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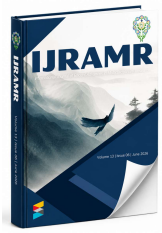

REVIEW ARTICLE

PATENT-BASED TECHNOLOGICAL PROSPECTING: METHODOLOGICAL TRANSPARENCY AND REPRODUCIBILITY IN STUDIES WITHIN PROFNIT

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ABSTRACT

This study evaluates the level of methodological transparency and potential reproducibility in patent-based technological prospecting dissertations developed within the Professional Graduate Program in Intellectual Property and Technology Transfer for Innovation (PROFNIT). A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 guidelines, resulting in the analysis of 23 dissertations defended between 2016 and 2026. The study applied an adapted methodological compliance checklist based on international standards for patent landscape studies. The results revealed high levels of conformity regarding the definition of databases, search strategies, analytical methods, and presentation of quantitative findings. The dissertations demonstrated strong alignment with internationally recognized practices in technological intelligence and patent analysis, particularly through the use of IPC and CPC classifications. However, important weaknesses were identified concerning dataset sharing, documentation transparency, and discussion of methodological limitations. Only a minority of the studies provided complete access to the analyzed patent corpus, limiting auditability and reproducibility. The findings indicate that PROFNIT has achieved significant operational maturity in technological prospecting studies, although challenges remain regarding open science practices and methodological standardization. The study contributes to discussions on transparency, scientific reliability, and quality standards in patent landscape research.

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INTRODUCTION

The advancement of knowledge-based economies has elevated technological innovation to a central element of competitiveness, technological sovereignty, and economic development. In this context, the strategic management of technological information has become indispensable for public and private organizations seeking to anticipate trends, monitor competitors, reduce investment risks, and identify Research and Development (R&D) opportunities. Among the instruments available for this purpose, technology forecasting based on patent documents stands out as one of the most robust approaches for producing strategic intelligence, particularly due to the high technical density, international standardization, and broad informational scope of patent records (Firat; Woon; Madnick, 2008; Paranhos, 2019). Patent documents constitute unique sources of technological information, often containing knowledge that is not published in scientific journals or other traditional academic communication channels (Quintella *et al*., 2018). Beyond their legal function of protecting inventions, patents provide concrete evidence of technological trajectories, corporate competitive strategies, and emerging innovation fields. Consequently, patent landscape studies and technological monitoring have assumed a strategic role not only within productive sectors but also in scientific and governmental institutions responsible for the formulation of innovation policies (Grant; Van den Hof; Gold, 2014). In Brazil, the expansion of innovation management and intellectual property activities fostered the creation of public policies aimed at training specialized human resources. Within this scenario, the Graduate Program in Intellectual Property and Technology Transfer for Innovation (PROFNIT) has emerged as a nationwide network designed to qualify professionals for activities in Technology Innovation Centers (NITs), entrepreneurial ecosystems, and innovation systems (Quintella; Santos; Pires, 2025). According to its institutional guidelines, the program aims not only to train specialists in intellectual property but also to develop competencies related to competitive intelligence, technology forecasting, and technology transfer (PROFNIT, 2018a).

Despite the growing use of prospective studies in both academic and professional environments, the international literature has highlighted significant methodological weaknesses related to transparency, standardization, and reproducibility. Grant, Van den Hof, and Gold (2014) argue that the absence of harmonized protocols compromises the comparability and reliability of patent analyses, producing reports that are frequently heterogeneous in terms of search strategy descriptions, selection criteria, temporal delimitations, and presentation of results. This issue was empirically reinforced by Smith *et al*. (2017), whose systematic review identified an average compliance rate of only 64% with fundamental methodological reporting criteria in international patent landscape studies. According to the authors, the omission of critical information, such as complete search strings, exclusion criteria, and availability of the analyzed corpus, directly compromises the auditability and potential reproducibility of the analyses performed. Consequently, strategic decisions based on such studies may be affected by methodological biases that remain invisible to readers and decision-makers.

This scenario reveals a central tension in the contemporary state of the art of technology forecasting. Although analytical tools have evolved significantly, incorporating text mining, data visualization, artificial intelligence, and sophisticated bibliometric analyses, structural fragilities associated with methodological transparency and data-sharing practices still persist (Firat; Woon; Madnick, 2008; Jeong; Yoon, 2015). In other words, the field has advanced rapidly in analytical capacity, but not necessarily in scientific standardization. Furthermore, a substantial portion of the international literature remains concentrated on the development of quantitative techniques for patent mining, technological classification, and trend analysis, while relatively little attention has been devoted to critically assessing the methodological quality of the prospective studies themselves. This gap becomes particularly relevant in professionally oriented graduate programs such as PROFNIT, whose institutional mission involves training specialists capable of producing reliable analyses to support public policies, business decisions, and innovation strategies. Against this backdrop, there is a clear need to critically investigate the level of methodological transparency present in technology forecasting dissertations developed within PROFNIT, seeking to understand the extent to which such studies incorporate practices aligned with international recommendations concerning auditability, traceability, and scientific reproducibility.

Accordingly, the general objective of this study is to evaluate the degree of transparency, clarity, completeness, and methodological detail in patent-based technology forecasting studies contained in PROFNIT dissertations defended between 2016 and 2026, identifying elements that potentially favor or limit the reproducibility of the analyses conducted. The relevance of this article is grounded in multiple scientific, institutional, and strategic dimensions. First, technology forecasting studies have become increasingly central within contemporary innovation ecosystems, functioning as strategic intelligence instruments capable of supporting decisions related to Research and Development (R&D), technology transfer, competitive monitoring, and the definition of technological priorities (Canongia *et al*., 2004; Paranhos, 2019). In this context, the methodological reliability of such analyses becomes essential for organizations to safely and consistently use prospective results. From a scientific perspective, this research contributes to a still underexplored gap in both national and international literature: the systematic evaluation of methodological transparency in patent landscape studies produced within academic environments. Although there is extensive literature focused on patent data mining, technological classification, and competitive intelligence techniques, studies critically investigating methodological reporting quality, dataset availability, and the conditions necessary to ensure auditability and reproducibility remain limited. Additionally, this research presents strong institutional relevance for PROFNIT itself. As a national public policy program dedicated to training professionals in intellectual property, technology transfer, and innovation, PROFNIT explicitly establishes the development of technology forecasting and competitive intelligence competencies among its essential objectives (PROFNIT, 2018b). Therefore, critically evaluating the program's academic production not only enables the diagnosis of methodological maturity patterns but also helps identify recurring weaknesses that may support curricular improvements, methodological standardization, and the strengthening of open science practices across the network.

The study also holds practical and social relevance, considering that a substantial portion of the analyzed dissertations results in technological products aimed at addressing concrete demands from public organizations, companies, startups, and social institutions. Thus, increasing methodological transparency and robustness directly contributes to enhancing the reliability of information used in strategic decision-making processes, reducing risks associated with incomplete, biased, or poorly documented analyses. Finally, this study contributes to bringing the field of technology forecasting closer to contemporary debates on open science, data sharing, and scientific reproducibility, themes that have gained growing international relevance amid criticisms regarding low transparency across different scientific domains (Munafò *et al*., 2017; Nosek *et al*., 2015).

In this sense, the research transcends the specific analysis of PROFNIT dissertations and engages with broader discussions concerning methodological quality, scientific standardization, and the reliability of academic production in innovation-oriented studies. This article is structured into four main sections. Section 2 presents the theoretical framework, addressing the conceptual foundations of technology forecasting, competitive intelligence, patent document analysis, patent landscape methodologies, and contemporary discussions on methodological transparency, open science, and scientific reproducibility. Section 3 describes the methodological procedures adopted in the research, including the systematic literature review design, sample selection criteria, data collection and extraction processes, adaptation of the methodological compliance checklist, and analytical techniques employed. Section 4 presents and discusses the research findings, encompassing the characterization of the analyzed dissertations, the identified levels of methodological compliance, the main weaknesses and strengths observed, and the institutional and scientific implications derived from the results. Finally, Section 5 presents the study's concluding remarks, highlighting its contributions, limitations, and recommendations for strengthening methodological transparency and standardization in technology forecasting studies developed within PROFNIT.

THEORETICAL FRAMEWORK

Technology Forecasting and Competitive Intelligence: Technology forecasting has become a fundamental strategic activity for organizations operating in innovation- and knowledge-intensive environments. According to Firat, Woon, and Madnick (2008), technology forecasting comprises the set of methods employed to identify emerging trends, anticipate technological changes, and support decision-making processes related to the future of innovation. Complementarily, technological competitive intelligence involves the collection, interpretation, and transformation of scientific and technological information into applicable strategic knowledge (Canongia *et al*., 2004). While forecasting is predominantly future-oriented and exploratory, competitive intelligence operates more immediately in monitoring external environments, enabling the identification of threats, opportunities, and relevant competitive movements (Mayerhoff, 2008). The integration of these approaches has become particularly relevant in innovation ecosystems characterized by rapid technological evolution, regulatory complexity, and intensified global competition. Within this scenario, public and private organizations increasingly employ prospective studies not only for technological monitoring but also as instruments for strategic planning, R&D prioritization, and innovation policy formulation (Antunes *et al*., 2018).

Patent Documents as Strategic Sources of Technological Information: Patent documents represent one of the most important primary sources of technological information currently available. According to Grant, Van den Hof, and Gold (2014), patents simultaneously perform legal, economic, and informational functions by providing detailed technical descriptions of inventions, industrial processes, and emerging technological solutions. Several authors argue that a significant portion of global technological knowledge is exclusively recorded in patent documents, without equivalent publication in scientific articles or other academic outlets (Quintella *et al*., 2018). This characteristic makes patent databases fundamental tools for monitoring technological frontiers and identifying the state of the art. In addition to the technical density of the information, patents exhibit high levels of international standardization through classification systems such as the International Patent Classification (IPC) and the Cooperative Patent Classification (CPC), enabling comparative analyses and large-scale technological data mining (Paranhos, 2019). However, the literature also highlights important limitations associated with the use of patent documents. These include the 18-month confidentiality period, indexing inconsistencies, differences in database coverage, terminological variations, and the possibility of protection through industrial secrecy. Such factors reinforce the need for methodological rigor and specialized validation in technology forecasting studies (Firat; Woon; Madnick, 2008).

Patent Landscape Methodologies and Tech Mining: The development of patent landscape and tech mining techniques has significantly expanded the analytical capacity of prospective studies. According to Jeong and Yoon (2015), these approaches make it possible to transform large patent datasets into visual representations and strategic indicators capable of supporting complex innovation decisions. Among the most widely used methods are text mining, bibliometric analysis, cluster analysis, citation networks, multidimensional scaling, temporal analysis of patent filings, and geographical and competitive mapping.The combined application of these techniques enables the identification of emerging technologies, technological gaps (“white spaces”), innovation trajectories, leading assignees, collaboration networks, and competitive intensity across technological sectors. In this context, platforms such as Orbit Intelligence, Lens, and Espacenet have become widely adopted tools in prospective studies due to their ability to process massive patent datasets and integrate patent information with non-patent scientific literature (Rocha, 2020).Nevertheless, despite the technical sophistication of these tools, the literature still points to persistent challenges concerning methodological standardization, scientific reporting transparency, and data-sharing practices (Smith *et al*., 2017).

Methodological Transparency, Open Science, and Reproducibility: Contemporary discussions on open science and scientific reproducibility have directly influenced technology forecasting studies. According to Nosek *et al*. (2015), methodological transparency constitutes one of the central pillars for strengthening scientific reliability and enabling independent validation of research findings. Within this context, the availability of datasets, complete search strategies, selection criteria, and detailed documentation of analytical procedures has become an increasingly important requirement for ensuring research auditability and potential reproducibility. International literature has demonstrated growing concern regarding the so-called “reproducibility crisis,” characterized by the difficulty of replicating scientific studies across multiple fields of knowledge (Munafò *et al*., 2017). In patent landscape studies, this issue becomes particularly relevant due to the high sensitivity of analyses to methodological decisions related to search descriptors, consulted databases, applied filters, and classification systems.

The study conducted by Smith *et al*. (2017) represents one of the main international references in this debate by proposing a structured checklist for evaluating methodological transparency in patent landscape studies. The authors identified relatively low compliance levels across several essential criteria, particularly regarding the availability of analyzed datasets and the complete description of search strategies. These findings reinforce the need to strengthen more transparent methodological standards, especially within academic programs aimed at training specialists in innovation and intellectual property, such as PROFNIT.

METHODOLOGY

This study is characterized as a Systematic Literature Review (SLR), conducted with the objective of evaluating the transparency of methodological reporting and the elements that potentially favor reproducibility in technological prospecting dissertations based on patent documents developed within the Graduate Program in Intellectual Property and Technology Transfer for Innovation (PROFNIT). The research was conducted in accordance with the PRISMA 2020 guidelines for systematic reviews, aiming to ensure transparency, traceability, and potential replicability of the selection and analysis process of the documentary corpus. The methodological flow comprised the stages of identification, screening, eligibility, and inclusion of the selected dissertations. Data collection was carried out in two complementary stages. The primary source of information was the PROFNIT Institutional Repository, since it centralizes the academic production of the program’s Focal Points across the national network. Considering that the repository does not provide advanced search mechanisms with Boolean operators or refined retrieval filters, the

identification of studies was performed through manual navigation of the dissertation collections defended between 2016 and 2026. As a complementary strategy to verify coverage and mitigate potential indexing losses, an additional search was conducted in the CAPES Theses and Dissertations Catalog. For this stage, descriptors related to technological prospecting and patent analysis were combined using the Boolean operator OR, as follows: ("technological prospecting" OR "patent prospecting" OR "patent mapping" OR "prior art search" OR "patent landscape" OR "technological monitoring" OR "patent search"). The retrieval of records was conducted on January 20, 2026. Considering the indexing and display limitations of the platforms at the time of collection, the search strategy resulted in the recovery of dissertations potentially relevant to the scope of this review. For the composition of the analytical corpus, rigorous inclusion and exclusion criteria were established. The inclusion criteria considered exclusively professional master's dissertations approved within the PROFNIT program, available in full text, and necessarily containing structured technological prospecting or patent landscape studies based on patent documents. Conversely, studies were excluded when they: used patents only as occasional references; consisted exclusively of bibliographic reviews of scientific articles; addressed intellectual property management, regulatory frameworks, or technology transfer without effectively conducting patent prospecting; did not present a structured methodology for searching and analyzing patent documents; or were unavailable in full text due to institutional confidentiality or access restrictions.

The dissertation selection process was conducted in three sequential stages

Identification: consolidation of records retrieved from different databases and removal of duplicates;

Screening: reading of titles and abstracts for preliminary application of the inclusion and exclusion criteria, excluding studies clearly misaligned with the scope of the review;

Eligibility: full-text reading of the Methodology and Results and Discussion sections of the pre-selected dissertations to confirm the existence of structured patent technological prospecting studies and their relevance for methodological reporting evaluation. The complete selection flow was systematized in a PRISMA diagram, enabling visualization of the number of records identified, excluded, and included, as well as the justifications associated with exclusions at each stage of the process.

Table 1. Inclusion and Exclusion Criteria Applied in the Systematic Review

Category	Applied Criteria
InclusionCriteria	PROFNIT dissertations available in full text
	Studies containing technological prospecting based on patent documents
	Studiesdefendedbetween 2016 and 2026
	Research presenting a structured patent search methodology
ExclusionCriteria	Studies without structured technological prospecting
	Exclusivelybibliographic reviews
	Intellectual property studies without direct patent analysis
	Studies unavailable in full text
	Studies using patents only as secondary references

Source: Prepared by the authors.

For data extraction and evaluation, a structured methodological compliance checklist adapted from the protocol developed by Smith *et al*. was employed. The original instrument was designed to evaluate transparency in methodological reporting in international patent landscape studies. The original checklist consisted of 20 criteria. However, in order to adapt the instrument to the academic context of PROFNIT dissertations, specific methodological adjustments were implemented. The item concerning blind and independent validation of patent selection and extraction was removed, considering that the analyzed dissertations correspond to individual research projects conducted by master's students under academic supervision, making the requirement for additional independent evaluators impractical.

Furthermore, the item related to conflict of interest and funding disclosure was adapted to reflect the applied nature of the program's dissertations. Thus, the criterion evaluated whether the institutional stakeholder of the technological product resulting from the technological prospecting, company, public institution, association, or organization, was clearly identified in the dissertation. Accordingly, the final evaluation instrument consisted of 19 criteria organized into five main dimensions: Title and Abstract, Introduction, Methodology, Results, and Discussion.

Table 2. Structure of the Methodological Compliance Checklist

Section	EvaluationObjective
Titleand Abstract	Verify appropriate identification of the study and clarity of the summary
Introduction	Assess the explicit presentation of objectives and justifications
Methodology	Analyze transparency of patent search, data collection, and analysis
Results	Verify presentation of data, statistics, and availability of the corpus
Discussion	Assess analytical criticality, limitations, and stakeholder identification

Source: Prepared by the authors.

Data extraction was performed through full-text reading of each dissertation included in the sample. Each checklist criterion was evaluated dichotomously, assigning binary values: "Yes" when the item was explicitly present, and "No" when the information was not clearly identified in the text.

After the coding stage, the individual Compliance Index (CI) of each dissertation was calculated, representing the percentage of criteria fulfilled in relation to the total number of applicable checklist items.

$$CI = \frac{\sum \text{Fulfilled Items}}{19} \times 100$$

Where:

CI corresponds to the dissertation Compliance Index;

Σ Fulfilled Items represents the number of criteria classified as "Yes";

19 corresponds to the total number of evaluated criteria in the adapted instrument.

Subsequently, the data were consolidated into spreadsheets for descriptive quantitative analysis, enabling the calculation of: absolute and relative frequencies of criterion compliance; average compliance rates; identification of recurring weaknesses; and levels of methodological adherence among the analyzed studies.

The compliance criteria were grouped into four interpretative categories to facilitate analysis of methodological adherence patterns in the sample: "Excellence" (100% compliance), "High Compliance" (>80%), "Attention" (<80%), and "Critical Bottleneck" (<50%). This classification was used exclusively as an interpretative tool to support the visualization of methodological transparency and reproducibility levels among the analyzed dissertations.]

Finally, the results were interpreted in light of the international literature on patent landscape studies, methodological transparency, open science, and scientific reproducibility, enabling the identification of both strengths and recurring weaknesses in the analyzed dissertations.

Nevertheless, some limitations inherent to this study should be acknowledged. Data extraction and classification were conducted by a single researcher, which may introduce interpretative biases associated with documentary evaluation. Additionally, the existence of dissertations under institutional confidentiality and the structural indexing limitations of the PROFNIT institutional repository may have restricted the full retrieval of the program's academic production related to technological prospecting.

RESULTS AND DISCUSSION

The searches conducted in the selected databases, followed by the screening process, resulted in the final inclusion of 23 dissertations in this systematic review. The selection process was conducted in accordance with the PRISMA 2020 guidelines, ensuring transparency, traceability, and potential reproducibility in the composition of the analytical corpus. The identification stage began with the PROFNIT Institutional Repository, defined as the primary source due to its role in centralizing the academic production of the network's Focal Points. At the time of data collection, the repository contained 371 deposited works. Manual navigation through dissertations defended between 2016 and 2026 enabled the identification of 26 potentially relevant studies, of which 21 were fully accessible and five were unavailable due to institutional confidentiality or temporary access restrictions. As a complementary strategy to verify coverage and mitigate potential indexing losses, an additional search was conducted in the CAPES Theses and Dissertations Catalog using the same descriptors and Boolean operators previously defined. This stage resulted in the identification of 20 records potentially aligned with the research objective, of which 17 were retrieved in full text and three were unavailable due to confidentiality restrictions. The consolidation of both sources initially resulted in 38 retrieved records. After identifying and removing three duplicates, a total of 35 unique studies remained for the screening phase. Subsequently, titles and abstracts were reviewed, leading to the exclusion of eight dissertations that did not present structured technological prospecting studies based on patent documents or that used patents merely as ancillary references within broader bibliographic reviews. The remaining 27 studies advanced to the eligibility phase, characterized by a full-text review of the Methodology and Results and Discussion sections. At this stage, four dissertations were excluded because they did not effectively conduct a structured patent prospecting study, despite employing related terminology in the title or abstract. At the conclusion of the methodological refinement process, a final sample of 23 dissertations was defined, constituting the definitive corpus for data extraction and application of the methodological compliance checklist.

Table 3. Summary of the Sample Selection Process

Stage	Procedure	Numberof Records
Identification	Studies retrieved from the PROFNIT Repository	26
Identification	Studies retrieved from the CAPES Catalog	20
Initial total retrieved	Sum of identifiedrecords	38
Duplicateremoval	Repeatedrecordsacrossdatabases	-3
Screening	Unique studies submitted to title and abstract review	35
Exclusionsduringscreening	Studies outside the review scope	-8
Eligibility	Studies submitted to full-text review	27
Exclusionsduringeligibility	Studies without structured patent prospecting	-4
Final sample	Dissertations included in the analysis	23

Source: Prepared by the authors.

The characterization of the sample demonstrates the progressive consolidation of technological prospecting as a methodological instrument within PROFNIT. A significant increase in academic production was observed between 2020 and 2022, a period responsible for more than 85% of the dissertations included in the sample. The peak of production occurred in 2022, with eight defended dissertations, indicating the institutional maturation of the program and the growing incorporation of technological intelligence and intellectual property tools into the applied research developed by graduate students. From a geographical perspective, a significant diversity of Focal Points was identified within the sample. Although institutions such as UFAL and UNICENTRO concentrated a larger number of studies, the dissertations were distributed across different regions of Brazil, demonstrating the decentralization of technological prospecting activities and the national capillarity of PROFNIT as a network dedicated to education in intellectual property and technology transfer. Regarding thematic areas, a predominance of studies focused on Health, Biotechnology, and Assistive Technologies was identified, accounting for approximately 30% of the sample. In several cases, these fields were articulated with Information and Communication Technologies (ICTs), particularly in projects related to accessibility, remote monitoring, and cognitive support for neurodegenerative diseases. In addition, a significant presence of studies linked to agribusiness, environmental sustainability, and green technologies was observed, reflecting contemporary trends associated with innovation driven by social and environmental challenges. From a methodological standpoint, the dissertations demonstrated strong alignment with internationally consolidated practices in patent landscape studies. The use of the International Patent Classification (IPC) constituted the main structural axis of analytical strategies, frequently complemented by the Cooperative Patent Classification (CPC). This approach enabled the development of temporal, geographical, and competitive analyses, including the mapping of applicants, inventors, and emerging technological trends. The adoption of these instruments demonstrates the internalization of procedures recognized in the international literature on technological intelligence, particularly with regard to the organization of large volumes of patent documents and the transformation of technological information into strategic support for decision-making, competitive monitoring, and identification of innovation gaps. Additionally, a strong applied orientation was identified in the analyzed dissertations, particularly in the development of software, applications, technical manuals, and institutional regulations as technological products linked to the conducted prospecting studies. These products addressed concrete demands from public and private organizations, including municipalities, sectoral associations, startups, and industries, reinforcing the professional and technology transfer-oriented nature inherent to PROFNIT.

Table 4. General Characterization of the Dissertations Included in the Review

Analyzed Dimension	MainObservedResults
Period of highestconcentration	2020–2022
Year with the highest number of dissertations	2022
Main Focal Points	UFAL and UNICENTRO
Predominantthematicareas	Health, Biotechnology, ICTs, and Assistive Technologies
Other relevantsectors	Agribusiness and Green Technologies
Mainanalyticaltechniques	Temporal evolution, geographical analysis, mapping of applicants and inventors
Mainclassificationsused	IPC (predominant) and CPC
Most frequenttechnologicalproducts	Software, applications, technical manuals, and regulations
Main stakeholders	Municipal governments, startups, associations, and industries

Source: Prepared by the authors.

The application of the structured checklist to the 23 dissertations enabled the evaluation of the level of transparency in methodological reporting and the identification of compliance patterns across the different stages composing a patent technological prospecting study. Overall, the results revealed a high degree of adherence to criteria related to the structuring of patent information search and retrieval methodologies. Criteria associated with the definition of the databases used (C5), temporal delimitation (C6), specification of geographical scope (C7), screening criteria (C10), description of analytical methods (C12), presentation of descriptive statistics (C13), presentation of quantitative results (C15), and discussion of the main findings (C17) achieved full compliance, being addressed in 100% of the analyzed dissertations. These findings demonstrate that the program's students adequately master the fundamental stages of planning and executing technological prospecting studies, particularly regarding the structured retrieval of patent information and the analytical organization of the obtained results. The high level of compliance observed in these criteria indicates the consolidation of a relatively homogeneous methodological culture within the program, especially in the operational stages of prospective research. Furthermore, a high compliance rate was observed for the criterion related to the disclosure of the complete electronic search strategy (C9), present in approximately 96% of the sample. This finding is methodologically significant, since the explicit presentation of the search string constitutes one of the main elements favoring the auditability and potential reproducibility of technological prospecting studies. To a lesser extent, but still with high levels of compliance, the criteria related to the identification of software used in the analyses (C11) and the explicit identification of institutional stakeholders associated with the resulting technological products (C19) were both present in approximately 87% of the dissertations. These results suggest a growing concern among authors regarding the documentation of analytical instruments employed and the explicit presentation of organizational contexts associated with innovation demands.

Table 5. Levels of Compliance in Methodological Reporting Across the Dissertations (N = 23)

Compliance Level	EvaluatedCriteria	Compliance Rate
Excellence (100%)	C2, C3, C4, C5, C6, C7, C10, C12, C13, C15, and C17	100%
High Compliance (>80%)	C9	~96%
	C11 and C19	~87%
	C1 and C8	~83%
Attention (<80%)	C14	~78%
	C18	~57%
CriticalBottleneck (<50%)	C16	~43%

Source: Prepared by the authors.

Despite the high compliance observed in the search and analysis stages, the results revealed important weaknesses related to the transparency of raw data and the critical discussion of methodological limitations. The main bottleneck identified refers to criterion C16, associated with the availability of the final dataset or means of access to the analyzed patent corpus. Only approximately 43% of the dissertations provided complete lists of selected patents, documentary appendices, or supplementary links enabling consultation of the analyzed corpus. This result reveals a significant limitation from the perspective of open science and scientific reproducibility. Although the studies demonstrated rigor in data collection and treatment, the absence of sharing the final documentary corpus compromises the possibility of external validation of the conducted analyses. In technological prospecting studies, transparency regarding the patent corpus is particularly relevant, since small changes in the search strategy, applied filters, or exclusion criteria may substantially alter the obtained results and the strategic conclusions derived from the analysis.

Table 6. Main Methodological Weaknesses Identified in the Dissertations

IdentifiedWeakness	ObservedEvidence	PotentialScientificImpact
Absence of final dataset availability	Only ~43% provided the complete patent corpus	Reduced auditability and potential reproducibility
Limited discussion of methodological limitations	Only ~57% discussed biases and limitations	Weakening of criticalanalysis
Omission of method in the title	~17% did not identify the study as technological prospecting	Reducedscientificvisibility
Low standardization in data sharing	Absence of links and supplementary materials	Difficulty in externalvalidation
Excessive dependence on specific databases	Predominance of a few patent offices	Possibletechnologicalcoverage gaps

Source: Prepared by the authors.

Similarly, a low frequency of in-depth discussions concerning the methodological limitations of the conducted prospecting studies was identified (C18), being present in only approximately 57% of the dissertations. This finding suggests the predominance of approaches focused on the presentation of results and practical applications, to the detriment of critical reflections regarding potential biases in patent searches, limitations of the utilized databases, linguistic restrictions, incomplete coverage of patent offices, or possible losses associated with the selection of technological descriptors. This gap becomes particularly relevant in prospective studies, in which apparently discrete methodological decisions, such as the exclusion of technical synonyms, geographical scope limitations, or the isolated use of specific patent classifications, may directly affect the comprehensiveness and precision of the constructed technological landscape. Another relevant aspect concerns the scientific visibility and indexing of the dissertations. Although all analyzed abstracts adequately presented the objectives, methods, and main research findings (C2), approximately 17% of the studies did not explicitly indicate in the title that they were "Technological Prospecting," "Patent Landscape," or equivalent studies. This omission significantly reduces the capacity for automated retrieval in academic search engines, institutional repositories, and bibliographic databases, potentially limiting their reach, impact, and citation rates.

From a broader perspective, the results suggest that PROFNIT demonstrates a high level of operational maturity in conducting technological prospecting studies, particularly regarding the stages of patent search, classification, and analysis. Nevertheless, important challenges remain related to the institutionalization of practices associated with open science, data sharing, complete documentation of the analyzed corpus, and critical reflection on methodological limitations.

Table 6. Main Methodological Strengths Identified in the Sample

Positive Aspect	Compliance Evidence	Interpretation
Clarity of objectives	100% of dissertations	Strong scientificstructuring
Description of databases	100% of dissertations	Methodologicaltransparency
Definition of temporal scope	100% of dissertations	Consistentdelimitation
Well-definedscreeningcriteria	100% of dissertations	Robustselectionprocess
Description of analyticalmethods	100% of dissertations	Methodologicalmaturity
Disclosure of searchstrings	~96% of dissertations	High traceability
Identification of utilized software	~87% of dissertations	Operationaltransparency
Discussion of findings	100% of dissertations	Strong interpretativecapacity

Source: Prepared by the authors.

The results also demonstrate an important approximation between academic research and concrete demands from the productive sector. The high identification rate of institutional stakeholders associated with the resulting technological products (C19) demonstrates strong alignment between the dissertations and applied problems and real needs from public and private organizations, reinforcing the professional and technology transfer-oriented nature characteristic of PROFNIT. Nevertheless, the findings indicate the need to strengthen institutional guidelines aimed at establishing minimum standards for methodological reporting, particularly regarding dataset availability, supplementary material documentation, and the systematic incorporation of critical discussions concerning methodological limitations.

Table 7. Institutional Implications and Recommendations for PROFNIT

Review Finding	InstitutionalImplication	ProposedRecommendation
Lowdatasetavailability	Limitation to open science practices	Establish mandatory guidelines for appendices and supplementary materials
Lack of methodologicalstandardization	Heterogeneity in scientificreporting	Develop an institutional methodological manual
Absence of limitationdiscussions	Reducedscientificcriticality	Include a mandatory section in dissertation guidelines
Problems in indexing and retrieval	Reducedscientificimpact	Standardizetitlesandkeywords
Dependence on manual repository navigation	Difficulty in documentretrieval	Modernize the PROFNIT repository search system

Source: Prepared by the authors.

In summary, the results demonstrate that PROFNIT has achieved a high level of operational maturity in conducting patent technological prospecting studies, particularly in the stages of methodological planning, information retrieval, and quantitative analysis of patent data. However, weaknesses persist regarding transparency in data sharing, critical discussion of methodological limitations, and the broader incorporation of principles associated with open science and scientific reproducibility.

Table 8 . Interpretative Synthesis of the Systematic Review Results

Evaluated Dimension	ObservedSituation	MaturityLevel
Methodologicalplanning	High compliance	High
Patentinformationretrieval	Highlystructured	High
Transparency of methodologicalreporting	Consistent	High
Data sharing	Limited	Low
Criticaldiscussion of limitations	Partial	Moderate
Adherenceto open science	Still incipient	Low
Reproducibilitypotential	Partiallysupported	Moderate
Integrationwithmarketdemands	Very high	High

Source: Prepared by the authors.

FINAL CONSIDERATIONS

This study analyzed the methodological transparency and reproducibility elements present in patent-based technological prospecting dissertations developed within PROFNIT between 2016 and 2026. Through a Systematic Literature Review conducted according to PRISMA 2020 guidelines, it was possible to identify both methodological strengths and recurring weaknesses in the scientific reporting of the analyzed studies. The results demonstrated that the dissertations present a high level of operational maturity in the execution of patent landscape studies, particularly regarding search strategy design, patent data collection, analytical procedures, and presentation of quantitative results. The widespread use of IPC and CPC classifications, combined with temporal, geographic, and competitive analyses, indicates alignment with internationally recognized practices in technological intelligence and patent analytics. At the same time, the findings revealed important limitations associated with methodological transparency and scientific reproducibility. The low availability of complete patent datasets, the absence of supplementary materials, and the limited discussion of methodological constraints represent significant barriers to external validation and replication of the studies. These aspects become especially relevant in patent prospecting research, where small variations in search strategies and filtering procedures may substantially affect the resulting technological panorama. The study also highlighted the strong applied orientation of PROFNIT dissertations, particularly their connection with real demands from public institutions, companies, startups, and associations. This characteristic reinforces the professional and technology-transfer-oriented nature of the program and demonstrates the strategic role of patent prospecting as a tool to support innovation and decision-making processes.

From an institutional perspective, the results suggest the need for strengthening methodological standardization practices within the program, including guidelines for dataset sharing, supplementary materials, reporting standards, and critical discussion of methodological limitations. Initiatives aligned with open science and reproducibility principles may contribute to increasing the scientific visibility, reliability, and international impact of future studies developed within PROFNIT. Finally, it is important to recognize some limitations of the present review. The data extraction and classification procedures were conducted by a single researcher, which may introduce interpretative bias. In addition, institutional confidentiality restrictions and limitations in repository indexing may have prevented the retrieval of all potentially relevant dissertations. Future studies may expand the scope of analysis by including comparative evaluations with other graduate programs, international patent landscape studies, and additional indicators related to open science and research reproducibility.

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