Geospatial Data Management at Iphan: Trajectory, Challenges and Perspectives

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Keywords: Cultural Heritage, Geospatial Data, Territorial Management, NSDI.

SUMMARY

The National Institute of Historic and Artistic Heritage (Iphan), established in 1937, plays a central role in preserving Brazil's cultural heritage. Throughout its history, the institution has progressively incorporated the use of geospatial data, transitioning from analog records to digital systems in line with advances in information technologies. This article discusses Iphan's trajectory in the territorial management of cultural assets, addressing historical, normative, and technological achievements that have shaped its practices of documentation, protection, and oversight. It presents the main systems and tools developed for handling geospatial data, as well as the institutional and technological challenges that influence their consolidation. The study aims to contribute to the debate on the modernization of cultural heritage management by situating Iphan within the broader context of national geoinformation policies and its integration into the National Spatial Data Infrastructure (INDE).

Palavras-chave: Patrimônio Cultural, Dados Geoespaciais, Gestão Territorial, INDE.

RESUMO

O Instituto do Patrimônio Histórico e Artístico Nacional (Iphan), criado em 1937, desempenha papel central na preservação do patrimônio cultural brasileiro. Ao longo de sua história, a instituição incorporou progressivamente o uso de dados geoespaciais, passando de registros analógicos a sistemas digitais, em consonância com os avanços das tecnologias de informação. Este artigo discute a trajetória do Iphan na gestão territorial de bens culturais, abordando marcos históricos, normativos e tecnológicos que estruturaram suas práticas de documentação, proteção e fiscalização. São apresentados os principais sistemas e instrumentos voltados ao tratamento de dados geoespaciais, bem como os desafios institucionais e tecnológicos que permeiam sua consolidação. O estudo busca contribuir para o debate sobre a modernização da gestão do patrimônio cultural, situando o Iphan no contexto das políticas nacionais de geoinformação e da integração à Infraestrutura Nacional de Dados Espaciais (INDE).

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1. INTRODUCTION

The National Institute of Historic and Artistic Heritage (Iphan), a brazilian federal government agency created in 1937, is responsible for the protection and promotion of national cultural heritage, playing a fundamental role in its preservation and safeguarding. Since its foundation, the Institute has needed to territorially represent tangible cultural assets (buildings, complexes, and sites) of historical, artistic, archaeological, and landscape interest - even though, in its early decades, it relied on traditional cartographic methods and analog records. With the growing complexity of territorial and urban demands, and the advancement of information technologies, Iphan began a gradual process of modernizing the handling of geospatial data to support actions of recognition, protection, and oversight of cultural assets.

The process of land measurement and registration, used since Ancient times (Martinelli; Graça, 2015 apud Linheira; Oliveira, 2020), gained such relevance throughout History that, in the Contemporary Age, it became a branch of cartographic science called Cadastral Cartography - whose products are known as "land cadastres" (LOCH, 2001). Initially, land cadastres were used for legal and tax purposes, but their information gradually began to be used for other ends, such as territorial and environmental planning (Linheira; Oliveira, 2020). The International Federation of Surveyors (FIG) defines a land cadastre as a public inventory that gathers information about all legal land parcels and objects (public or private) - thus including every element that materializes on the Earth's surface with a specific legal framework.

In Brazil, land cadastre initiatives only began in the 1960s, driven by the 1946 Constitution, which expanded municipal autonomy and enabled the charge of local taxes. Nevertheless, governmental actions did not establish technical or legal parameters, resulting in fragmented initiatives and a lack of standardization. This gap hindered spatial data integration until 2008, when, due to the growing production and volume of geospatial data, the Brazilian government established the National Spatial Data Infrastructure (INDE) through Decree No. 6,666/08 (amended by Decree No. 12,402 of 2025), instituting common rules and standards for organizing and sharing geospatial data across all administrative levels. INDE's objectives are:

> I – to promote proper organization in the generation, storage, access, sharing, dissemination, and use of geospatial data from federal, state, district, and municipal sources, for the country's development;
>
> II – to encourage the adoption, in geospatial data production by federal, state, district, and municipal agencies and entities, of standards and rules approved by the National Commission on Geoinformation – Congeo; and
>
> III – to avoid duplication of efforts and waste of resources in obtaining geospatial data by public administration bodies, through the dissemination of metadata on such data

available from federal, state, district, and municipal entities and agencies (BRAZIL, 2025a).

In the context of establishing INDE, the National Commission on Cartography (CONCAR) created the Brazilian Geospatial Metadata Profile (Perfil MGB), based on ISO 19115/2003, setting attributes to ensure quality, standardization, and integration of geospatial data. This advancement enabled the publication of Ordinance No. 511/2009 by the Ministry of Cities, which defined technical guidelines for developing multipurpose land cadastres (CTM). The ordinance conceptualized CTM as the official municipal inventory, based on surveying land parcels identified by geographic coordinates and linked to the Property Registry. It also foresaw their integration with thematic cadastres, forming the Territorial Information System (SIT) - since, given the diversity of territorial elements, specific (thematic) cadastres, developed by specialized institutions, are often needed to complement the main land cadastre. In Brazil, in addition to geospatial databases from municipalities, there are thematic cadastres maintained by various agencies, such as the Federal Revenue Service (tax), INCRA (environmental), ICMBio (conservation units), and Iphan (historical and cultural heritage), among others (Linheira; Oliveira, 2020). The ordinance emphasized that, due to the complexity of the territory, no single agency could manage all cadastres alone, highlighting the need for systems that allow information flow among them (Cunha; Erba, 2010 apud Linheira; Oliveira, 2020).

Thereby, the National Spatial Data Infrastructure (INDE) aims to catalog and integrate geospatial data from various Brazilian government institutions that produce and maintain this type of data, so that they can be accessed by anyone with Internet access. This cataloging occurs through metadata published by the data producers and custodians themselves. The INDE viewer offers mechanisms to explore the metadata catalog and geoservices hosted on servers of various organizations and institutions participating in the Brazilian Directory of Geospatial Data (DBDG) (BRAZIL, 2025b).

Accordingly, this article discusses Iphan's current practices in geospatial data management, analyzing its historical trajectory to understand how Iphan has evolved and implemented processes of data collection, processing, and use. The objective is to identify good practices and bottlenecks that may contribute to guidelines for enhancing Iphan's territorial management and its articulation with INDE. First, a review was carried out on the Institute's institutional practices since the 1930s, covering regulations, projects, and technological systems developed, focusing on the theme of cultural asset mapping. Then, a SWOT matrix analysis was performed - that is, identifying strengths, opportunities, weaknesses, and threats for Iphan's geospatial data management. This strategic planning methodology encompasses scenario studies for decision-making, created in the 1960s by Albert Humphrey at Stanford University. Thus, the article discusses advances, existing gaps, and opportunities to strengthen the institution's spatial data infrastructure through the lens of thematic land cadastre, within the context of cultural heritage management amid new technologies.

2. HISTORY OF IPHAN AND GEOSPATIAL MANAGEMENT

2.1 The Analog Phase (1930-1990)

The official regulation of historic heritage preservation in Brazil began to take shape in the 1930s. The first action aimed at monument preservation was the creation of the National Monuments Inspectorate (IMN) in 1934, linked to the National Historical Museum (MHN), which operated for three years (Shitaku et al., 2024). Also in 1934, Brazil's third Constitution placed historic heritage under the legal protection of the State, declaring it the responsibility of both the Union and the States to protect "natural beauties and monuments of historical or artistic value" (BRAZIL, 1934, Art. 10). In this early context of heritage preservation policies, there was no specific mention of geospatial treatment of assets or monuments. Decree No. 24,735 of July 14, 1934 defined the inspectorate's main purpose as overseeing the sale of historic and artistic objects and harmonizing legislation among states. At that time, the main concern was controlling the trade of artworks and antiques, although there was already some interest in organizing a catalog of buildings with artistic-historical value in the country. However, the geographic location of these assets was intended mainly to delegate responsibilities for guarding and supervising objects to state authorities (Magalhães, 2015).

In 1936, Mário de Andrade was tasked by the Ministry of Education and Public Health with drafting a bill regulating the constitutional principle of monument protection. The draft proposed creating a service to "determine, organize, conserve, defend, and disseminate the national artistic heritage" (Andrade, 1936 apud Dultra; Vieira, 2014, p.03). In 1937, the SPHAN - National Historical and Artistic Heritage Service (today Iphan, Instituto do Patrimônio Histórico e Artístico Nacional) was created, and Decree-Law No. 25 of November 30, 1937 was enacted, instituting the mechanism of tombamento (listing). This decree introduced modifications to the draft, particularly in the concept of heritage, now within the Estado Novo political context: it was less democratic and disregarded intangible cultures (Dultra; Vieira, 2014). However, in both the draft bill and the decree-law, the debate focused on what should or should not be considered national heritage, with minimal reference to the geographic location of assets. Articles referring to changes in location or removal from the country addressed only movable property, artworks, and antiques.

In SPHAN's first 30 years, the main challenge was selecting the collection to be listed. Faced with numerous possibilities, the institution's experts and intellectuals defined the universe of assets eligible for preservation: examples of colonial architecture, monuments of other periods and styles provided they were monumental or exceptional for Brazilian architectural history, and buildings deemed monuments for having hosted memorable historical events. At that time, the activity consisted of locating such assets, recording their aesthetic and stylistic features to prevent demolition or collapse, and recommending urgent listing (tombamento) when necessary (Motta; Silva, 1998).

In the 1960s, the concept of heritage broadened in the postwar European reconstruction context, which deepened debates on valuing the culture of all peoples. Iphan's actions aligned with emerging international best practices consolidated by the Venice Charter (1964), which expanded the concept of heritage beyond isolated monuments to include territorial and spatial contexts. At the same time, with Brazil's urban growth, listing buildings, architectural ensembles, and natural areas became a way to resist real estate speculation (Motta; Silva, 1998). Thus, requests for listing expanded to include assets beyond the initial standards. Also in the 1960s, the "Archaeology Law" (Law No. 3,924, of July 26, 1961) was enacted, protecting archaeological sites as Union-owned heritage. In the following decade, state and municipal preservation institutions began to take shape (Motta; Silva, 1998).

In the 1980s and 1990s, many of Iphan's regional offices struggled to apply the established selection criteria and began conducting research and records to demonstrate the value of specific buildings or ensembles in their regions. The territorial component emerged strongly as a way to contextualize occupation, its importance for regional development, and its role in shaping national identity, even when the aesthetic features diverged significantly from those previously protected.

From Iphan's creation until the 1990s, it is clear that although the geospatial dimension was not yet systematically addressed, Iphan had already adopted mapping and cataloging practices that laid the foundation for future territorial heritage management. The legislation supporting institutional actions during this period includes milestones such as Decree-Law No. 25/1937, which established tombamento as a preservation tool, and Law No. 3,924/1961, which ensured protection for archaeological sites, recognizing their historical and scientific importance. Despite the technological limitations of the time, this period marked significant conceptual evolution, "paving the way" for future integration of geospatial tools into heritage management.

2.2 The Digital Transition Phase (1990-2015)

The first concrete action established by Iphan in the context of geospatial data management was the National Register of Archaeological Sites (CNSA), created in 1997 to establish national standards for the geolocation process of archaeological sites (Linheira; Oliveira, 2020) - which will be further detailed later in this article. Also, in the late 1990s and early 2000s, Iphan consolidated and standardized several inventories: the Inventory of Architectural Assets (IBA); the National Inventory of Movable and Integrated Assets (INBMI); the National Inventory of Urban Space Configurations (INCEU); and the National Inventory of Immovable Assets in Listed Urban Sites (INBISU). These inventories included location maps of assets, based on cartographic resources available at the time. Most of the inventoried urban ensembles were located in small towns, where cartographic bases were often rare, simplified, or outdated (Motta; Silva, 1998; Iphan, 2001).

In 2000, with the expanded concept of heritage, Decree No. 3,551 was enacted, establishing the "Registry of Intangible Cultural Assets." These assets could include knowledge, crafts and practices; celebrations; performing, visual, musical, or recreational expressions; and places (such as markets, fairs, and sanctuaries hosting collective cultural practices), known as "registered assets" (Iphan, 2025b). From then on, a new stage began in organizing Brazil's historical, cultural, and artistic heritage, and the INRC - "National Inventory of Cultural References" - was added to the preservation instruments, creating a database that enabled documentation, research, and planning of safeguarding (intangible) and conservation (tangible) actions.

In 2009, the "Seal of Cultural Landscape" was introduced: Iphan defines cultural landscape as "a peculiar portion of the national territory, representative of the process of interaction between humans and the natural environment, upon which life and human science have imprinted marks or attributed values" (Iphan, 2009). Protection of this type of cultural asset is granted through the Seal, established by Ordinance No. 127 of 2009, which requires shared management among different actors operating in the protected territory. In 2007, Law 11,483 of May 31, 2007 had already assigned Iphan responsibility for cultural assets from the extinct

Federal Railway Network (RFFSA). These railway heritage assets - protected through inclusion in the Railway Cultural Heritage List, established by Iphan Ordinance No. 17 of 2022, and called "valued assets" (Iphan, 2025c) - significantly increasing the number of assets under Iphan's responsibility.

From 2011 onward, digitization of collections became a priority at the Institution, according to Iphan's website[1]. The "Iphan Archives Network" [2], developed in this context, is a digital repository with free search Options - by free text, "asset name," "other names," "subject," "geographic location," or "type." Among the documents available are inventories, images, plans, maps, dossiers, construction reports, and listing processes, among others. A search by type "maps/plans" returns 585 results, as shown in the screenshot of Figure 1. When searching by geographic location, localities with digitized documents of cultural assets are listed. Figure 2 shows the result when selecting "Laguna, Santa Catarina," as an example.

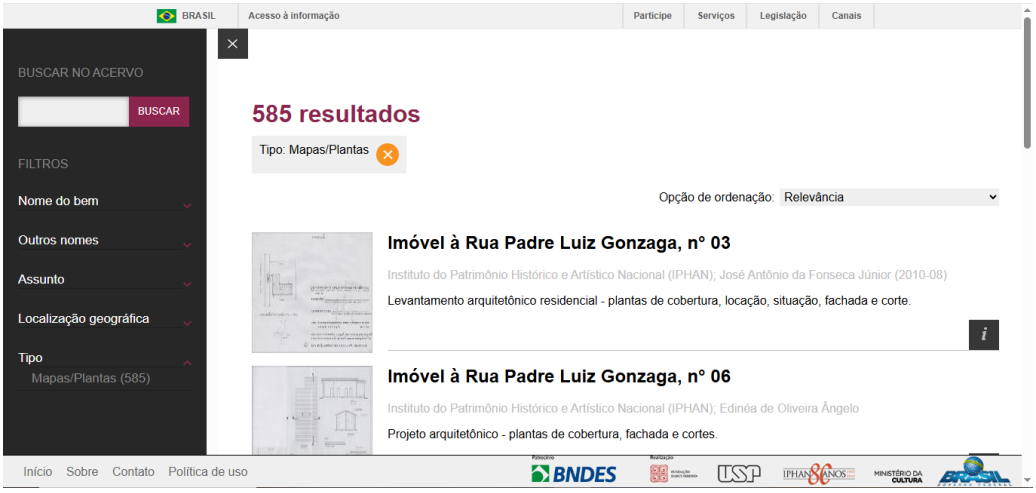

Figure 1. Search results for maps/plans in the Iphan Archives Network. Source: The authors, 2025.

[1]Iphan. Collections and Publications. Available at: http://portal.Iphan.gov.br/pagina/detalhes/617. Accessed on: Sept. 24, 2025.

[2]Iphan. Archives Network. Available at: https://acervodigital.Iphan.gov.br/xmlui/. Accessed on: Sept. 24, 2025.

Figure 2. Search results by geographic location in the Iphan Archives Network. Source: The authors, 2025.

Furthermore, during the late 1990s and early 2000s, there was a strong need to modernize and streamline administrative process management - not only at Iphan but across Brazilian institutions. The creation of the Electronic Information System (SEI!), developed from 2009 by the Federal Regional Court of the 4th Region (TRF4), gradually eliminated paper use, as it is a virtual platform that allows for document production, editing, signing, and case processing[3]. Thus, one can say that Iphan's digital transition phase occurred between 1990 and 2015, marked by the beginning of governmental digitization and the spread of geotechnologies in the public sector, as well as the first, though still incipient, initiatives for collection digitization, with no integration between systems.

2.3 Present Day (2015-2025)

In addition to the context of the need for digitization and informatization of public administration, the structuring of INDE (2008) and the Brazilian Geospatial Metadata Profile (2009) (Linheira; Oliveira, 2020), and the debate on inventories within Iphan (2009) (Corrêa, 2014 apud Shitaku et al., 2024), the implementation of the Integrated Knowledge and Management System (SICG) began. SICG is Iphan's first system to apply geographic intelligence to the organization, consultation, and sharing of information related to Brazilian cultural heritage. According to Mongelli (2023), the system managed to bring together information fields from the main inventories then in force at Iphan, specifically those linked to the Department of Tangible Heritage and Oversight (Depam) - which until then were independent databases or digital repositories that did not communicate with each other.
Besides aggregating, in a single interface, the registration of various types of assets, one of SICG's goals is also to gather information from other institutions, such as assets safeguarded at the state and municipal levels. SICG was effectively implemented as a computerized system in 2014 (Mongelli, 2023), and its search interface was consolidated at the end of 2017 (http://sicg.iphan.gov.br/sicg/pesquisarBem) (Soster; Pratschke, 2020). As an integrated

[3] Iphan. SEI!. Available at: https://www.gov.br/iphan/pt-br/servicos/sei. Accessed on: Sept. 24, 2025.

knowledge and management system, its primary purpose is to retrieve information produced about the cultural assets legally protected by Iphan to support decision-making regarding different stages of institutional work (Mongelli, 2023).

In the context of environmental licensing of projects - one of the main processes for preserving cultural assets today (Iphan, 2018) - Normative Instruction No. 01/2015, which established administrative procedures to be observed by Iphan, required that along with the Activity Characterization Form (FCA) submitted by developers, the project area must also be submitted in shapefile format, compatible with georeferenced data management systems. Furthermore, in 2021, the Heritage Impact Assessment System (SAIP) was created, aiming to standardize the analysis of the impact of licensed activities on cultural heritage. In SAIP, data from Iphan's database, based on georeferencing, is cross-referenced with information submitted by those requesting infrastructure project evaluations. The system then indicates whether a heritage impact study is required for the cultural assets within the project area or whether the activity is exempt from such requirement. There is also the possibility of integrating SAIP with the Federal Environmental Licensing Management System (SisG-LAF) of Ibama - the Brazilian Institute of Environment and Renewable Natural Resources, the main agency responsible for environmental licensing in Brazil.

According to SAIP's official website[4], starting in June 2025, the system will also encompass environmental licensing at state and municipal levels. Currently, it is available for requests related to cultural heritage impact assessments in the environmental licensing processes of the following states: Acre, Amapá, Ceará, Federal District, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Paraná, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, Roraima, and São Paulo. The other states will be gradually integrated according to the schedule established in Iphan Ordinance No. 259, of June 25, 2025, which created the Program for Managing Environmental Licensing Processes at Iphan.

Thus, the recent period is marked by more consistent efforts to create integrated systems and georeferenced databases, although initiatives are still incipient and not yet widely disseminated or fully implemented.

3. EXPERIENCES IN PROCESSING GEOSPATIAL DATA BY IPHAN

3.1 The Experience of CNSA and SICG

As previously presented, the National Register of Archaeological Sites (CNSA) was Iphan's first concrete action in geospatial data management. It can still be accessed today[5] and contains search and filtering tools by municipality name, state, archaeological site name, registration officer, and temporal typology (historic, pre-colonial, or contact period) (Figure 3).

[4] Iphan. SAIP. Available at: https://saip.iphan.gov.br/. Accessed on: Sept. 29, 2025.
[5] Iphan. CNSA. Available at: http://portal.iphan.gov.br/sgpa/?consulta=cnsa. Accessed on: Sept. 24, 2025.

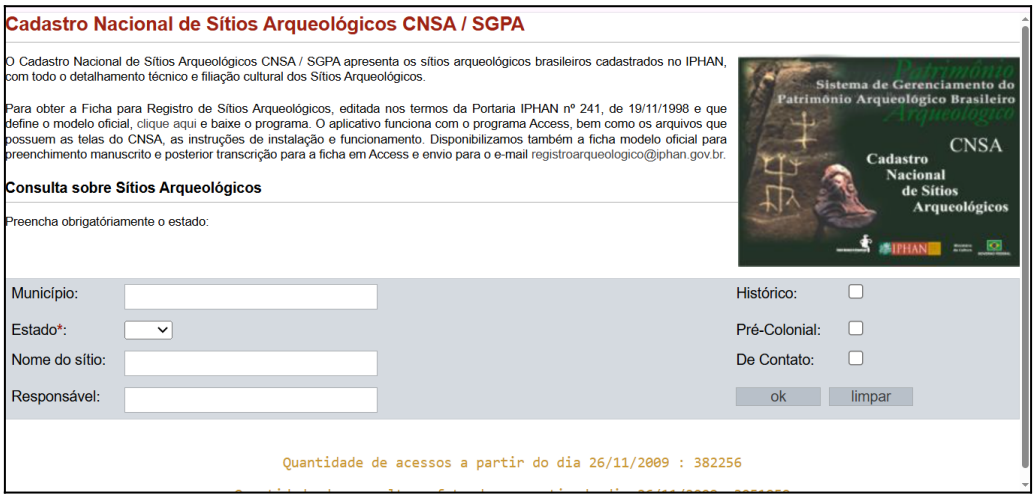

Figure 3. National Registry of Archaeological Sites search page. Source: The authors, 2025.

In the search results, the registration form of each site can be accessed individually. Although there is a field for recording coordinates in the CNSA form, this information is not disclosed to the public[6]. Ordinance No. 241/98, which regulates the registration of archaeological sites by professionals, requires that site boundaries be indicated by "reference points in the UTM coordinate system (Universal Transverse Mercator) with meter precision (…)" (BRAZIL, 1988, p.47 apud Linheira; Oliveira, 2020, p.406), and that the Datum used in the GNSS equipment and the margin of error be reported. However, it does not specify the minimum acceptable scale for obtaining the values and accepts various measurement techniques (including even step counting, for example), which can result in positional error. Thus, although it functions as a Thematic Land Cadastre, the CNSA database is not truly geographic; it is structured under a specific logic: site location data are numeric attributes in the registration forms, not primitive elements of the dataset. This hinders integration with geographic databases from other institutions (Linheira; Oliveira, 2020).

The Integrated Knowledge and Management System (SICG), as already presented, is Iphan's first platform to use geographic intelligence resources to structure, access, and disseminate data on cultural heritage. According to the User Manual (Iphan, 2025a), it uses open-source software and provides open data for all other information systems, in addition to offering integration with Iphan's own systems.

Browsing SICG's website revealed some difficulties, such as slow information loading and a lack of responsiveness in commands and buttons. Moreover, a pop-up message indicates that the page failed to load Google Maps data correctly. Figure 04 shows SICG's user interface.

[6] The public content of the files includes the identification of the site, its geometric, physical-geographical, and archaeological characteristics, the research activities carried out, among others.

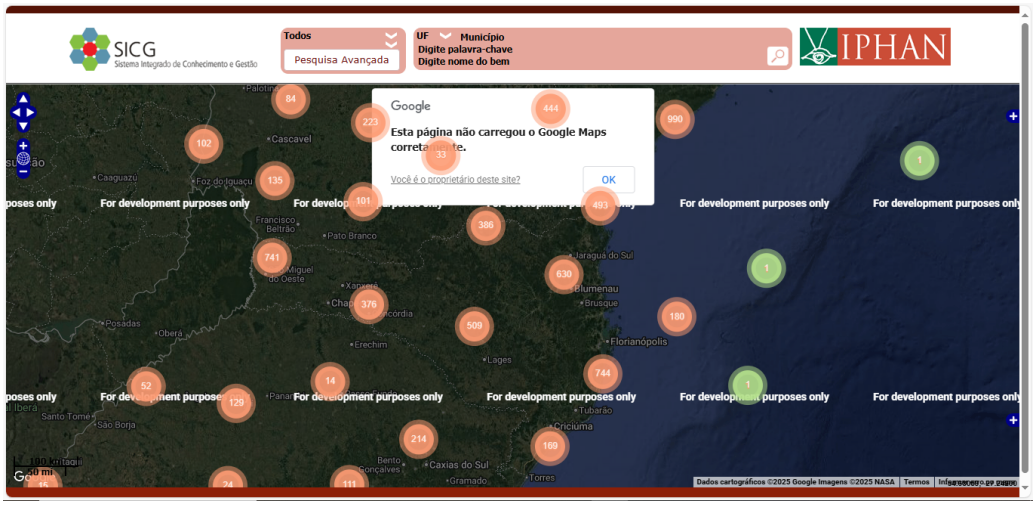

Figure 4. SICG website interface for the State of Santa Catarina. Source: The authors, 2025.

The system already has administrative modules in operation for years; however, a unified register requires participation from different institutions in its consolidation, which represents a barrier to its full development. In addition, Iphan faces difficulties in keeping it updated, according to Soster and Pratschke (2020), due to several factors such as limited understanding of the role of geoinformation technologies and a shortage of technically specialized professionals. Added to this is the fact that, historically, cultural and heritage policy in Brazil has faced challenges: until the early 2000s, these themes received little effective attention from the government (Soster; Pratschke, 2020). Like any system, SICG requires constant maintenance and adjustments as failures arise through daily use. Despite being a structuring system for management, it has become "more of a data repository than a user-friendly portal" (Mongelli, 2023, p.12).

Some of SICG's issues are less about technological development and more about internal institutional processes, including budget prioritization and lack of integration among Iphan's own departments (Mongelli, 2023). SICG began as a system focused on tangible heritage data —that is, under the Department of Tangible Heritage and Oversight (Depam)—and later expanded to include assets from the Department of Intangible Heritage (DPI). The goal was to level procedures and technologies to make data from both departments available. However, designing projects that equally serve both areas has been challenging, whether internally within Depam or between Depam and DPI. The proposal to integrate heritage categories in SICG "highlighted the difficulty of integration within Iphan" and the challenges of treating heritage holistically, since the two departments use different methods, timelines, and perspectives in acquiring information (Silva, 2014, p.107 apud Mongelli, 2023, p.14). "Minimizing these dissonances and strengthening the macro-process of heritage identification as a whole still seems to be one of the objectives of current management" (Mongelli, 2023, p.14).

In the 2020s, the Institute has been making efforts to re-register archaeological sites. These efforts have taken place in the context of environmental licensing requirements, Terms of Conduct Adjustment (TACs), and other research carried out by non-Iphan teams at Iphan's request, as well as in incentive calls such as those funded by the "Aldir Blanc Law" (Law No. 14,017, of June 29, 2020). Many surveys that recorded sites in CNSA were conducted over 50

years ago—making it necessary not only to reassess the conservation state of sites but also to improve their location accuracy, now possible with more modern equipment. With Ordinance No. 23 of May 17, 2021, Iphan incorporated the goal of re-registering archaeological sites into its strategic planning, precisely due to the need to migrate from the old CNSA to the new georeferenced system, SICG.

3.2 Current conection between Iphan and INDE

Regarding the integration of Iphan's georeferenced data with the National Spatial Data Infrastructure (INDE), when searching by Institution layers and selecting Iphan, the following layers are available for selection: "intangible heritage safeguarding actions," "ada_saip," "aid_saip" (related to directly affected and directly influenced areas listed in SAIP), "bem_zrp" (heritage in SAIP's Opinion Request Zones, i.e., valued assets and assets without defined listing polygons or buffer zones), "Intangible Assets," "Tangible Assets," "Tangible Assets – Polygons," "International Millionth Map," "Immediate Context," "Enterprises – FCA," "Entry_FCA," "fca," "Hydrography," "Hydrography 1:5,000,000," "Custody and Research Institutions – CNIGP," "Ethno-historical Map of Curt Nimuendaju," "Ethno-historical Map of Curt Nimuendaju (IBGE 1981)," "Ethno-historical Map of Curt Nimuendaju (IPHAN – 2017)," "Pre Sector," "Protection – Tangible Assets," "Archaeological Sites," "Archaeological Sites – Polygons," "tg_municipio," "tg_tribo," "Federative Units – UF," "zrp_especial," and "zrp_padronizada."
However, none of the layers, when selected, return graphic data for the map. This situation is shown in Figure 5.

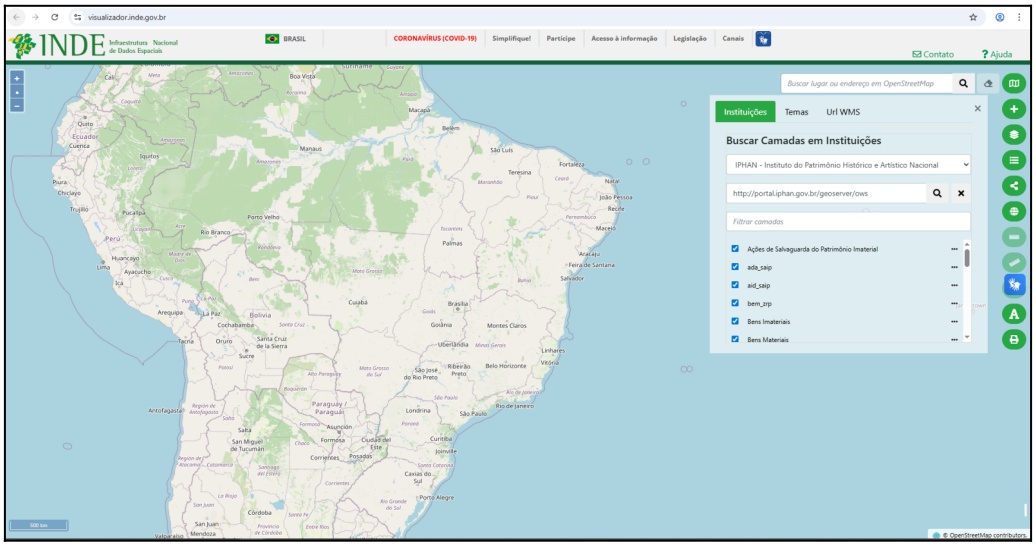

Figure 5. Result of the search for Iphan layers, in INDE viewer. Source: The authors, 2025.

Despite the absence of graphic layers on the map, attribute tables of each layer are integrated. The metadata, i.e., alphanumeric data, are present in the integration between Iphan and INDE systems, but spatial integration elements are lacking for the data to effectively appear on the map in georeferenced form. Figure 06 shows, as an example, the attribute table of the "Archaeological Sites" layer.

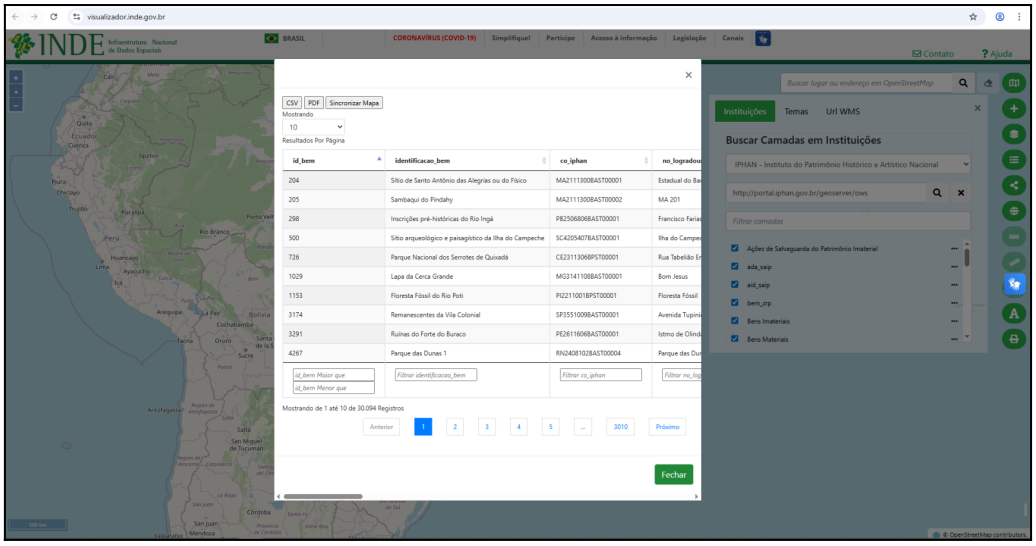

Figure 6. Example of metadata (attribute table) of the "Archaeological Sites" layer of Iphan, in INDE viewer. Source: The authors, 2025.

Thereby, although there has been progress in integrating Iphan's data with INDE, a gap remains in the effective spatial representation of this information in INDE's cartographic environment. The absence of graphic data compromises full use of the analytical and visual potential of these georeferenced layers, limiting the practical application of the information for planning, management, and safeguarding cultural heritage.

4. CHALLENGES AND PERSPECTIVES IN HANDLING GEOSPATIAL DATA AT IPHAN

The SWOT analysis method, previously mentioned, was applied to highlight the challenges and perspectives faced by Iphan in managing geospatial data, based on a set of strengths, weaknesses, opportunities, and threats that summarize the progress already achieved and the challenges conditioning present and future actions.

Among the main strengths, the institutional tradition in cultural heritage preservation stands out, supported by legal milestones since 1937 (Decree-Law No. 25/1937, Law No. 3,924/1961, among others), as well as the creation of pioneering systems such as the National Register of Archaeological Sites (CNSA) and the Integrated Knowledge and Management System (SICG). These introduced the logic of geographic intelligence into heritage management and helped consolidate inventories and databases. Another positive factor is the adoption of open-source software and open data policies, which foster integration with other public platforms. The institutional recognition of the need for re-registering collections also signals alignment with recent technological transformations. The gradual expansion of the preservation scope, encompassing tangible heritage, intangible heritage, railway heritage, and cultural landscapes, can be considered a strength by highlighting the institution's relevance, but it may also represent a weakness if staffing and resources are not expanded proportionally to the increasing responsibilities.

There are, however, weaknesses that limit the full use of these initiatives. Historically, Iphan's inventories and registries were built in a fragmented and poorly standardized manner, hindering data interoperability. Although innovative, SICG presents technical usability limitations and has been used more as an information repository than as an analytical tool. Additionally, the institution lacks professionals specialized in geotechnologies, and struggles to achieve full integration between departments (tangible and intangible heritage), which maintain different methodologies and perspectives, complicating the systemic view of territory. Moreover, Iphan's integration into the National Spatial Data Infrastructure (INDE) remains partial: while metadata are available, the effective graphic representation of information in the cartographic environment is missing, reducing the potential for spatial analysis.

Opportunities, in turn, arise from the strengthening of national geoinformation policy and the expansion of INDE, which establish favorable standards and technical norms for interoperability. The development of the Heritage Impact Assessment System (SAIP) and its potential integration with the Federal Environmental Licensing Management System (SisG-LAF/IBAMA) and other environmental platforms represent significant progress in using georeferenced data in licensing processes. At the same time, technological advances - such as high-precision GNSS receivers, artificial intelligence techniques, and interoperability solutions - offer means to update and qualify the re-registration of archaeological sites and other cultural assets. There is also room to expand partnerships with state, municipal, and academic institutions, as well as access to funding programs such as the Aldir Blanc Law, which can foster research and strengthen actions for updating and integrating registries.

Threats include the risk of discontinuity in public policies and instability in funding programs, which could compromise the maintenance and evolution of the systems in place. This lack of maintenance and updates, in turn, increases the risk of obsolescence. Another issue is the absence of effective standardization and interoperability among different agencies, which risks information loss or duplication of efforts. Furthermore, the pressure of real estate speculation and the rapid pace of large-scale projects demand quick responses from Iphan, posing a threat to heritage data management given current limitations. Finally, since the consolidation of registries depends on inter-institutional collaboration, political and administrative barriers may hinder the effective implementation of an integrated territorial management policy for cultural heritage. These strengths, weaknesses, opportunities, and threats are summarized in Figure 07.

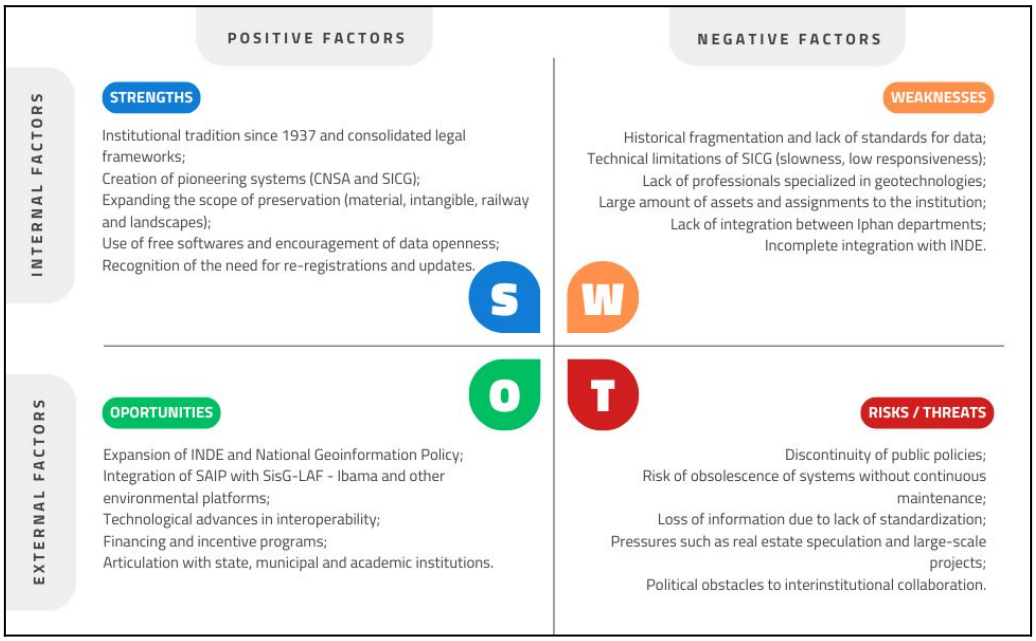

Figure 7. Representative diagram of the SWOT analysis prepared for the management of geospatial data by Iphan. Source: The authors, 2025 – Canva graphic model created by Luíza Alvarenga.

Thus, the SWOT analysis shows that although Iphan has solid foundations and relevant progress in geospatial data management, there is still a long way to go to consolidate fully integrated, updated, and interoperable systems. Addressing internal weaknesses and external threats, while seizing opportunities and strengthening existing assets, is essential for the institution to achieve greater efficiency in territorial management of cultural heritage in Brazil.

5. CONCLUSION

Iphan's historical trajectory reveals a gradual maturation in the use of geospatial data, moving from fragmented analog records to the creation of integrated digital systems. Although these advances highlight the institution's relevance and modernization efforts, the analysis indicates that important gaps persist: weaknesses in interoperability between registries, difficulties in integration across departments, a shortage of specialized technical staff, and the still partial integration of Iphan's data into the National Spatial Data Infrastructure (INDE), limiting the full potential of the implemented systems.

There is a need for a more comprehensive and cross-cutting data governance policy. It is essential to adopt technical and operational measures to ensure the full geospatial integration of data, enabling its visualization on maps and promoting greater efficiency in access and use by the public and interested institutions. The opportunities identified point to a favorable scenario for consolidating territorial management within Iphan. The standardization introduced by INDE, the development of systems such as SAIP, and the availability of new technologies can enhance the Institute's performance. It is also important to consider

partnerships with universities and civil society, strengthening the perspective of collaborative and integrated cultural heritage management.
In light of this context, it is recommended to improve system interoperability and integration - prioritizing the strengthening of SICG as a central platform and ensuring its effective communication with INDE and other thematic registries; to invest in technical training - expanding the number of professionals trained in geotechnologies to consolidate institutional expertise; to systematically update and re-register collections - using precise technologies and standardized methodologies to reduce margins of error and improve reliability; to establish routines for continuous maintenance and updates - avoiding obsolescence and ensuring real-time availability of data to support public management; and to expand inter-institutional partnerships - especially with state and municipal institutions, fostering multi-scale integration of information.
Therefore, it can be concluded that Iphan has solid foundations and consistent legal frameworks to advance in geospatial management of cultural heritage. However, consolidating a fully integrated, interoperable, and updated system will depend on overcoming internal weaknesses, addressing external threats, and, above all, capitalizing on emerging opportunities in the field of geoinformation.

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