively functioning.

Our study has some limitations, which point at future areas for research and improvement. Perhaps the most relevant ones are the limited availability and quality of

variables related to the students' socioeconomic characteristics, as well as the academic selectivity of the institutions. Although characteristics such as the type of school (public or private) where the student finished high school are present in the 2019 data, the large number of missing information in 2010 makes this variable unusable. There are also no public data sources that we can use with entrance exam scores for all HEIs. Finally, more complete information about the for-profit conglomerates that make up one of the estimated clusters may allow us to advance our understanding of the group that has dominated the offer of higher education in Brazil.

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Appendix

Table 1. Factor loadings and percentages of explained variance for Varimax Rotated seven-factor solution for 19 HEC/CAPES variables (N = 4,982)

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Number of staff	0,94	-0,05	0,02	0,04	0,23	0,01	0,04

Number of professors	0,97	-0,05	0,02	0,04	0,20	-0,02	0,01
Number of students	0,91	-0,07	0,05	0,06	0,05	0,15	0,05
Number of courses	0,89	0,00	0,00	0,01	-0,07	0,09	0,15
Distance learning	0,20	0,07	0,03	-0,04	0,08	0,66	0,04
Bachelor degrees	0,08	-0,60	-0,01	0,78	0,06	-0,10	0,08
Teaching programs	-0,02	0,95	0,29	0,00	-0,03	0,07	-0,08
Technological degrees	-0,08	-0,16	-0,25	-0,95	-0,05	0,05	-0,02
Evening courses	-0,29	0,05	0,01	-0,01	-0,78	-0,36	-0,16
Full-time courses	0,18	-0,03	0,01	0,06	0,70	-0,15	0,17
Enroll. in Education	-0,02	0,95	0,29	0,00	-0,03	0,07	-0,08
Enroll. in Engineering	0,07	-0,05	-0,49	-0,06	-0,05	-0,06	0,11
Enrollments in Health	0,03	-0,20	0,26	0,07	0,16	-0,05	0,46
Female enrollments	0,02	0,22	0,88	0,08	-0,08	-0,01	0,06
Female professors	0,05	0,22	0,61	0,04	-0,04	-0,02	0,16
18-24 years olds	0,29	-0,15	-0,03	0,12	0,25	-0,34	0,13
Master's and doctoral programs	0,57	0,09	-0,08	0,03	0,28	-0,01	0,12
PhD professors	0,34	-0,02	-0,12	0,01	0,26	0,05	0,46
Full-time professors	0,42	0,02	-0,07	0,01	0,14	0,06	0,35
% of variance	34	18	13	12	11	6	6

Source: Authors' elaboration based on Higher Education Census/Capes data.

Table 2. Model fit statistics for different cluster solutions generated by latent profile analysis (LPA)

Number of clusters	AIC	BIC	Log-Likelihood
1	110735	111021,6	-55323,48

2	--	--	--
3	--	--	--
4	97102,71	97565,17	-48480,35
5	95633,84	96154,93	-47736,92
6	93029,46	93609,17	-46425,73
7	95152,98	95791,32	-47478,49
8	93497,39	94194,34	-46641,70
9	91233,25	91988,82	-45500,62
10	92577,77	93391,97	-46163,88

Note: AIC = Aikake information criterion. BIC = Bayesian Information Criterion.

Source: Authors' elaboration based on Higher Education Census/Capes data.

Table 3. Descriptive statistics (2010 and 2019)

		1	2	3	4	5	6	7	8	9
N Enroll.	Mean	2328	322	932	331	508,9	3569,5	13836	31610	348
	SD	7857	487	1374	385	833,2	7742,5	10864	70916	570
N. Courses	Mean	11,1	4,0	4,1	3,5	4,2	21,5	74,6	48,5	3,4
	SD	28,4	3,7	5,8	2,7	4,6	25,8	53,5	106,9	4,5

N of professors	Mean	120,3	21,9	137,0	27,1	41,0	154,9	1227,7	283,0	27,8
	SD	268,3	18,8	165,5	22,0	54,0	193,6	942,0	651,2	27,5
N of staff	Mean	218,5	47,5	294,6	48,7	78,3	288,5	2531,3	676,2	53,7
	SD	514,0	39,9	405,3	41,6	122,5	396,7	2419,1	1309,5	59,8
Prop. Distance learning	Mean	0,00	0,00	0,00	0,00	0,01	0,02	0,06	0,72	0,00
	SD	0,03	0,01	0,01	0,03	0,05	0,07	0,09	0,20	0,02
Prop. Bachelor degrees	Mean	0,85	0,92	0,97	0,86	0,04	0,85	0,59	0,43	0,11
	SD	0,18	0,15	0,09	0,19	0,11	0,14	0,22	0,28	0,16
Prop. Teaching programs	Mean	0,09	0,03	0,01	0,10	0,02	0,07	0,33	0,35	0,87
	SD	0,14	0,08	0,05	0,16	0,07	0,09	0,17	0,29	0,16
Prop. Technological degrees	Mean	0,05	0,05	0,01	0,04	0,94	0,08	0,08	0,21	0,01
	SD	0,11	0,11	0,05	0,10	0,13	0,10	0,14	0,25	0,06
Prop. In Evening courses	Mean	0,83	0,73	0,06	0,90	0,81	0,76	0,36	0,21	0,89
	SD	0,23	0,32	0,11	0,22	0,25	0,20	0,14	0,17	0,24
Prop. Full-time professors	Mean	0,16	0,29	0,30	0,12	0,21	0,28	0,80	0,29	0,17
	SD	0,15	0,27	0,28	0,15	0,26	0,18	0,18	0,20	0,24
Prop. Enroll. in Education	Mean	0,10	0,03	0,01	0,10	0,02	0,07	0,33	0,36	0,87
	SD	0,14	0,08	0,05	0,16	0,07	0,09	0,17	0,29	0,17
Prop. Enroll. in Engineering	Mean	0,06	0,04	0,06	0,15	0,22	0,14	0,17	0,05	0,00
	SD	0,16	0,15	0,19	0,31	0,35	0,16	0,16	0,07	0,03
Prop. Female enrollments	Mean	0,56	0,72	0,56	0,49	0,39	0,59	0,52	0,61	0,76
	SD	0,14	0,15	0,19	0,18	0,22	0,09	0,08	0,18	0,19
Prop. Female professors	Mean	0,43	0,58	0,44	0,39	0,35	0,50	0,44	0,46	0,60
	SD	0,13	0,16	0,16	0,17	0,16	0,09	0,07	0,14	0,18
Prop. 18-24 years olds	Mean	0,49	0,50	0,72	0,48	0,44	0,56	0,63	0,26	0,39
	SD	0,15	0,21	0,18	0,18	0,16	0,13	0,10	0,12	0,17
Prop. PhD professors	Mean	0,10	0,33	0,41	0,16	0,16	0,25	0,52	0,26	0,11
	SD	0,11	0,21	0,26	0,16	0,15	0,14	0,23	0,20	0,13

Source: Authors' elaboration based on Higher Education Census/Capes data.

Table 4. Prevalence of types of HEIs, 2010 and 2019

Cluster	Type of institution	2010	2019
1	Medium-sized private colleges and university centres with a predominance of evening courses	1637	0

2	Small for-profit private colleges, academically oriented and focused on female courses	0	133
3	Academically and research-oriented small-scale public and private institutions	64	104
4	Small and diversified private colleges, academically oriented focused on evening courses	0	681
5	Small-sized, vocationally oriented private and public institutions	252	282
6	Medium-sized and diversified for-profit colleges and university centres	0	977
7	Public and confessional universities, with low virtualization and full-time qualified professors	104	148
8	Large private institutions with a high level of virtualization	27	80
9	Small private colleges focused on mostly evening teaching programs	291	202
	Total	2375	2607

Source: Authors' elaboration based on Higher Education Census/Capes data.

Figure 1. Change and stability between institutional types, 2010, 2019
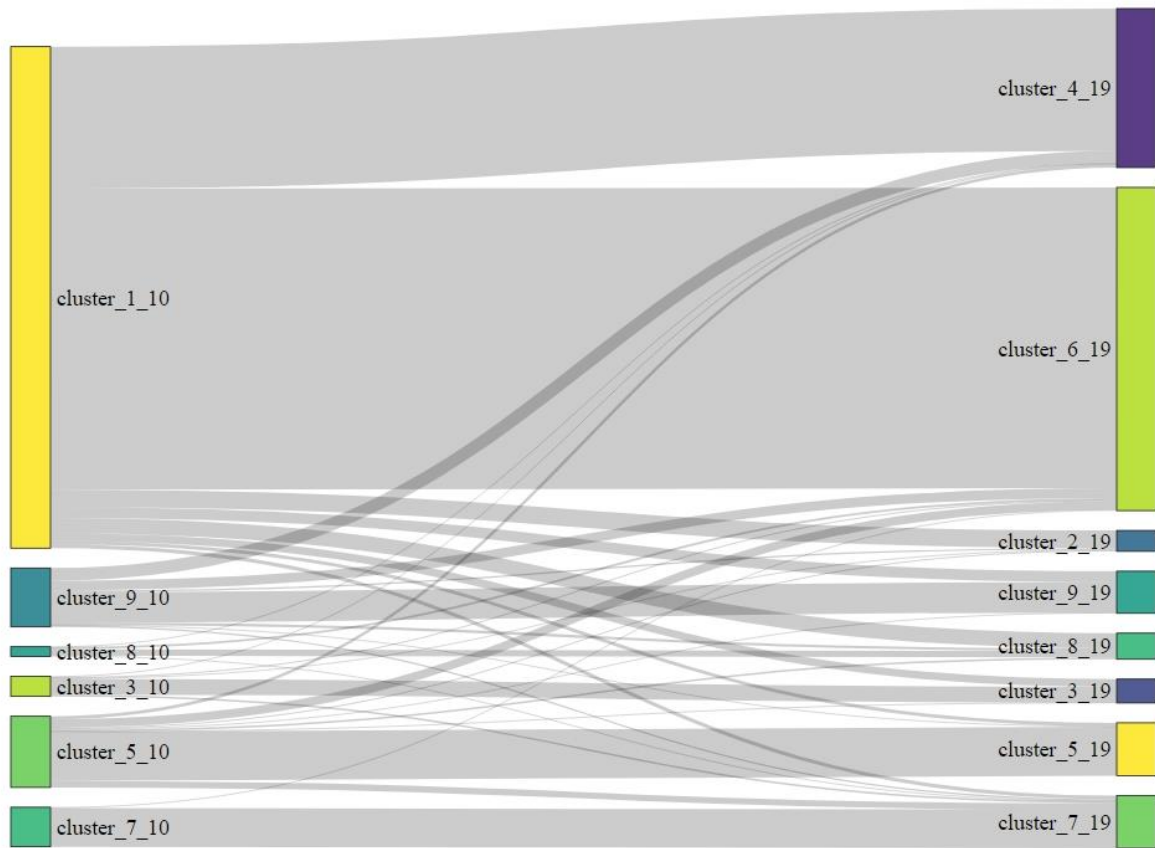
Source: Authors' elaboration based on Higher Education Census/Capes data.

Table A: Variables selected for the EFA…

Table B: Percentage of institutions by type of control

Cluster	1	2	3	4	5	6	7	8	9
For-profit	43,8	74,4	39,3	55,9	39,9	61,3	0,4	53,3	41,2
Non-profit	52,5	24,1	44,0	40,7	32,6	36,0	7,5	42,1	47,3
State	0,5	0,0	6,0	0,0	23,8	0,1	26,6	1,9	5,1
Federal	0,4	0,0	8,3	0,1	3,4	0,2	64,7	2,8	0,6
Municipal	2,9	1,5	2,4	3,2	0,4	2,4	0,8	0,0	5,9
Total	100	100	100	100	100	100	100	100	100

Table C: Percentage of institutions by academic organization

Cluster	1	2	3	4	5	6	7	8	9
University centers	7,2	0,8	3,6	0,7	0,4	26,3	1,2	26,2	0,0
Colleges	87,5	99,2	91,1	99,3	96,3	66,0	0,4	52,3	98,6
Federal institute	0,2	0,0	0,0	0,0	3,4	0,1	20,6	1,9	0,2
Universities	5,1	0,0	5,4	0,0	0,0	7,6	77,8	19,6	1,2
Total	100	100	100	100	100	100	100	100	100

Table D: Percentage of institutions that remained in the same cluster or shifted between clusters

Clusters in 2010	Clusters in 2019							
	2	3	4	5	6	7	8	9
1	3,5	1,6	28,4	0,7	60	0,7	3	2,2
3	3,7	77,8	3,7	–	5,6	9,3	–	–
5	1,6	0,5	4,2	69,1	12	8,9	2,6	1
7	–	–	–	–	1,9	98,1	–	–
8	–	–	3,8	–	23,1	7,7	65,4	–

| 9 | 2,5 | – | 21,5 | 0,6 | 16,5 | 2,5 | 4,4 | 51,9 |