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# Quantitative Analysis of Invention and Utility Models Patent Deposits at Public Universities in the State of Mato Grosso do Sul

*Análise Quantitativa dos Depósitos de Patentes de Invenção e Modelos de Utilidade das Universidades Públicas do Estado do Mato Grosso do Sul*

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## Abstract

This research analyzed the production of patents in public universities in the state of Mato Grosso do Sul. A quantitative approach was used using data collected at INPI. Based on the data collected, it was possible to show that UFMS stands out as the main depositor, with 64.57% of applications. However, there is a low rate of grants, only 12.60%, and a high rate of archiving (28.35%), reflecting weaknesses in the processes of preparation, monitoring of applications and slowness of INPI. University-university partnerships represent 22.83% of applications, while those with companies total only 4.72%, showing low alignment with the objectives of the Innovation Law. The predominant technological areas are linked to human needs, especially health. The results indicate the need to strengthen the Centers of Technological Innovation (NITs) and improve institutional protection strategies, aiming at greater effectiveness in transforming academic knowledge into technological assets.

Keywords: Intellectual Property; Patents; Public University.

## Resumo

Esta pesquisa analisou a produção de patentes nas universidades públicas do Estado do Mato Grosso do Sul. Foi realizada uma abordagem quantitativa utilizando os dados pesquisados no Instituto Nacional da Propriedade Industrial (INPI). A partir dos dados coletados, foi possível evidenciar que a UFMS se destaca como a principal depositante, com 64,57% dos pedidos. Contudo, observa-se baixo índice de concessões, apenas 12,60%, e alta taxa de arquivamento 28,35%, reflexo de fragilidades nos processos de elaboração, acompanhamento dos pedidos e morosidade do INPI. As parcerias universidade-universidade representam 22,83% dos depósitos, enquanto as com empresas somam apenas 4,72%, mostrando baixo alinhamento com os objetivos da Lei de Inovação. As áreas tecnológicas predominantes estão ligadas às necessidades humanas, especialmente saúde. Os resultados indicam a necessidade de fortalecer os Núcleos de Inovação Tecnológica (NITs) e aprimorar as estratégias institucionais de proteção, visando maior efetividade na transformação do conhecimento acadêmico em ativos tecnológicos.

Palavras-chave: Propriedade Intelectual; Patentes; Universidade Pública.

Technological Areas: Intellectual Property, Patents, and Innovation.



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## 1 Introduction

Brazil enacted Law No. 10,973/2004, commonly known as the Innovation Law, to encourage innovation and scientific and technological research within the productive sector. This legislation aims to promote integration among universities, research institutes, and industry, creating favorable conditions for innovation. Its key guidelines include encouraging partnerships between universities and companies for Research and Development (R&D), enabling Scientific and Technological Institutions (STIs) to provide technical and technological services, facilitating technology transfer between the public and private sectors, supporting the creation of innovation-promoting environments such as business incubators and technology parks, and regulating the activities of Technology Innovation Centers (NITs), which are responsible for managing intellectual property policies within STIs.

The Innovation Law represented a milestone in the Brazilian government's strategy to foster innovation, competitiveness, and technological development. However, for this legal instrument to effectively achieve its objectives, it is essential to employ indicators capable of evaluating its effectiveness by measuring its actual impact on patent generation, university-industry collaboration, and increases in productivity and innovation within organizations. Such data are fundamental for guiding more effective public policies and refining innovation support mechanisms.

An important indicator is patent statistics (OECD, 2005, p. 29), which refer to data collected and analyzed from patent applications and granted patents. This indicator can be used to quantitatively measure the number of patent applications filed within a given country, state, region, or university.

In this context, academic research has shown increasing interest in analyzing patenting activities conducted by Brazilian public universities, with studies ranging from national overviews to regional and institutional analyses (Oliveira & Velho, 2009). Studies such as those by Colla and Esteves (2013) and Ortiz (2019) mapped the landscape of patent applications filed with the Brazilian National Institute of Industrial Property (INPI) during specific periods (2005–2010 and 2000–2018, respectively), while other investigations focused on specific regions, such as the Northeast (Júnior & Almeida, 2019; Guimarães, Araújo, & Cardoso, 2016) and the state of Minas Gerais (Diláscio et al., 2021), or on individual institutions, such as the University of São Paulo (USP) (Entorno et al., 2008) and the Federal University of Tocantins (UFT) (Oliveira & Medeiros, 2020).

Despite the existence of studies examining the number of patent applications filed with INPI by Brazilian public universities, no specific study focusing on the public universities of the state of Mato Grosso do Sul was identified. Although some studies encompass the Central-West region of Brazil, they do not specifically address the state of Mato Grosso do Sul. In light of this gap, the present study aims to generate indicators capable of measuring the patent output of public universities in Mato Grosso do Sul through INPI records. Specifically, the study seeks to analyze the temporal evolution of patent applications and grants, identify the university with the highest patent output, examine the existence of collaborative partnerships (university-industry and university-university), determine which technological fields account for the largest number of patent applications, identify the causes of application abandonment as determined by INPI examiners, and compare patenting performance with the size and research potential of each institution. This comparison considers factors such as the number of graduate programs, the number of faculty members holding doctoral degrees and engaged in research activities, student enrollment figures, the number of graduates, and the number of scholarship recipients funded by CAPES.

## 2 Methodology

This study employed a quantitative research approach. Data regarding patent applications and utility model filings were collected from the website of the Brazilian National Institute of Industrial Property (INPI), using the Basic Patent Search tool available at https://busca.inpi.gov.br/pePI/jsp/patentes/PatenteSearchBasico.jsp. During the search process, the full name of each university was entered in the "contains" field under "applicant name," followed by searches using the institution's acronym. This procedure enabled the confirmation of the collected data through cross-validation with information available in BADEPI 9.0. The searches were conducted between June 13 and June 30, 2024, and the data encompass all patent applications filed with INPI up to May 2024.

Data related to the number of graduate programs, faculty members holding doctoral degrees and engaged in research activities, enrolled students, graduates, and CAPES scholarship recipients were collected from the GEOCAPES Portal, the Georeferenced Information System, available at https://geocapes.capes.gov.br/geocapes/. These data correspond to the 2023 Census of Graduate Programs conducted by CAPES and were collected on May 29, 2025.

The collected data were organized using Microsoft Office Excel® spreadsheets and analyzed through descriptive statistics. The adoption of this methodological procedure aimed to provide greater rigor to the analysis and interpretation of the results, thereby enhancing the reliability of the inferences derived from the data obtained (Baptista & Cunha, 2007). The findings are presented in the form of indicators, graphs, and tables.

The public higher education institutions included in this study were the Federal University of Mato Grosso do Sul Foundation (UFMS), the Federal University of Grande Dourados Foundation (UFGD), the State University of Mato Grosso do Sul (UEMS), and the Federal Institute of Education, Science and Technology of Mato Grosso do Sul (IFMS).

## 3 Results and Discussions

Before presenting the patent output data for each university, it is important to demonstrate the size and research potential of each institution. Accordingly, the following indicators are presented: the number of graduate programs, faculty members holding doctoral degrees and engaged in research activities, enrolled graduate students, graduates, and CAPES scholarship recipients at each university.

The analysis revealed that, in 2023, the public universities of the state of Mato Grosso do Sul offered a total of 81 graduate programs. Of these, 43 were offered by the Federal University of Mato Grosso do Sul Foundation, representing 53.09% of the total; 24 by the Federal University of Grande Dourados Foundation, corresponding to 29.63%; 12 by the State University of Mato Grosso do Sul, equivalent to 14.81%; and two by the Federal Institute of Education, Science and Technology of Mato Grosso do Sul, representing 2.47% of the total.

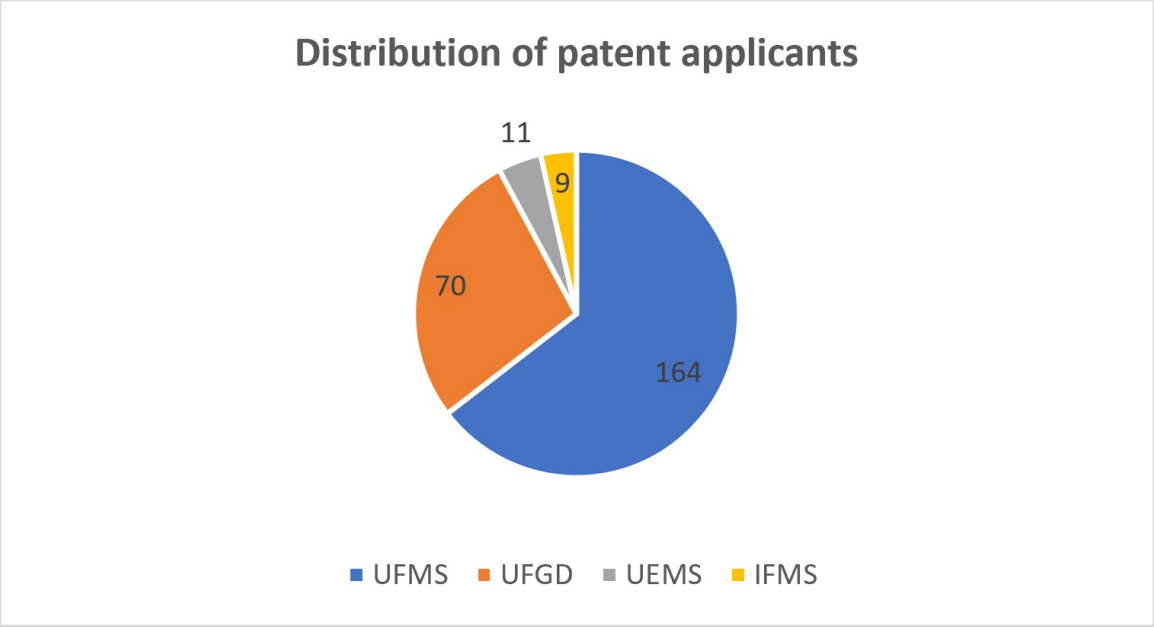
With regard to faculty members holding doctoral degrees and actively involved in research, a total of 1,447 were affiliated with graduate programs in 2023. Of this total, 801 were faculty members at UFMS (55.35%), 386 at UFGD (26.67%), 237 at UEMS (16.38%), and 23 at IFMS (1.60%).

Regarding graduate student enrollment at the public universities of Mato Grosso do Sul, a total of 3,941 students were enrolled in graduate programs in 2023, of whom 1,343 were CAPES scholarship recipients. Among these students, 2,320 were enrolled at UFMS (58.87%), including 756 scholarship recipients (56.29%); 1,033 were enrolled at UFGD (26.21%), including 464 scholarship recipients (34.55%); 530 were enrolled at UEMS (13.45%), including 123 scholarship recipients (9.16%); and 58 were enrolled at IFMS (1.47%), which did not record any CAPES scholarship recipients during the period analyzed.

In terms of graduate degrees awarded in the same year, 749 graduates were from UFMS (60.84%), 305 from UFGD (24.78%), 155 from UEMS (12.59%), and 22 from IFMS (1.79%).

These data demonstrate that UFMS outperforms the other public universities in the state of Mato Grosso do Sul with respect to the number of graduate programs, enrolled students, and research faculty members. This scenario suggests that the institution possesses the greatest potential for patent generation within the state, as illustrated in Graph 1.

**Graph 1 – D**istribution of patent applicants from 1998 to may 2024




Source: Data collected from INPI (2024)

Graph 1 presents a total of 254 patent applications filed by the public universities of the state of Mato Grosso do Sul between 1998 and May 2024, comprising 240 invention patent applications and 14 utility model applications. Of this total, the Federal University of Mato Grosso do Sul Foundation accounted for 164 applications (64.57%), the Federal University of Grande Dourados Foundation for 70 applications (27.56%), the State University of Mato Grosso do Sul for 11 applications (4.33%), and the Federal Institute of Education, Science and Technology of Mato Grosso do Sul for 9 applications (3.54%).

During the period analyzed, the year with the highest number of applications was 2018, with 36 patent applications filed, whereas the years 1998, 2001, 2005, and 2006 each recorded only one application. The annual mean number of applications was 11.55, the median was 6.5, the standard deviation was 10.83, and the range, defined as the difference between the highest and lowest values, was 35.

The fact that the median is lower than the mean indicates that the data distribution is right-skewed (positively skewed), meaning that there are years with substantially higher values than the majority of observations, which increases the mean. The standard deviation of 10.83, which is relatively high in relation to the mean, demonstrates considerable variability in the number of patent applications over time. This finding indicates that the data are not concentrated around the mean, reflecting an irregular pattern and the occurrence of years with atypical performance.

Furthermore, the range value of 35, when compared with the mean of 11.55, confirms the existence of years with exceptionally high or low numbers of patent applications, reinforcing the notion of a highly dispersed distribution. To further support this interpretation, the coefficient of variation was calculated and yielded a value of 93.75%, which is extremely high and confirms the substantial variability of the dataset, given that coefficients above 30% are generally considered indicative of high dispersion.

An analysis of Graph 2 reveals an increase in the number of patent applications beginning in 2010, culminating in a peak in 2018. However, a decline can be observed in 2019. Regarding this reduction, Araújo and Macedo (2022) argue that Brazil's federal public universities, the Coordination for the Improvement of Higher Education Personnel (CAPES), and the National Council for Scientific and Technological Development (CNPq) experienced successive budget cuts that began under previous administrations and intensified following the approval of Constitutional Amendment No. 95/2016.

According to the authors, these budget reductions were further intensified during the first three years of the Bolsonaro administration (2019–2021), directly affecting several institutional policies, including participation in academic events, the allocation of graduate and research scholarships, and the maintenance of technical and academic staff. These constraints may have contributed to the decline in patenting activity observed during the period.

Graph 3 presents the distribution of patent applications filed by all public universities in the state of Mato Grosso do Sul between 1998 and May 2024. The data indicate that the COVID-19 pandemic period did not result in a decline in patent applications. On the contrary, the universities and their researchers demonstrated resilience in the face of adverse circumstances, with the number of applications increasing again in 2020.

During this period, the precarious research infrastructure of public universities and the need for greater investment led to a resumption of federal funding allocated to research activities. Nevertheless, structural and budgetary constraints continue to affect public universities in the state of Mato Grosso do Sul. These limitations may help explain the relatively slow growth in patent application activity observed during the post-pandemic period.

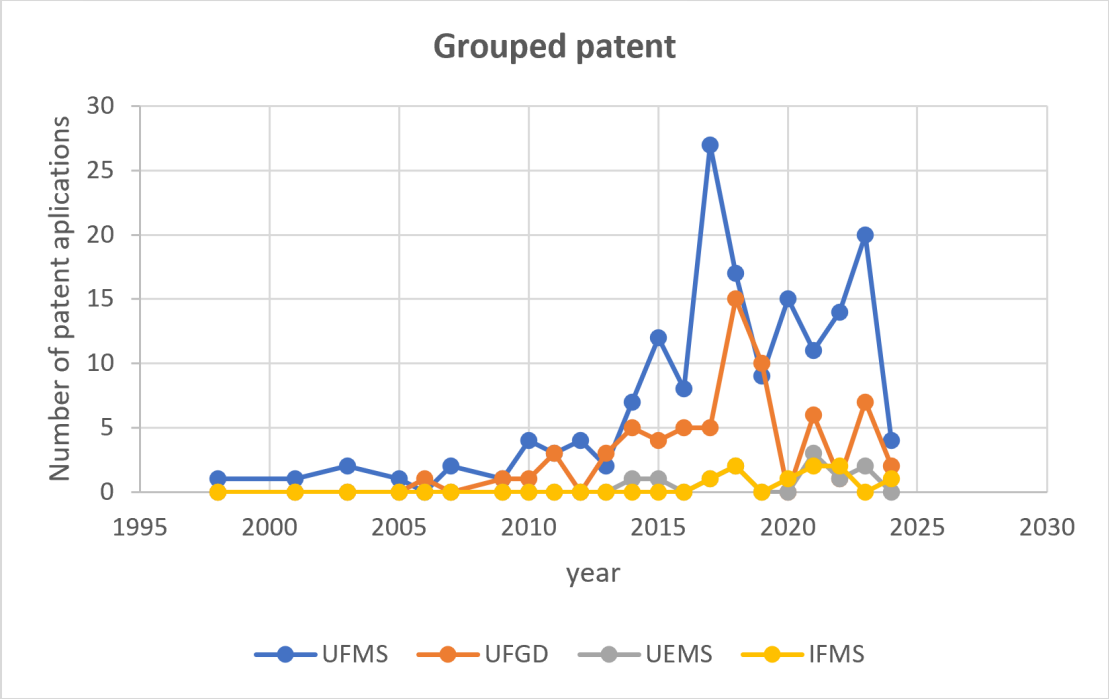
The number of invention patent and utility model applications alone is not a precise indicator of the level of scientific and technological output (Ortiz, 2019). It is essential to consider how many of these applications ultimately resulted in granted patents. Graph 4 presents, grouped by filing year, the invention patent and utility model applications filed by the universities analyzed in this study that were subsequently granted by the Brazilian National Institute of Industrial Property (INPI).

Graph 4 shows an increase in the number of patent grants between 2019 and 2023, indicating that the Brazilian National Institute of Industrial Property (INPI) continued to examine patent applications even during the COVID-19 pandemic. For the public universities of the state of Mato Grosso do Sul, this period recorded the highest number of patent grants. In 2024, no invention patent or utility model application filed by the state's public universities had been granted. However, this does not necessarily indicate a decline in patenting performance, as many of these applications may still be undergoing examination by INPI.

Of the total 254 invention patent and utility model applications filed, 32 resulted in granted patents, representing 12.60% of all applications submitted by the universities analyzed (Graph 5). This grant rate reflects the challenges encountered throughout the patent examination process, as well as potential limitations related to the quality of the applications or the intellectual property protection strategies adopted by the institutions.

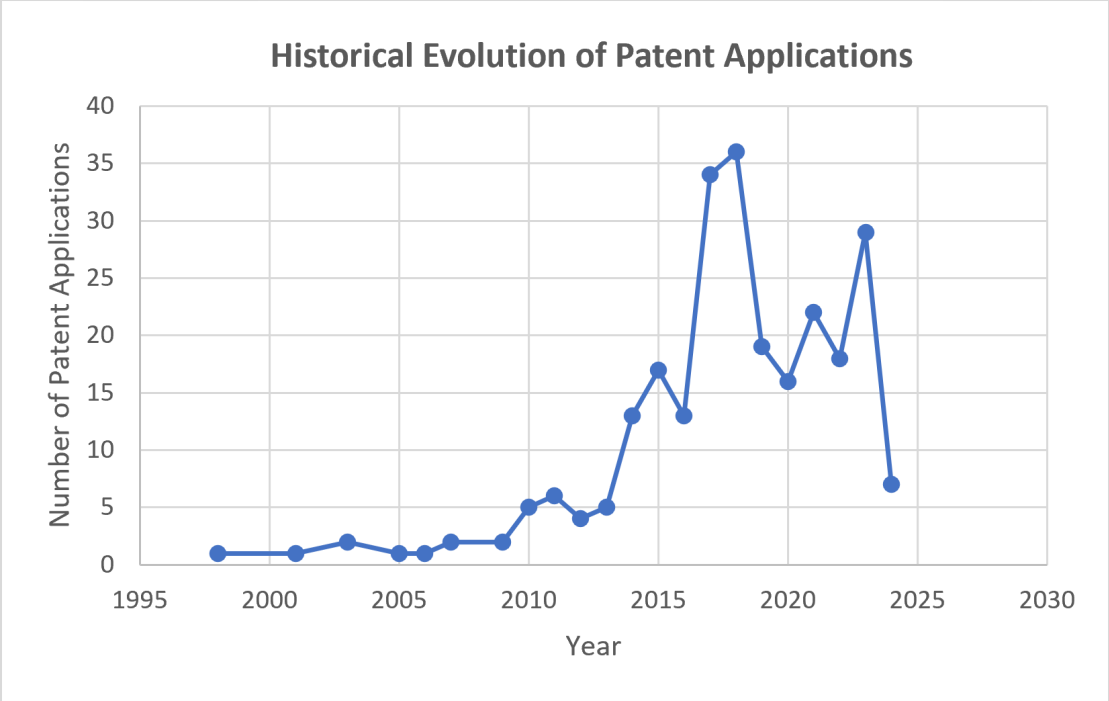
Graph 6 presents the average number of days elapsed between the patent application filing date and the patent grant date. For this calculation, all patents granted to each university were considered, and the interval between the filing date and the grant date recorded by the Brazilian National Institute of Industrial Property (INPI) was measured.

**Graph 2 –** Patent applications grouped by year for the period from 1998 to may 2024



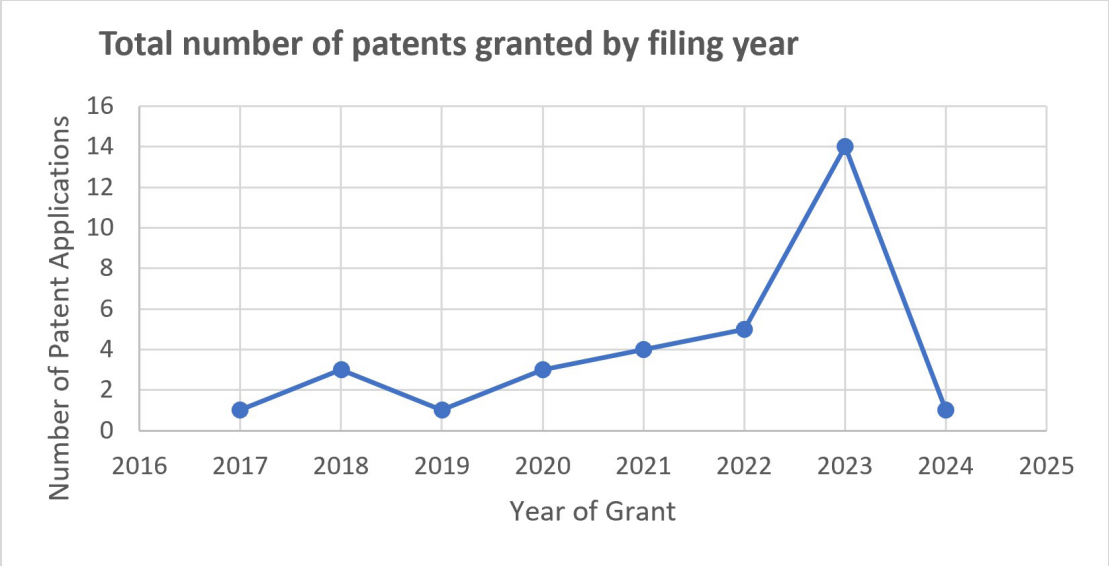

Source: Data collected from INPI (2024)

**Graph 3 –** Historical evolution of patent applications from 1998 to may 2024



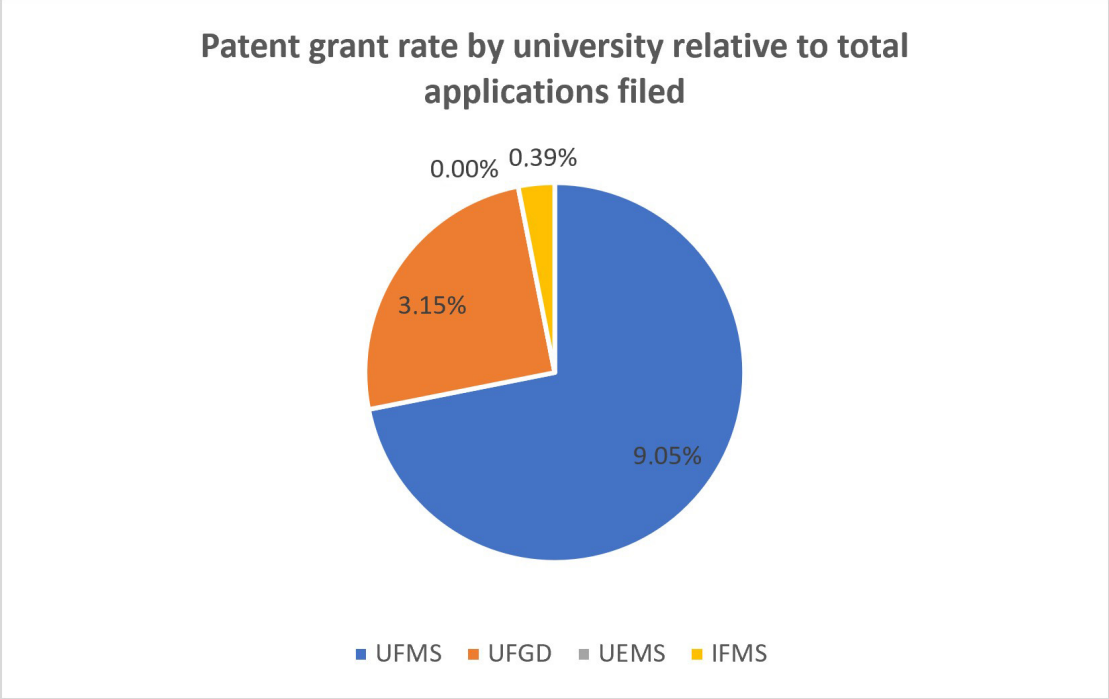

Source: Data collected from INPI (2024)

**Graph 4 –** Total number of patents granted by filing year




Source: Data collected from INPI (2024)

**Graph 5 –** Patent grant rate by university relative to total applications filed

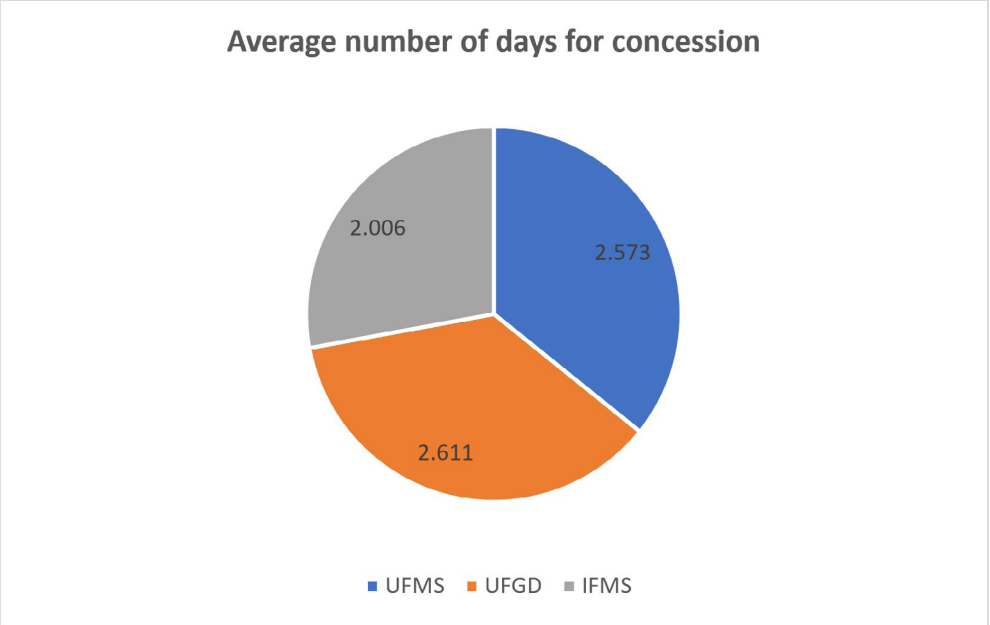



Source: Data collected from INPI (2024)

It is important to highlight the considerable length of time required, on average, for INPI to grant a patent. For the Federal University of Mato Grosso do Sul Foundation, the average time was 2,573 days (7 years and 16 days); for the Federal University of Grande Dourados Foundation, 2,611 days (7 years, 1 month, and 24 days); and for the Federal Institute of Education, Science and Technology of Mato Grosso do Sul, 2,006 days (5 years, 5 months, 3 weeks, and 6 days). The State University of Mato Grosso do Sul did not have any patents granted during the period analyzed.

Graph 7 presents the patent applications filed by the universities of the state of Mato Grosso do Sul in partnership

**Graph 6 –** Average number of days to patent grant




Source: Data collected from INPI (2024)

with other higher education institutions. These applications generally result from research projects developed under technical cooperation agreements established between the participating institutions. UFMS stands out in this regard, with 31 patent applications filed through collaborative partnerships.

Graph 8 illustrates the number of patent applications filed through collaborative partnerships among higher education institutions in the state of Mato Grosso do Sul that ultimately resulted in granted patents. The most notable performers were the Federal University of Mato Grosso do Sul Foundation, with five granted patents, and the Federal University of Grande Dourados Foundation, with four. The State University of Mato Grosso do Sul and the Federal Institute of Education, Science and Technology of Mato Grosso do Sul did not have any collaborative patent applications that resulted in patent grants during the period analyzed.

Table 1 presents the five patent applications filed by the Federal University of Mato Grosso do Sul Foundation in partnership with other higher education institutions that resulted in granted patents. It is noteworthy that, in the case of patent application No. PI1103021, in addition to the partnership with the University of São Paulo, the Foundation for the Support of Education, Science and Technology Development of the State of Mato Grosso do Sul is also listed as an applicant. In this case, FUNDECT holds ownership rights due to its role in funding the research that led to the invention.

Box 2 presents the five patent applications filed by the Federal University of Grande Dourados Foundation in partnership with other higher education institutions that resulted in granted patents. It is noteworthy that, similar to the Federal University of Mato Grosso do Sul Foundation, UFGD also obtained patent grants through collaborations with institutions located outside the state of Mato Grosso do Sul.

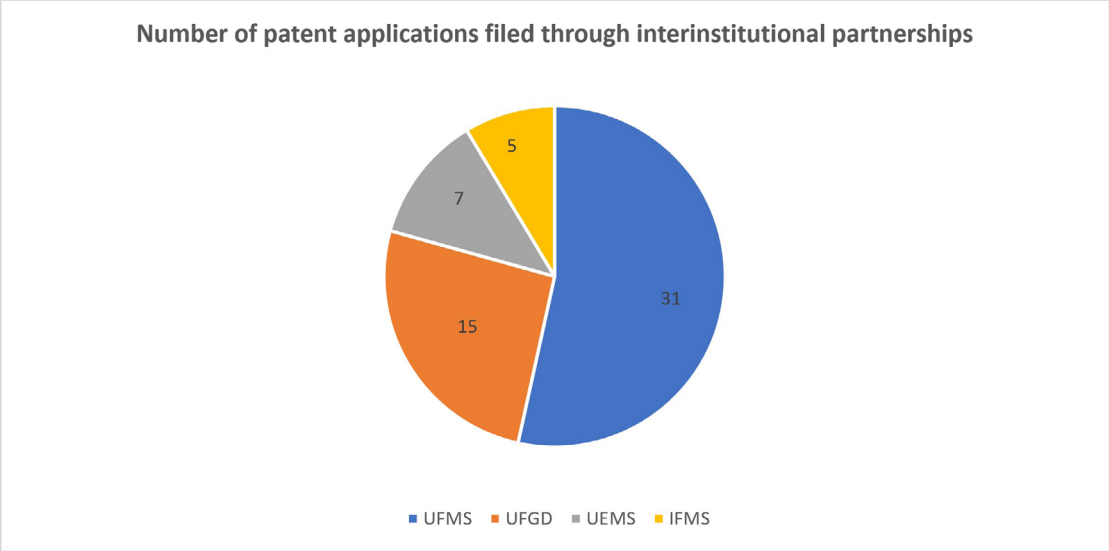
This is a relevant factor, as it promotes knowledge exchange among universities and contributes to the formation of scientific and technological collaboration networks, thereby strengthening the innovation capacity of the institutions involved.

Graph 9 presents the patent applications filed by the public universities of the state of Mato Grosso do Sul in partnership with private companies. Despite the enactment of Law No. 10,973 of December 2, 2004, as amended by Law No. 13,243 of January 11, 2016, which encourages collaboration between public institutions and the private sector, the number of patent applications jointly filed with private companies remains relatively low.

Among the institutions analyzed, the Federal University of Mato Grosso do Sul Foundation stands out, with eight patent applications filed in partnership with private companies, representing the highest number among the public universities of the state.

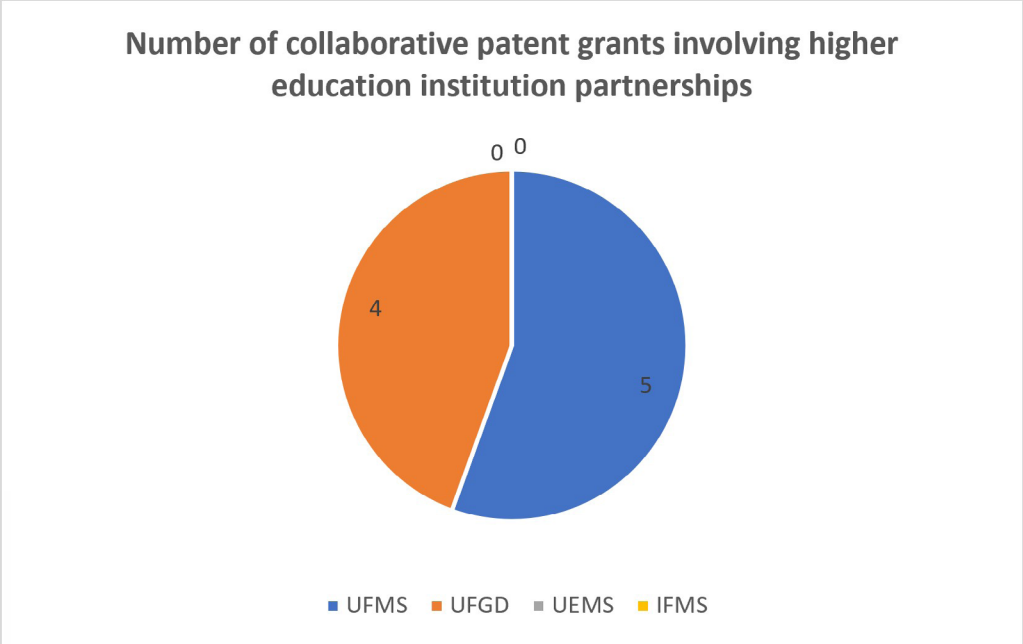
Analysis of the data presented in Graph 9 revealed that only two patent applications resulting from partnerships between higher education institutions and private companies ultimately achieved patent grant status, both of which were filed by the Federal University of Mato Grosso do Sul Foundation (Box 3). The Federal University of Grande Dourados Foundation, the State University of Mato Grosso

**Graph 7 –** Number of patent applications filed through interinstitutional partnerships




Source: Data collected from INPI (2024)

**Graph 8 –** Number of collaborative patent grants involving higher education institution partnerships




Source: Data collected from INPI (2024)

do Sul, and the Federal Institute of Education, Science and Technology of Mato Grosso do Sul did not have any patent applications filed in partnership with private companies that resulted in granted patents during the period analyzed.

Graph 10 presents the percentages of patent applications archived for each public university in the state of Mato Grosso do Sul. These percentages were calculated based on the total number of patent applications filed by each institution and the number of patents granted. Of the 254 invention patent and utility model applications filed by the state's public universities with the Brazilian National Institute of Industrial Property (INPI), 98 were archived, representing 38.58% of the total.

**Box 1 –** Invention patents resulting from university–higher education institution partnerships involving UFMS that achieved patent grant

| Item | Patent Application | Grant Date | Partner Institution |
|---|---|---|---|
| 1 | PI1103021 | 22 December 2020 | University of São Paulo – USP (BR/SP)<br>Foundation for the Support of Education, Science and Technology Development of the State of. Mato Grosso do Sul – Fundect (BR/MS) |
| 2 | 102014028528 | 22 August 2023 | State University of Campinas – Unicamp (BR/SP) |
| 3 | 102014030002 | 12 January 2021 | Federal University of Grande Dourados – UFGD (BR/MS) |
| 4 | 102015032492 | 14 November 2023 | (UFGD) (BR/MS)<br>Federal University of Minas Gerais (BR/MG) |
| 5 | 102017025952 | 10 January 2023 | Anhanguera Educacional Participações S/A (BR/MS)) |

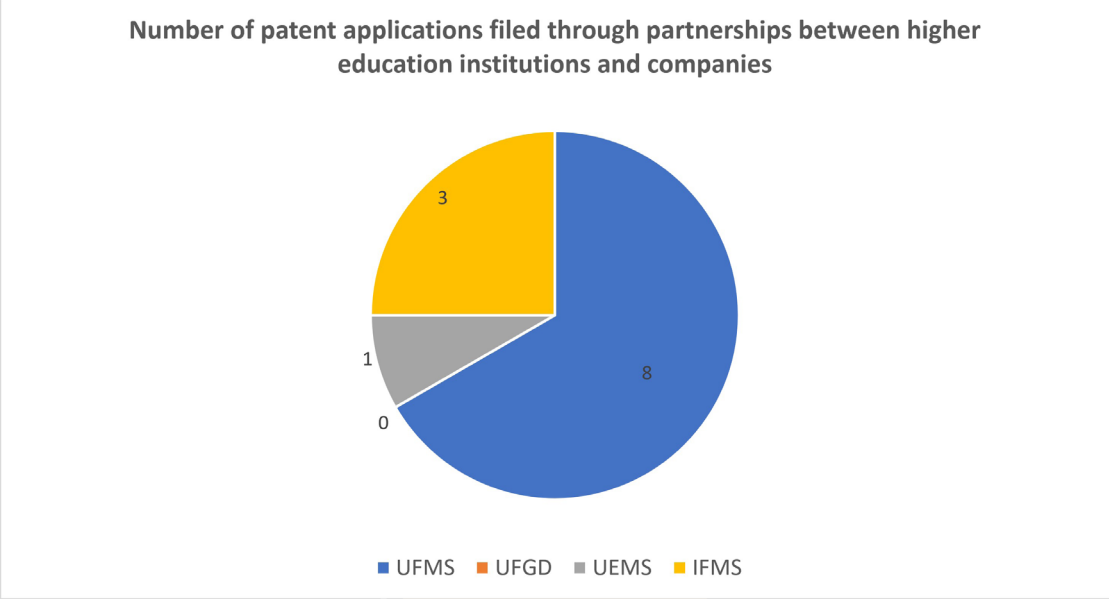
Source: Data collected from INPI (2024)

**Box 2 –** Granted invention patents from collaborative partnerships between ufgd and other higher education institutions

| Item | Patent Application | Grant Date | Partner Institution |
|---|---|---|---|
| 1 | 122019019848 | 24 November 2020 | State University of Campinas (UNICAMP) (BR/SP) |
| 2 | 102014029204 | 28 February 2023 | Federal University of Paraná (UFPR) (BR/PR) |
| 3 | 102014030002 | 12 January 2021 | Federal University of Mato Grosso do Sul Foundation (UFMS) (BR/MS) |
| 4 | 102017025878 | 12 September 2023 | State University of Campinas (UNICAMP) (BR/SP) |

Source: Data collected from INPI (2024)

**Graph 9 –** Number of patent applications filed through partnerships between higher education institutions and companies




Source: Data collected from INPI (2024)

The archiving of patent applications by INPI occurs for various reasons, which are classified through codes and abbreviations published in the Electronic Industrial Property Gazette. These reasons are communicated to applicants through official notices that establish deadlines for compliance with specific requirements. If such requirements are not fully met, or if no response is provided, INPI proceeds with the archiving of the application. In the present study, the primary cause of archiving was identified as "failure to comply with legal requirements," which accounted for 72 archived applications. This was followed by "failure to meet formal requirements," responsible for 17 archived applications, and "failure to pay the annual maintenance fee," which resulted in the archiving of four applications.

All published patent applications are classified according to the technological field to which they belong. INPI adopts the International Patent Classification (IPC) system and, since 2014, has also utilized the Cooperative Patent Classification (CPC) system for classifying patent applications. The primary objective of patent classification is to provide an effective search tool for the retrieval of patent documents by intellectual property offices and other users, facilitating the assessment of novelty and inventive activity in the technical disclosures contained in patent applications (INPI, 2024).

Graph 11 presents the IPC sections and the percentage distribution of each section corresponding to the invention patent and utility model applications filed with INPI by the public universities of the state of Mato Grosso do Sul.

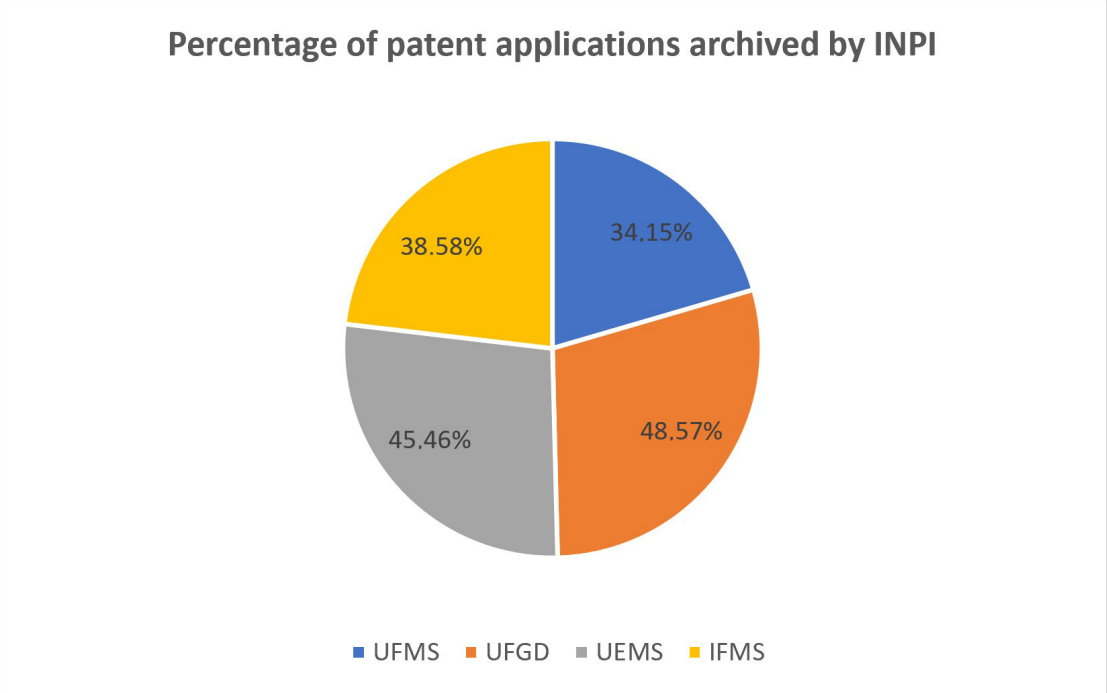
The applications for which it was not possible to identify the IPC section and classification corresponded to the following situations: "Patent Application or Certificate of Addition to an Invention Filed," "Patent Application or Certificate of Addition to an Invention Received," "Application Number Cancelled Due to Failure to Meet Formal Requirements," and "Withdrawal Approved." In these cases, identification of the relevant classification information was not feasible because the Brazilian National Institute of

**Box 3 –** Granted invention patents resulting from university–industry partnerships involving UFMS

| Item | Patent Application | Grant Date | Partner Institution |
|---|---|---|---|
| 1 | 102012016838 | 18 October 2022 | Medica Medical Products Ltda. (BR/MS) |
| 2 | 102014020091 | 2 March 2021 | COIMMA – São Cristóvão Timber and Metallurgical Industry and Commerce Ltda. (BR/SP) |

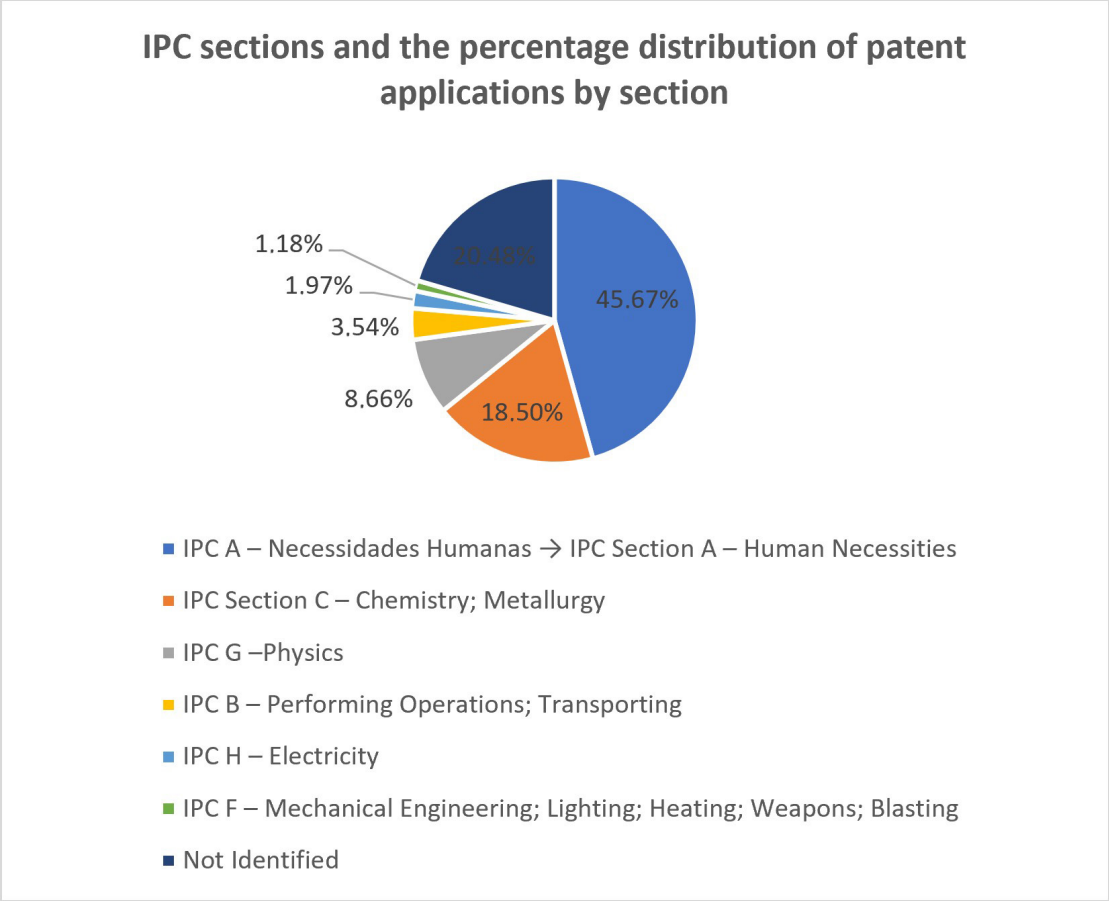
Source: Data collected from INPI (2024)

**Graph 10 –** Percentage of patent applications archived by INPI




Source: Data collected from INPI (2024)

**Graph 11 –** IPC sections and the percentage distribution of patent applications by section




Source: Data collected from INPI (2024)

Industrial Property (INPI) does not provide such data in its search results.

This study identified the six IPC classes most frequently represented among the patent and utility model applications filed by the public universities of the state of Mato Grosso do Sul. Of the 254 applications analyzed, 44 were classified under IPC class A61, corresponding to 17.32% of the total. In addition, 28 applications were classified under IPC class A01, representing 11.02%, while 25 applications fell within IPC class A23, accounting for 9.84%.

A total of 24 applications were classified under IPC class C07, corresponding to 9.45% of all filings, followed by 13 applications in IPC class G01 (5.12%) and 11 applications in IPC class A21, representing 4.33% of the total number of applications filed.

## 4 Final Considerations

The study demonstrated that the Federal University of Mato Grosso do Sul Foundation is the leading institution among the public universities of the state of Mato Grosso do Sul in both patent filing activity and patent grants. The university filed 164 patent applications between 1998 and 2024, representing 64.57% of all applications submitted by the universities analyzed. In contrast, the remaining institutions exhibited substantially lower and more fluctuating levels of patenting activity. This prominent position of UFMS can be attributed to its larger number of graduate programs, enrolled graduate students, and research faculty members, whose combined totals exceed those of the other universities analyzed.

One of the most notable findings of this study concerns the low patent grant rate relative to the total number of patent applications filed. Only 12.60% of all applications submitted by the universities analyzed resulted in granted patents by the Brazilian National Institute of Industrial Property (INPI). This percentage indicates a level of performance below expectations in terms of securing intellectual property protection. Such a result may be attributed to factors including insufficient technical quality of applications, failure to fully satisfy

patentability requirements, and the well-documented delays associated with the patent examination process at INPI. Furthermore, this scenario may reflect weaknesses in institutional intellectual property strategies, which are often more focused on increasing the number of filings to meet performance indicators than on maximizing the likelihood of obtaining patent grants. These findings highlight the need to strengthen innovation support structures within universities, with particular emphasis on improving application quality and fostering effective integration among research, development, and intellectual property protection activities.

UFMS also stands out in terms of granted patents, having secured 23 patent grants, corresponding to 14.20% of its total applications. Nevertheless, this grant rate remains relatively low, especially when compared with the institution's number of graduate programs and the substantial human resources dedicated to research activities.

Two major factors contributing to delays in patent grants were identified. The first is the slow publication process of patent applications in the Industrial Property Gazette, and the second is the frequency of formal and technical requirements imposed by INPI during the examination process. Together, these factors suggest that delays may result both from the high volume of applications processed by the patent office and from the technical complexity of certain inventions under examination.

With regard to interinstitutional collaborations, the study identified 58 patent applications filed jointly by universities or by universities in partnership with other educational institutions, representing 22.83% of all applications. Of these, only nine resulted in granted patents, corresponding to 15.51% of collaborative applications. Although such partnerships do exist, the results indicate that they remain well below the objectives established by the Innovation Law (Law No. 10,973/2004, as amended by Law No. 13,243/2016), which seeks to promote collaboration among the public sector, academia, and industry in order to transform knowledge into commercially applicable products and technological processes.

Once again, UFMS emerged as the institution with the highest number of patent applications filed through collaborations with other universities, totaling 31 applications, of which five resulted in granted patents.

University–industry partnerships showed even more modest results. Only 12 patent applications were identified within this collaboration model, representing 4.72% of all applications filed, with only two resulting in granted patents, both originating from UFMS. This scenario indicates that collaboration with the productive sector is still progressing slowly among the public universities of Mato Grosso do Sul and remains far from the objectives envisioned by the current legislative framework.

Regarding technological fields, the analysis based on the International Patent Classification (IPC) revealed that Section A, Human Necessities, accounted for the largest share of patent applications, representing 45.67% of the total. Within this section, IPC class A61, Medical or Veterinary Science; Hygiene, was particularly prominent, accounting for 17.32% of all applications. This finding demonstrates the predominance of research activities focused on health and well-being.

Another important concern identified in the study was the high number of patent applications archived by INPI. In total, 72 applications were archived, representing 28.35% of all filings. The primary reason for archiving was failure to comply with legal requirements, indicating weaknesses in both the preparation and management of patent applications. This finding serves as an important warning for Technology Innovation Centers (NITs), which should further investigate the causes of this issue and develop strategies to mitigate its occurrence.

Finally, the study revealed that utility models account for only a small proportion of total applications and are significantly less common than invention patents. This finding suggests that this form of intellectual property protection remains underutilized by the universities of the region.

## 5 Future Perspectives

In light of the findings of this study, the need to adopt more robust and effective strategies to strengthen the culture of intellectual property and innovation within the public universities of the state of Mato Grosso do Sul becomes evident. Despite specific advances, particularly at the Federal University of Mato Grosso do Sul (UFMS), the current landscape is still characterized by low patent grant rates, a high proportion of archived applications, and an insufficient pace in the consolidation of partnerships with the productive sector.

Among the main future priorities is the urgent need to improve internal intellectual property management processes within higher education institutions. This includes investments in the technical training of Technology Innovation Centers (NITs), as well as the enhancement of patent drafting, filing, and application monitoring procedures. The high number of archived applications, especially those resulting from noncompliance with legal requirements, reveals a significant weakness that should be addressed through structured and continuous training programs for researchers, inventors, and innovation support teams.

Another important perspective concerns the need to strengthen interinstitutional collaborations and, above all,

university–industry partnerships, which remain incipient in the region. Achieving the objectives established by the Innovation Law (Law No. 10,973/2004, as amended by Law No. 13,243/2016) requires universities to adopt more proactive policies aimed at increasing interaction with the productive sector, thereby encouraging the transformation of scientific knowledge into value-added products, processes, and services for society and the marketplace.

In addition, the technological profile of the patent applications, predominantly concentrated in IPC Section A (Human Necessities), particularly IPC class A61 (Medical or Veterinary Science; Hygiene), indicates a fertile area for the development of health-related innovations. However, it is essential that universities broaden their activities into other technological domains, promoting a more diversified innovation portfolio that reflects the full range of their research capabilities.

Finally, future studies should further investigate the causes of patent application archiving, the barriers affecting collaborative partnerships, and the factors contributing to low patent grant rates. Additional research should also examine best practices adopted by universities in other regions of Brazil. Such investigations may provide valuable insights for the formulation of more effective institutional policies, helping the public universities of Mato Grosso do Sul strengthen their role as active agents in promoting innovation and fostering regional and national socioeconomic development.

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