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Virtual Return of Italian Architectural Heritage: The KNOW.it Project

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Abstract

The article illustrates the digital documentation workflow adopted to effectively use digital survey outcomes in supporting the knowledge and conservation of built heritage. This study was developed as part of the Project of Significant National Interest (PRIN), titled "KNOW.it Transition in Digital Age: KNOWing our background to refine our future". The research focuses on the cities of Jaú and São Carlos, applying a rigorous methodology that combines archival research, photogrammetry, laser scanning, and 3D modelling. This approach is used to identify, analyse, and digitally reconstruct Italian-influenced eclectic architecture from the late 19th to early 20th century. The initiative supports both scholarly research and public dissemination through a digital platform that will host interactive maps, historical documents, 2D drawings and 3D models. By linking academic research with diasporic memory, KNOW.it highlights how digital tools can preserve and reactivate cultural legacies, fostering transnational heritage dialogue. The project's use of social media further engages local communities in a participatory process, enriching its digital archive with crowdsourced memories and documents. The project opens up new possibilities for international cooperation, digital heritage practices, and the study of architectural migrations, showing how critically informed digital tools can recontextualise and enhance dispersed historical knowledge.

Keywords: digital documentation; built heritage; virtual return; digital models; ecletismo paulistano; digital archive

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1. Introduction

In recent years, digital technologies have assumed a strategic role in documentation, cataloguing, and long-term conservation of cultural heritage [1]. Within this framework, digitization is no longer understood merely as a technical process of data acquisition, but as a critical process capable of transforming survey outputs into structured and interoperable knowledge systems. In line with this perspective, the present study offers a reflection on the opportunities of digital archive as an operational infrastructure that supports research, monitoring, and future conservation strategies, while simultaneously enhancing the interpretative and communicative value of built heritage.

The research was developed within the framework of the Progetti di Rilevante Interesse Nazionale (PRIN) project "KNOW.it—Transition in the Digital Age: KNOWing our background to refine our future". The project responds to a broader European agenda that recognizes digital innovation as a key driver for cultural sustainability and inclusive growth. National and international programmes—such as the Piano Nazionale di Ripresa e Resilienza (PNRR), the Piano Nazionale Complementare (PNC), and Horizon Europe (Work Programme 2023–2024, Culture, Creativity and Inclusive Society)—have identified the digitization of cultural heritage as a priority investment area, acknowledging its potential to foster accessibility, preservation, and cultural innovation. Within this context, KNOW.it positions the digital archive as a dynamic environment capable of integrating heterogeneous materials into a coherent and accessible system.

The study focuses on architectural heritage of Italian origin located overseas, with particular attention to the Brazilian cities of Jaú and São Carlos, in the state of São Paulo (Figure 1).

Figure 1. Geographical location within the State of São Paulo of the case study cities of Jaú and São Carlos. Graphic reconnection between São Paulo and Italy based on the "virtual return" principle promoted by the KNOW.it project.

The large-scale Italian migrations of the nineteenth century exported not only labour and craftsmanship, but also a consolidated architectural lexicon shaped by centuries of building traditions. In Brazil, these influences materialized in a distinctive architectural language commonly referred to as Ecletismo Paulistano, which combined Italian-inspired compositional schemes and decorative elements with spatial solutions adapted to local climatic, social, and cultural conditions. Between the late nineteenth century and the early decades of the twentieth century, Italian architects, designers, draftsmen, and skilled workers contributed significantly to shaping this built environment. Today, many of these civil and religious buildings remain deeply embedded in the urban fabric, yet are often under-recognized and insufficiently documented. Against this background, the project advances the concept of "virtual return", understood not simply as symbolic restitution but as the digital reactivation of dispersed heritage through systematic documentation, survey, interpretation, and dissemination [2]. By transforming survey data into structured digital archives, the research reconnects academic investigation with diasporic memory and collective identity, fostering transnational dialogue between Italy and Brazil. The digital platform developed within KNOW.it is conceived not as a static repository, but as an interoperable and evolving knowledge infrastructure. It integrates archival documents, historical sources, metric surveys, 2D drawings and 3D reconstructions into a coherent cataloguing system capable of supporting both scholarly analysis and operational decision-making processes related to conservation.

Methodologically, the study adopts a rigorous, multi-scalar workflow that combines archival research, field surveys, photogrammetry, terrestrial laser scanning, and advanced 3D modelling. Archival investigations conducted in Jaú and São Carlos, in collaboration with local institutions—including AJAC (Associação Jauense de Ambiente e Cultura), the Museu Municipal José Raphael Toscano de Jahu, and the Fundação Pró- Memória de São Carlos—enabled the identification and historical contextualization of selected case studies. Metric surveys and digital acquisitions provided high-resolution geometric data, which were processed into 2D and 3D representations. These models were subsequently organized within a structured digital archive designed to ensure long-term accessibility, and the possibility of future updates. The resulting digital archive operates on multiple levels. Scientifically, it strengthens methodological practices related to the documentation and analysis of Italian-influenced architecture abroad. Operationally, it offers a reliable basis for monitoring, maintenance planning, and potential restoration interventions. Culturally, it enhances public engagement through an online platform featuring interactive maps, multimedia content, and social media integration, encouraging participatory contributions and the enrichment of the archive through crowdsourced memories and private documentation. In this sense, digital documentation becomes a shared and evolving process, capable of expanding beyond institutional boundaries. The urgency of such an approach has been dramatically confirmed by recent events. In August 2025, one of the buildings digitally documented within the project collapsed, underscoring the vulnerability of this heritage and the irreplaceable value of accurate digital records (Figure 2). This episode highlights the necessity of comprehensive digital archives that preserve not only visual memory but also precise metric data, ensuring that knowledge of endangered architectures remains available for future research and conservation strategies. By critically framing the digital archive as both a research tool and a catalyst for cultural reactivation, this study demonstrates how digitally informed practices can support the preservation of architectural migrations and foster international cooperation. The KNOW.it project thus proposes a model in which digital documentation evolves into a structured, participatory, and future-oriented knowledge infrastructure, capable of bridging past and present while guiding sustainable heritage strategies.

Figure 2. Images of the documented collapsed historic civic building located at Rua Visconde do Rio Branco, 273, São Carlos. Image processing by the authors.

2. Case Studies of Jaú and São Carlos

Between the late 19th and early 20th centuries, Brazil experienced one of the largest Italian migration waves in its history, with over 1.5 million Italians arriving between 1870 and 1920 [3]. This demographic movement deeply reshaped Brazil's social, economic, and urban landscape [4]. Among the states most affected by Italian immigration was São Paulo, where cities like Jaú and São Carlos (Figure 3) became key recipients of Italian labor and expertise.

Figure 3. The cities of Jaú and São Carlos—State of São Paulo, Brazil.

Despite being frequently overlooked in academic literature, these two cities preserve rich architectural testimonies that reflect the influence of Italian craftsmen, engineers, and designers. Both Jaú and São Carlos emerged as important urban centers during the coffee boom and developed strong ties with Italy through chain migration and labor recruitment programs [5]. In both cities, Italian immigrants found work not only in agriculture but also in construction and urban development (Figure 4). Italian stonemasons, sculptors, and builders introduced artisanal techniques that significantly influenced local architectural language [6]. These two cities share similar urban growth patterns and contain architectural elements that mirror the stylistic preferences and construction methods of Italian professionals active during that period. The eclectic style, known in Brazil as ecletismo paulistano, played a central role in shaping the visual identity of Jaú and São Carlos.

Figure 4. A collection of advertisements from Italian-owned companies based in São Paulo State. Image Source: [6].

This stylistic movement, an amalgam of neoclassical, neo-Gothic, baroque, and Renaissance influences, was adapted by Italian immigrants to the Brazilian context. Key architectural features include ornamented façades, symmetry, decorative stucco work, balustrades, and iron detailing. The buildings range from single-story bourgeois villas to multi-story public institutions, often reflecting the original function of the space—residential, civic, or religious. These typologies were catalogued based on several structural and stylistic parameters: original use, number of floors, and building morphology [7]. The significance of this study lies in the use of archival documentation to rediscover these architectural contributions. Local archives in Jaú and São Carlos hold a wealth of material, plans, sections, elevations, and commission records that reveal the hidden work of lesser-known architects. These sources are invaluable for understanding how architectural decisions were made, who was involved, and how styles and techniques circulated between regions. Moreover, this research attempts to map, analyze, and digitally archive these under-recognized architectural forms. While major works by famous designers have received some academic attention, the broader corpus of buildings shaped by Italian hands remains largely unstud-

ied. The architectural heritage of Jaú and São Carlos offers a unique lens through which to examine the legacy of Italian immigration in Brazil. It reveals not only the transmission of aesthetic values and technical skills but also the social and cultural adaptation of immigrant communities. The analysis of these eclectic buildings is essential to understand the stylistic design process that has shaped Brazil's urban and multicultural identity and to ensure its preservation.

3. Materials and Methods

In this framework, which recognizes knowledge as the starting point of all activities, the KNOW.it project integrates archival research, architectural surveys, digital modeling, and structured data processing. The research is grounded in a methodological approach that integrates digital models and stylistic analysis to document and investigate architectural heritage in Jaù and São Carlos. This heritage consists of numerous buildings, primarily intended for residential or commercial use, designed by architects and/or constructed by firms of Italian origin. Many of these buildings have undergone transformations of varying intensity over the centuries, affecting both their physical configuration and the perception of the urban landscape. The original design drawings—which in some cases correspond to the current state of the buildings—are preserved in municipal archives. These drawings are commonly known as blueprints, as they are cyanotypes produced by contact printing original drawings on tracing paper onto photosensitive paper, which turns blue during development while the unexposed areas remain white.

The methodological framework consists of four interrelated phases.

The first phase of the project focuses on the collection and classification of archival materials, primarily blueprints (Figure 5), sketches, and project documents held in fragmented public and private collections [8]. This investigation is conceived to address specific analytical objectives, establishing connections between archival documentation and the built heritage, identifying stylistic features, and assessing historical transformations.

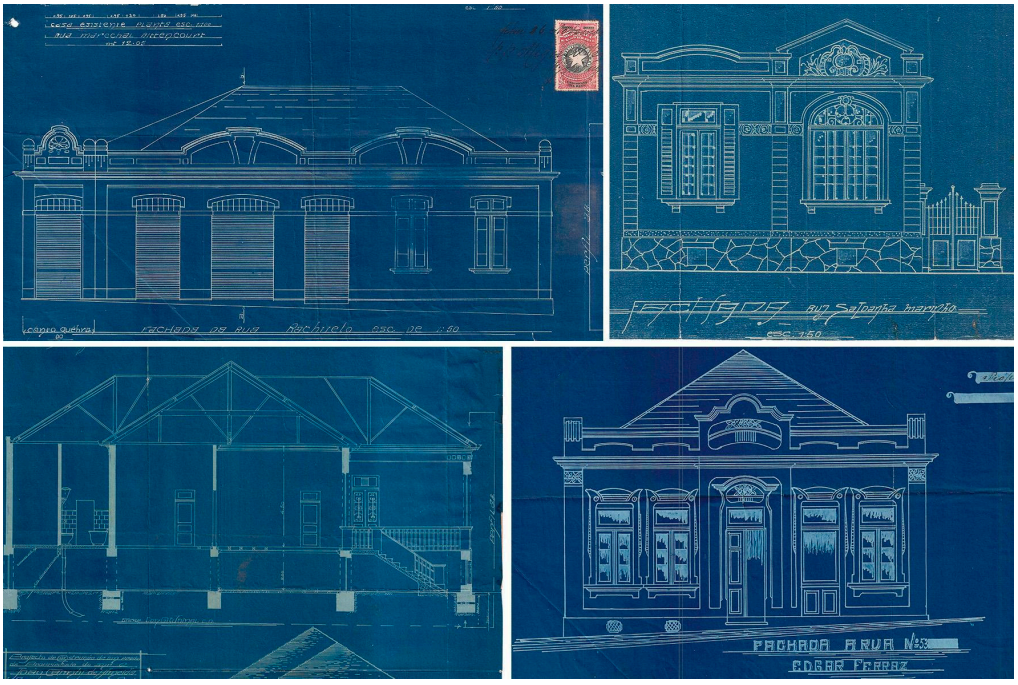

Figure 5. Selection of blueprints by Beppino Terrieri. Source: Arquivo Municipal de Jaù. From (**left**) to (**right**): building in Rua Marechal Bittencourt, Rua Saldanha Marinho, Rua Major Prado, Rua Edgar Ferraz.

257 blueprints realized between 1910 and 1940 have been collected. This phase reveals the numerous Italian architects—often overlooked in historical narratives—who played a significant role in shaping Brazil's urban fabric. Bibliographic research enables the identification of these professionals through the consultation of historical archives, immigration records, and professional registries. All documents are catalogued according to standardized criteria, including the name of the designer and/or construction company, the year of construction, and the building typology. In addition, this phase addresses the technical interpretation of the graphic documents, supporting the integration of archival sources with survey data and representational outputs. The content of representation and the graphic conventions are examined: number and typologies of drawings (generally plans, main elevations, only one section), scale of drawings (1:100 or 1:50), notation systems, line weights, hatching patterns, and measurement units are studied to decode implicit design information. The drawn elements—such as architectural elements, cornices and decorative features—are also scrutinized to infer the construction methods employed by Italian builders from a compositional and stylistic standpoint [9].

The second phase is devoted to linking architectural drawings to existing buildings, enabling comparisons between design and realization and clarifying the extent of Italian influence. To operationalize this objective, the research integrates survey activities as a key methodological step, providing the metric and morphological data necessary to establish a reliable correspondence between archival drawings and the existing built environment. The survey phase focused on a subset of buildings selected according to two primary criteria: the persistence of the built structure (Figure 6) and the reliable attribution of authorship based on archival sources. This selection resulted in a dataset of 97 extant buildings associated with 17 identified architects.

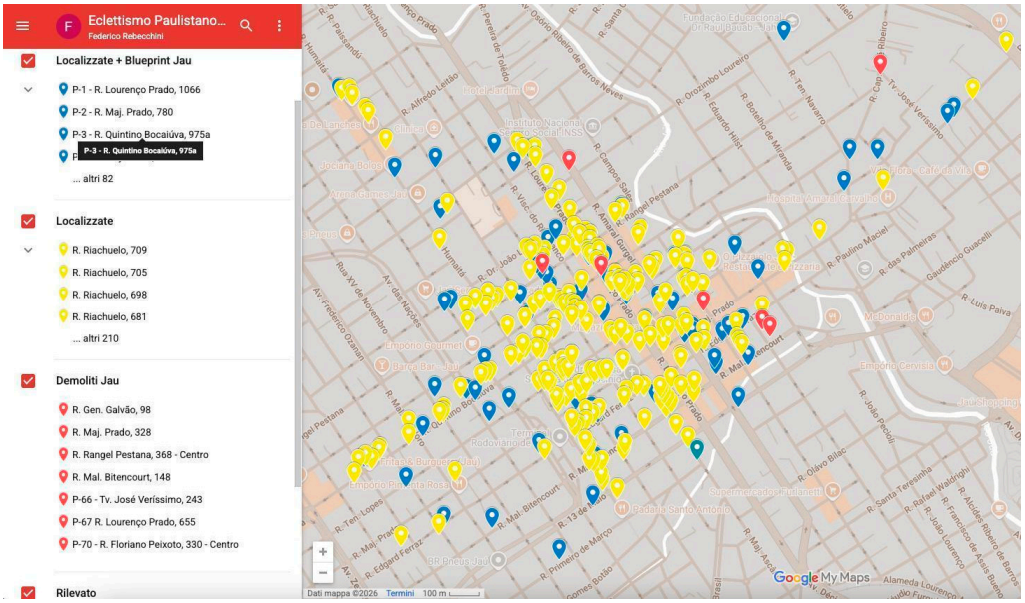

Figure 6. Analytical map used to identify and survey the architectural case studies relevant to the project. Buildings highlighted in blue represent those for which original design blueprints are available and that have been located within the current urban fabric; in yellow, eclectic buildings identified across the area that potentially reflect Italian influences; in red, buildings for which blueprints exist but which have since been demolished. Source: authors.

These cases were subsequently surveyed and analysed through an integrated workflow, enabling the comparison between archival design documentation and the current built condition, while accounting for transformations and deviations from the original project (Figure 7).

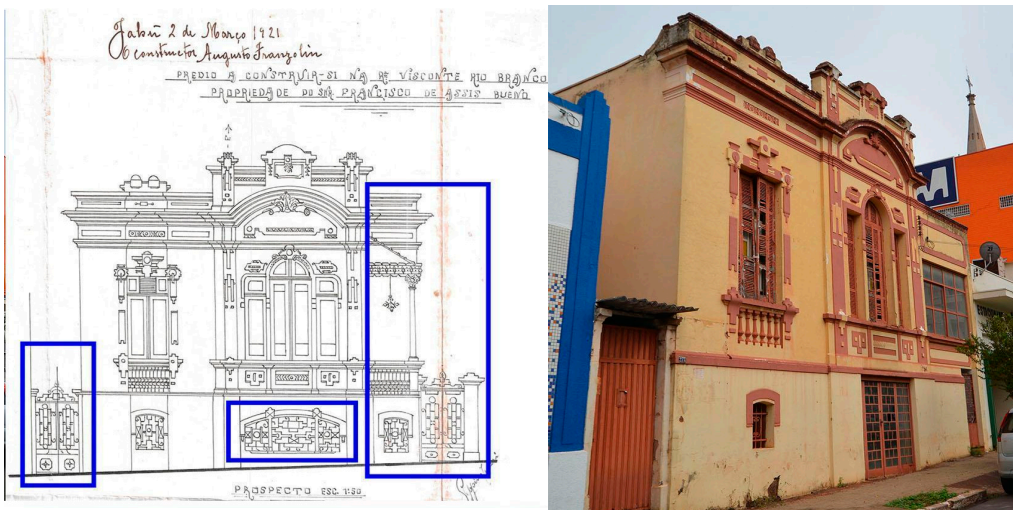

Figure 7. Comparison of Blueprint and current state of the building. Buildings at Rua Visconde de Rio Branco, 273. Architect: Augusto Franzolin. On the left: drawing by Augusto Franzolin (blueprint source: Arquivo Municipal de Jaú); on the right: photograph of the building in its current state. The comparison highlights the differences between the design and the realized building (highlighted in blue in the drawing), particularly regarding the two lateral entrances flanking the central door. Photo source: authors.

Survey technologies such as 3D laser scanning and photogrammetry play a crucial role [10,11]. In particular, laser scanning made it possible to document the as-built condition of the building by considering not only the individual structure but also its surrounding context, thereby collecting morphological and metric data. Photography, on the one hand, allows for the immediate comparison of the current state of the building with historical photographs; on the other hand, by contributing to the democratization of surveying practices and to the generation of 3D models from images, it aligns with the project's objectives of raising community awareness and reaching a wide audience beyond disciplinary specialists. These models are nevertheless metrically controlled, as they are scaled using the coordinates of the point clouds obtained from the alignment of the laser scans [12].

The survey is followed by the 2D representation phase [13], conducted with the aim of producing a record sheet describing the current condition of each of 95 buildings. On this basis, the representation scales were defined as 1:500 for the area plan, 1:50 for elevations, and 1:20 for architectural details. Architectural details concern windows, doors, and decorative elements. All drawings follow unified graphic conventions, employing consistent line weights and standardized layout templates. Each document includes a standardized header containing project information, author, survey date, and drawing type. Guidelines for labeling, formatting, and digital file organization ensure visual coherence and interoperability among all members of the research group. The outputs include 2D vector drawings and annotated 3D models of each surveyed building, which together constitute the backbone of the digital archive dedicated to architecture of Italian origin in Brazil (Figure 8).

Comparing historical drawings with contemporary surveys, the research identifies changes, structural damage, or the loss of original elements. These analyses could inform preservation strategies that rely on historical documentation and material studies to propose conservation approaches tailored to each site.

The third phase defines the main characteristics of Brazilian eclecticism. Given the plurality of influences characterizing this architectural language, its classification requires a structured and systematic approach [14,15]. The analysis of the blueprint led to defining features of Italian-influenced eclecticism, beginning with compositional aspects such as symmetry, façade articulation, and ornamental systems derived from Renaissance and Baroque

traditions. The analysed buildings can be classified into three main categories: symmetrically planned residential buildings, asymmetrical residential buildings with lateral distributive elements, and buildings with commercial or mixed use. In the first category, the façade is characterised by a clear axial organisation, with a central entrance and a regular distribution of openings, reflecting a rational and ordered internal layout. In the asymmetrical variants, the composition adapts to specific contextual or functional conditions, introducing elements such as verandas or lateral entrances that modify the original balance without compromising the overall readability of the façade. Commercial and mixed-use buildings, while significantly altering the solid-to-void ratio through the introduction of large ground-floor openings, retain a decorative language consistent with that of residential architecture, highlighting the transferability of the formal lexicon across different functional typologies. From a compositional perspective, façades are structured according to principles of symmetry, modularity, and hierarchy. The vertical organisation is generally articulated into two main registers: a primary body, defined by the rhythmic arrangement of windows, and an upper zone characterised by cornices and decorative elements. Horizontal articulation is emphasised by the presence of string courses and continuous mouldings, which contribute to unifying the composition even in cases where the distribution of openings varies.

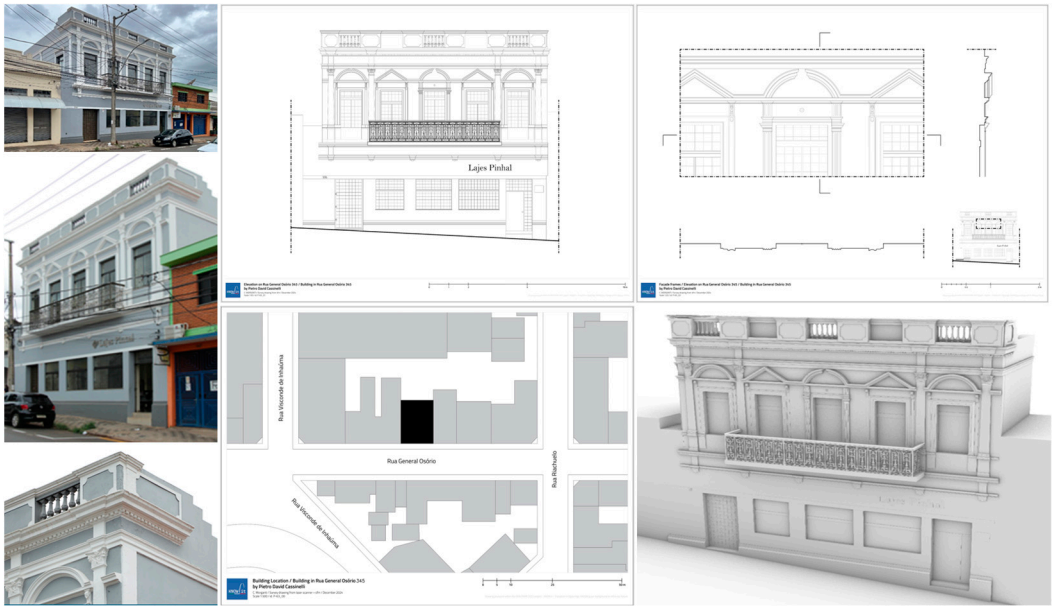

Figure 8. Example of the generated data for the Hotel União, São Carlos (SP). On the left: picture of the actual state of the building, on the right: plan at 1:500 scale, elevation at 1:100 scale, details of the window at 1:20 scale and 3D model. Elaboration by Caterina Morganti.

The analysis of architectural elements further confirms the presence of a recurring formal repertoire (Figure 9).

Windows are predominantly vertically proportioned and are often framed by mouldings that reinforce their compositional role. In several cases, they are surmounted by arched decorative elements or pediments, introducing controlled variations within an otherwise serial system. Doors, particularly in residential buildings, are centrally positioned and treated as hierarchically significant elements, either through increased dimensional emphasis or richer decorative articulation. In commercial buildings, openings are enlarged and lose part of their original formal definition, while maintaining integration with the upper decorative system. Entablatures play a key role in defining the architectural image, contributing to a clear and legible articulation of the compositional hierarchy. The crowning system is particularly significant, representing one of the elements with the greatest degree of variation.

Adopted solutions include curvilinear profiles, segmental arches, small pediments, and sequences of superimposed mouldings, often enriched with ornamental details.

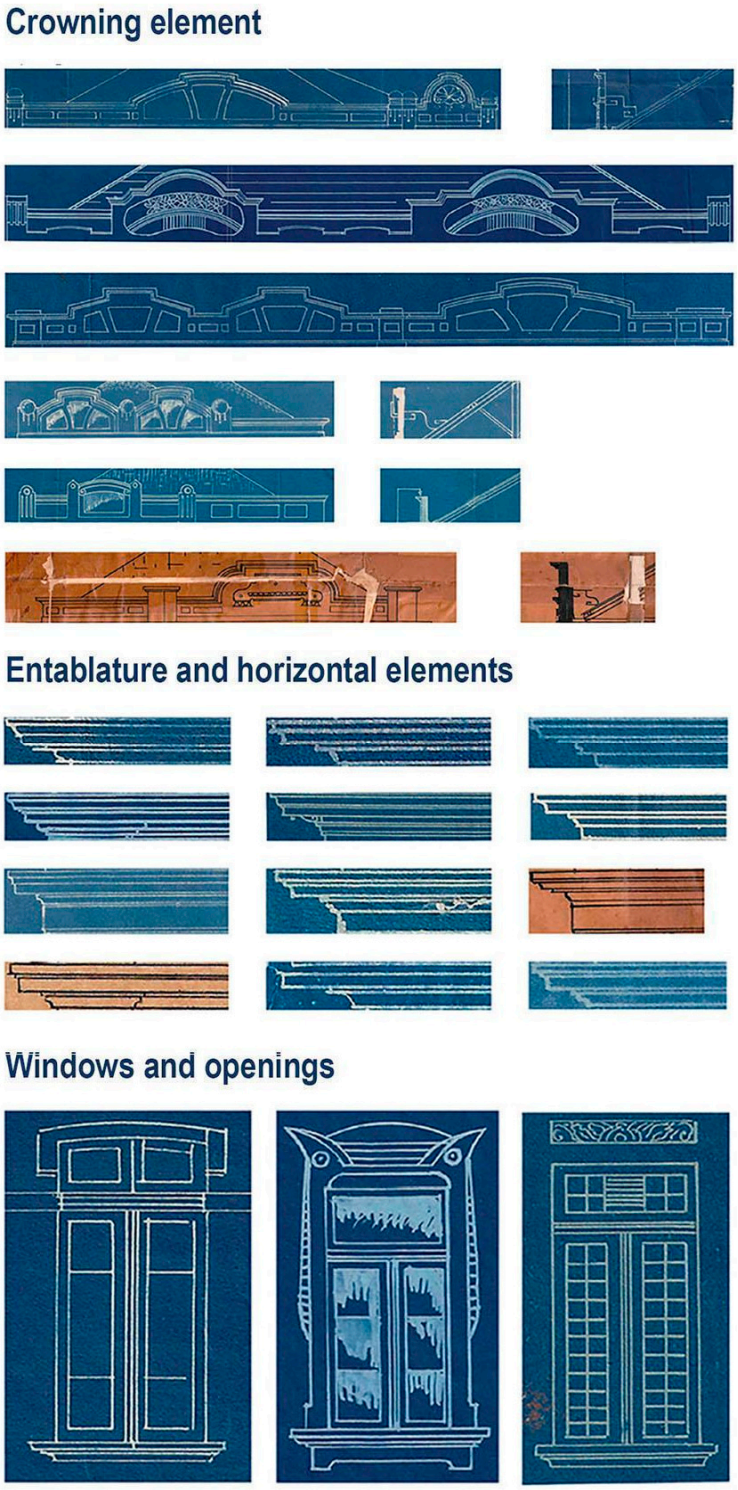

Figure 9. Morphological classification of some decorative elements in Beppino Terrieri's drawings. Elaboration by Martina Attenni. The figure presents a structured taxonomy of façade components—including crowning elements, entablatures and horizontal profiles, as well as windows and openings—highlighting recurring formal patterns, compositional schemes, and ornamental vocabularies. The identification of different typologies of the same elements supports the recognition of diverse expressions of Brazilian eclecticism.

It should be noted that the above considerations primarily apply to buildings that have remained largely unaltered with respect to their original configuration. In fact, the survey activities and the construction of 2D and 3D models enabled the formulation of considerations grounded in the current condition of the buildings and their correspondence with the original design. In several cases the analyzed architectures have experienced significant transformations over time, including additions, substitutions, and partial reconstructions. Such processes have often resulted in the presence of later accretions that obscure the original compositional scheme, making the formal principles of Brazilian eclecticism and the associated decorative vocabulary less clearly legible (Figure 10).

Figure 10. Examples of buildings currently characterized by significant transformations and functional adaptations. The image highlights the introduction of large ground-floor commercial openings, signage, and surface alterations, which modify the original solid–void relationships and partially obscure the compositional and decorative features of Brazilian eclecticism. Left: building in Rua Sebastião Ribeiro 576, corner building with extended shuttered openings and applied signage. Right: building at Rua Lourenco Prado 737, façade with altered ground-floor access and superimposed contemporary elements. Photo source: authors.

The fourth phase focuses on the dissemination of knowledge related to architectural heritage of Italian origin located in Jaù and São Carlos. This process (paragraph 5) not only supports the recognition and conservation of this heritage but also materializes through the development of a digital archive conceived as an integrated platform for research, documentation, and public dissemination. The archive is designed to host all the models (2D drawings and 3D digital models) of the analyzed buildings to document their actual state and explicitly link them to archival sources, historical drawings, and bibliographic references. Beyond its role as a scientific repository, the digital archive functions as a communication tool aimed at conveying to a broader, non-specialist audience the cultural values, construction knowledge, and historical processes that contributed to the formation of a high-quality architectural heritage. In this sense, the archive supports both scholarly research and public engagement, fostering awareness, accessibility, and appreciation of Italian-influenced architecture within the Brazilian urban context [16].

4. Development of Digital Archive

The development of a digital archive constitutes the core objective of this project, establishing a systematic and sustainable framework for the preservation, analysis, and dissemination of architectural documentation. The material collected from local institutions proved to be heterogeneous and fragmented. Architectural blueprints emerged as the most tangible and consistent evidence of the architectural memory of Jaú and São Carlos.

From the outset, it became clear that the minimum archival unit would be the architectural project itself, regardless of whether it was built, demolished, or unbuilt. Unlike a single artwork, typically documented through one primary object or image, the architectural project functions as a complex container of materials: historical and contemporary drawings, archival and recent photographs, bibliographic references, and technical documentation. Each project record therefore aggregates multiple interrelated items and is associated with precise geolocation data.

For the development of the digital archive a preliminary phase focused on reviewing best practices in digital cultural heritage archiving. This first survey of the state of the art in the digitization and archiving of cultural heritage represented a necessary step in structuring an archive capable of responding to the needs of the project, while ensuring a solid methodological foundation grounded in established practices and consolidated references. At present, this field remains highly fragmented. Each research group, institution, or stakeholder tends to propose partially different approaches, largely due to the intrinsic heterogeneity of cultural heritage, whether tangible or intangible. This condition results in a significant dispersion of information, closely linked to the continuous evolution of technologies and archiving systems, which often renders case studies, best practices, and guidelines obsolete within a relatively short time span.

The field of digital cultural heritage archiving is therefore characterized by a fragmented body of literature and operational practices, in Europe and overseas. The rapid succession of technological innovations, including 3D acquisition, advanced imaging, artificial intelligence, cloud infrastructures, and semantic metadata, has hindered the stabilization of shared standards and methodologies [17]. This fragmentation is also reflected in national and European policy documents and guidelines, which frequently adopt flexible frameworks precisely because operational practices evolve faster than unified protocols can be established. As a result, recent literature often presents a patchwork of sector-specific approaches spanning archives, libraries, museums, archaeology, and architecture, which do not always effectively communicate with one another. This condition makes a critical selection of reference models necessary.

Within this context, it becomes essential to adopt flexible approaches while carefully selecting case studies and best practices that align with the objectives of the research. Since the early 2000s, rapid technological change has required adaptable archiving strategies and a continuous rethinking of practices across the information lifecycle [18]. In 2020, the European Union provided a set of general guidelines that proved useful in establishing initial criteria for the proper digitization and long-term preservation of cultural heritage [19]. Similar guidelines were adopted following the Italian Piano Nazionale di Digitalizzazione del Patrimonio Culturale [20]. A first survey of digital archives, primarily related to architecture and architectural drawing, was conducted during the conference Architectural drawing archives: contemporary uses, held at the Department of History, Representation and Restoration of Architecture at Sapienza University of Rome on 16–17 November 2023. During the conference, numerous institutions and stakeholders presented research projects that outlined methodologies and solutions for the archiving and communication of architectural heritage. Several case studies were discussed directly by their authors, while others were introduced as best practices to be considered as references.

Following this initial selection, and considering the nature of the research project, which integrates architectural survey, historical and archival research, and the subsequent critical interpretation of collected data, it was necessary to identify case studies aligned with these approaches. Among the references considered, the archive ATARAL—Atlas de Arquitectura Almohade—emerged as particularly relevant. The project, developed by Antonio Almagro Gorbea at the Real Academia de Bellas Artes de San Fernando in Madrid,

is dedicated to cataloguing Almohad architecture across Spain, Portugal, and North Africa through surveys, photography, historical reconstructions, and geolocation. Its open and academically oriented model, which includes downloadable survey drawings, constituted a significant reference for the development of the present archive.

The methodological and technical framework underlying ATARAL is directly connected to the archival system of the Real Academia de Bellas Artes de San Fernando, developed under the supervision of Prof. José María Luzón Nogué together with a team of academics and developers. The same framework has been adopted and further developed by the Istituto Centrale per la Grafica, where it has been implemented using open-source technologies such as MySQL and Directus, and integrated with tools including OpenStreetMap and analytics services. This continuity between institutions provided an opportunity to investigate the system more closely through direct contact with its implementation in an Italian context.

For this reason, the research strategy included direct engagement with institutions that adopt comparable approaches and that were accessible for consultation. The investigation therefore began in Rome, allowing for direct interaction with professionals involved in cataloguing, archiving, and platform management. Interviews with the Istituto Centrale per la Grafica provided detailed insight into database design, metadata structuring, and the management of relational systems. These exchanges confirmed the relevance of adopting the architectural project as the primary referential unit and of structuring the archive according to relational database principles, where different entities are interconnected.

Relationality emerged as a central aspect of the system. Architects, draftsmen, clients, and families are documented as interconnected entities, allowing for the reconstruction of broader architectural narratives over time. Additional interviews were conducted with institutions such as the MAXXI—Museo nazionale delle arti del XXI secolo and ArchiDIAP, which offered complementary perspectives on archiving practices.

At MAXXI, the archival system is primarily structured to support the management of architectural collections within a museum context. Materials such as drawings, models, photographs, and documents are catalogued according to typological and collection-based criteria, reflecting both conservation needs and institutional workflows. These materials are physically preserved and progressively digitized, becoming accessible through the Arianna4 platform, developed by Hyperborea. The system supports both internal cataloguing operations and public access, and integrates IIIF protocols for image visualization, while maintaining restricted access to high-resolution master files. This case highlighted the importance of consistent cataloguing standards, controlled vocabularies, and clearly defined classification systems within a large institutional archive.

ArchiDIAP, the archive of modern architecture of the Department of Architecture and Project at Sapienza University of Rome, represents a different but complementary approach. Developed as a collaborative platform based on WordPress, it organizes its content around individual architectural projects. Each entry combines descriptive texts, historical photographs, and original drawings, constructing a layered and narrative-oriented digital archive. This model emphasizes the role of critical interpretation alongside documentation, as well as the integration of heterogeneous materials within a structured yet accessible system. The availability of downloadable resources further reinforces its openness and usability.

Taken together, these case studies illustrate a range of possible approaches to digital cultural heritage archiving, from highly structured institutional databases to more flexible and narrative-oriented platforms. Their comparison allowed for the identification of key principles, including the centrality of relational data structures, the importance of rigorous

cataloguing, and the potential of integrating different types of materials and levels of interpretation within a single archival system.

Based on these precedents, an initial selection of the most relevant projects was organized within a structured spreadsheet, conceived as a preparatory cataloguing tool for future implementation within a web-based archival and communication system (see paragraph 6). Given the heterogeneity of the documentation—ranging from historical drawings and photographs to bibliographic sources and digital models—a standardized cataloguing framework was required. Each project was assigned a unique identifier (e.g., P-1, P-2), while associated resources follow progressive alphanumeric codes (e.g., P-1_01, P-1_02) to ensure traceability. The cataloguing system is structured into six primary sections: General Data, Location, Project, Analysis, Bibliography, and Resources. Controlled vocabularies ensure terminological consistency and support relational querying. Particular attention was devoted to aligning current site observations, including geospatial data and photographic surveys, with archival records, thereby constructing a multilayered account of both extant and lost architectural heritage.

5. Project Outcome: KNOW.it Digital Platform

The recovery of historical material from archival sources and private citizens, combined with fieldwork, architectural surveys, 2D and 3D modeling, and bibliographic research, has resulted in a body of documentation sufficient for dissemination. This material allows the first structured presentation of São Paulo's eclectic architectural heritage through a dedicated communication channel: the digital archive. Cataloguing, designed to highlight the historical and morphological characteristics of each building, constitutes the foundation of the archive's structure.

Among the various web-based archiving and communication solutions available, a platform was selected that ensures long-term maintenance, technical support, and a reliable institutional framework. The project adopted Archiui Cloud Software (Promemoria Group), a digital management system for the description and enhancement of cultural heritage assets. Accessible via browser, the platform includes both a back-end and a customizable front-end. The back-end is based on the open-source software CollectiveAccess, while the front-end can be adapted to specific project requirements. Its standardized yet flexible data model proved suitable both in terms of budget and functionality, enabling precise geolocation of buildings, structured relational links among records, and the integration of downloadable digital resources.

Preservation, standardization, and interoperability represent central challenges in the development of an online archive. Digital platforms require continuous maintenance to avoid technological obsolescence. To address this, the archive will be supported by a three-year development and maintenance plan, including academic dissemination activities, public events, and periodic updates. Long-term sustainability will depend on the integration of future research projects, ensuring both expansion and continued relevance.

The archive is currently being populated with an initial group of projects to test accessibility and usability. Resources are made available primarily in PDF and JPG formats, selected for compatibility and digital preservation. Users can download survey drawings, blueprints, and historical and contemporary photographs for research or personal use (Figure 11).

The infrastructure supports collaborative input: authorized members of the research group may upload and edit content, fostering coordinated academic curation. All project members, distributed across three research units in different cities, have access to a shared private repository for material management. A selected group is responsible for maintaining cataloguing standards within the archive, while broader access ensures continuity in data entry and long-term management. In addition to administrative profiles, future

researcher accounts will provide extended access levels where necessary, alongside the publicly accessible interface, which already offers comprehensive consultation across most sections of the site. In conclusion, the archive functions as both a research infrastructure and a dissemination platform. The tagging system used to catalogue the projects—identifying architects, draftsmen, and clients, as well as location (past and present), construction period, and the most recognizable aesthetic features—becomes within the platform a dynamic tool for detecting recurring patterns, uncovering unexpected connections, and isolating projects with specific characteristics, thereby enabling a more effective interpretation and narration of this architectural heritage. Through rigorous cataloguing, standardized outputs, and a structured sustainability strategy, it aims to preserve and critically document an architectural heritage that has remained largely understudied, providing scholars and the wider public with an accessible and evolving resource. The platform is progressively populated with new entries as survey activities are completed, further enriching the range of possible relationships; it is accessible at the following address: https://knowit.archiui.com/.

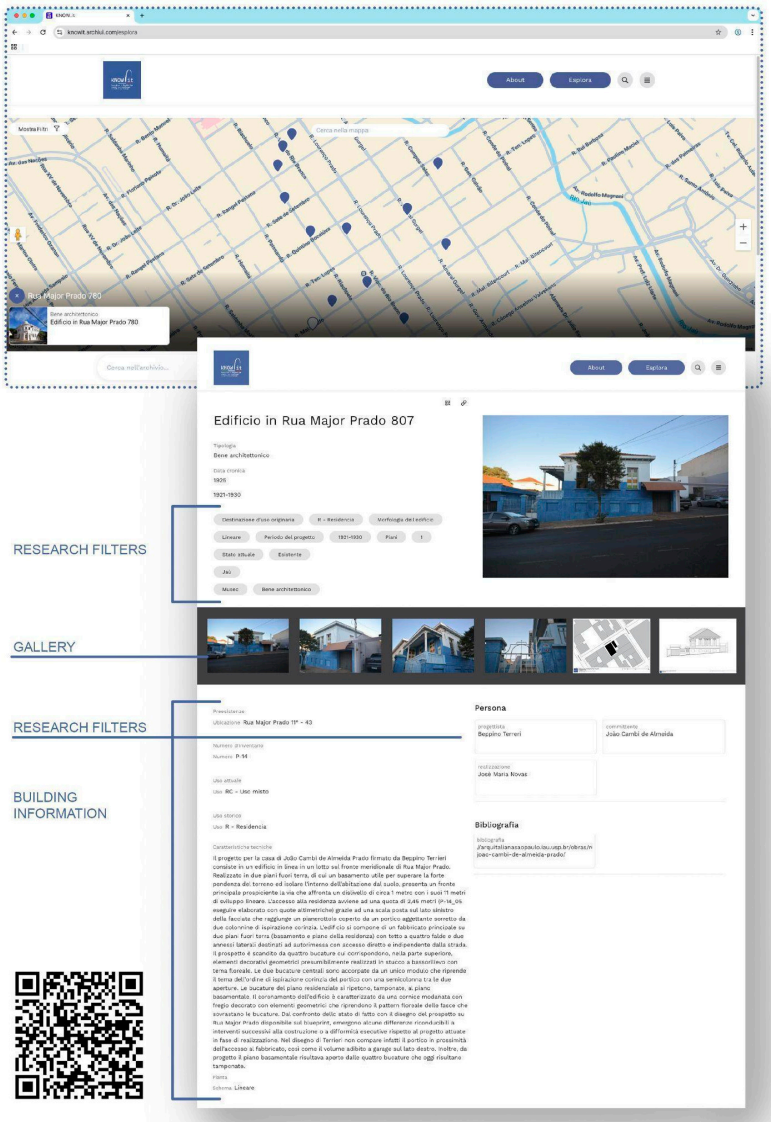

Figure 11. "Explore" section of the project's digital platform. Opening a project allows users to browse and download drawings and photographs. Each page also provides a historical and critical overview, along with links to the building's designer and client. The search can be refined through predefined filters, such as architect, client, building typology, period, and other parameters. https://knowit.archiui.com/oggetti/26-edificio-in-rua-major-prado-807?i=0 (accessed on 11 May 2026) Source: authors.

6. Digital Accessibility and Heritage Communication: Scalable Outputs and Social Media

The evaluation criteria for the allocation of research funding increasingly include an assessment of the project's potential impact across multiple dimensions, such as cultural development and the dissemination of scientific knowledge. Funding calls, such as those issued by the European Union, increasingly emphasize the need for communication strategies capable of reaching audiences beyond the scientific community [21].

The KNOW.it project aims to raise awareness among Italian and Brazilian populations of the cultural dynamics that connect the two countries. It achieves this by focusing on architecture as a tangible result of Italian migration to South America, and as a means of cultural hybridization, making this heritage intelligible both as a scientific object of study and as a shared cultural resource.

To ensure that dissemination is not treated as a secondary activity but as an integral component of the research pipeline, KNOW.it explicitly pursues the definition of a standardized and replicable process capable of capitalizing on scientifically validated workflows and transforming them into scalable outputs. Accessibility is therefore understood not only as public visibility, but also as the possibility to reuse, compare, and expand research results over time through homogeneous documentation standards. This approach is tightly connected to the platform's architecture: the platform does not merely host content, but structures it so that different user groups—citizens, students, local stakeholders, researchers—can access materials at different depths, while relying on the same coherent, traceable production workflow [22].

From this perspective, the project identifies a set of architectural character-defining elements and information categories that support the indexing, cataloguing, and classification of buildings. These parameters include morphological and typological attributes (façade composition, openings, decorative apparatus, volumetric articulation, construction techniques and materials) as well as contextual descriptors derived from archival evidence (architect, client, chronology, later transformations, documentary sources and state of preservation). By translating these features into structured metadata, the archive enables cross-comparison among case studies and supports multi-criteria consultation, strengthening the platform's role as both a dissemination tool and a research environment (see paragraph 5).

A key aspect of accessibility concerns the production of 2D technical drawings describing the current state of buildings, as mentioned in paragraph 3, to remain as durable documentation over time, ensuring a minimum shared standard of legibility, metric reliability and archival consistency. In fragile contexts where architectural heritage may be threatened by neglect, rapid transformations, or demolition, these drawings are conceived as persistent documents that preserve knowledge even if the physical asset is altered or lost, and they constitute a stable reference for future monitoring, comparative studies, and potential conservation actions. Accordingly, the platform disseminates research outputs through multiple levels of access that balance inclusivity with scientific usability. For non-specialist audiences, interpretative materials and survey drawings are provided as downloadable PDFs, designed to support narrative comprehension and visual clarity. For experts and researchers, the same documentation is also made available in editable vector formats (DWG), enabling further analysis, verification, and integration into other scholarly workflows. In parallel, the same 2D drawings are adapted for outreach through simplified layouts, excerpts, and visual storytelling formats optimized for social media dissemination, allowing the project to communicate methods and results in a way that is immediate and shareable while remaining grounded in validated documentation practices (Figure 12).

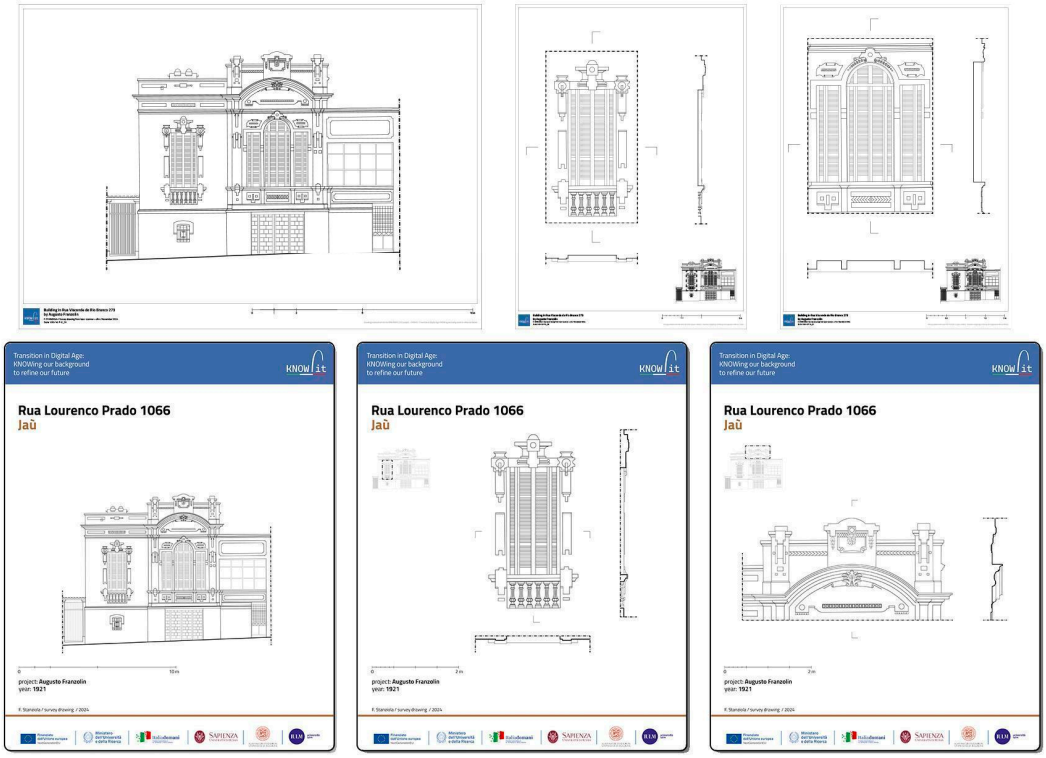

Figure 12. Example of the adaptation of architectural survey drawings as outputs for dissemination through social media, achieved through the use of a standardized graphic processing system. Source: authors.

In parallel with the implementation of the digital platform, a communication strategy was developed to promote active and direct engagement from local communities through social media. As part of the PRIN 2022 KNOW.it project, dissemination activities are carried out via the two most widely used social networks: Instagram and Facebook [23]. Both platforms, owned by the Meta group, enable the synchronized management of communication channels, thereby ensuring a broader and more diverse audience reach (Figure 13). The communication strategy is structured around two complementary flows.

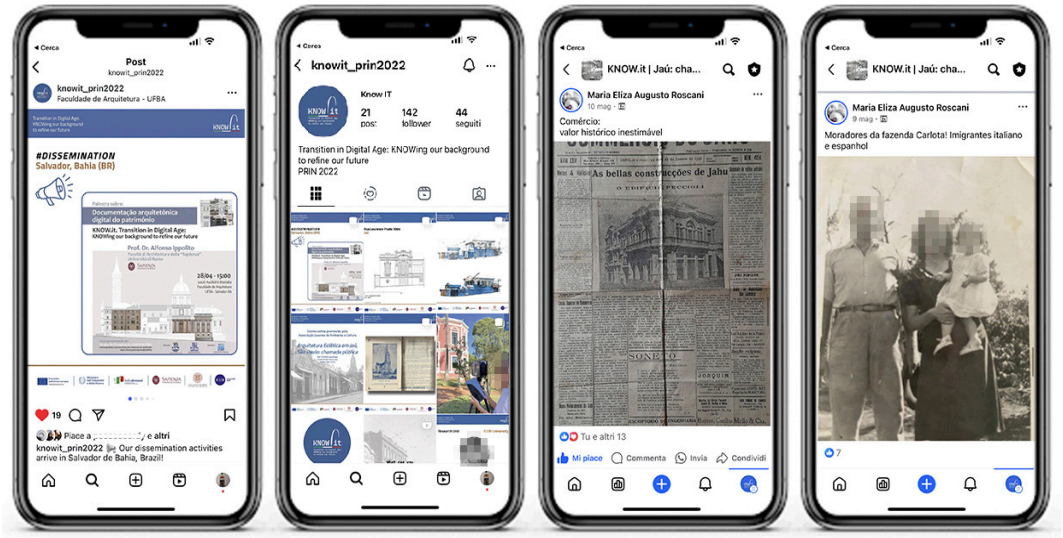

Figure 13. Examples of research results dissemination through Instagram and Facebook, including the collection of feedback and user-generated content from the local community via dedicated groups. Source: authors.

On one side, project updates and research outcomes are disseminated via dedicated Facebook and Instagram pages. On the other, a "bottom-up" data collection campaign has been launched through two Facebook groups targeting the cities of Jaú and São Carlos [24]. To address the issue of fragmented archival data in Brazilian repositories, the project launched a "Call for Memories" initiative directed at local communities. The aim is to gather diverse forms of knowledge concerning Italian Eclectic architecture in São Carlos and Jaú: community members are invited to share—through the aforementioned groups—photographs from their personal archives that depict buildings or individuals linked to the historical and architectural context of the research, as well as documents such as almanacs, books, magazines, and newspapers related to construction activity between 1870 and 1940 [25].

Many social media web-based archives already host citizen-created groups devoted to the preservation and sharing of urban collective memory [26]. These virtual communities attract large and active memberships, driven by individuals' desire to document and recall aspects of the cultural and urban environments to which they belong (the Facebook group "Fotos Antigas De Jaú = Jaumais Antigo" has more than 26,000 members, while "Roma scomparsa: immagini e storie" has over 90,000). The "Call for Memories" initiative seeks to harness this widespread participatory impulse, with the goal of fostering stronger connections between academic research and non-specialist audiences. By leveraging one-to-many and many-to-many communication models, social media platforms can foster cultural and academic dialogue, facilitating the dissemination of credible, research-based knowledge within communities of interest. In this way, social media helps to break down barriers between academic research and the wider public, encouraging engagement from non-expert audiences [27,28].

7. Discussion

The KNOW.it project provides an opportunity to reflect on the current epistemological shift affecting digital heritage practices more broadly. Rather than simply improving the accuracy of documentation by integrating archival sources, survey data and digital platforms, the interactive digital archive operates more as a relational system in which meanings are continuously reconfigured through interaction between data, information and users.

Within the broader field of digital heritage studies, this approach can be situated in relation to a growing body of research that advocates the transition from static repositories to dynamic, interconnected knowledge systems. Recent contributions—such as the concept of the Heritage Digital Twin [29] and recommended 3D workflows for digital heritage practices [30]—emphasize the integration of multi-source datasets, interoperability, and continuous updating as key principles.

Established projects such as the ATARAL archive (Atlas de Arquitectura Almohade), discussed in the methodological framework of this study, demonstrate how survey data, historical documentation, and geospatial information can be combined within relational and publicly accessible platforms. These experiences highlight a shared methodological convergence toward systems that not only store data but actively structure knowledge through connections between objects, actors, and contexts.

From this perspective, the KNOW.it project aligns with and contributes to these practices by integrating rigorous survey-based documentation with relational database structures and user-oriented interfaces. At the same time, it extends them by explicitly incorporating participatory mechanisms—such as social media-based data collection and community engagement—which resonate with research on digitally assisted storytelling and participatory communication in heritage contexts [1,27]. This positioning situates KNOW.it within an emerging paradigm in which digital archives operate as open, evolving

ecosystems, where knowledge is continuously enriched through the interaction between institutional research, technological infrastructures, and public contributions.

This relational dimension extends beyond scholarly interpretation to encompass the social sphere. One of the project's most significant outcomes is its ability to increase local awareness of Italian-influenced Brazilian architecture. By making architectural information accessible through interactive, explorable digital environments, the project fosters renewed sensitivity towards cultural assets within local communities. In contexts such as Jaú and São Carlos, where heritage is often perceived as fragmented or marginalised, the visualisation and narration enabled by the digital archive help to reactivate collective memory and reinforce a sense of identity and belonging. This process demonstrates the dual role of digital tools as instruments of analysis and mediators of cultural engagement and public participation.

This shift has significant implications for interpreting dispersed heritage located abroad, as demonstrated by the case study. The architectural corpus analysed in Jaú and São Carlos challenges conventional, geographically bounded narratives by revealing how design knowledge circulates, adapts and transforms across different contexts. The adopted approach enables the comparison and aggregation of scattered evidence, making these processes more visible. However, it also introduces new interpretative layers shaped by the logic of classification, modelling and visualisation. Translating complex architectural realities into datasets, taxonomies, and parametric models inevitably involves simplification to some extent, which can obscure the ambiguities, inconsistencies, and context-specific meanings embedded in the original artefacts. The tension between analytical clarity and interpretative richness highlights the need for hybrid approaches that can integrate quantitative precision with qualitative interpretation while preserving the multiplicity of narratives inherent in historical architecture.

At the same time, the creation of an explorable digital archive has concrete implications for heritage safeguarding and conservation. By systematically organizing and visualizing architectural data, the archive establishes a foundational knowledge base that can support informed decision-making processes. This is particularly relevant in contexts where built heritage is exposed to significant risks, not only due to natural factors but also—and more critically—to anthropic pressures such as urban expansion and real estate speculation, which often result in the demolition or irreversible alteration of historic structures. In this sense, the archive functions as both a documentation tool and a preventive conservation instrument, enabling the identification of vulnerable assets, supporting heritage impact assessments, and providing a reference framework for future preservation strategies.

On a theoretical level, these outcomes align with a growing body of research that explores consolidated techniques and experimental approaches for the visualization and exploration of digitized architectural heritage. The KNOW.it project confirms the validity of integrating established methods—such as structured data modeling, digital surveying, and archival integration—with more creative and user-oriented strategies, including interactive environments and narrative-based visualization. This convergence reflects a broader disciplinary trend toward multimodal and experience-driven representations of heritage, in which knowledge is not only stored but also actively performed and interpreted through digital interfaces.

A further point of reflection concerns temporality. Digital archives tend to project an image of stability and completeness, yet the heritage they document is inherently dynamic, subject to ongoing transformations, reinterpretations, and sometimes disappearance. In this sense, the archive should be understood as a provisional and evolving construct rather than a definitive record. Future developments could explore versioning systems, temporal

stratifications, and diachronic visualizations that explicitly represent change over time, allowing users to engage with heritage as a process rather than a fixed state.

Furthermore, the adopted workflow in the KNOW.it project is structured as a modular and interoperable pipeline [29], ensuring a high degree of replicability across comparable research contexts, while the underlying project logic demonstrates clear scalability [30], enabling its extension to larger datasets and its application to analogous case studies across South America, particularly in contexts such as Argentina and Brazil, where similarly dispersed and transnational architectural heritage conditions can be observed.

8. Conclusions and Future Scenarios

The project is a structured effort to identify, document and virtually return Italian architectural heritage developed overseas in the Brazilian cities of Jaú and São Carlos. The concept of virtual returning is intended not as a merely technological act of reconstruction, but an epistemological gesture that restores visibility, recognition, and agency to marginalized or displaced architectural narratives [31]. This practice challenges the persistent asymmetries between center and periphery in cultural heritage discourses, contributing to a rebalancing of the geography of knowledge production and subverting established paradigms in the interpretation and preservation of cultural assets [2]. The operational workflow, grounded in methodological rigor and interdisciplinary collaboration, enabled the construction of an extensive database of information accessible to both the academic community and the general public. The scientific agreements signed with local institutions mentioned above support outreach activities aimed at disseminating knowledge of eclectic Italian architecture beyond disciplinary boundaries (Figure 14), fostering an international dialogue on shared cultural heritage.

Figure 14. Presentation of the project "KNOW.it. Transition in Digital Age: KNOWing our background to refine our future" at the Leopoldo Amaral Auditorium, Polytechnic School, Federal University of Bahia (FAUFBA), Brazil—28 April 2025.

The KNOW.it project has yielded multiple tangible results: the systematic cataloguing of dozens of buildings, the creation of 3D digital models, the recovery of previously unpublished archival sources, and the establishment of a collaborative network with local institutions in Brazil have all contributed to building an open, interdisciplinary, and replicable digital ecosystem. The adopted methodology successfully combined advanced technological tools with historical awareness, providing new opportunities for researching and disseminating

migrant architectural heritage. A particularly significant example is the case of a recently demolished building, whose archival documentation and 3D digital reconstruction, produced within the project, have become valuable tools not only for scholarly analysis but also for the local community, which now uses these materials to preserve memory, support educational initiatives, and reinforce a shared sense of identity despite the physical loss of the structure. The engagement of local communities through social media and participatory campaigns also generated a significant cultural impact, fostering identity re-appropriation and active participation. Looking ahead, the KNOW.it approach could be extended to other migration-affected contexts, contributing to the creation of a digital atlas of diasporic architectures. The convergence of a scientific approach, digitally assisted solutions, and cultural inclusion emerges as one of the project's most promising achievements. On a wider scale, KNOW.it highlights how digital tools, embedded in a critically informed and historically conscious methodology, can not only preserve fragile or lost architectural heritage, but also reactivate its cultural significance in contemporary contexts. As such, the project opens up new perspectives for international cooperation, digital heritage practices and future research on the migrations of architectural knowledge and languages.

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