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Analytical Framework for Identifying Universities and Public Research Institutes Intellectual Property Misassignment

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ABSTRACT

This research analyzes intellectual property (IP) management in Brazilian scientific, technological, and innovation (STI) institutions, focusing on the phenomenon of IP outside universities and public research institutes—also referred to as IP misassignment—and its implications for patent ownership. Adopting a quantitative and descriptive approach, the study employs a case study at a public university. Patentometric analysis revealed that 52% of the inventors' IP filings were not properly assigned to the institution. The most frequent deviation was the improper use of IP information belonging to the institution for economic exploitation (56 cases), followed by the appropriation of ownership by the inventor (34 cases). These findings highlight the diversion of intellectual capital generated with public resources. To address this systemic challenge, the research proposes a six-step framework designed to support Technological Innovation Centers, which, according to the literature, are related to various areas, such as Health, Biomedicine, Engineering, Physical and Life Sciences, Aerospace, and Defense, in monitoring, quantifying, and proactively mitigating such deviations. Ultimately, the study contributes as an essential diagnostic tool for strategic IP management, strengthening the protection of intellectual capital and ensuring appropriate social and economic returns from academic inventions.

Keywords: Patents; Management; Research; Aerospace industry; Defense.

INTRODUCTION

In the contemporary global scenario, the knowledge economy is driven by technological innovation and strategic management of intangible assets. Intellectual property (IP), particularly patents, has emerged as a fundamental tool for protecting and monetizing inventions, granting a temporary exclusive right to the owner. Although traditionally associated with the industrial sector, patents have gained relevance in the university environment (Brandão Neto *et al.* 2023; 2024; Jesus *et al.* 2023).

This change reflects the evolution of higher education institutions, which, in their 'third mission,' have come to be recognized not only as centers of teaching and research but also as drivers of economic and social development through the transfer of knowledge and technology (Chen *et al.*, 2025; Dassoler *et al.*, 2023). In the Brazilian context, universities and research institutes play an increasingly prominent role in the generation of patents, consolidating themselves as key players in the national innovation chain, seeking to respond to emerging social, economic, and cultural demands.

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Despite the growing prominence of Brazilian universities and research institutes in patent filing, the effective management of this intellectual capital faces systemic challenges. One of the most relevant and, paradoxically, least investigated problems in the literature is IP misassignment. This phenomenon manifests primarily in the omission of the educational institution from patent ownership, even when inventions are developed using its infrastructure, resources, and public funding (Chen *et al.* 2025; Garnica *et al.* 2006).

Early-career researchers may not be aware of the services offered by the Technology Innovation Center (TIC) (or Technology Transfer Office, TTO, in international nomenclature), while academics with experience and networks in industry may choose to dispense with the TIC's intermediation, favoring alternative routes such as informal commercialization, independent patenting, or the creation of a startup (Chen *et al.* 2025).

This practice not only disregards the institutional contribution but also implies the misappropriation of an asset generated in a public environment. This management gap compromises the institution's ability to exercise its rights over the invention, directly affecting its potential to generate revenue through licensing and, consequently, its autonomy to reinvest in new research, weakening the innovation ecosystem (Chen *et al.* 2025; Garnica *et al.* 2006).

In this context, the study analyzes IP management in Brazilian public universities and research institutes, focusing on patent ownership and IP misassignment. It examines the causes and implications of this phenomenon and proposes a patent-based framework to identify and assess such cases institutionally.

This study enhances IP management in TICs and TTOs of public universities and research institutes. The proposed method to detect IP misassignment serves as a diagnostic tool to prevent ownership omissions and promote an IP culture that strengthens technology transfer and the social impact of publicly funded inventions.

It is important to highlight that the phenomenon of patenting outside the university or research institute—a practice in which patent applications are filed on behalf of inventors or companies, without assigning ownership to the institution of origin and without the formal knowledge of its TICs—is inherent to various areas of knowledge. This fact is exemplified by studies that address specific sectors, such as: Health and Biomedicine (Aldridge and Audretsch 2010); Chemical, Materials, Electrical, and Electronic Engineering, as well as Pharmaceuticals and Biotechnology (Hayter and Feeney 2017); Physical Sciences and Life Sciences (Goel and Göktepe-Hultén 2017); Aerospace and Defense (NASA 2019); multiple areas of knowledge (Van Burg *et al.* 2021); and high-tech entrepreneurship (Babina *et al.* 2022).

INTELLECTUAL PROPERTY

Intellectual property has become increasingly relevant in Brazil's scientific, technological, and innovation institutions (STIs). It provides the legal framework for protecting knowledge and technologies from institutional and collaborative research through a multidisciplinary perspective.

For a deeper conceptual understanding, it is necessary to refer to the meaning of property. According to Gomes (2001), property is conceptualized as a real right that grants the owner possession of an asset in all its relations, guaranteeing them the power to use, enjoy, and dispose of the asset, as well as the right to recover it from those who possess it unjustly (Brazil 2002).

Property is either tangible or intangible, the latter encompassing inventions, artworks, software, and distinctive symbols. From this perspective, IP refers to creations of the mind, ranging from artistic and literary works to inventions, computer programs, trademarks, and other commercial signs (World Intellectual Property Organization 2021).

Intellectual property is classically divided into copyright and industrial property. Copyright protects authors and their intellectual creations in literature, art, and science, regardless of the medium or format of expression (Jungmann and Bonetti 2010). Industrial Property protects technical and distinctive creations, granting exclusive rights and promoting innovation and dissemination (Lima 2006).

The industrial property system covers patents, trademarks, industrial designs, geographical indications, and protection against unfair competition. This study focuses on patents, the most relevant form of IP within Brazil's STIs, whose management is assigned to TICs under the Innovation Law.

In terms of volume, invention patents are the most widely used form of IP protection by Brazilian TICs Fortec associates (Fortec 2019, 2020, 2021, 2022, 2023, 2024). Fortec acts as a representative entity for innovation and technology transfer managers, covering TICs, agencies, and similar offices (Fortec 2025).

In its classical conception, a patent is a State-granted exclusive right to exploit a technology in exchange for public disclosure of its essential knowledge, replacing de facto secrecy with time-limited exclusivity for greater social benefit (Barbosa 2010).

Formally, a patent is a temporary title granted by the State, conferring exclusive rights over a product, process, or improvement. Third-party use requires the holder's authorization, typically via licensing (INPI 2021).

Any creation that provides a technical solution, advances the state of the art, and has industrial application may, in principle, be protected. Such creations fall into two main categories: products—equipment, objects, computer-implemented inventions (CIIs), compounds, compositions, kits—and processes—methods and uses, and CIIs (INPI 2021).

Patents are classified into invention and utility model types, with the certificate of addition as complementary protection.

A patentable invention is a creative concept that provides a novel solution to a technical problem, capable of being manufactured in a given technological field. This modality provides protection for technical creations aimed at obtaining a specific technical effect, covering industrial products (compounds, appliances, devices), and industrial activities (processes and methods). The term of validity of a patent for an invention is 20 years. The inventor is the individual who created the invention (INPI 2021).

The utility model patent protects functional improvements to existing products and remains valid for 15 years from filing (Jungmann and Bonetti 2010).

Finally, the Certificate of Addition of Invention protects enhancements to the original invention that keep its inventive concept and may be converted into an invention or utility model if rejected for conceptual divergence (INPI 2021).

Intellectual Property Ownership

The eligibility to file for patent ownership with the competent office, in the case of Brazil, the National Institute of Industrial Property (INPI), varies depending on the specific case (Jungmann and Bonetti 2010). Brazilian IP legislation, notably Law No. 9,279/96, establishes the conditions for inventions and utility models that occur during the term of an employment contract (Sousa and Belarmino 2015).

Brazilian Law No. 9,279/96, Articles 88 to 91, governs employee inventions and ownership rights. It distinguishes between service creations—those made under the employer's direction and contractual scope (Art. 88)—free creations, developed independently and without institutional resources (Art. 90)—and mixed creations, arising from the use of company facilities despite no direct contractual link (Art. 91) (Barbosa 2012).

In the context of public STIs, the IP developed belongs to the institution, which is listed as the owner. It is up to the institution, through its TICs, to manage and sign licensing and assignment agreements, in compliance with innovation legislation, with emphasis on Law No. 10,973/2004 (Dias and Argollo 2022). This reality reinforces the role of STIs as protagonists in technology management and transfer, in line with public policy to stimulate innovation.

Sectoral analyses show that TICs in public universities file patents on behalf of their institutions, strengthening institutional ownership in technology protection and transfer (Fujita *et al.* 2023).

Legal literature and institutional innovation policy clearly distinguish moral authorship from property ownership:

Moral Authorship: Should be recognized exclusively to individuals directly involved in the creation. The inventor (individual) has a duty to ensure the protection of the creation and to communicate any potentially protectable results to the responsible body within the institution (Arrabal *et al.* 2022; Zibetti and Ziegler Filho 2014).

Patrimonial Ownership: This generally falls to the organizations that lead or finance the research. It is established practice for public universities to retain the patrimonial rights to creations obtained through the use of their resources, especially when there are a functional link and the use of public employer resources (Arrabal *et al.* 2022; Barbieri 1999).

The National Council for Scientific and Technological Development (CNPq) Ordinance No. 502/2021 exemplifies this logic by establishing that the definition of IP ownership is the responsibility of the institutions executing the projects, which are responsible for assuming the costs of managing, filing, and registering the IP (Arrabal *et al.* 2021).

In summary, ownership of creations in public STIs is, as a rule, held by the institution when resulting from an employment relationship. However, the inventor is always guaranteed moral recognition of authorship and a share in the economic gains resulting from the exploitation of the technology (Arrabal *et al.* 2021; 2022; Barbieri 1999; Dias and Argollo 2022; Zibetti and Ziegler Filho 2014).

The inventor, creator, or author of technology developed in public STI is legally entitled to a share of the economic gains obtained by the institution, directly or indirectly (through technology transfer or licensing), limited to a minimum of 5% and a maximum of one-third (33.33%) of the net royalties earned (Brazil 2004).

Intellectual Property Misassignment

The phenomenon of not assigning institutional ownership of IP is frequently described in academic literature as IP leakage, since this broader term may encompass various forms of knowledge or asset diversion. In this study, however, the focus is restricted to the specific case of IP misassignment, which refers to situations in which IP is improperly registered in the name of inventors or companies, rather than the originating university or public research institute. Related terminology has also been employed, such as patenting outside university (Hayter and Feeney 2017; Van Burg *et al.* 2021), backdoor route or backdoor commercialization (Belitski *et al.* 2019; Halilem and Diop 2025), and TTO bypassing (Goel and Göktepe-Hultén 2017; Halilem and Diop 2025), to describe similar patterns of deviation from formal technology transfer processes.

In the academic context, IP misassignment refers to the loss or misappropriation of IP assets generated in a university environment by third parties. This situation, which typically involves patents for inventions (where the concept of ownership is central) but also covers trade secrets and other assets, compromises the intellectual capital of the institution (Halilem and Diop 2025; Markman *et al.* 2008). The phenomenon can be categorized into four types, based on the inventor's awareness and intent.

Unintentional Non-Compliance: This path is an unintentional action that results in the university's omission in the patenting process. In this case, the deviation occurs due to a limited understanding of institutional rules regarding IP ownership and invention protection obligations. Although the researcher may be aware of the existence of the TIC, they decide to circumvent it due to a lack of familiarity with the IP regime, which suggests a failure in institutional communication on the rules governing the protection of inventions. In short, the invention is patented externally not out of a desire to violate the rules but because of a critical lack of awareness of how and when protection should occur in the academic environment (Halilem and Diop 2025).

Passive Compliance: Involves a conscious and intentional choice to proceed with the protection of technology without the knowledge or involvement of the TIC but complying with the established procedures related to ownership. In this way, the academic inventor understands the role of the TIC but chooses to manage the protection process on their own, foregoing the services of the office and bearing the costs of patent submission and maintenance. This is an intentional decision to legally deviate from the formal procedure, motivated by the perception that bureaucracy and associated administrative delays make the protection process time-consuming (Halilem and Diop 2025).

Calculated Risk-Taking: Represents a deliberate deviation in the protection process, in which the inventor consciously decides to violate the university's ownership and disclosure rules. The researcher, being fully aware of the legal risks and potential institutional repercussions, proceeds with patenting in their own name or on behalf of third parties (Markman *et al.*, 2008; Thursby *et al.* 2009). This type of intentional deviation is often associated with highly experienced researchers, who feel more "empowered" to patent outside the university (Goel and Göktepe-Hultén 2017). The decision to divert IP outside the university is thus a rational choice to ignore formal IP policies (Halilem and Diop 2025).

Tactical Avoidance: This is the most sophisticated category, characterized by strategic flexibility in the rules to manipulate the protection process. In this way, the academic entrepreneur actively seeks to circumvent the TIC. A common strategy is to make the technology appear unattractive or of limited value in the initial stage of analysis, so that the TIC/TTO decides not to invest resources in formal IP protection, allowing ownership to be legally reassigned to the inventor or an external entity, as provided for in many university policies when the TIC is not interested in proceeding with patent filing. This tactical approach demonstrates the inventor's mastery of IP policies, using them to their advantage to retain control over intellectual assets (Halilem and Diop 2025).

The decision by academic inventors to pursue protection for their inventions through external channels, deviating from the formal route (IP misassignment), is a complex phenomenon that challenges the institutional ownership regime. The literature

points out that the motivation for such deviation is multifactorial, often influenced by researchers' perception that the TIC presents significant obstacles to rapid and efficient IP protection (Belitski *et al.* 2019; Markman *et al.* 2008). These determining factors can be grouped into organizational (related to the TIC), individual (related to the inventor), and contextual (related to the ecosystem) influences.

Organizational factors (perception of inadequacy of the TIC): IP deviation is strongly influenced by the perception of inefficiency, bureaucracy, and misalignment of interests of the TIC, which would increase uncertainty and transaction costs for the inventor (Halilem and Diop 2025).

Incompetence and bureaucracy: Researchers often criticize the TIC for having highly bureaucratic rules and practices and for lacking the specialized knowledge needed to protect specific technologies (Belitski *et al.* 2019; Halilem and Diop 2025). The perception that the patenting process at the TIC is slow and complex pushes inventors toward faster and more efficient paths. High staff turnover in offices also hinders long-term management, reinforcing mistrust (Chen *et al.* 2025; Halilem and Diop 2025).

Excessive control and loss of autonomy: Dissatisfaction with the control imposed, albeit legally, by the TIC over the invention is a strong motivation for deviation, as inventors want to be the "captain of the ship." This aversion to control is linked to procedural justice and the perception that internal policies are inflexible and do not accommodate the specific needs of academic entrepreneurs, although the public interest should prevail in such cases (Halilem and Diop 2025).

Financial disincentives: Although Brazilian law allows inventors to receive up to one-third of royalties, this practice is still in its infancy (Jesus *et al.* 2023). The perception that the financial benefit is limited or that "very little remains for the inventor" discourages cooperation with the TIC (Halilem and Diop 2025), although public STI, TICs cannot increase the royalty rate above one-third, as provided for by law.

Individual and professional factors: The personal ability and experience of the researcher are crucial factors that increase the likelihood of TIC deviation (Goel and Göktepe-Hultén 2017; Van Burg *et al.* 2021). Researchers with a high level of experience, education (doctorate), and higher academic rank tend to register patents externally more frequently. This correlation stems from the greater autonomy perceived by these inventors, making them more likely to bypass the formal IP channel in search of control and agility (Goel and Göktepe-Hultén 2017; Van Burg *et al.* 2021). Additionally, the literature suggests that scientific discipline also influences the tendency to deviate, with inventors in the fields of Physical Sciences and Life Sciences tending to circumvent the TIC more frequently (Goel and Göktepe-Hultén 2017; Thursby *et al.* 2009).

Contextual factors (interaction with the ecosystem): The external environment offers alternative patenting routes that are perceived as more efficient, directly influencing the decision to deviate. The existence of strong industrial ties and networks, such as previous experience in companies or consulting, makes circumventing the TIC more likely. Researchers with these robust external connections feel more "empowered" and confident to manage the IP protection process on their own (Goel and Göktepe-Hultén 2017; Markman *et al.* 2008). Additionally, the local entrepreneurial ecosystem plays a crucial role: universities located in regions with a high concentration of business activity expose their researchers to markets that facilitate both the diversion and private appropriation of IP (Markman *et al.* 2008).

Deviating from the formal IP route, in which the invention is patented externally without granting ownership or co-ownership to the university through the TIC, has direct negative consequences for the university and the innovation ecosystem (Belitski *et al.* 2019; Chen *et al.* 2025; Markman *et al.* 2008).

The misassignment of IP deprives the university of the economic value generated by research, directly impacting the operational capacity and legitimacy of the TTO. Bypassing the TTO means the invention is "never disclosed," preventing the office from commercializing it, negotiating licenses, and generating revenue for the university (Belitski *et al.* 2019). This revenue is crucial, as TIs depend on royalties and other earnings to sustain their operating costs. When scientists interact directly with private companies, leaving out the university administration and the TI, the university does not receive the revenue that could be generated for reinvestment in research (Markman *et al.* 2008).

The deviation from IP affects the core mission of the university, influencing the nature of research and making it difficult to measure institutional impact. Externally registered patents make it much more difficult to measure the true effect of academic involvement and, consequently, are not credited as university impact (Van Burg *et al.* 2021). Additionally, focusing solely on profit

and access to private channels, which facilitate external patenting, can lead to a distortion of the nature of research, directing it exclusively towards finding solutions to specific technical problems of companies, with little concern for basic and exploratory research (Goel and Göktepe-Hultén 2017).

According to Markman *et al.* (2008), bypassing—the direct commercialization of inventions outside official university channels—reduces institutional returns and creates disputes over IP ownership. Such misappropriation increases uncertainty and weakens governance between universities and technology-transfer offices. In the Brazilian context, the lack of a formal ownership mechanism led by the TIC may intensify this uncertainty, discouraging collaboration and licensing. Ambiguous ownership perceptions thus hinder technology transfer and commercialization, undermining the institution's credibility in managing intellectual assets.

To mitigate IP misassignment, it is essential that universities reformulate their management strategies and policies, addressing the structural causes and perceived disincentives for inventors who seek to protect their technologies outside the formal channel (Halilem and Diop 2025). Mitigation strategies should focus on improving the operational efficiency of the TIN, reviewing policies and incentives, and strengthening governance and compliance.

The main strategy involves transforming the TIC from a bureaucratic center into a facilitator and strategic partner for researchers. This requires investment in expertise and the hiring of specialists with scientific knowledge, as well as the simplification of workflows and the reduction of administrative complexity to ensure a faster and more transparent protection process (Belitski *et al.* 2019; Chen *et al.* 2025). Additionally, it is imperative that universities improve awareness and education about IP policies, writing the rules in accessible language so that disclosure of the invention becomes a clear institutional requirement.

Intellectual property policies should be revised to realign institutional and inventor interests and to improve internal dissemination. In line with Markman *et al.* (2008), increasing royalty shares—within the limits of the Brazilian Innovation Law for public STIs—can reduce deviation by incentivizing faculty. Technology Innovation Centers should pursue flexible, entrepreneur-oriented agreements that encourage external collaboration while avoiding restrictive clauses, establishing a regulatory framework that safeguards public assets yet supports innovation agility.

Ensuring integrity in the IP system requires stronger governance and independent oversight with stakeholder participation to secure fair outcomes from public research. Universities must clarify and enforce the ethical and legal consequences of breaching ownership rules, eliminating ambiguity about sanctions.

This proposal aims to provide a methodology for identifying IP misassignment, offering TICs the necessary tools for governance and oversight of intellectual assets in universities and research institutes.

METHODS

This study adopts a descriptive and quantitative approach, using technical data collection procedures, in line with the classification proposed by Gil (2017). This methodology was selected to enable the analysis of the characteristics of the IP misassignment phenomenon in a given period, through a case study focused on a Brazilian public university.

Data collection focused on the IP records of a Brazilian public university, covering from the filing of the first patent to the final date of collection, September 13, 2025. The sample included IP documents (invention patents and utility models), with no restriction on research area or country of publication.

The chosen Brazilian public university was selected for being a high-volume patent-filing STI that maintains robust engagement with the industry and other universities, leading to numerous collaborative Research and Development (R&D) projects.

The database used for patent prospecting was the Orbit Intelligence platform. The search strategy consisted of querying the university's name in the "Assignee Name" field of the Orbit Intelligence platform, with filters applied to the names of the inventors. The use of the English term ("Names-Assignee") is justified by the absence of a Portuguese interface on the platform.

The modeling and analysis of the results were conducted following the bibliometric and patent methodology proposed by Cavalcanti *et al.* (2019). This process was structured in seven stages, as detailed in Table 1, which ensured a systematic and robust analysis of the document corpus.

Table 1. Steps used for bibliometrics and patentometrics.

No.	Objective	Parameters used
1	Define what you want to measure	Emerging patents at Brazilian public universities that did not include the university as the owner, in the period from the first patent to the present, in any area of research, published in any country and in any type of document
2	Determine what measurements are available	Total number of records, date of publication, owner, inventor, inventor's connection to the university, category of partners listed in the patents
3	Define what is wanted with the measure	Identify IP misassignment at Brazilian public universities
4	Create combinations/relati onships with the measures	Year of publication, total published per year, university partnerships in production, main inventors, total IP misassignment by category, total IP misassignment per year
5	Select instruments and processes for data collection	Orbit Intelligence database, analysis, and compilation of results in your own systems, and export to text files
6	Perform data modeling	Import, tabulation, and combination of data in MS Office Excel 2016 software, in addition to generating graphs
7	Perform data analysis	Analysis and interpretation of results, considerations

Source: adapted from Cavalcanti *et al.* (2019).

After the initial search in the Orbit Intelligence database, the identification of the main inventors required the completion of data on their institutional affiliation. To this end, secondary searches were carried out on platforms such as Lattes, LinkedIn, and the university's institutional website. The objective of this stage was to verify the inventors' employment or functional relationship with the institution, as well as to record their area of activity and the year in which the relationship began.

Based on the analysis of the results and confirmation of the methodological feasibility of the mapping, recommendations will be proposed for the continuation of the work. The main objective is to propose a robust framework for mapping IP misassignment, in order to equip TICs with the necessary tools for the proper governance of IP assets at universities or research institutes.

RESULTS

The initial stage consisted of surveying, via the Orbit Intelligence platform, the corpus of patents and patent applications in which the university under study appeared as the owner or coowner. To preserve the identity of the institution, the total number of records and the number of inventors involved will not be disclosed.

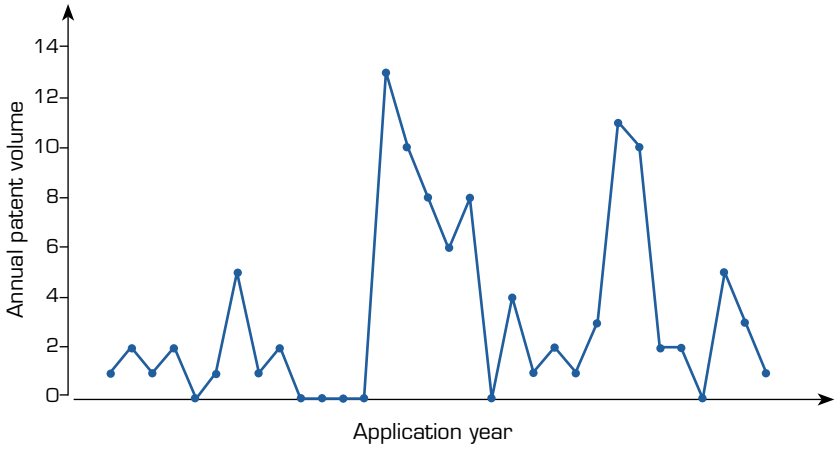
The next step focused on identifying the institution's main inventors. Once these names were obtained, their IP portfolios were individually verified by cross-referencing the patents (and applications) registered in the inventor's name with the total number held by the university as the owner. The aim was to ascertain whether all the inventor's patent production was duly linked to the institution.

To attribute IP misassignment, a confirmation protocol was applied, which included collecting additional information about the inventor:

- Verification of formal ties to the university (date of entry or termination, such as retirement);
- Certification that the technical area of the patent was compatible with the researcher's field of activity at the institution.

Due to the high volume of patents and inventors, the analysis focused on a basic statistical sample corresponding to 10% of the total number of inventors.

The findings revealed that, during the period studied, only about 48% of the patents (and applications) of the inventors analyzed indicated the university as the owner or co-owner. In terms of IP misassignment, this result indicates that 52% of the cases analyzed were classified as potential IP misassignment (or deviation of ownership). The temporal distribution of these patents classified as suspected IP misassignment is detailed in Fig. 1.



Note. The year of publication has been suppressed to avoid identifying the university targeted by this study. Source: Elaborated by the authors.

Figure 1. Annual distribution of suspected cases of IP misassignment.

To understand the destination of the deviation of ownership, an analysis was conducted of the owners listed in patent applications that omitted the university as co-owner. The results of this investigation are detailed in Table 2.

Table 2. Categorization of owners listed in patents that included the inventors but did not list the university as coowner.

Type of institution listed as holder	Total number of registrations
Companies	56
Inventor's own name	34
Another individual	13
Private STI	8
University foundation	7
Universities	5
State agency	1
Total	124

Note. The total number of institution registrations does not correspond to the total number of patents, as in several cases there was more than one owner per patent. Source: Elaborated by the authors.

The results show that, in about half of the cases, at least one private company appeared as the patent holder, while in 34 cases the inventor registered the patent in their own name. This pattern of ownership deviation is consistent with prior empirical evidence found in university contexts.

At the Federal University of São Carlos (UFSCar), Garnica *et al.* (2006) identified that only 23% of patents with inventors linked to UFSCar were institutionally assigned, while 31% were owned exclusively by companies and 20% by the inventors themselves.

Similarly, research conducted at a Dutch university by Van Burg *et al.* (2021) found that institutional ownership occurred in only 42.3% of the patents analyzed, with 57.7% assigned to companies or individual inventors.

Comparable proportions were also found in the United States, where Markman *et al.* (2008) reported that 42% of patents from university scientists were not owned by their institutions of origin, and Thursby *et al.* (2009) later confirmed that only 62.4% of patents by academic researchers were university-owned.

These convergent results support the conclusion that the phenomenon of IP misassignment is systemic, transcending institutional boundaries and national jurisdictions.

DISCUSSION

Although a precise correlation cannot be established categorically, it is conjectured that the significant increase in IP misassignment observed in certain years (as shown in Fig. 1) may be related to the intensification of partnerships undertaken by the university. Such collaborations involve conducting research in conjunction with other educational institutions or the business sector.

The analysis in Table 2 reveals that, in approximately half of the cases with evidence of IP misassignment, at least one private company appeared as the patent holder. This reinforces the interpretation that ownership deviations are frequently associated with informal or poorly managed partnership agreements, especially during periods of intensified research collaboration—a pattern consistent with the external studies cited in the Results.

In addition to corporate appropriation, there were a significant number of filings (34 occurrences) in which the inventor was listed as the owner. This indicates possible misappropriation of institutional results by researchers unaware of, or indifferent to, IP regulations. Such individual-level deviations also reflect the broader international dynamics previously documented in comparable academic systems.

Drawing on these results, the study proposes a six-step framework for identifying and validating cases of IP misassignment and addressing the structural factors underlying ownership deviation within research institutions (Table 3).

Table 3. Proposed framework for mapping and validating IP misassignment in STIs.

Step	Action	Technical Details	Motivation and Significance
1	Identification of Institutional Portfolio	Compile the total number of patents and patent applications in which the target STI is listed as the owner or co-owner.	The search should be conducted directly in official databases, given that the STI's internal control may be flawed or entirely absent. This direct search is also necessary to provide a contrast with the information regarding the inventors
2	Extraction of Authorship Data	Identify the inventors listed in the institutional portfolio (Step 1).	From the portfolio data, the inventors' names must be extracted to identify the most prolific individuals, meaning those who exhibit the highest productivity in patent generation
3	Sampling Definition	Apply a cutoff point based on the frequency of deposits per inventor, defining the sampling for in-depth analysis (ensuring statistical validity).	It will typically be unfeasible to analyze all inventors, as many of those listed belong to external institutions. Therefore, greater emphasis is placed on those with the highest number of patents. Moreover, these individuals are usually the ones most involved in R&D partnerships. The sampling approach should vary on a case-by-case basis, depending on the need or time availability to carry out the analyses
4	Cross-checking of Ownership	Check all IP records in the name of the inventors in the sample, whether the target STI is listed as owner or co-owner.	This finding suggests the initial presence of suspected IP misassignment, evidenced by inventors holding patents that do not involve their original STI. These clues will be further investigated in subsequent stages
5	Identification of Suspicions and Links	For cases where STI is absent (suspected IP misassignment), verify the formal link (employment or functional) between the inventor and the institution.	Since the listed inventor may not be affiliated with the STI, verification of this information is required. Access to the STI's human resources database will substantially expedite this verification step
6	Confirmation Protocol	For cases with an active or recent link (step 5), cross-check the following data: (a) Date of entry versus date of filing; (b) Date of termination of link (e.g., retirement); (c) Compatibility between the inventor's scientific field of the inventor and the technical content of the patent.	After confirming the inventor's affiliation, it is necessary to certify whether this affiliation was still active on the patent filing date. Furthermore, it is essential to analyze whether there is compatibility between the inventor's technological area of expertise and that present in the technology protected by the patent. If the answers are positive, then it is likely a case of IP misassignment

Source: Elaborated by the authors.

Based on the evidence presented, the proposed mapping framework serves as an essential starting point for institutions to monitor, quantify, and proactively intervene in the phenomenon of IP misassignment, ensuring the proper social and economic return on the assets generated—thus reinforcing the consistency between this study's findings and the broader international evidence highlighted in the Results section.

CONCLUSION

This research analyzed IP management in Brazilian universities, focusing on patent ownership challenges and the issue of IP misassignment. Its main contribution is the proposal of an analytical framework for detecting instances of IP misassignment through patent database searches.

The quantitative analysis revealed that the problem of IP misassignment is significant in the institution studied. The most frequent ownership deviation was the improper use of IP information belonging to the institution for economic exploitation, totaling 56 cases, followed by the appropriation of ownership by the inventor in 34 occurrences These findings underscore the urgent need for institutional monitoring and intervention.

The study provides practical contributions to IP management in TICs (TTOs). The proposed methodology serves as a diagnostic tool for systematically identifying and mitigating ownership omissions, thus strengthening institutional governance and technology transfer. By improving IP asset protection, the research aims to enhance the social and economic returns of inventions developed with public funding.

While the proposed methodology serves as a diagnostic tool, resolving this issue fundamentally requires raising technical staff awareness regarding IP legislation—specifically the ownership of inventions developed at the STI's facilities—and implementing tailored training to foster a stronger IP culture.

A key limitation of this research is the sample size, as only ten percent of the target STI's patent portfolio was analyzed. Furthermore, the absence of a complete official registry of STI members significantly protracted the analysis time required to investigate the suspected IP misassignment cases. Another constraint is that the study was applied to only one university, representing a single case study.

Future research should focus on validating this methodology through its application in diverse institutional contexts, particularly within other universities and research centers, to test the generalizability of the results.

CONFLICT OF INTEREST

Nothing to declare.

AUTHORS' CONTRIBUTION

Conceptualization: Leite BRA and Santos RL; **Research:** Leite, BRA and Santos RL; **Methodology:** Leite, BRA and Santos RL; **Supervision:** Frey IA, Lima AA and Melo FCL; **Preparation of original draft:** Leite, BRA and Santos RL; **Writing:** Leite, BRA and Santos RL; **Writing – Proofreading and editing:** Frey IA; Lima AA and Melo FCL; **Final approval:** Santos RL.

DATA AVAILABILITY STATEMENT

All data sets were analyzed in the current study.

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DECLARATION OF USE OF ARTIFICIAL INTELLIGENCE TOOLS

Use of AI software (ChatGPT and NotebookLM) for grammatical correction and support in locating references, with manual verification, in accordance with ethical standard.

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REFERENCES

Aldridge TT, Audretsch DB (2010) Does policy influence the commercialization route? Evidence from National Institutes of Health funded scientists. Res Pol 39(5):583-588. https://doi.org/10.1016/j.respol.2010.02.005

Arrabal AK, Wiggers VR, Arrabal OHB, Colombo, AP, Cardoso, RS (2022) Authorship management in innovation projects, concerning the academic environment. Res Soc Dev 11(15):e55111536996. https://doi.org/10.33448/rsd-v11i15.36996

Arrabal AK, Wiggers VR, Arrabal OHB, Colombo, AP, Cardoso, RS, Santos, EIS (2021) Intellectual property and Research, Development and Innovation incentives: CNPq Administrative Act nº 502/2021 considerations. Res Soc Dev 10(11):493101119978. https://doi.org/10.33448/rsd-v10i11.19978

Babina T, He AX, Howell ST, Perlman ER, Staudt J (2022) Cutting the innovation engine: How federal funding shocks affect university patenting, entrepreneurship, and publications. SSRN Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3560195

Barbieri JC (1999) As invenções realizadas por empregados no Brasil: uma análise da legislação atual e propostas de mudanças. Rev Adm Pública 33(1):7-26. In Portuguese. https://periodicos.fgv.br/rap/article/view/7664/

Barbosa DB (2010) Uma introdução à propriedade intelectual. 2nd ed. Rio de Janeiro: Lumen Juris. In Portuguese.

Barbosa DB (2012) Sobre a apropriação originária da titularidade das patentes por pessoas jurídicas. In: Plaza CMCA; Del Nero PA, editors. Proteção jurídica para as ciências da vida: propriedade intelectual e biotecnologia. Rio de Janeiro: IBPI. p. 305-327. In Portuguese. https://ibpieuropa.org/book/protecao-juridica-para-as-ciencias-da-vida-propriedade-intelectual-e-biotecnologia

Belitski M, Aginskaja A, Marozau R (2019) Commercializing university research in transition economies: Technology transfer offices or direct industrial funding? Res Pol 48(3):601-615. https://doi.org/10.1016/j.respol.2018.10.011

Brandão Neto N, Faria LA, Melo FCL (2024) Identifying technological trends and promoting strategies to boost innovation and technology transfer: A case study on the patent portfolio of Brazilian public research institutions. J Aerosp Technol Manag 16:e1624. https://doi.org/10.1590/jatm.v16.1336

Brandão Neto N, Leite BRA, Floriano VDM, Teixeira CS, Melo FCL (2023) Produção científico-tecnológica da Universidade Federal de Santa Catarina: evolução de artigos e patentes em duas décadas de pesquisa. Paper presented at Proceedings of the IX ENPI 9(1):2742-2752; Santa Maria, Brazil. In Portuguese. https://api.org.br/conferences/index.php?conference=ENPI2023&schedConf=ENPI2023&page=paper&op=viewFile&path%5B%5D=1632&path%5B%5D=837

Brazil (1996) Law No. 9,279, of May 14, 1996. Regulates rights and obligations relating to industrial property. In Portuguese.

Brazil (2002) Law No. 10,406 of January 10, 2002. Establishes the Civil Code. In Portuguese. [accessed Nov 25 2025]. https://www.planalto.gov.br/ccivil_03/leis/2002/l10406compilada.htm

Brazil (2004) Law 10,973, of December 2, 2004. Provides incentives for innovation and scientific and technological research in the productive environment and other measures. In Portuguese. http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.973.htm

Cavalcanti DB, Leite BRA, Farias GB (2019) Contribuição metodológica dos estudos métricos da informação para a análise da interdisciplinaridade nas ciências ambientais. Braz J Inf Sci Res Trends 13(4):89-112. https://doi.org/10.36311/1981-1640.2019.v13n4.06.p89

Chen Z, Little VJ, Thuan NH (2025) The evolving role of technology transfer offices in the entrepreneurial university: Go-betweens or playmakers? J Technol Transf 50:1060-1079. https://doi.org/10.1007/s10961-024-10123-4

Dassoler FE, Trierweiller, AC, Ferenhof, HA, Konrath, AC, Vincenzi, SL (2023) Indicators of the third university mission: Perspectives to measure universities contributions to society. Educ Rev 39:e36619. https://doi.org/10.1590/0102-469836619t

Dias JM, Argollo LL (2022) O licenciamento e a cessão de patente de titularidade de ICT. Diké Rev Jur 20:146-162. https://doi.org/10.36113/dike.20.2022.3411

Fortec (2019) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2018. In Portuguese. [accessed Nov 25 2025]. https://fortec.org.br/wp-content/uploads/2021/01/Relatorio_anual_Ano_Base_2018.pdf

Fortec (2020) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2019. In Portuguese. https://fortec.org.br/wp-content/uploads/2021/01/Relatorio_anual_Ano_Base_2019.pdf

Fortec (2021) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2020. In Portuguese. https://fortec.org.br/wp-content/uploads/2021/12/Relato%CC%81rio_anual_Ano_Base_2020_final_dez2021.pdf

Fortec (2022) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2021. In Portuguese. https://fortec.org.br/wp-content/uploads/2022/10/RelatA%CC%83%C2%B3rio-Ano-Base-2021.pdf

Fortec (2023) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2022. In Portuguese. https://fortec.org.br/wp-content/uploads/2023/10/Relatorio-Pesquisa-Fortec-de-Inovacao-Ano-base-2022.pdf

Fortec (2024) Pesquisa Fortec de inovação: Políticas e atividades de propriedade intelectual e transferência de tecnologia: Relatório ano base 2023. In Portuguese. https://fortec.org.br/wp-content/uploads/2024/12/Relatorio-FORTEC-2023_final-5.pdf

Fortec (2025) About. https://fortec.org.br/sobre-o-fortec/

Fujita AT, Mata JF, Sousa LC (2023) Intellectual property management in public higher education institutions in Minas Gerais. Avaliação (Campinas) 28:e023025. https://doi.org/10.1590/S1414-40772023000100041

Garnica LA, Oliveira RM, Torkomian ALV (2006) Propriedade Intelectual e Titularidade de Patentes Universitárias: Um Estudo Piloto na Universidade Federal de São Carlos – UFSCar. Paper presented at Proceedings of the Symposium on Technological Innovation Management; Gramado, Brazil. https://arquivo.anpad.org.br/abrir_pdf.php?e=NjQyMg==

Gil AC (2017) Como elaborar projetos de pesquisa. 6th ed. São Paulo: Atlas. In Portuguese.

Goel RK, Göktepe-Hultén, D (2017) What drives academic patentees to bypass TTOs? Evidence from a large public research organization. J Technol Transf 43:240-258. https://doi.org/10.1007/s10961-017-9595-7

Gomes O (2001) Direitos reais. 18th ed. Rio de Janeiro: Forense. In Portuguese.

Halilem N, Diop B (2025) "Meet me at the backdoor": A multiple case study of academic entrepreneurs bypassing their technology transfer offices. Res Pol 54(2):105156. https://doi.org/10.1016/j.respol.2024.105156

Hayter CS, Feeney MK (2017) Determinants of external patenting behavior among university scientists. Sci Publ Policy 44(1):111-120. https://doi.org/10.1093/scipol/scw037

Instituto Nacional da Propriedade Industrial (2021) Manual Básico para Proteção por Patentes de Invenções, Modelos de Utilidade e Certificados de Adição. https://www.gov.br/inpi/pt-br/servicos/patentes/guia-basico/ManualdePatentes20210706.pdf

Jesus CS, Cardoso DO, Souza CG (2023) Motivational factors for patenting: A study of the Brazilian researchers profile. World Pat Inf 75:102241. https://doi.org/10.1016/j.wpi.2023.102241

Jungmann, DM, Bonetti EA (2010) A caminho da inovação: proteção e negócios com bens de propriedade intelectual guia para o empresário. Brasília: IEL. https://www.gov.br/inpi/pt-br/servicos/patentes/materiais-de-consulta-e-apoio/guia-do-empresario.pdf

Lima, JAA (2006) Bases teóricas para gestão da propriedade intelectual. Campina Grande: EDUFCG.

Markman GD, Gianiodis PT, Phan PH (2008) Full-Time Faculty or Part-Time Entrepreneurs. IEEE Trans Eng Manag 55(1):29-36. https://doi.org/10.1109/TEM.2007.912813

National Aeronautics and Space Administration (2019) NASA's technology transfer process (Report No. IG-19-016). https://oig.nasa.gov/docs/IG-19-016.pdf

Sousa ALF, Belarmino AS (2015) O trabalhador inventor e o limite da sua invenção. Dir Trab Proc Trab 1:107-117. In Portuguese. https://site.conpedi.org.br/publicacoes/z307l234/p7k0v9u2/00i8aWmb131C6hs0.pdf

Thursby J, Fuller AW, Thursby M (2009) US faculty patenting: Inside and outside the university. Res Pol 38(1):14-25. https://doi.org/10.1016/j.respol.2008.09.004

Van Burg E, Du J, Kers, JG (2021) When do academics patent outside their university? An in-depth case study. Technovation 107:102287. https://doi.org/10.1016/j.technovation.2021.102287

World Intellectual Property Organization (2021) O que é Propriedade intelectual? https://www.wipo.int/edocs/pubdocs/pt/wipo_pub_450_2020.pdf

Zibetti, FW, Ziegler Filho, JA (2014) Os direitos de propriedade intelectual de programa de computador desenvolvido por servidor público do estado de Santa Catarina. Rev ESMESC 21(27):299-324. https://doi.org/10.14295/revistadaesmesc.v21i27.104