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Geographical Indication as a Strategic Tool for Valuing Family Farming in Brazil: A Technological Prospecting Study of Digital Programs

Indicação Geográfica como Ferramenta Estratégica para Valorização da Agricultura Familiar no Brasil: uma prospecção tecnológica de programas digitais

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Abstract

This exploratory and applied research investigates Geographical Indication (GI) as a strategic tool to enhance family farming in Brazil, a crucial sector for the economy and food production. Given the relevance of GIs and the challenges facing family farming, such as low competitiveness, little access to certification and a lack of digital tools, the study sought to analyze existing computer programs that support GIs. The mixed methodology, with technological prospecting at the INPI, revealed the existence of various agricultural management software programs, but a clear technological gap in solutions that efficiently integrate family farming management with GI processes. No programs were found that link these two spheres in a satisfactory way. This absence points to an opportunity to develop innovative tools. In the future, applied studies with cooperatives are suggested to validate system requirements.

Keywords: Geographical Indications; Family Farming; Computer Programs.

Resumo

Esta pesquisa exploratória e aplicada investiga a Indicação Geográfica (IG) como ferramenta estratégica para valorizar a agricultura familiar no Brasil, setor crucial para a economia e a produção de alimentos. Diante da relevância da IG e dos desafios da agricultura familiar, seja a baixa competitividade, pouco acesso à certificação e a carência de ferramentas digitais, o estudo buscou analisar programas de computador existentes que suportam IGs. A metodologia mista, com prospecção tecnológica no INPI, revelou a existência de diversos softwares de gestão agrícola, mas uma clara lacuna tecnológica em soluções que integrem eficientemente a gestão da agricultura familiar com os processos de IG. Não foram encontrados programas que unam essas duas esferas de forma satisfatória. Essa ausência aponta para uma oportunidade de desenvolvimento de ferramentas inovadoras. Sugere-se que futuramente sejam realizados estudos aplicados com cooperativas para validar requisitos de sistemas.

Palavras-chave: Indicações Geográficas; Agricultura Familiar; Programas de Computador.

Technological Areas: Technology and Innovation, Intellectual Property, and Software Development.

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1 Introduction

This article proposes an in-depth study of Geographical Indications (GIs) as a strategic tool for enhancing the value of family farming in Brazil. The relevance of this topic stems from the growing need to discuss and implement mechanisms capable of promoting the competitiveness and sustainability of this important productive sector in the face of challenges related to market access and product valorization.

Family farming in Brazil accounts for an impressive 77% of all rural establishments, a figure that rises to 79% in the Northeast Region, underscoring its essential role in food production, income generation, and regional socioeconomic development (IBGE, 2019). Despite its significance, however, family farming faces substantial challenges, including limited competitiveness in a globalized market, restricted access to certification processes such as Geographical Indications (GIs), and a lack of adequate digital tools to support management and organizational activities.

Within this context, GIs emerge as a highly effective strategy for adding value to products and territories by providing differentiation, recognition, and enhanced market value. Based on this premise, the present study proposes to investigate the existence of software specifically designed for family farming, with a primary focus on data organization, traceability, and mapping, with the objective of facilitating and democratizing access to GI certification. Consequently, it becomes evident that this topic deserves discussion from both technological and legal perspectives, giving rise to the central research question that guides this study: To what extent do software solutions currently available in the Brazilian market provide integrated and effective support for the strategic application of Geographical Indications (GIs) in enhancing the value of family farming?

Based on this research problem, the general objective of the study is to analyze which software solutions available in the Brazilian market provide integrated and satisfactory support for the strategic application of GIs in the valorization of family farming. To achieve this overarching objective, the study was structured around the following specific objectives: defining relevant keywords for the identification of GIs related to family farming; conducting a survey of GI registrations at the Brazilian National Institute of Industrial Property (INPI) based on the selected keywords; analyzing the correspondence between the identified registrations and the research object; and, finally, assessing the degree of similarity between the identified registrations and the characteristics of the family farming context under investigation. Therefore, in order to provide both a fundamental and comprehensive understanding of Geographical Indications and family farming, it is also necessary to establish the key concepts underlying these themes within the scope of the present study.

1.1 Geographical Indications (GIs)

Geographical Indications (GIs) are recognized as an intellectual property instrument intended to identify the geographical origin of a product or service. This identification is intrinsically linked to the qualities, characteristics, or reputation of the product, which are essentially attributable to its place of origin. As highlighted by the World Intellectual Property Organization (WIPO, 2021), GIs are distinctive signs used on products that possess a specific geographical origin and qualities or a reputation attributable to that origin.

In Brazil, Geographical Indications are intended to distinguish the geographical origin of a particular product or service. Historically, the practice of distinguishing products according to their geographical origin dates back centuries, when producers and consumers recognized that certain qualities were associated with specific locations, leading to the designation of products by names that reflected their place of origin (INPI, 2021).

The legal basis for GIs in Brazil is established by Law No. 9,279 of May 14, 1996, which regulates rights and obligations related to industrial property. Internationally, GI protection is reinforced through agreements such as the Paris Convention for the Protection of Industrial Property (Paris Convention) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which establish minimum standards for intellectual property protection (WIPO, 2021).

Geographical Indications are divided into two categories. The first is the Indication of Source (IP), which refers to a geographical name, such as a country, city, region, or locality, that has become renowned as a center for the extraction, production, manufacture of a product, or the provision of a service. Evidence demonstrating that the geographical name has achieved such recognition must be supported by multiple sources (INPI, 2021).

The second category is the Designation of Origin (DO), which refers to a geographical name identifying a product or service whose qualities or characteristics are due exclusively or essentially to its geographical environment. This includes both natural factors, such as soil, topography, climate, flora, and fauna, and human factors, including local know-how, traditions, and production techniques. For the registration of a DO, it is essential to demonstrate the influence of both natural and human factors on the characteristics of the product or service (INPI, 2021).

The benefits associated with the implementation of a GI are numerous and encompass economic, social, and cultural dimensions. GIs function as market differentiation tools, enabling consumers to associate a specific level of quality with the geographical origin of a product (FAO, 2018, p. 5). Furthermore, they contribute to rural development by generating additional value for regional producers and fostering local job creation, which may help reduce rural outmigration. GIs also promote the development of a regional brand identity and generate important secondary effects in sectors such as tourism and gastronomy (WIPO, 2021).

As collective assets, GIs require coordinated action and structured organization to achieve success. Their management involves the establishment of a set of rules and standards, often formalized in a **technical specification document**, which describes production and processing methods as well as the geographical area concerned (INPI, 2021). Legal protection of GIs also helps prevent the unauthorized use of geographical names and the proliferation of imitations, thereby safeguarding the reputation and value of the protected product (Janin; Perron, 2020).

1.2 Family Farming

Family farming is a fundamental production system in Brazil, characterized by property management and the majority of labor being concentrated within the family unit. This system extends beyond the mere use of family labor in agricultural production, functioning as a mechanism of social reproduction that, through family and individual strategies, is directly associated with the transmission of both material and cultural heritage (Savoldi & Cunha, 2010). As such, it plays a crucial role in national food security and employment generation (Aquino; Alves, & Vidal, 2020, p. 64).

Data from the 2017 Agricultural Census, compiled in the *Atlas of Rural Brazil*, highlight the importance of family farming in the country. In 2017, family farming accounted for 77% of all rural establishments in Brazil, occupied 23% of the total agricultural area, and contributed 23% of the national agricultural production value (IBGE, 2020). In the Northeast Region, this participation was even more significant, representing 79.2% of agricultural establishments and employing more than 4.7 million people in 2017.

The recognition of family farming in Brazil is a relatively recent phenomenon, gaining national prominence from the 1990s onward. This process was driven by renewed academic interest in the subject, the resurgence of social and labor movements, and the role of the State in developing specific public policies (Delgado & Bergamasco, 2017). The National Program for Strengthening Family Farming (PRONAF) is an example of such policies, representing, for many, the social and political recognition of family farmers by the federal government. Likewise, the principles established by the 1988 Federal Constitution played a fundamental role by promoting the decentralization of public policies and encouraging civil society participation in their formulation.

Despite its importance, Brazilian family farming is characterized by considerable heterogeneity and faces numerous challenges (Menezes & Alves, 2024). Structural obstacles include land concentration, limited access to resources and efficient technologies, and insufficient technical assistance, with more than 90% of family farmers in the Northeast receiving no technical guidance in 2017. Additional challenges stem from the impacts of severe climatic events, such as the prolonged drought that affected the region between 2012 and 2017 (Aquino; Alves & Vidal, 2020).

Pluriactivity, defined as the supplementation of household income through non-agricultural activities and social programs, has become an increasingly common strategy, particularly among less-capitalized family farmers (Fossá & Renk, 2021). Furthermore, Law No. 11,326/2006 formally established the National Policy for Family Farming and Rural Family Enterprises, defining the criteria for classifying a family farmer, including limits on property size (up to four fiscal modules) and the requirement that at least half of the labor force be provided by family members (Brazil, 2017). These measures have contributed to strengthening the identity and institutional recognition of family farming in Brazil.

1.3 Intersection between Geographical Indications and Family Farming

The intersection between Geographical Indications (GIs) and family farming represents a promising pathway toward sustainable rural development. By enhancing the value of products whose qualities are linked to their origin and local know-how, GIs can directly benefit family farmers, who often preserve unique traditions and production practices. The effective participation of producers constitutes the foundation of local GI development initiatives. Collective organization, frequently through associations and cooperatives, is a decisive factor in the success of a GI (MAPA, 2021).

Law No. 13,806/2019 granted cooperatives the possibility of acting as procedural representatives, provided that specific legal requirements are met. Associations, trade unions, and other representative entities are likewise recognized as qualified procedural representatives for filing GI registration applications with the Brazilian National Institute of Industrial Property (INPI) (INPI, 2021, pp. 51–53).

However, an important challenge lies in balancing the inclusion of small-scale producers with the economic success of an exclusive quality-based strategy. Small producers may be excluded if they are unable to comply with the GI specifications, either because their production practices differ from the established standards or because their baseline quality levels do not meet the expectations associated with a recognized quality product. Therefore, GI specifications should acknowledge local practices and the fundamental role played by traditional and small-scale farmers. Technical assistance programs can support these producers by helping them improve their production practices and achieve compliance with GI requirements (FAO, 2018).

1.4 Technology and Innovation in the Rural and Agricultural Context

A Technology has assumed a central role in the modernization of the agricultural sector, promoting advances in production, management, and product traceability. However, the reality of Brazilian family farming is still marked by limited access to effective technologies, which undermines its competitiveness and its ability to engage strategically in the marketplace (Delgado & Bergamasco, 2017). Overcoming this challenge requires not only the introduction of technical innovations but also the development of digital solutions that respect the cultural and socioeconomic specificities of rural communities.

Geographical Indications (GIs) constitute powerful instruments for territorial development because they enhance the value of local knowledge, cultural ties, and the distinctive productive characteristics of a given region. The establishment of a GI, however, requires the mobilization of multiple stakeholders and the completion of several stages, including historical documentation, territorial delimitation, preparation of technical specifications, and institutional coordination. In this context, technological innovation can provide strategic support by making the process more agile, participatory, and accessible (FAO, 2018).

The development of dedicated software solutions aimed at supporting the establishment of GIs represents a concrete opportunity for innovation tailored to family farming. Digital tools can assist in the geographic mapping of production areas, the registration of participating producers, the systematization of historical and cultural information, and the collaborative development of technical specification documents. Furthermore, educational features designed with clear and accessible language can strengthen the autonomy of local producers and facilitate interaction with certification bodies.

It is essential, however, that such technologies be developed through participatory methodologies that take into account rural realities, connectivity limitations, and the existing levels of digital literacy among users. In this sense, innovation is not merely about creating new tools but about adapting them to the ways of life and collective organizational structures of family farmers. Therefore, the use of software to support the implementation of GIs represents not only a technological advancement but also a strategy for productive inclusion and territorial valorization.

2 Methodology

With regard to the methodology employed, this study is classified as applied research with an exploratory character, adopting a mixed-methods approach that integrates both qualitative and quantitative elements and follows a deductive method. The investigation is grounded in a solid theoretical framework concerning the relevance of Geographical Indications (GIs) for family farming and seeks to analyze software solutions currently available in Brazil that support the mapping, certification, and management of GIs. The quantitative component focuses on the identification and categorization of existing market solutions, whereas the qualitative component is dedicated to the critical assessment of the extent to which these tools address the specific needs of Brazilian family farming. The study was structured into four distinct stages, ensuring a rigorous and comprehensive research process.

During the preparatory phase, the central objective of the research was defined as verifying the existence of software solutions specifically designed to support Geographical Indications for family farming in Brazil. The scope of the study was limited to Brazilian family farming, with an initial focus on the Northeast Region. To achieve this objective, technological prospecting was selected as the primary methodological technique, given its suitability for identifying and analyzing existing technological solutions.

The pre-prospective stage focused on defining the most relevant keywords for the search process. The primary sources consulted included the Brazilian National Institute of Industrial Property (INPI), the Brazilian Institute of Geography and Statistics (IBGE), and the World Intellectual Property Organization (WIPO). The search strategy involved combining terms related to Geographical Indications, family farming, and software applications in order to encompass a broad range of potential solutions.

The prospective phase consisted of applying data collection and analysis techniques. An in-depth search was conducted within the INPI software registration database using 12 carefully selected keywords designed to investigate the relationship between Geographical Indications and family farming. The keywords employed were: “Geographical Indication,” “GI,” “Family Farming,” “Indication of Source,” “Designation of Origin,” “Small

Producers," "Rural Product Origin Management," "GI Certification," "Family Farming Traceability System," "Family Farming Georeferencing," "Agricultural Cooperatives GI," and "Precision Agriculture."

The search within the INPI database focused on software titles and employed different search modes, including exact phrase, all words, approximate word, and any word searches. After potentially relevant results had been identified, a secondary analysis was conducted using Google to verify the actual relevance of each software solution to the research objective, ensuring that only genuinely pertinent technologies were included. Subsequently, the collected information was tabulated and analyzed, culminating in the preparation of the present article and the figures that summarize its findings.

3 Resuls and Discussion

Technological prospecting, a fundamental stage for understanding the landscape of existing software solutions, revealed a vast universe of 24,452 registered programs, of which 150 exhibited some degree of similarity to the scope of this study. The categorization of these records according to the selected keywords can be examined as illustrated in Graph 1 and Table 1.

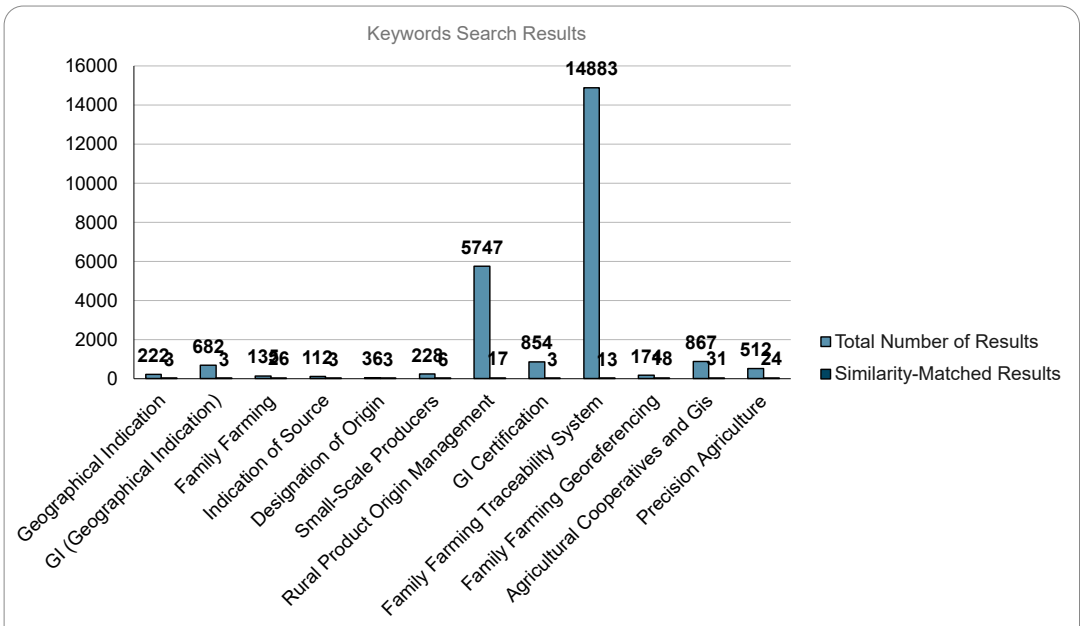
Complementarily, Table 1 presents a comparative analysis of the keywords and the results exhibiting the highest degree of similarity, enabling the identification of recurring patterns of thematic association.

The analyzed data illustrate the distribution of these records, revealing significant variation in the volume of results associated with each keyword. Terms such as "Agricultural Cooperatives and GIs" (31 records), "Family Farming" (26 records), "Precision Agriculture" (24 records), "Family Farming Georeferencing" (18 records), and "Rural Product Origin Management" (17 records) showed the highest incidence. In contrast, keywords directly related to Geographical Indications, such as "Geographical Indication," "GI," "Indication of Source," and "Designation of Origin," yielded only three records each.

This initial discrepancy already suggests a potential imbalance in the availability of technological solutions between general agricultural management applications and those specifically designed for Geographical Indications (GIs). It indicates that, although agricultural technology is a growing field, development efforts have primarily focused on functionalities related to production efficiency, traceability, and commercialization, rather than on the more complex institutional demands associated with the recognition, valorization, and monitoring of GI-certified products.

The segmented analysis, which isolated searches restricted to "Geographical Indication" or "GI" while excluding terms related to family farming, further confirmed the scarcity of dedicated solutions. The few records identified, such as "Geographical Indication Traceability Program (IGFB 10) for Bragança Flour" and "IG Brasil: Geographical Indications," suggest that existing systems mentioning GIs tend to be highly specialized. In general, they focus either on the traceability of products already certified under a GI scheme or on the dissemination of institutional and educational information related to the subject.

Graph 1 – Search Results by Keyword Across Different Access Platforms



Source: Prepared by the authors (2025)

Table 1 – Comparative Analysis of Keywords and Similarity-Based Results

Keyword	Listed Records
1.Geographical Indication	3
2.GI (Geographical Indication)	3
3.Family Farming	26
4.Indication of Source	3
5.Designation of Origin	3
6.Small-Scale Producers	6
7.Rural Product Origin Management	17
8.GI Certification	3
9.Family Farming Traceability System	13
10.Family Farming Georeferencing	18
11.Agricultural Cooperatives and GIs	31
12.Precision Agriculture	24

Source: Prepared by the authors (2025)

This finding is particularly relevant because it highlights a critical gap: the absence of comprehensive digital platforms capable of providing integrated support for the creation, management, and promotion of new GIs. The lifecycle of a GI, encompassing territorial mapping, development of usage regulations, governance structuring, traceability mechanisms, and market integration, requires tools capable of continuously monitoring production practices, social control mechanisms, and compliance with the technical and legal criteria required for certification. The currently available systems do not appear to address these functions in a comprehensive manner.

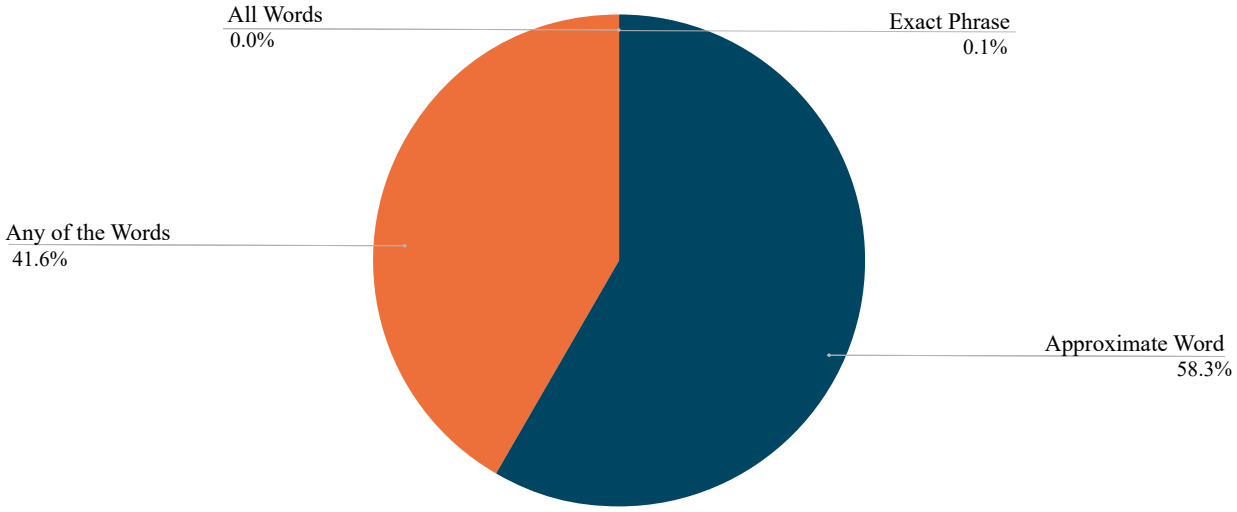
The limited scope of existing software solutions, including less prominent examples such as "IG MANEJO" and "Geographical Indication – INFORME," reinforces the perception that technology has not yet approached the GI lifecycle from a systemic perspective, nor adequately addressed its complex cultural, social, and economic dimensions that characterize territories of origin. In contrast, when the technological prospecting focused on terms such as "Family Farming," "Precision Agriculture," or "Agricultural Cooperatives," combined with keywords such as "Management," "Georeferencing," or "Traceability," while deliberately excluding GI-related terms, a considerably more robust ecosystem of software applications emerged, displaying substantial functional diversity.

The prevalence of systems related to rural management and traceability demonstrates that significant investments have been directed toward this segment, reflecting a higher level of technological maturity. Examples such as "Management and Project Development System for Family Farming Cooperatives," "GeAgriFam," "AgroCloud," and "Conecta Produtor" demonstrate the existence of a consolidated technological infrastructure capable of addressing the operational needs of family farming. These solutions provide functionalities for production control, commercialization, logistics management, and agronomic decision-making, establishing themselves as important tools for farmer organization and integration into value chains.

The high incidence of software designed to support property management and precision agriculture decision-making clearly demonstrates the alignment of technological development with field-level agricultural practices. These solutions commonly feature user-friendly interfaces, modular architectures, and, in many cases, compatibility with mobile devices and Internet of Things (IoT) sensors. This finding is strategically important because it suggests the existence of a technical foundation that could be expanded or adapted to incorporate GI-related functionalities. Solutions such as "Syscaf – Family Farming Call Management System" and modules of the "Regional Information System for Family Farming in Northeast Brazil (SIRAF-NE)" reinforce this perspective by functioning as information-sharing and territorial decision-support networks, directly aligning with the governance processes required for Geographical Indications.

The analysis of result distribution by search type, as illustrated in Figure 2, reveals that most findings originated from "approximate word" or "any word" searches. This indicates that many software applications address central themes such as origin, traceability, and quality, yet do not explicitly employ GI-specific terminology.

Graph 2 – Search Results by Search Type in Relation to the Keyword or Key Phrase



Source: Prepared by the authors (2025)

This suggests a limitation in both language and conceptual scope among the available systems. The absence of terms such as "Designation of Origin," "GI Registration," or "GI Producer Organization" in software titles and descriptions, even among solutions that could theoretically address such needs, reflects a disconnect between technology developers and the normative and institutional framework governing Geographical Indications.

Another relevant finding is the clear trend toward the development of mobile applications targeted at family farming, such as "Conecta Produtor" and "IoT Vertical Farm Manager." This mobility is strategically important given the decentralized nature of family farming enterprises, which are often located in regions with limited connectivity. The availability of solutions compatible with offline environments and low-cost devices is essential to ensuring inclusive access to digital technologies. Nevertheless, despite this promising scenario, search attempts combining the categories "Geographical Indication/GI" and "Family Farming/Agricultural Management" did not yield satisfactory results. In other words, no solutions were identified whose core architecture offered a value proposition capable of functionally and comprehensively integrating the processes required for a GI with the socioeconomic specificities of family farming.

This strategic gap represents more than the mere absence of tools; it constitutes a critical opportunity for digital innovation in Brazil. The development of software capable of integrating functionalities such as participatory mapping, technical specification development, governance management, traceability, and commercial promotion within a single platform could transform the way GIs are established, monitored, and communicated. Such tools have the potential to strengthen the territorial identity of family farming products, expand their access to markets, and promote sustainable local development. Consequently, this area emerges as a promising field for applied research and technological development, with the potential to directly influence public policies, development programs, and innovation initiatives aimed at strengthening the socio-biodiversity economy. Furthermore, the integration of existing technologies with the specific demands of GIs may catalyze strategic partnerships among universities, research institutes, producer organizations, and startups, generating scalable and replicable solutions throughout the country.

Beyond the quantitative and qualitative mapping of existing software solutions, it is necessary to deepen the discussion regarding the technological maturity of the identified systems. Most software applications related to family farming provide well-defined functionalities with practical applications in daily agricultural operations, including inventory control, direct marketing, and crop planning. However, there is a notable shortage of platforms adopting multidimensional approaches that integrate socioterritorial, environmental, legal, and market-related aspects within a single framework. This finding suggests that, although consolidated solutions exist for specific operational needs, the field of technology applied to Geographical Indications requires a new level of complexity and interoperability that is not yet addressed by currently available tools.

From an institutional perspective, the absence of software dedicated to supporting the complete lifecycle of Geographical Indications may be linked to fragmentation among technological development initiatives, public policy frameworks, and territorial governance structures.

Existing systems, even those with a high degree of technical sophistication, generally do not interact directly with the regulatory instruments of the Brazilian National Institute of Industrial Property (INPI) or with the guidelines established by the Ministry of Agriculture and Livestock (MAPA) for the registration and monitoring of GIs. This misalignment may undermine the effectiveness of certification and territorial valorization processes, while also hindering integration among the diverse stakeholders that comprise the Brazilian GI ecosystem, ranging from producers to higher education institutions, research organizations, and rural extension services.

On the other hand, the analyzed data reveal fertile ground for the development of digital solutions capable of operating as intelligent infrastructures for governance and traceability. The combination of technologies already tested in the field, such as remote sensing, georeferencing, territorial databases, and artificial intelligence, with the regulatory requirements of Geographical Indications represents a concrete opportunity for the creation of modular platforms.

Finally, it is important to emphasize that the findings of this study not only reveal a gap in the current technological landscape but also provide a clear direction for innovation-support policies. The adoption of open-source platforms, interoperable protocols, and inclusive business models constitutes a key set of elements for ensuring the scalability of these solutions and democratizing access to technologies capable of transforming the dynamics of Geographical Indications in Brazil.

4 Final Considerations

The present study examined Geographical Indications (GIs) as a strategic tool for enhancing the value of family farming in Brazil. The research proved relevant due to the pressing need to develop effective mechanisms capable of increasing the competitiveness of Brazilian family farming while promoting the valorization of its products and territories, particularly in light of the scarcity of integrated digital tools that support access to GI certification processes.

Throughout the study, the primary limitation identified was the nature of the database maintained by the Brazilian National Institute of Industrial Property (INPI). Because the database focuses on the titles and registered descriptions of software programs, it does not always allow for an in-depth assessment of their functionalities or their actual applicability within the context of family farming without direct access to the systems themselves.

Despite this limitation, the objectives established at the outset of the research were successfully achieved. Regarding the general objective, which was to analyze which software solutions available in the Brazilian market provide integrated and satisfactory support for the strategic application of Geographical Indications (GIs) in enhancing the value of family farming, the findings revealed the absence of software platforms capable of comprehensively and effectively integrating family farming management functionalities with the specific requirements associated with the GI process. Existing systems tend to be either highly specialized in the traceability of already established GIs or focused on general agricultural management, without adequately addressing the complexity and regulatory requirements inherent to Geographical Indications.

Regarding the specific objectives, the following results were achieved: the definition of relevant keywords for the identification of Geographical Indications related to family farming was fully accomplished through the development of a robust keyword set; the survey of GI-related records within the INPI database identified a total of 24,452 records, of which 150 exhibited some degree of similarity, providing the necessary overview of the technological landscape; the analysis of the correspondence between the identified records and the research object revealed that most systems focus either on Geographical Indications in a limited and highly specific manner or on family farming management in a broader sense, without integrating the two domains, thereby confirming the proposed technological gap; and the assessment of the degree of similarity between the identified records and the characteristics of the family farming context under investigation demonstrated that, although numerous management-oriented software solutions exist for family farming, few, if any, are specifically designed to facilitate the GI process, indicating a low level of direct alignment with the integration needs identified in this study.

Considering the central research question, namely, “To what extent do software programs available in the Brazilian market provide integrated and effective support for the strategic application of Geographical Indications (GIs) in enhancing the value of family farming?”, the findings of this study lead to the following conclusion: software solutions currently available in the Brazilian market provide fragmented support, rather than integrated and effective support, for the strategic application of Geographical Indications in the valorization of family farming. A clear technological gap exists that prevents the effective integration of existing agricultural management tools with the specific processes required for the mapping, certification, management, and promotion of products through Geographical Indications.

5 Future Perspectives

As a future perspective for advancing Geographical Indications (GIs) within the context of family farming, a

fundamental step lies in conducting applied studies with associations and cooperatives that are already engaged in the process of obtaining or managing a GI.

This practical approach will enable researchers to move beyond the identification of generic gaps and focus on validating the specific functional requirements of an ideal system. By interacting directly with the stakeholders involved, it will be possible to gain a deeper understanding of their real challenges, existing workflows, bureaucratic bottlenecks, and day-to-day technological needs, thereby ensuring that any future software solution is genuinely aligned with and useful for its intended users in rural settings.

Such field validation is essential for translating theory into practice. Direct engagement with associations and cooperatives will allow researchers and developers to capture detailed information regarding documentation requirements, challenges in collecting traceability data, difficulties associated with organizing origin-related information, and user expectations concerning the usability of digital tools. This level of immersion will ensure that the resulting functional requirements are not only technically feasible but also socially and operationally relevant to the target audience of family farmers.

Consequently, this approach will pave the way for the development of more comprehensive, effective, and innovative solutions capable of genuinely enhancing the value of family farming products through the strategic use of Geographical Indications.

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