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Sustainable Management of International Partnerships for Cultural Heritage Digitization in Brazil

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Abstract: The demand for digitized cultural heritage has increased over the last few decades; digitization is indeed considered a powerful means to preserve and enhance cultural heritage and make it accessible to the wider public for education and research purposes. However, digitizing cultural heritage is a complex process, requiring specific competencies, skills, software, technologies, and, therefore, human and financial resources. Cultural organizations are therefore rethinking their traditional business models, often deciding to outsource their digitization projects or implementing PPPs—public–private partnerships. This is particularly evident in developing countries, where it is also challenging to find the required resources locally and international cooperation is sometimes necessary. However, international PPPs for the digitization of cultural heritage present several unsustainable aspects. There is therefore a need for a deeper understanding of which practices should be implemented to sustainably manage these collaborations. This paper aims to investigate this topic using a case study analysis of two international PPPs for the digitization of cultural heritage in Brazil. The analysis highlights relevant managerial choices that led these projects to positively impact local social, economic, and environmental development, thus bringing early insights to advance the academic and practice discussions on the above-mentioned topic.

Keywords: international public–private partnerships; international project management; sustainable management of digitization projects; cultural heritage digitization



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1. Introduction

Over the last few decades, there has been a steady increase in the demand for the digitization of cultural heritage, seen as referring to a complex process that encompasses various stages, beginning with the digitization of cultural artefacts and extending to the entire lifespan of digital cultural content. Hence, it comprehensively embraces all facets of the emerging field of digital content management, representation, and reproduction, extending beyond the limited scope of three-dimensional (3D) digitization of objects and landmarks. The digitization of cultural heritage has been further accelerated by the restrictions imposed during the recent pandemic: due to the inability to physically access cultural locations, cultural heritage organizations endeavored to maintain engagement with their consumers by disseminating digitized information and offering virtual cultural activities [1,2].

Digitization has been considered a viable way not only to preserve cultural heritage but also to make it accessible to the wider public as well as to researchers [3], thus strengthening its impact for a wider variety of audiences and positively contributing to unlocking cultural heritage contribution to social and cultural sustainable development [4,5].

However, it is often a demanding process, not just in terms of financial investments but also in terms of the required software and hardware as well as of specific competencies and skills [3]; this means that digitization often becomes unsustainable. As a result, rather than embedding it in their management practices, many cultural heritage organizations opt to

outsource it to specialized companies or research institutes, reduce it to occasional projects, or not implement digitization at all. This becomes particularly evident for built cultural heritage, which currently is one of the most expensive heritages to digitize, and in Global South and fast-developing countries (the list of Global South countries to which we will refer is the one provided by the UN—United Nations and IMF—International Monetary Fund, which classify Brazil as part of the Global South countries and emerging market and developing economies (<https://unctadstat.unctad.org/EN/Index.html> and https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/ADVEC/WEOWORLD/OEMDC, accessed on 9 September 2023)). Indeed, many cultural organizations in developing nations have difficulties both building these types of competencies and skills [6] and finding them locally and therefore carry out the digitization of their assets using international cooperation often in the form of international public–private partnerships. Local governmental and corporate institutions establish these collaborations with international counterparts in order to obtain the requisite expertise and technological equipment required for the process of digitization. Although they are necessary, these partnerships present several challenges in terms of sustainability (social, economic, or environmental) and often do not bring long-term benefits to local organizations and communities. There are, however, some good examples of digitization partnerships for built cultural heritage that adopt a more sustainable and participatory approach to managing digitization and seem to overcome some of the traditional limitations highlighted above.

The objective of this research is to investigate this topic, addressing the following research questions:

What are the best practices in the management of international public–private partnerships for digitization projects of built cultural heritage that can help overcome their traditional sustainability challenges?

How can these practices lead us to rethink international cooperation for digitization processes, which can in turn unlock the potential of the digitization of cultural heritage for sustainable development in Global South countries?

This paper is divided into five sections. After this introduction, the following section presents a literature review addressing the topic of the digitization of cultural heritage, as well as international cooperation and public–private partnerships in the digitization of cultural heritage. Section 3 explains the research design and methodology: this part provides a rationale for the selection of cases and elucidates the manner in which the researchers integrated case study analysis and action research methodologies to enhance the investigation of the research inquiries. Section 4 presents the case study reports of two international projects of built cultural heritage digitization in Brazil (the digitization of the building of FAU USP (Faculty of Architecture of São Paulo University) and the Casa de Vidro, both carried out under the label of the Getty Foundation Keeping it Modern initiative). Section 5 discusses the results of the research, emphasizing the measures undertaken to mitigate the social, economic, and environmental consequences associated with certain multinational projects. Section 6 presents some concluding remarks and implications for research, policy, and practice, highlighting the limitations of the research and potential developments of future investigation on these topics.

2. Literature Review

Digitization offers stimulating prospects for cultural organizations, allowing them not only to reach out to diverse groups but also to make artifacts and collections accessible for research and exchange purposes. According to Evens and Hauttekeete [3], the economic and societal values of heritage collections are created by optimizing digital accessibility. In turn, the impact of the digitization of cultural heritage on its preservation, management, and enhancement has been a hot topic over the last four decades [3,7,8]. However, digital technologies have been used in the cultural heritage field since the 1970s [9,10]. In the beginning, digital technologies were viewed primarily as a tool for recording, preservation, and enabling easier research on cultural heritage assets (Figure 1). In the 1970s, we had

the first digital catalogs, while in the 1980s, pioneering projects (among them, particularly relevant is the “Optical Digital Image Storage System (ODISS)”, launched by the National Archives and Records Administration (NARA, 1991) in Washington) started to use digital image and optical disk technologies for the reproduction and storage of archival documents [11–13], although mainly about rare or valuable objects [14–16]. In the 1990s, libraries, archives, museums, and cultural organizations in general started to explore digitization technologies for teaching, training, and learning and as research-supporting tools [17], thus launching broader digitization projects involving their whole collections [18]. After those decades “of digitization and documentation for the Web [...] created a rich array of cultural and historical information across the museum, library and archive sectors” [18], digitization projects for cultural heritage boomed at the beginning of the new millennium, while new digital-born material started to appear alongside digitized objects. Cultural heritage institutions began to apply interactive showings, reconstructive 3D modeling techniques, and WEB 1.0 capabilities, while multimedia tours, online virtual reality, and 3D survey techniques became progressively popular. Currently, these tools have been completed with 3D interpretive models, mobile applications, artificial intelligence, and the use of the semantic web and WEB 2.0 and 3.0 capabilities [6]. International programs, such as the Europeana initiative launched through the European Commission’s eContentplus Programme, promoted a further wave of digitization, which was further reinforced by the increase in the demand for digitized cultural content during the COVID-19 pandemic [1,2].

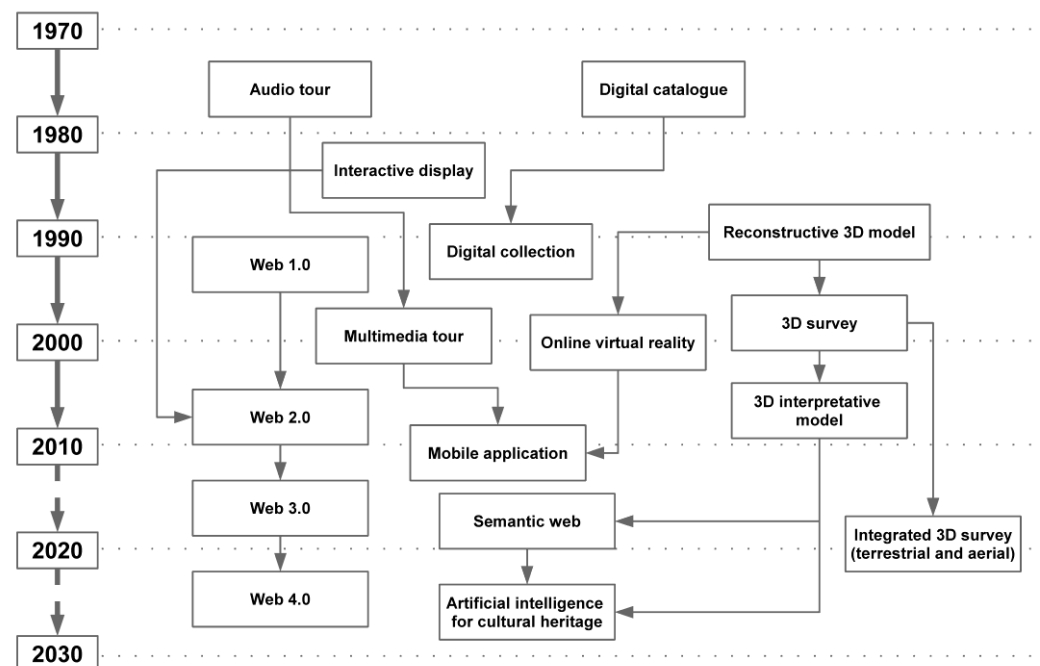


Figure 1. More than 50 years of applications of digital technologies for cultural heritage have produced a growing request for skills specialization and the development of new tools and methodologies. Image by the authors.

The growing request for digital content requests a reflection on the best way to implement digitization processes, thus leading researchers to also focus on the governance and management aspects of digitization.

As described above, digitization frequently has a significant impact on management, particularly on an international scale: it implies a clear vision, strategic thinking, project planning skills, technological knowledge, the availability of technological tools, and thus a careful organization of financial and human resources. Indeed, as highlighted in early research such as that part of the project Enumerate (more information about the Enumerate project as well as its main outputs of the core surveys are available at <https://pro.europeana.eu/page/results>, accessed on 9 September 2023) conducted in 2011 or the studies by Duester

et al. [19], Lavoie and Dempsey [20], and Navarrete [21], heritage institutions are often discouraged by the high costs and low availability of funds for digitization, as well as their time-limited character and the lack of specific competencies and skills in their human resources [21,22]. As a result, new business models for cultural heritage organizations were implemented, either establishing in-house digitization offices or outsourcing these services [3], creating operational or strategic alliances to carry out these activities and to increase management efficiency, economies of scale, and knowledge and innovation exchange [23,24]. However, these relationships were frequently temporary and project-based, making it difficult for structural cooperation to develop [25].

The importance of creating fruitful partnerships for digitization processes in cultural heritage became particularly evident in emerging and developing countries, where the abundant cultural heritage often has not been able to be digitized due to a lack of local technologies, software, and skills. As the level necessary for digitization capabilities and skills rises, professionals tend to be hired at an international level, often through public–private partnerships (the majority of cultural heritage is public-owned) or contractual agreements aimed at capturing international best practices for digitization [6,25,26]. Public–private partnerships are defined as long-term collaboration arrangements set up between public and private partners to plan, design, finance, construct, and manage projects that would normally be implemented and provided by the public sector [27]. PPPs have been at the center of debate since their first implementation and mainly in the framework of the NPM—New Public Management reflection. PPPs gained popularity in the early 1980s due to the specific requirement of alleviating the strain on public authorities and local governments caused by activities and initiatives that placed significant demands on financial, human, and technological resources; the necessity of transferring certain functions to the private sector was accompanied with the expectation that the dynamic nature of private players could be advantageous in enhancing particular public services. PPP models can be broadly categorized into two main types: institutionalized PPPs and contractual PPPs. Institutionalized PPPs involve the establishment of a dedicated body that incorporates both public and private sector partners in its governance structure. On the other hand, contractual PPPs rely on a contractual agreement between the involved parties to control the implementation of the project. The literature on PPPs, nevertheless, has allowed for broader definitions, such as “cooperative arrangements that occur between governments and private entities and are more informal than many of the equity partnerships and concession-type franchise arrangements” [28]. This kind of PPP is referred to as the “loosen type” [29], and it has recently gained popularity and has emerged in a variety of sectors. PPPs encompass a wide range of structures and objectives, which can often contribute to the complexity of comprehending their nature [30–33]. Despite the variations in techniques and models, PPPs typically exhibit some common characteristics [34,35]. These include the provision of co-financing by the partners, the allocation of risks, the sharing of duties, and the implementation of partnerships within competitive contexts [36].

Recently, their implementation in developing countries has brought further elements of discussion, highlighting the importance of ensuring the long-term sustainability of PPP projects to ensure the creation of public value and public health [37]. Sustainability, as defined by the Triple Bottom Line (TBL) framework including environmental, social, and economic components [38], has emerged as a significant subject in global discourse [39,40]. Due to significant governmental measures, the adoption and reassessment of projects and development plans have increasingly embraced this notion [41,42]. In Global South countries, public–private partnerships are often implemented to help public institutes develop infrastructure and services [43,44] to increase the transition to a more sustainable model of growth, sometimes based on the use of technologies, digital tools, or AI to support smart model development [45]. This, however, poses further challenges in finding the competencies and technological means, as in the case of the digitization of the local cultural heritage. Thus, these partnerships often imply, as mentioned before, looking for international partners to complement the lacking elements. International public–private

partnerships, however, are threatening different sustainability dimensions of digitization projects, namely, the economic, environmental, and social sustainability aspects. Concerning financial unsustainability [46], challenges are related to the significant costs of bringing international staff on site to carry out the project. Moreover, the decision to outsource digitization phases will generate a permanent lack of local competencies in this field, thus requiring locals to call for international teams also for future digitization projects and phases of those projects, creating a dependency, and further increasing the costs in the long run. As for environmental unsustainability [47], it is mainly related to the need to relocate experts coming from faraway countries to carry out the digitization, increasing the carbon footprint of the project. Moreover, since local competencies are not created, in the case of international contingencies (such as a pandemic) that prevent the international team from traveling to the location of the cultural heritage, nobody is able to carry out a prompt intervention/digitization of the cultural heritage, which potentially causes a threat to the local cultural landscape. In relation to social sustainability, the digitization projects do not fully exploit the potential of digitization for local development and job creation. They also pose ethical challenges in terms of the decolonization of digitized cultural content [48]. Moreover, they lack local participation: a study by the International Council on Archives found that digitization projects often prioritize the technical aspects of digitization over local ownership and participation [49]. This study highlights the need to involve local stakeholders in the planning and implementation of digitization projects to ensure local ownership and sustainability. The lack of involvement could also negatively impact the knowledge and awareness of the importance of cultural heritage among locals.

As a result, more solid reflection on the management and governance of these international collaborative projects for the digitization of cultural heritage is needed to unlock their potential for local sustainable development and address their main sustainability challenges. This paper aims to bring insights into this topic, analyzing significant case studies that will be presented below.

3. Research Design and Methodology

The goal of this study is the in-depth examination of international public–private partnership projects for cultural heritage digitization in the Global South to identify best managerial practices and propose alternative and more sustainable solutions for international cooperation.

The authors chose a qualitative research approach based on a case study analysis because it was thought to be the most appropriate for the complex nature of the investigation and for delving deeper into the research subject. Indeed, this methodology is thought to be particularly useful for shedding light on how the research topics manifested themselves [50,51]. The authors decided to focus on international digitization projects that began before the pandemic and continued for at least one year after it to have a sufficient period to observe their management.

The case studies were selected in a specific country of the Global South, Brazil, which was chosen as a research area for three main reasons. First, local communities of experts and professionals have been increasingly reflecting on the need for the digitization of their cultural heritage in recent years, particularly as a result of emergencies such as the fire at the National Museum in Rio de Janeiro in 2018, which destroyed almost the whole museum collection and was described as the country's worst loss of cultural heritage in its history. Second, over the last decade, Brazil has been one of the countries facing both rapid development and several challenges in terms of sustainability, issues that were exacerbated during the pandemic. In particular, the COVID-19 crisis implied not only temporary isolation and difficulties in the implementation of international cooperation but also less attention to issues related to culture. Therefore, one of the imperatives to ensure the protection and enhancement of its cultural heritage and its cultural and creative sector, in general, is to find cost-effective and sustainable solutions for the future. In this scenario, innovative approaches to international projects of the digitization of cultural heritage could

represent an interesting starting point for a broader reflection. Finally, Brazil was selected given the authors' in-depth knowledge of the country, its socio-economic scenario, and the accessibility of data.

As a preparation activity, a mapping of potentially relevant case studies was completed, with a special focus on projects related to the digitization of cultural heritage of architectural relevance. This mapping aimed to find suitable case studies that met three main criteria. First, the architectural heritage should belong to the same architectural period and style and be possibly located in the same geographical area to reduce asymmetries in the type of required intervention and the surrounding environment. Second, the projects should have been carried out by a team of international experts working alongside local professionals. Third, the projects should have lasted for more than one year so that the international collaboration continued long enough to assess its progress.

Based on these criteria, the most suitable international projects for digitization seemed those implemented in the framework of the KIM—Keeping it Modern—funding program of the Getty Foundation (USA). KIM is an international funding scheme that builds on the Getty Foundation's long-standing commitment to architectural preservation, with an emphasis on significant twentieth-century structures and modernist architecture. The program lasted from 2014 to 2020, funding 77 grant projects of great architectural significance related to modernist heritage around the world. The financial support aimed to enable the beneficiaries to develop conservation management plans to implement preservation and long-term maintenance policies, as well as the full investigation and understanding of building fragilities and the testing and analysis of contemporary materials. In Brazil, four projects have benefited from the KIM grants, two of them also implying cooperation with international teams of experts for the digitization part of the preventive analysis. These two projects were therefore selected for this research; they were the digitization project of the Faculty of Architecture of Sao Paulo University, the FAU USP (a modern building designed by the famous architect, João Batista Vilanova Artigas), and the digitization of a private residence, the Casa de Vidro in Sao Paulo (a modernist masterpiece by architect Lina Bo Bardi).

The analysis of each case study was based on the triangulation of several sources of data, following the approach identified by Yin [51], namely, the analysis of project reports, the analysis of the conservation management plan, an in-depth examination of online material presented on the websites of the authorities managing the cultural heritage, and four semi-structured interviews with the staff who were working on the projects (two managers for each case study, both belong to the local staff). It must be pointed out that the approach was also partially based on action research methodologies [52–54], since one of the authors was involved in the project partnership. This direct involvement implied that theory building was integrated with practice to tackle critical organizational, community, and social challenges in collaboration with those who were affected by them.

The results of both research approaches (case study analysis and action research) were blended to create a case report for each case study, thus complying with the recommendations of Yin [51]. The purpose of the research interviews was to provide further clarification on the aspects that were inadequately explained in the documentary material and were not observed by the researcher involved in the digitization process. Consequently, the data obtained from the interviews were integrated with the information presented in the case study reports of the two aforementioned examples. Each case study report includes, first, an overview of the case and then addresses the topics that are most relevant to answering the research questions. Concerning this point, following the case study analysis, the discussion on the results is based on three dimensions of sustainability of international projects that were identified in the analysis of the literature. First, financial/economic sustainability mainly refers to the considerable costs related to the relocation of the international teams to follow the different phases of implementation of international digitization projects and also the fact that, usually, international experts have higher salaries and wages in comparison to those of potential local staff of Global South countries, thus increasing the overall costs of

the projects. Second, environmental sustainability, again, refers to the environmental impact of the travel of international teams on site for digitization. Third, social sustainability is related to the fact that the involvement of foreign experts is to some extent hindering job and expertise creation at the local level of these projects and having a negative or no impact on the improvement of the local socio-economic context and the development of the local social milieu.

The following sections of this paper will critically analyze the results of the case study analysis concerning the research questions.

4. Results of the Empirical Research

4.1. Faculty of Architecture and Urban Planning Center, João Batista Vilanova Artigas, and Carlos Cascaldi, 1969, São Paulo, Brazil

In the early 1960s, João Batista Vilanova Artigas, one of the most prominent Brazilian modernist architects, was invited by the School of Architecture and Urbanism at the University of São Paulo to design their faculty building in partnership with Carlos Cascaldi. Inspired by the Brutalism of the late Le Corbusier, Artigas and Cascaldi designed a monumental structure that accentuates the elegance of modern materials (e.g., glass and concrete) by combining them with minimal decoration. The structure is distinguished by a vast grid of skylights embedded into reinforced concrete that forms a dramatic and visible roof and floods the courtyard below with natural light [55]. Previous reparation works were carried out as case-by-case interventions, but the coordinators realized that a more structured and holistic method was needed to properly conserve the building.

In 2017, the Getty Foundation granted USD 200,000 in the framework of the program “Keeping it Modern” to develop a coherently organized preservation management plan for the building. This management plan aimed to promote a holistic methodology for the preventive conservation of the key building elements: among the main tasks, it included a digitization phase “to document the transformations and the several ways of appropriation of the space throughout time [...] which cannot be a mere gathering of information, is also intended to analyze the spatial features and to propose guidelines for the use and proper treatment of spaces, respecting their features of composition, understood as a value to be protected, and allowing their proper perception” [56].

“Aware of the fact that a full plan for the Preventive Conservation of the building would take more time than that stipulated by the grant support rules, and would consume more funds than the limit defined, since the grant request phase, the plan focused on [specific] aspects” [56]. Among them, the 3D survey was considered a fundamental part of the whole preventive conservation approach.

The development of the project was divided into three main tasks. Task one consisted of the documentation and in-depth analysis of the use, transformations through time, and perception of the spatiality of the building through documentation via 3D surveys. In addition, the task included proposals about its future developments, consisting of guidelines for the occupation and its spaces, and the setup of parameters for the required review of installations (air conditioning, electrical plants, etc.). Task two concerned the waterproofing system, mainly its monitoring, and the roof’s preventive maintenance program, aiming at identifying conservation and preventive maintenance measures for the system. Task three was related to reinforced concrete blinds and aimed at understanding their conservation state and composition.

The Faculty of Architecture of Sao Paulo University (FAU USP) Digitization Project

The above-mentioned targets necessitated a comprehensive study of the building based on an in-depth survey conducted through a digitization process: it mostly consisted of a 3D laser-scanning study performed by an international team of experts, since specific skills were lacking in local partners. The team of the Integrated Automatic Procedures for Restoration of Monuments (DIAPReM) of the Ferrara University Department of Architecture (Italy) was the international partner selected for this task.

This research laboratory was asked to work alongside the Brazilian partners of the project, who had complementary skills and competencies. Indeed, the Getty Foundation founded the project and acted as supervisor, but the actual implementation was coordinated by two professors of the FAUUSP and several staff members of the FAUUSP as line coordinators for each of the specific tasks (Figure 2). The faculty was supported by a team of local professionals and students who benefited from a scholarship to work on the elaboration of the conservation management plan. Moreover, the coordinators were responsible for managing the work of several research laboratories and collaborating companies, which included (1) the Instituto de Pesquisas Tecnológicas do Estado de São Paulo (in charge of chemical surveys and experts' materials resistance); (2) the Escola Politécnica da Universidade de São Paulo (with expertise in concrete porosimetry analysis); (3) Pires Giovanetti and Guardia architects (concrete cleaning testing); (4) Polígono Arquitetura e Engenharia (study and application in place of finishing repair mortar); (5) Podarte (arboreal survey); and (6) Relevô Topografia (metric survey) and SGS do Brasil (polyurea testing). The only international research laboratory was DIAPReM from Ferrara University (Italy), which was specifically responsible for laser 3D scanning but also asked to carry out training activities for the local team [39].

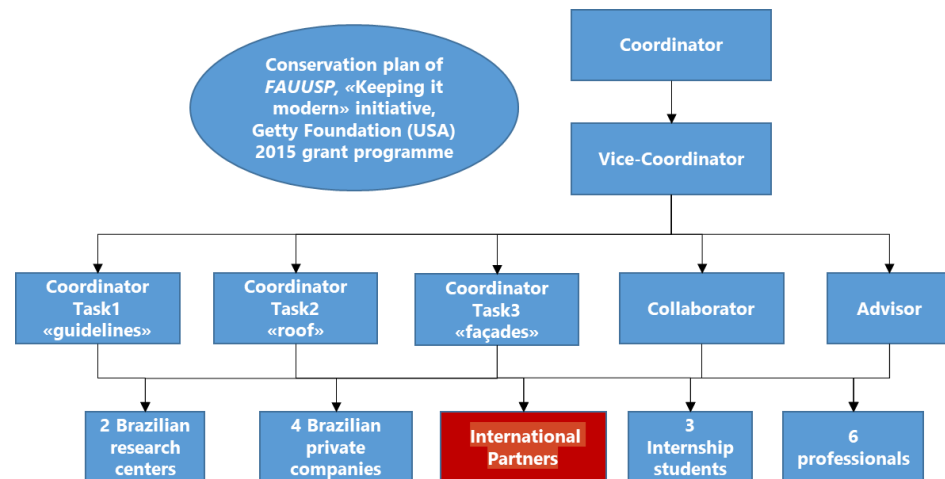


Figure 2. Structure of the KIM project management for FAU USP building. Image by the authors.

As highlighted in the analysis of the literature, so far, the scheme could appear quite traditional among the projects of digitization in Global South countries. However, the FAU USP included some elements of innovation that point towards more sustainable management of this type of project.

In the first phases, the international staff was asked to come on site in Brazil for the digitization of the building just once, and, during their visit, the digitization activities were coupled with the training of local staff in the digitization process, technologies, and tools. Furthermore, the international team worked alongside the local team to increase the exchanges of knowledge and techniques, empowering locals and helping them develop competencies previously missing in their staff. The laser scanning survey and training, performed mainly in 2016, enabled the local architects and professionals to use the outputs of digitization both for architectural analysis and representations and for diagnostic purposes (Figure 3). An additional section of the knowledge transfer was aimed at training participants on the use of laser scanner data as a support for in-depth analysis of the state of conservation of external surfaces and future monitoring of the building. This aimed at creating a next generation of Brazilian architects who would not just have specific technical competencies but also be aware of the value of strategic preservation and the management of historical sites.



Figure 3. Image used during a training session at FAU USP to teach the right positions of scanning stations (in this case, 55, in orange color) and the elaboration of a 2D image of the main façade of FAU USP building. Image by DIAPReM center.

Second, due to the limited budget allocated to the project, the costs of software had to be reduced by using open-source software, thus increasing the financial sustainability of the project. Bearing this in mind, the training was also focused on the “navigation” and querying of the 3D models through the open-source software CloudCompare (v2.13 alpha) to facilitate the direct use and application of digital geometric data for several research purposes.

Third, in the design phases, in-person and remote work were integrated. As explained above, the team was asked to come on site just once, and the local and international teams worked online, using databases that were specifically created for the project.

The online exchanges were conceived from the beginning as parallel and complementary to the face-to-face exchanges, substituting several phases that otherwise would have been carried out on site. More specifically, an online database and internet platforms were included from the start among the tools and work methodologies on which the project was based. Then, the outputs of the 3D survey were digitally shared among the various partners and the Getty Foundation, stimulating exchange and discussion among them. This methodology enabled the local stakeholders to also use the data collected through laser scanning afterward, especially during the pandemic period. Indeed, in the following years, the international and local teams (especially the ones of the University of São Paulo) continued online exchanges and elaborating on the database. This further increased the preparation of the local partners, building upon the competencies developed during the on-site activities. The above-mentioned use of open software was crucial in facilitating this phase and was indicated by a DIAPReM staff as one of the most important tools to ensure the long-term implementation of the project.

The digitization project was successfully carried out and constituted an integral part of the conservation management plan delivered in 2017 as the main output of the Keeping

it Modern grant. In addition, targeted instruction on the utilization of these technologies was incorporated into the standard curriculum of the doctoral program. One of the six Brazilian students who participated in the digitization partnership conducted a four-year doctoral research thesis on the utilization of digital documentation in a separate case study conducted in São Paulo. Subsequently, she was appointed as a member of the university staff with the responsibility of overseeing the coordination of various operations related to digital documentation, which are primarily reliant on the utilization of these technologies.

4.2. *Casa de Vidro, Lina Bo Bardi, 1951, São Paulo, Brazil*

Lina Bo Bardi designed the Casa de Vidro as her residence after deciding to live in Brazil and becoming a Brazilian citizen in 1946. Casa de Vidro exemplifies Bo Bardi's inventive use of low-cost manufacturing techniques and mass-produced materials while also expressing her style in adapting European modernism to Brazil's natural landscapes and artisan traditions. The main volume of the home rises gently above the ground, connected to the ground with delicate pillars and keeping a harmonious interaction with the surrounding landscape through vast panes of transparent, sliding glass. The Instituto Lina Bo e B.M. Bardi, which was founded by the architect and her husband to display and promote Brazilian arts, crafts, and culture, has been in charge of the Casa de Vidro since 1995.

In 2016, the Getty Foundation selected the Casa de Vidro for its Keeping it Modern (KIM) program. "The Casa de Vidro was the third Brazilian project to receive support from the Getty Foundation in this program, after the USP School of Architecture and Urbanism, in São Paulo, and the Burle Marx's panel at the Arthur Neiva Pavilion of the Oswaldo Cruz Foundation (designed by Jorge Ferreira), in Rio de Janeiro, both in 2015. The following year, 2017, the São Paulo Art Museum (MASP) would also be selected to participate in the program" [57].

The Instituto Lina Bo e P.M. Bardi was given a USD 195,000 grant designed to mobilize an international team of heritage experts, architects, architectural historians, landscape architects, civil engineers, and consultants to develop a long-term conservation management plan. In the framework of this grant, specific attention was paid to 3D surveying techniques, a task assigned to the DIAPReM of the University of Ferrara: engineers were able to discover potentially dangerous structural deformations at the tiniest scale, which were not noticeable, through a 3D topographic assessment of the site.

The project of the elaboration of the conservation management plan was divided into four main tasks (Figure 4). Task one consisted of historical research on the house; task two was the elaboration of digital bases in the BIM system, encompassing the house, annexes, and garden, with the laser scanning phase attributed to DIAPReM; task three was related to a survey of the state of conservation of the buildings, including the preparation of a pathology diagnosis and suggestions of corrective actions; and task four focused on the survey and conservation measures for the garden.

The Casa de Vidro Digitization Project

The Casa de Vidro project, like the FAU USP one, was based on a collaboration between international and local partners, albeit on a smaller scale: the DIAPReM research center, University of Ferrara, Department of Architecture, the Instituto Lina Bo e P.M. Bardi (Sa Paulo, Brazil), the IAU (Instituto de Arquitetura e Urbanismo (Saõ Carlos, Brazil)), Leica Geosystem Brazil, and some local professionals with specific expertise. FAU USP, DIAPReM, and Leica Geosystem Brazil were the partners responsible for the digitization and 3D survey. As in the previous case study, this partnership aimed at combining the skills of the Italian and Brazilian teams but with a stronger attempt to leave project coordination to local specialists. As a result, the conservation plan digitization task was led by a Brazilian scholar, with teams of two coordinators carrying out specialized responsibilities (one local and one international).

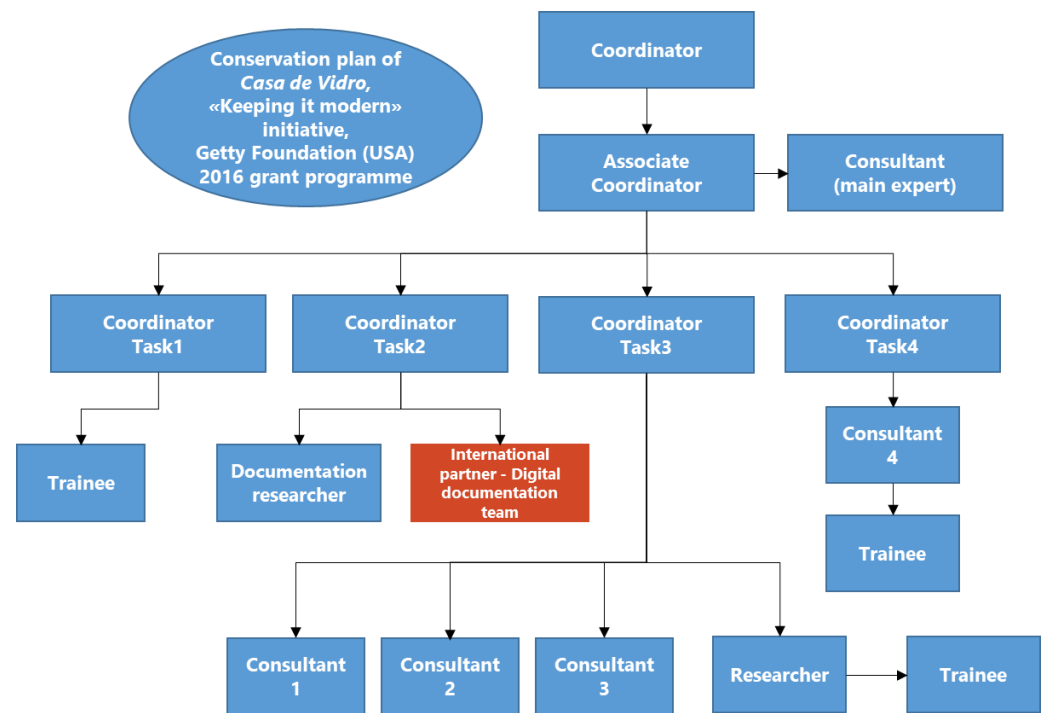


Figure 4. Illustration of the management of the *Casa de Vidro* KIM project.

Compared to the previous project, the *Casa de Vidro* digitization seems to put even more emphasis on using the project to leverage the development of specific competencies and skills in the local partners. The sustainable approach of the digitization project could be exemplified in several of its main characteristics.

First, the on-site part of the digitization was concentrated in a limited time frame—about two weeks. The international team worked together with several local academics and professionals, among which Leica provided the technical instruments for the survey and carried out some parts of the work on site. Taking stock of the previous experience, students were also involved in the whole process, and seminars and workshops were organized to empower the local professionals and stakeholders. But this time, the local stakeholders went a step further: indeed, unlike the previous case study, the international staff of DIAPReM was coordinated and supervised by a Brazilian academic of USP FAU and provided mainly raw data and point clouds. These data needed to be further interpreted and developed to provide needed information about the status and necessary interventions of the building.

Second, this time, open-access software was used to reduce the costs of digitization and allow Brazilian partners to better manage the outputs of the project. Furthermore, the results of the point cloud were delivered to the leading partner for further elaboration. This was aimed also at tackling one of the main problems faced by the Bardi Institute, the economic sustainability of interventions (Figure 5). Indeed, as stated in the report, “the main challenge for the preservation of the *Casa de Vidro* is the achievement of its long-term financial sustainability” [57]. The reduction in costs was also influenced by the involvement of an industrial partner, Leica Geosystems Brazil, who provided the necessary tools at a convenient price.

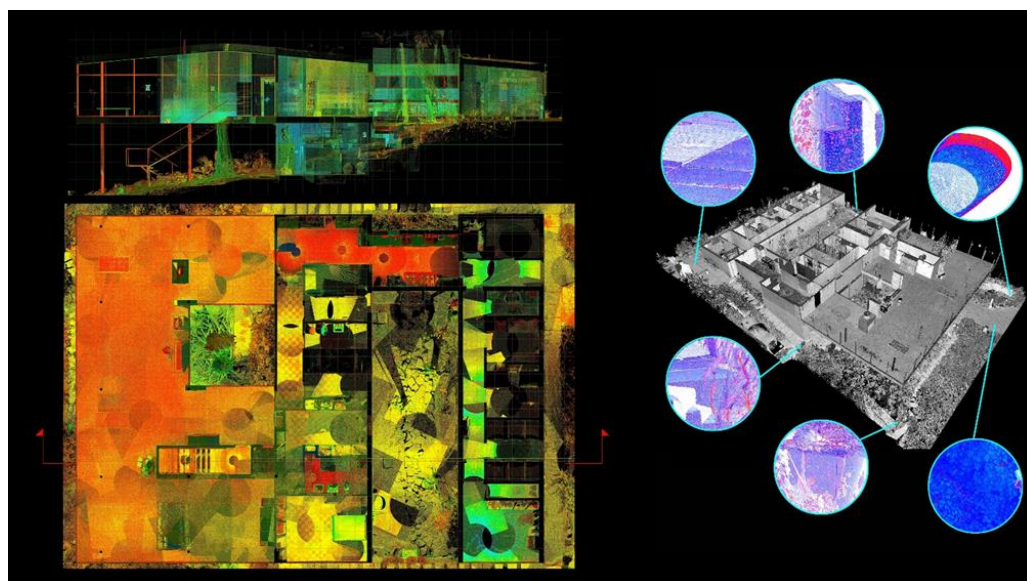


Figure 5. Digital analyses via point cloud elaboration of Casa de Vidro (on the left side is the plan and section, and on the right side is the main cracks individuation). Image by DIAPReM center.

Third, the in-person work of the international staff was reduced to a limited time frame of approximately two weeks, since the most important activity after and throughout the experiment was online data exchange, which had been intended from the start. The 3D database developed by the Italian partner was transmitted to the Brazilian teams and served as the foundation for the production of informative 3D models (BIM—building information modeling), making it easier for local stakeholders to apply the project’s results for conservation and maintenance. Online databases and Internet platforms were integrated into the work methodologies, and several phases that were traditionally allocated to the international experts (e.g., the manipulation of the point cloud data to create updated renderings and maps of the site) were left to local partners after proper training. This constituted further empowerment of the local stakeholders and could be interpreted as an additional attempt to make locals more independent in the path towards locally developing specific digitization expertise. In addition, “the Casa de Vidro 3D survey carried out by DIAPReM Centre at Ferrara University (Italy), along with the important outputs extracted from the database, was also useful to test, in cooperation with local stakeholders, several activities meant to increase awareness. To face the challenge of preserving modernist buildings, government agencies and professionals should be able to pick the most suitable tools for the tasks of documenting, monitoring, and carrying out the yearly maintenance of such buildings” [57].

Fourth, the focus of the project seemed to go beyond the specific case and embrace a larger objective. As declared in the final report of the conservation project, the empowerment of local professionals, at all levels of the project, was a primary objective of the digitization part but meant to bear positive consequences for the whole country. “The cooperation with the manufacturers of the scanners in Brazil has shown how it could be possible to use expensive tools even in medium-budget projects. This could help to improve the spread of new technologies in the heritage field in Brazil and the creation of a net of laboratories able to autonomously develop local methodologies for the preservation of modernist buildings [57]. The digitization task was conceived as a tool for creating the ‘proactive environment’ whose creation was advocated in the academic field” [58].

Finally, the 3D documentation and point cloud processing processes allowed for several analyses in a multidisciplinary framework that implied the involvement of a broader variety of stakeholders compared to the previous case study. The survey included a 3D laser scanning survey, topographic survey, on-site analysis, and photographic documentation due to the project’s entire complexity.

As a result of the above-mentioned characteristics of the project, the final report and conservation management plan for the Casa de Vidro published in 2019 reflected a broader and more multidisciplinary interpretation of conservation and digitization based also on the enhancement and empowerment of locals. It is important to mention that the data on digitization were initially provided by the international team. However, it is noteworthy that the local staff subsequently demonstrated their ability to independently generate photos and drawings using these data. This serves as evidence of the successful transfer of technology during the course of the project.

5. Discussion

As emerged in the literature review, the decision to create international public–private partnerships involving international experts in the digitization of cultural heritage presented potential criticalities that were also implicit in the above-analyzed case studies, namely, threats to the economic, environmental, and social sustainability of the digitization process.

However, the two case studies presented interesting solutions to these sustainability challenges, which could be taken as inspiration for the future development of cultural heritage digitization through international cooperation. The process of organizing and categorizing these solutions has the potential to enhance the sustainability of management practices in worldwide public–private partnership initiatives focused on digitizing cultural property. This applies not only to Brazil but also to other nations in the Global South or those experiencing rapid development.

In terms of financial and economic sustainability, both projects adopted significant solutions to reduce current and future costs, as well as improve the economic development of the areas where the cultural heritage was located. First of all, the projects were both designed to reduce to a minimum the need for the international team to work on site, privileging online exchanges and data elaboration and designing the project by blending the two working methods. This considerably reduced the costs of travel for the international team. A second solution was the choice to use mainly open-access software, which facilitated the exchanges and was easily available for both the local and international teams. Third, the decision to invest in the training of local professionals and students (aiming at developing these competencies in-house) prospectively reduced the recourse to international experts in the future, thus potentially reducing the costs related to their involvement. Indeed, in addition to the relocation costs, international staff coming from foreign countries (which in many cases are European or North American countries) had considerably higher wages compared to local experts.

The above-mentioned choices had also an impact in terms of environmental sustainability: reducing travel and investing in online exchanges reduced the overall carbon footprint of the digitization process.

Some of these choices also represented an improvement in the social sustainability of digitization. The fact that locals (professionals, stakeholders, students, etc.) worked alongside international experts and were trained by them allowed the development of lacking competencies and skills, which will positively impact social well-being and economic development in the long term. This was also interpreted as an awareness-raising tool, especially in the Casa de Vidro project, which was reinforced by making the reports and research results available to the broader public, stakeholders, and citizens. The evolution in the attempt to develop competencies in the local professionals and make them independent in carrying out this type of project was particularly visible in the second case study, which was based on the double coordination of the digitization survey by a local and international coordinator.

6. Conclusions

As emerged in the literature review, the digitization of cultural heritage is becoming a common phenomenon thanks to the increasing demand for digital cultural content and the potential of digitization for the preservation, enhancement, and accessibility of cultural heritage. However, it is a complex phenomenon that requires specific skills, competencies, and technological and financial resources. Cultural heritage organizations, especially public ones, are often unable to find these resources internally and prefer to establish external cooperation agreements and public–private partnerships for developing their digitization projects. In Global South and emerging countries, the creation of these partnerships is frequently designed involving international partners given the difficulties in finding the required technologies and competencies locally. This international dimension, however, poses several threats to the sustainability of the projects and includes potential negative aspects related to their economic, environmental, and social impacts.

Our research investigated these topics through qualitative analysis, studying two cases of international public–private partnerships for the digitization of built cultural heritage inserted in the framework of the development of their management plans. The results of this analysis led us to identify best managerial practices that could be key to ensuring their economic/financial sustainability, reducing their environmental impact, and maximizing their positive impact on the social development of the local communities.

Concerning the economic/financial aspects, our analysis highlighted the importance of adopting a blended approach (online and on-site) in the management of the different phases of the project by attempting to reduce travel costs, privileging the use of open-access software, and creating shared and open databases to facilitate exchanges between the local and international partners. Training for local staff, students, and future workers in the field could also be useful for developing required competencies locally, positively impacting the job market and creating the conditions for avoiding international partnerships in the future.

Concerning the environmental dimensions, the research emphasized that the decision to use digital working models could be beneficial also to reducing the carbon footprints of the project. The decision to carry out training activities for locals is also beneficial in the long term, reducing the environmental impact of involving international partners.

Finally, concerning the social dimensions, making digitized materials available and open-access as well as creating training activities and mixed working groups with international and local partners, including professionals, academics, and students, is beneficial for improving the social development of the areas, as well as for raising awareness and increasing the sense of belonging based on this heritage.

These results, therefore, can be interpreted as recommendations on how to best manage international cooperation for digitizing cultural heritage, thus contributing both to the scientific and professional debate. Additionally, the findings suggest the importance of promoting the utilization of the managerial strategies mentioned above, such as the blended approach and training initiatives, by implementing coherent policies pertaining to international collaboration. This will ultimately enhance the long-term viability of international cooperation endeavors.

The main limitations of the research are, however, the limited sample of investigation and the restricted geographical scope. Future research could therefore replicate our analysis on a higher number of case studies in other Global South countries, thus allowing for a broader comparative analysis. Furthermore, it would be of scholarly interest to conduct an in-depth examination of the aforementioned situations over an extended duration, with the aim of identifying exemplary approaches in terms of strategizing and implementing digitization initiatives for cultural assets in developing nations.

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