

BIOTECHNOLOGY PATENTS AND PATENT INTELLIGENCE IN THE AMAZON BIOECONOMY: AN INTEGRATIVE NARRATIVE LITERATURE REVIEW

PATENTES DE BIOTECNOLOGIA E INTELIGÊNCIA PATENTÁRIA NA BIOECONOMIA AMAZÔNICA: UMA REVISÃO NARRATIVA INTEGRATIVA DA LITERATURA

PATENTES DE BIOTECNOLOGÍA E INTELIGENCIA PATENTARIA EN LA BIOECONOMÍA AMAZÓNICA: UNA REVISIÓN NARRATIVA INTEGRATIVA DE LA LITERATURA

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ABSTRACT

In this integrative narrative review, with an analytical-critical orientation, we examine how patent information in biotechnology can leverage the Amazon bioeconomy. Three axes are integrated: the technical-legal foundations of patentability and compliance (IPL; SisGen; IN 118/2020; INPI/CPAPD Technical Note 01/2023; WIPO ST.26; WIPO Treaty 2024); methods and best practices for patent landscaping; and an applied analysis of the guaraná, açaí, and copaíba value chains. The findings show that the systematic use of patents—combined with IPC/CPC classifications, family-based analysis, and claim interpretation—enhances technological diagnostics and reduces search biases. Opportunities emerge in bioactives, bioprocesses, functional ingredients, and nanoformulations, conditioned by governance of access and benefit-sharing and by rules regarding digital sequence information. It is concluded that institutionalizing patent intelligence within the R&D&I cycle is essential for transforming biodiversity into responsible innovation, strengthening regional capacities, and avoiding rework.

Keywords: Patents. Amazon Bioeconomy. Biotechnology. Patent Intelligence. Genetic Resources.

RESUMO

Nesta revisão narrativa integrativa, de caráter analítico-crítico, examinamos como a informação patentária em biotecnologia pode alavancar a bioeconomia amazônica. Integram-se três eixos: fundamentos técnico-jurídicos de patenteabilidade e conformidade (LPI; SisGen; IN 118/2020; Nota Técnica INPI/CPAPD 01/2023; WIPO ST.26; Tratado OMPI

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2024); método e boas práticas de panorama patentário; e uma leitura aplicada a cadeias de guaraná, açaí e copaíba. Evidencia-se que o uso sistemático de patentes, combinado a IPC/CPC, análise por famílias e leitura de reivindicações, qualifica o diagnóstico tecnológico e reduz vieses de busca. Oportunidades emergem em bioativos, bioprocessos, ingredientes funcionais e nanoformulações, condicionadas à governança de acesso e repartição de benefícios e às regras sobre informações de sequência digital. Conclui-se que institucionalizar a inteligência patentária no ciclo de P&D&I é condição para transformar biodiversidade em inovação responsável, fortalecer capacidades regionais e evitar retrabalhos.

Palavras-chave: Patentes. Bioeconomia Amazônica. Biotecnologia. Inteligência Patentária. Patrimônio Genético.

RESUMEN

En esta revisión narrativa integrativa, de carácter analítico-crítico, examinamos cómo la información patentaria en biotecnología puede impulsar la bioeconomía amazónica. Se integran tres ejes: los fundamentos técnico-jurídicos de patentabilidad y conformidad (LPI; SisGen; IN 118/2020; Nota Técnica INPI/CPAPD 01/2023; WIPO ST.26; Tratado OMPI 2024); el método y las buenas prácticas para la elaboración de panoramas patentarios; y una lectura aplicada a las cadenas de valor de guaraná, açaí y copaíba. Se evidencia que el uso sistemático de patentes—combinado con IPC/CPC, análisis por familias y lectura de reivindicaciones—califica el diagnóstico tecnológico y reduce sesgos de búsqueda. Surgen oportunidades en bioactivos, bioprocesos, ingredientes funcionales y nanoformulaciones, condicionadas a la gobernanza de acceso y reparto de beneficios y a las reglas sobre información de secuencias digitales. Se concluye que institucionalizar la inteligencia patentaria en el ciclo de I+D+I es condición para transformar la biodiversidad en innovación responsable, fortalecer capacidades regionales y evitar retrabajos.

Palabras clave: Patentes. Bioeconomía Amazónica. Biotecnología. Inteligencia Patentaria. Patrimonio Genético.

1 INTRODUCTION

The bioeconomy has been consolidated, in recent decades, as a strategic framework to articulate life sciences, biological processes and renewable raw materials in response to global challenges, with monitoring by economic, social and environmental indicators in official systems of the European Commission, through the Joint Research Centre (EUROPEAN COMMISSION; JOINT RESEARCH CENTRE, 2024). In

In Brazil, the agenda has gained density with studies by the National Confederation of Industry and recent policies that reposition the bioeconomy as a vector of decarbonization and innovation based on biodiversity (CNI, 2020). For the Amazon, the scenario is no longer propositional and has become effective instruments: Decree No. 12,044/2024 instituted the National Bioeconomy Strategy and determined the preparation of the National Bioeconomy Development Plan. In this context, the Financier of Studies and Projects (Finep) launched the call 'Finep Amazônia – Bioeconomy and Regional Development' (BRASIL, 2024; FINEP, 2024).

In parallel, global indicators show an increase in the use of the patent system and relevant geographic displacements, reinforcing technological competition (WIPO, 2024a). In 2024, Member States approved a treaty that makes it mandatory to disclose the origin of genetic resources and associated traditional knowledge in patent applications, changing expectations for compliance in sociobiodiversity-related research (WIPO, 2024b). For biotechnology, the adoption of WIPO ST.26 has imposed, since July 1, 2022, the filing of XML sequence listings with specific redaction, numbering, and search rules, with direct implications for prospecting, writing, and examination (WIPO, 2022; INPI, 2022).

In Brazil, there is still low appropriation of patent documents as an informational source: in 556 theses and dissertations in the health area, only 2.87% cited patents (PIMENTA, 2017); in a convergent way, a recent survey in Engineering I indicates that about 33% of researchers use patent databases and more than 65% do so mainly to verify the possibility of patenting, not to guide research (GRUNEVALD, 2024).

This work integrates foundations, methods and evidence to transform patent literature into actionable intelligence for Research, Development and Innovation, partnerships and policies, applying it to chains such as guarana (*Paullinia cupana*), açaí (*Euterpe spp.*) and copaiba (*Copaifera spp.*).

1.1 FUNDAMENTALS AND REGULATORY FRAMEWORK

The governance of biotechnology research depends less on the letter of the law and more on how compliance is operationalized. In practice, disclosure of origin, regularity in SisGen, and traceability of Digital Sequence Information (DSI) shift management from the declaratory plan to the evidentiary plan, recommending checklists and evidence records from conception so that Access and Benefit-Sharing (ABS), DSI, and WIPO ST.26 do not become late barriers to filing and transfer.

Industrial Property Law (LPI), Law No. 9,279/1996: Article 10 establishes that discoveries, literary, artistic, and scientific works, presentations of information, computer programs themselves, and methods of surgical, therapeutic, or diagnostic treatment are not considered inventions, among others; Article 18, III prohibits the patenting of living beings, except for transgenic microorganisms that meet legal requirements (BRASIL, 1996, arts. 10; 18, III). IN INPI/PR No. 118/2020 details novelty, inventive step, and descriptive sufficiency in biotechnology; INPI/CPAPD Technical Note No. 01/2023 harmonizes the understanding of transgenic plants and "elite events". Since July 1st. 2022, applications with sequence require XML listing according to WIPO ST.26, via WIPO Sequence (INPI, 2022; WIPO, 2022). In research with genetic heritage or associated traditional knowledge, SisGen (Law No. 13,123/2015; Decree No. 8,772/2016) and the automatic requirement of regularity by the BPTO are decisive. At the international level, DSI advances in a multilateral mechanism (CBD, 2024), and the 2024 WIPO Treaty imposes disclosure of origin (WIPO, 2024b).

2 MATERIALS AND METHODS

An integrative narrative review with an analytical-critical emphasis was adopted, according to methodological references (MENDES; SCOTT; GALVÃO, 2008; ROTHER, 2007; DIXON-WOODS et al., 2006). Legal documents, international standards, sectoral studies and recent scientific literature were integrated.

This was followed by good patent landscape practices: scope delimitation; searches by keywords and IPC/CPC classes; analysis by families (INPADOC); mapping of actors/jurisdictions; qualitative reading of claims (WIPO, 2015; VAN RIJN; TIMMIS, 2023). Retrieval techniques with natural language processing (NLP) were considered to mitigate biases (ALI et al., 2024). Integrating SisGen conditions and LPI guidelines, in addition to IN 118/2020, Technical Note INPI/CPAPD 01/2023 and the guidelines on WIPO ST.26 (INPI, 2020, 2022, 2023).

3 FINDINGS

Trends and patterns: global filing intensification and geographic displacement; source disclosure tends to reconfigure R&D&I and due diligence routines; WIPO ST.26 normalized listings and impacted redaction, examination, and search (WIPO, 2024a, 2024b, 2022; INPI, 2022).

National diagnosis: low use of patents in academia indicates surveillance gaps and risk of rework; sectoral studies point to potential in bioprocesses, ingredients and bioinputs (PIMENTA, 2017; CNI, 2020; GRUNEVALD, 2024).

Applications in prisons: guarana — interest in functional formulations and processes with sustained claims (TALIK; ZARÓW; BUČKO, 2024); açai — lipids, polyphenols, and the use of by-products (seeds) for ingredients and functional materials (SANTOS et al., 2024); copaiba — advancement in nanoformulations and toxicological evaluation with a focus on release and safety (BEZERRA et al., 2024).

Regulatory implications: requirement of regularity in SisGen focuses on writing and exam; DSI and disclosure of origin increase traceability (BRASIL, 2015; BRAZIL, 2016; CBD, 2024; WIPO, 2024b).

Interpretative reading: The densification reduces space for research outside the Patent Cooperation Treaty (PCT) and makes Freedom to Operate (FTO) and jurisdictional choices central; consortium arrangements are recommended to scale search, redaction and filing.

Compliance: It's not bureaucracy, but alignment between science, protection, and apportionment; each project must provide for a due diligence plan that synchronizes schedules, regulatory deadlines, and optimal filing windows.

4 DISCUSSION

Patent intelligence is risk governance, when it enters the R&D&I cycle early and dialogues with ABS, DSI and WIPO ST.26, it reduces rework and increases predictability of publication, partnership and licensing. Compliance is opportunity cost: the initial learning curve (e.g., ST.26) reduces rejections and uncertainty down the line. For Amazonian chains, we advocate portfolios that combine areas of technological concentration (hotspots) and white spaces (white spaces), in guarana, functional formulations and stabilization; in açai, waste valuation and microencapsulation; in copaiba, controlled release and toxicological safety. Institutionally, we propose: minimum prospecting protocols by family/classes,

integration between data management–SisGen–legal before the bench, and continuing education in ST.26 drafting and compliance.

5 FINAL CONSIDERATIONS

Patents are public knowledge infrastructures that, when handled with method and responsibility, raise the quality of choices in science and innovation. To convert biodiversity into responsible innovation and expand technological autonomy, it is recommended: i) to institutionalize surveillance routines integrating IPC/CPC, families and legal events; ii) couple ABS, DSI and WIPO ST.26 from the design of the project; iii) prioritize agendas that combine areas of technological concentration and white spaces in guaraná, açaí and copaiba; iv) measure results not only by deposits, but by partnerships, licenses and benefit sharing effectively implemented.

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