



Article

Heritage Cataloguing in History: Conceptual and Graphical Foundations of Immovable Cultural Heritage Data Bases in the Case of Spain

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Abstract: Cataloguing constitutes the main instrument for heritage assessment and management around the world, and is central in heritage studies. In the context of the growing international protection of heritage since the 20th century and the irruption and implementation of digital tools, cultural heritage data bases (CHDBs) have emerged as the main systems in accounting for and monitoring heritage. In the framework of culture preservation, as a driving force of sustainable development, this article aims to analyse the origins and development of CHDBs in order to critically observe the current situation and outline future challenges for systems of cataloguing heritage with the growing relevance of its graphical documentation. In this context, a historical overview of the origin and development of the European inventories since the 18th century to the present is key to trace the development of catalogue systems and the impact of IT in this field. The study then focuses on immovable cultural heritage data bases (ICHDBs); with Spain as case study, it develops an approach to the current panorama, with a special focus on the conceptual evolution of catalogues. In conclusion, ICHDBs need to transcend both instrumental and institutional roles and, supported in new digital systems, become interactive and flexible tools that respond to current needs and encourage heritage education, knowledge, and reflection.



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1. Introduction

Since the end of the 18th Century, the listing and cataloguing of heritage assets have been consolidated into one of the main branches of heritage studies. Although the dates provided for the origins of the current conceptualisation of heritage vary and different interpretations have been put forward, it was in the 20th century when the interaction between heritage and protection became firmly established as an inevitable social responsibility. In this context, cultural heritage data bases (CHDBs) have emerged from among the different disciplines as the main element in accounting for and monitoring heritage.

This article aims to analyse the origins and development of immovable cultural heritage data bases (ICHDBs) in order to critically observe the current situation and outline future challenges for systems of cataloguing heritage, focusing on its graphical dimension and its involvement in sustainability. In this context, a historical approach is fundamental to trace the development of traditional catalogue systems and the impact of IT in this field. Thus, as Harvey put forward referring to heritage, “we should supply” cataloguing “with a history of its own” [1]; and understand the cataloguing as a part of the complex process of heritage.

In the framework of the new demands and implication of sustainability raised by different international publications over the last years and mainly by the *2030 Agenda for*

Sustainable Development, cultural heritage must become a driving force to sustainability. The General Assembly of United Nations in the resolution 72/229 “emphasizes the important contribution of culture to the three dimensions of sustainable development—environmental, social and economic—and to the achievement of national development objectives and the Sustainable Development Goals and other internationally agreed development goals” [2]. In this context, different publications recognised culture and particularly cultural heritage as a critical asset for sustainable development.

Bearing into mind the significant advances in cataloguing achieved in Andalusia, the importance of inventories as the main tool for protection in Spain, the implementation of new technologies such as the geographic information system (GIS), and at the same time, the clear projection of this field in other countries, makes it necessary to reflect on the origin, development and present of ICHDBs.

Thus, this article focuses on the history of the cataloguing concept, considering this history as a base to understand current cataloguing systems and reflect on their future development. To ease comprehension of their current situation, a general overview of digital tools must be provided.

Nevertheless, the aim of this research is to understand the use and integration of these digital tools in the framework of that evolution; the article addresses the necessary dialogue and integration of cultural heritage and new technologies. More precisely it is focused on digital tools systematization, seeking a conceptual contribution from the perspective of experts in built environment heritage. Research projects and articles with a more technical scope endorse authors’ capacity to delve into this dialogue and integration, although it is not the aim of this article to offer an explicitly technical contribution in this field. This research, therefore, centres on the evolution of cataloguing and offers an overview of the technological tools involved.

This study presents a historical approach to heritage catalogues and the circumstances that led to their development, tracing the evolution of heritage inventories in Europe from its beginning to the present day; with especial emphasis on the increasing relevance of graphical documentation and its different media. A discussion based on the development of inventories for immovable heritage is presented, concluding with an overview of the current panorama in the field of heritage cataloguing.

Over the historic discourse, graphical documentation turned into a fundamental component for the representation, definition, and localization of assets in heritage cataloguing. From the original use of cartography and drawings, passing through the outbreak of photography, to the development and consolidation of GISs, graphical documentation has become a store of knowledge that overcomes the accessory function and develops value itself.

Since the dawn of heritage protection, the production of inventories listing cultural assets is a practice that has gradually consolidated into a growing trend adopted by a number of countries. The development of heritage and global society concepts (in the international context established by UNESCO) has led to the creation of generalized cross-border policies for the protection of cultural heritage worldwide.

Data bases alongside new systems of digital information and interaction, the information and communication technologies (ICTs), have forged a new panorama where heritage and new technologies inevitably coalesce. As Giaccardi and Palen highlight: “the encounter between the complex reality of heritage and ICT is not only an opportunity but also a need” [3].

The work outlined here pursues a line of research instigated by the authors concerned with the relationship between the current interpretation of heritage and the configuration of data bases able to meet the new needs [4]. It offers a pioneering focus that goes beyond the instrumental dimension of technology by addressing the background that prompted heritage catalogues as the main subject for reflection.

This research is based on the authors’ experience and expertise in heritage cataloguing. Their participation in the construction of various data bases both at regional and state level

culminated in the development of the N-340 roadway corridor project (<https://n-340.org/> Accessed on 25 July 2021), financed by European funds. The project developed the first online geo-spatial ICHDB applied to historical roadway corridors, with the N-340 national road serving as a case study. Reflecting the current openness in the field of heritage studies, the research proposes an interdisciplinary approach that reframes ICHDBs, both conceptually and technologically. Accessibility, flexibility, and ease of use do not preclude rigor: the data base works in conjunction with a GIS support system, substantiated by a bibliographical archive. A hierarchical multi-scalar heritage characterization was implemented to include a range of territorial scales and to facilitate the creation of itineraries. This data base, and the developed methodology were awarded nationally.

Heritage concern has become a social issue, and as such, requires a response that entails raising awareness and citizen participation. As expressed above, this collective understanding of heritage constitutes a fundamental part of sustainable development. Catalogues and ICHDBs as principal institutional tools for heritage preservation, have begun to diversify and widen in scope, even resulting in a personal proposal for cataloguing. Reading, production, and use of heritage catalogues can no longer be interpreted solely from an institutional point of view. To improve cultural sustainability, heritage characterization has thus permeated society, and it is our duty to construe it together.

2. Materials and Methods

Due to the diversity and the complexity entailed in the heritage concept and the fact that each culture interprets it in different ways, it is worth noting that the research presented here is framed within a western approach to the concept of heritage, with systematic analysis and classification as the main channels for interpreting the world. More precisely, the classification of immovable heritage is reviewed, with the inclusion of cases and trends of global relevance.

Data Bases have become a main tool for heritage management, but far from being fully developed, this field is in constant evolution responding to the new needs and possibilities offered by technology. “Tools and methods developed for appropriate preservation should be adapted to the evolving situations, which are subject to a process of continual change” [5]. In this context, the article proposes a conceptual framework around heritage data bases supported by the current state-of-the-art systems.

This research approaches heritage cataloguing from its origins by carrying out a historical analysis that spans from its antecedents, mainly concentrated in the 18th century, to the consolidation of the inventorying and cataloguing systems for heritage in the 20th century. Through the review of primary and secondary sources, the article shapes a historical account that helps to understand the situations and functions that began heritage cataloguing.

In this analysis, England, France, and Spain stand out as the main precursors of cataloguing systems in Europe. Of these three countries, Spain is developed as the key case study. Focusing on the Spanish situation, a more detailed historical study is carried out, allowing us to link it with the current situation, offering a review of the prolific Spanish production in this line. It is worth noting that in Spain, since the 1956 Land Law (Ley de 12 de mayo de 1956 sobre el régimen de suelo y ordenanza urbana), the creation of catalogues by each municipality has been mandatory for the conservation of heritage.

Thus, this article proposes research necessarily placed between heritage studies, and the technical development of digital tools, with catalogues as the central part of its systematization.

Since a detailed review of the origin and development of heritage catalogues of immovable assets has not been made so far, the main method applied to the research is the historical method; the transversality that history presents for every field of knowledge in this research is supported specifically in the history of architecture. The mentioned methodology therefore starts from the study and critical review of bibliographical sources related to heritage cataloguing as the main subject. In this process, two phases can be identified: the first, referring to the evolution of catalogues from a conceptual perspective

(Section 3.1), and the second, centred on the current situation where the implementation of new IT tools stands out as the main subject for disciplinary reflection (Section 3.2). Although, for reasons of methodological clarity we speak of two phases, both studies were carried out at the same time, with the aim of always placing the critical reflection of heritage cataloguing at the centre of the study.

Regarding the search for bibliographic sources, we started with a wide set of platforms that assure the implementation of impact sources in the study: Scopus, Web of Science, Google Scholar, RIBA, Avery, national and international libraries catalogues, and web projects and catalogues available online. In order to achieve a general perspective of the research corpus, the authors consulted a total of 272 references, although only 60 of them are directly referenced in the article. In relation with the historical evolution, the methodology significantly broadens the nature of the sources consulted, both primary and secondary, including: 29 articles, 44 books, 1 thesis, 2 web sources and 23 legal texts between 1792 and 1985. In reference to the current panorama, 109 articles, 5 congresses, 16 books, 4 theses, 3 web sources and 36 reports and international resolutions were consulted.

Even if the two phases bibliographical review are used as the main methodological bases, there are differences regarding the weight and nature of the sources in each case. Primary sources, for example legal documents and historical publications in book format, are the sources with the greatest impact in historical evolution. While the current situation, as a more published field, has articles as the main source with reports and international resolutions as primary sources in this phase.

To address the situation and challenges on the conceptualization of ICHDBs, the authors complemented the historical approach with a critical reflection in the field of heritage studies, and its changing goals in the specific field of heritage cataloguing.

To understand the functional evolution of catalogues, the historical review was developed with special attention to the objectives and materials used in different historical inventories. In this line, the article samples different cases to conform a comprehensive overview where graphic documentation become a main component with an exponential development throughout history.

Supported on the historical account and the review of literature, an overview of the current panorama that allows us to approach the subsequent reflection and projection of the ICHDBs towards the future is presented. Linked to this discourse, two reviews of contemporary material are carried out, one focused on the recognition of the main institutional ICHDBs and the other on the new trends applied to this field of knowledge.

3. Results

Following the development of the research, and based on the methodological process followed, three sections have been identified to ease comprehension of the evolution and current situation of cataloguing:

Section 3.1. A historical-conceptual approach to the origins of cataloguing, centred in Europe and exemplified in the case of Spain. Referring to historical evolution, the 19th century stands out as a turning point of cataloguing, indicating three periods: the precedents of cataloguing (prior to the 19th century), the dawning of cataloguing (beginnings of 19th century) and the consolidation of catalogues (during the 20th century).

Section 3.2. A general panorama of the current situation with special attention to ICHDBs; in this current panorama three blocks of contents have been developed:

- The first one is centred in an international framework;
- The second one is addressed from existing institutional data bases;
- Lastly, a joint analysis that relates history with the conception and goals of ICHDBs as the main instrument of heritage safeguarding;

Section 3.3. The last one as a summary of the relation between new IT systems and ICHDBs in the 21st century.

3.1. Heritage Characterization and Development of Catalogues in Europe in the Case of Spain

Although concern for heritage is deeply rooted in European society, arguably the branches of knowledge with the greatest social impact, such heritage awareness, did not always exist. The origins of the protection of cultural assets can be traced back to the Renaissance, a historical period which placed a growing sense of value on the presence of ancient ruins dating from the classical era.

While inventories of heritage assets from former times had already been carried out, for instance by the Romans in the monitoring of ruins from Ancient Greece, the systematic process of cataloguing heritage as an institutional monitoring tool only started towards the end of the modern era. An early heritage protection measure worth highlighting is the creation in 1534, under the auspices of Pope Paul III, of the post of *Comisario delle Antichità* (Curator of Antiquities), responsible for the protection of classical monuments and control over other objects of value, including antiquities [6].

In the mid-16th century, framed with the emergence of an atlas as a collection of graphic material, different monarchs and nobles gathered graphical documentation of cities. In this context two actions had an important impact in Spain: the publication of the six volumes of *Civitates Orbis Terrarum* (1572–1617) and the development of drawings of different Spanish cities by A. Wyngaerde [7]. These documentations, while not focused concretely on heritage inventories, spotlight the most significant building of an urban environment for the author, and constitute important historic material (Figure 1).



Figure 1. Views of Seville, Malaga and Cadiz. Braun, G., Hogenberg, F., Galle, P., and Kempen, G. (1577).

The grand tour favoured by Europe's elite classes from the end of the 17th century and throughout the 18th, alongside travel books that such journeys generated, indicates a profound interest in foreign cultures. These voyages had an educational ambition, based on the desire for knowledge of other peoples and their idiosyncrasies. Inside these journeys, drawings were part of the further training but did not have a systematic function (Figure 2). The figure of the tutor took on great significance in the planning stages of the trip as they were responsible for selecting routes and, as reflected in 1625 by Francis Bacon, "what things are worthy to be seen" [8]. Tutors established systemization in the selection of places to visit and the stages of the trip according to their own knowledge and personal perspective, framed by Enlightenment ideas and the new appreciation of the Greco-Latin in Neoclassicism.



Figure 2. “In the Villa Mondragone”, A Catalogue Raisonné of Francis Towne (1739–1816).

In this historical context, Spain received travellers from different parts of Europe and some of them produced their respective books or drawing series. In the late 17th century, Pier Maria Baldi carried out a series of 130 drawings, such as part of the entourage of Cosme de Medici in his travel to Spain and Portugal [7].

Along the 18th century, several travel books were developed, among them can be outlined: *Les delices de l’Espagne & du Portugal* (Álvarez de Colemar, 1707); *Viage de España* (Ponz, 1772–1794); *Atlante Español* (Espinalt y García, 1778–1795); *Travels through Spain, in the Years 1775 and 1776* (Swinburne, 1779); *A Journey from Gibraltar to Malaga* (Carter, 1780). Regarding graphical documentation, these books used different drawings to support the narrative, a broad range of scales were addressed going from national maps to concrete details. Urban perspectives and architectural drawings of monuments are the most used representation; however, city plans and reproductions of objects or details were also included (Figure 3).

The emergence of Romanticism, a movement in opposition to the rational character of the Enlightenment, generated fresh points of view: global perceptions, subjectivity, emotions, landscape, and ruins acquired value in their own right, and configured some of the major themes which to a greater or lesser degree would eventually affect the conceptualization of heritage. Personal experience, empirical in nature, and the refinement of taste, and rational in character, would come to define this new vision of artistic and historical assets.

A critical approach in the selection of heritage items is seen to emerge at this time with both the Romantic travellers and the grand tour tutors able to discern with variable grades of expertise which elements held greater merit for recognition over others. Subsequently, new transport facilities and the incipient generalization of tourism, with the first women travellers, led to the consolidation of a list of heritage assets now accessible to a wider public.

The first highly regarded tourist guidebooks were created almost concurrently in England by J. Murray and in Germany by J.A. Klein and the subsequent work of K. Baedeker (Figure 4) [9,10]. Intended as instructional, definitive lists of heritage items were produced based on personal criteria, directing tourists to sites and monuments deemed worth visiting. From its beginning, these books included graphical documentation even if it was not a fundamental part of the publication. Throughout the years, the graphic material became more relevant, cartography and drawing went from a supplementary use, supporting the

text, to an indispensable position, identifying and locating the assets. Therefore, these guides can be understood as the inception of the logic of cataloguing linked with the experience of the territory.

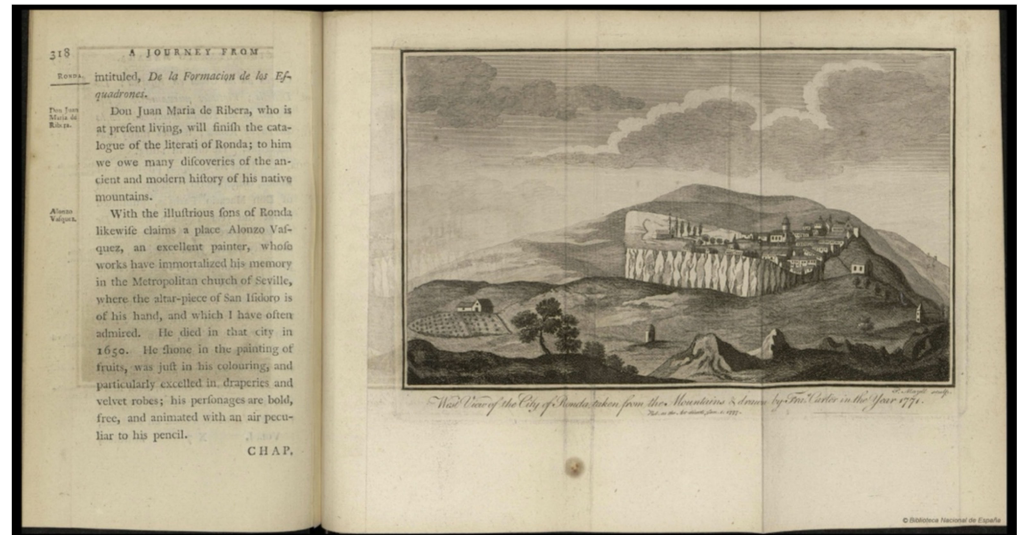


Figure 3. West view of the City of Ronda taken from the Mountains and draw by Fra Carter in the Year 1771. Carter, F. (1780).

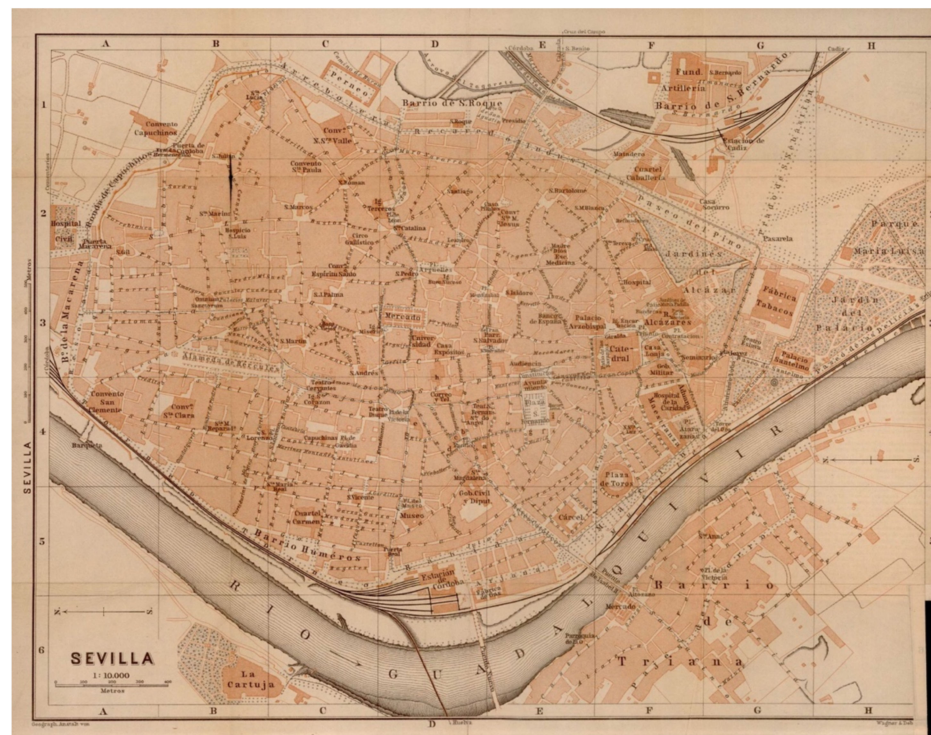


Figure 4. Plan of Seville. Baedeker, K. *Espagne et Portugal Manuel Du Voyageur: Avec 7 Cartes et 47 Plans*; Leipzig: Karl Baedeker; Paris: Paul Ollendorff; Leipzig/Paris, 1900.

Travel literature continued to grow over the years with the expansion of tourism and was consolidated in the 19th century alongside romanticism. Main samples of this line are the *Voyages pittoresques et romantiques dans l’Ancienne France* by C. Nodier, J. Taylor and A. Cailleux. Regarding Spain, the publications series of *Recuerdos y Bellezas de España*

and the works of A. Laborde *Itinéraire descriptive de l'Espagne* and the *Voyage pittoresque et historique en Espagne* can be highlighted [11].

In accordance with I. González-Varas, the concept of “cultural heritage” would not find form until the 19th century when “national monuments” were defined, incorporating a critical discussion on the historical value of such assets, resulting in an appreciation of their heritage characterization [11]. These initial reflections on heritage and its conceptual dimension reveal certain limitations. The assessment of specific characteristics, such as style, materiality, age, or level of antiquity, was based on knowledge received from other epochs. The influence of the Enlightenment and Classicism as well as the first institutional interventions towards protecting heritage, based on the use of inventories, would set clear precedents.

3.1.1. The Dawning of Heritage Catalogue in Europe

The development of heritage inventories originated towards the end of the 18th century, and was triggered by various factors relating to cultural, economic, and social change including: the discovery of the cities of Pompey and Herculaneum, as well as other archaeological sites from antiquity, the development of the Enlightenment movement, and the French Revolution.

Following the nationalization of ecclesiastical and royal assets during the French Revolution, a concern of the French State Assembly was the financial control of its new heritage assets. The Commission des Monuments (Commission for Monuments) was created in 1790 in response to this concern, it was commissioned to carry out: an inventory that would enable the various national assets to be catalogued, and rules for the management of these assets. This catalogue treated immovable assets and movable assets at the same time, focusing on their economic value [12]. One of the first treaties on inventories appeared at this time written by Vicq-d'Azyr and Lindet [13]; in it, graphic documentation was part of the inventory process of different assets. In accordance with F. Rücker, this specific moment in history represents the origin of the conservation of historical monuments in France [14].

In addition, the viability of re-purposing built assets to create spaces for education was studied during this period, but the idea was eventually modified, resulting instead in the conversion of convents and churches into munitions stores or prisons [12].

The enthusiasm shown for ordering and controlling the world as well as the advances initiated in France, especially the creation of the Commission for Monuments, served as precursors that led to the extension of institutional heritage cataloguing across borders and further developments in other European nations.

In the meantime, in England, by the beginning of the 18th century the Society of Antiquaries of London (1707) had already been formed, publishing images of artefacts and sites of antiquarian interest in the publication *Vetusta Monumenta* since 1718 (Figure 5). “The objects selected for inclusion in *Vetusta Monumenta* form a large and varied set, ranging from artifacts such as a Romano-British marble bust and medieval monastic seals to architectural monuments including Fountains Abbey” [15]. This publication signifies the value of the historic graphical documentation replicating originals drawing into engravings at the beginnings of 18th century. A key moment in the following century was the creation in 1882 of the National Heritage List for England, developed by the Historic Building and Monuments Commissions for England leading to the first heritage protection law enacted the same year, the Ancient Monuments Protection Act.

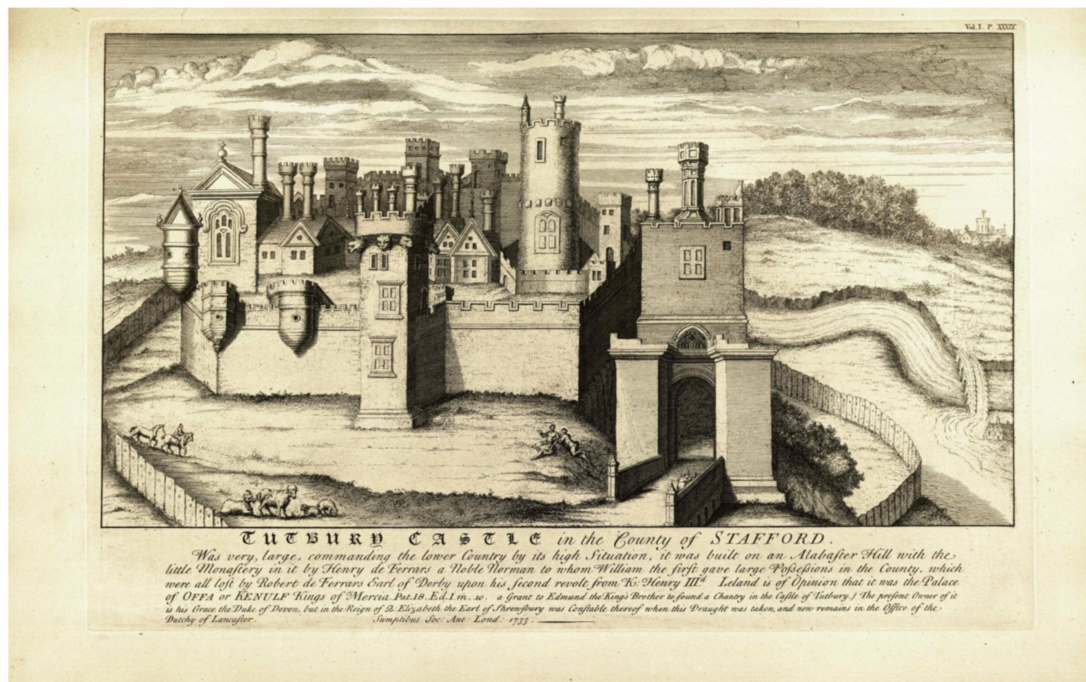


Figure 5. Plate 1.39 of *Vetusta Monumenta* depicts Tutbury Castle as it appeared in the sixteenth century. Engraving by George Vertue after a drawing originally produced for a survey of the properties of the Duchy of Lancaster conducted by the Chancellor of the Duchy, Ambrose Cave, in 1561. Further drawings from this cache were engraved as Plates 1.40, 1.41, 1.42, 1.44, 1.46, 2.11, and 2.13. 304 × 467 mm. Published by the Society of Antiquaries of London in 1733. Current location: Tutbury, Staffordshire, UK.

In the 18th century, under the influence of the Enlightenment, the Spanish crown sponsored the development of archaeological remains excavations, on which a certain common protection procedure was developed, which included the identification and description of the pieces through drawings. According to Gabardón de la Banda, the academicians of San Fernando “made drawings of the pieces, in the form of inventories; and finally, a selection of works was transferred to swell the royal collections” [16]. In these years, the academic commissions entrusted the drawing of great national monuments to prestigious academics such as the architect J. Hermosilla, who drew up the plans for the Alhambra in Granada. Together with D. Sánchez Sarabia, J. P. Arnal and J. Villanueva, J. Hermosilla produced the graphical documentation for *Antigüedades Arabes de España*, published between 1778 and 1804 [17,18]. According to O. Schubert “this was arguably the first attempt to make an inventory of the artistic monuments of the kingdom” [19].

The first glimmer of an inventory emerged with the creation, in 1792, of the Comisión de Antigüedades de la Real Academia de la Historia (Royal Academy of History Commission for Antiquities) [20]. In 1803, the need to carry out an inventory of assets was directly proposed, leading to what can be considered the first heritage law enacted in Spain, the Real Cédula del 6 de julio de 1803 (Royal Charter of the 6 July 1803), that regulated the means of recording and preserving ancient monuments that have been or will be discovered in the kingdom. The development of the catalogue as a mean of managing heritage was thus promoted via the new law and the direct intervention of the Real Academia de la Historia.

Despite the attempts to create an inventory, it was not until 1835 that fundamental developments occurred, precisely on account of two major events that led to a significant loss of historical heritage: the invasion of Spain by Napoleonic troops and the disentanglement of Mendizábal; in different periods the Spanish state by means of forced expropriation, acquired assets belonging to the church and/or religious orders. Under the auspices of the state, an increase in inventoried assets considered at risk was generated [11]. The Real Orden del 29 de julio de 1835 (Royal Order of 29 July 1835) was drawn up in order

to respond to the needs of managing and preserving recently acquired heritage. This law established the creation of Comisiones Provinciales Científico Artísticas (Provincial Commissions for Art and Science) whose objectives were to examine, inventory, and record all elements contained in expropriated properties seized by the state.

It would be via the Royal Orders of the 2nd April 1844 and the 13th June 1844 that the Comisiones Provinciales de Monumentos Históricos y Artísticos (Provincial Commissions for Historical Monuments) were created, showing such determination in their functions that interest in “national monuments” firmly took hold, leading to their inclusion in the inventory and their preservation in the facing political upheavals. The first building to receive official status as a monument was the Cathedral of León in 1844, highlighting the achievements of cataloguing as a fundamental activity in the process of establishing legal protection.

The arrival of photography at the Real Academia de Bellas Artes (Royal Academies of Fine Arts) was questioned because of the technical and scientific nature with which its discoveries were disseminated. Photography was associated with the reproduction of the real object without artistic freedom, and was even considered to be detrimental to art. In favour of the use of photography in heritage in Spain the figure of J. Laurent was crucial. J. Laurent, the royal photographer to Isabel II from 1861, was noted for his use of photography in various situations such as: photographing museum collections, drawing up tourist catalogues focusing on artistic itineraries or graphically documenting public works among others [21–23].

The origins of heritage cataloguing in Europe are thus clearly established. It should be highlighted, however, that the first inventories were developed largely for financial reasons. Ultimately, the aim of these inventories was to control and list assets of state property, rather than select elements deserving protection on the basis of their cultural value. Nevertheless, there existed certain initiatives that sought the use of heritage for its educational and social value, contrasting the financial incentive.

In 1830, the Spanish Real Academia de la Historia (Royal Academy of History), proposed the creation of a museum of antiquities connected to a library and a school teaching courses on related subjects [20]. Although the project focused on movable heritage and never materialised, this 19th century reflection that associated heritage with teaching and research, is worth note as an approach applicable today.

3.1.2. Management of Immovable Heritage in Spain in the 20th Century

As previously mentioned, the development of heritage protection and conservation in Spain has been based on the development of heritage catalogues or inventories as a method of knowledge and approach to assets. Although measures have been developed since the end of the 18th century, it was not until 1900, with the creation of the *Catálogo Monumental y Artístico de la Nación* (Monumental and Artistic Catalogue of the Nation), that an inventory of national heritage was effectively configured [24]. This catalogue was provided impetus by the Real Decreto del 1 de junio de 1900 (Royal Decree of the 1 June 1900), outlining the need to resume the work on inventories started after the 1844 law, creating a methodology that attempted to apply rigor to the process of cataloguing.

During the 20th century, a number of laws were drawn up in pursuit of national heritage defence, emphasizing the need for cataloguing as an essential instrument in the development of heritage protection. The following can be highlighted (Table 1):

Table 1. Key 20th century laws for the protection of heritage in Spain.

Rank	Date	Key Contribution
Royal Decree	1 June 1900	Promotion of a complete <i>Monumental and Artistic Catalogue of the Nation</i>
Royal Decree	14 February 1902	Definition of a general methodology, highlighting the importance of graphic material
Law	4 March 1915	Defines the architectural monument, regardless of style
Royal Decree Law	9 August 1926	Definition of Tesoro Artístico Nacional (National Artistic Treasure) and consolidation of the use of the catalogue
Decree	23 March 1931	Application of urgent measures for the safeguarding of heritage
Decree	3 June 1931	Declaration of 789 new historical or artistic monuments
Law	13 May 1933	Creation of the Junta Superior del Tesoro Artístico (Higher Committee for Artistic Treasures)
Decree	23 July 1936	Creation of a Committee for the Heritage Protection of Occupied Palaces
Decree	1 August 1936	Capacity for the seizure of assets provided to the Committee
Decree	22 April 1938	Creation of the Servicio de Defensa del Patrimonio Artístico Nacional (Service for the Defence of National Artistic Heritage)
Decree Law	12 June 1953	Change in competencies at the Ministry of Education
Decree	22 July 1958	Protection of area surrounding assets
Decree	22 September 1961	Creation of the Servicio Nacional de Información Artística, Arqueológica y Etnológica (National Service for Information on Art, Archaeology and Ethnology)
Law	25 June 1985	Definition of a new system of state organization based on the autonomous community

In comparison with 19th century legal texts, which evaluated factors such as age, nobility of materials, or the size of the buildings, laws dating from the early decades of the 20th century began to show advances in their assessment of diverse characteristics, styles, and origins. The first article of the 1915 law for the Conservación de Monumentos Arquitectónicos y Artísticos of 1915 states: in accordance with this law, artistic and architectural monuments are those which have artistic or historical merit, regardless of the style.

Among the different national actions linked to the Spanish government in the 20th century, the first is more ambitious and innovative, even if might not be completed. The promotion and development of the *Monumental and Artistic Catalogue of the Nation* since 1900, did not result in an effective method of heritage protection; however, is a compilation of information that we see today as a valuable source of information for heritage research and studies [25]. The reasons for the failure of this undertaking can be related to three aspects that evolved quickly in the 20th century: the concept of cultural heritage, the instruments of heritage protection, and the method of drawing up catalogues and inventories [26]. During the development of the provincial catalogues, the different authors recognized the importance of the graphic documentation, and among them they highlighted the value of photography, which would become the main graphic element in most catalogues (Figure 6) [27].

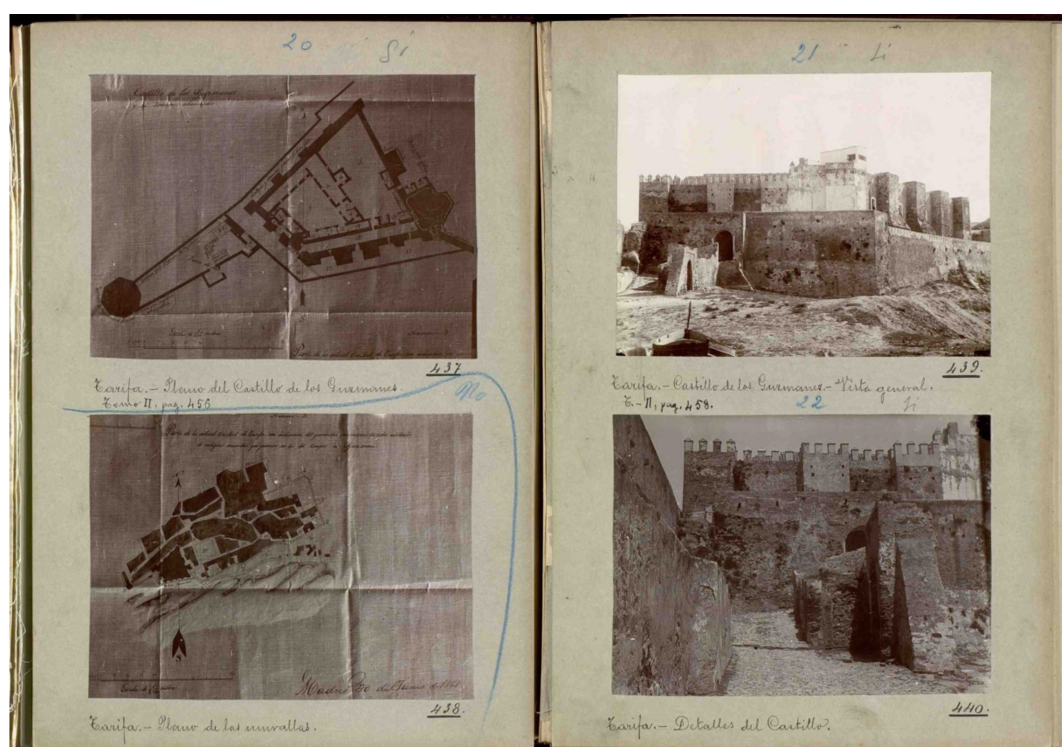


Figure 6. Romero de Torres, E; *Catálogo de los monumentos históricos y artísticos de la provincia de Cádiz [Manuscrito]*; 1907.

In the proposal of catalogues in 1900, there was no clear methodology for drafting, the process was left to the discretion of each author, thus the result in each province was heterogeneous. Although photography remained the main graphic element, some catalogues stand out for their quality, such as those produced by E. Romero de Torres, with a prolific production of photographs, or others written by M. Gómez Moreno, where the author accompanied photographs and texts with drawings (Figure 7) [27].

Referring to graphical documentation, different legal texts highlighted the importance of additional plates, drawings, and photographs. In 1902 the royal decree stated: the description of the monuments shall be illustrated with plans, drawings and photographs of those monuments which, because of their newness and importance, require it [28]. About the National Artistic Treasure the royal decree law of 1926 stated: in cities and towns that are totally or partially declared or that are declared to be included in the National Artistic Treasure, topographical plans shall be drawn up by the respective Town Councils at a scale of not less than 1:5000, and on them shall be delimited by means of circles the areas subject to the easement of not building freely, marking with different colours the artistic or historic buildings, places, streets, squares and picturesque districts, in which no work may be carried out without the authorisation of the corresponding central and provincial entities. Plans of this area shall be drawn up on a scale of not less than 1:200 [29]. Referring to the inventory of historical and artistic heritage, the law of 13 May 1933 declared: the reports, which will be illustrated with photographs, drawings, etc., and will be accompanied by a catalogue, guides, studies, etc. [30]. It is clear that cataloguing and graphical documentation are bound not only conceptually but also legally from the beginning of 20th century.

The construction of a national Spanish catalogue has undergone a number of phases, requiring the drafting of a series of laws as well as the intervention of multiple bodies. This onerous path reflects the significance of this process that remained through different historical and political periods throughout the 20th century. Despite the outbreak of the Spanish Civil War and the switch from democracy to dictatorship, measures to safeguard heritage deemed at risk were developed by both sides of the Civil War conflict, in 1936 and 1938.

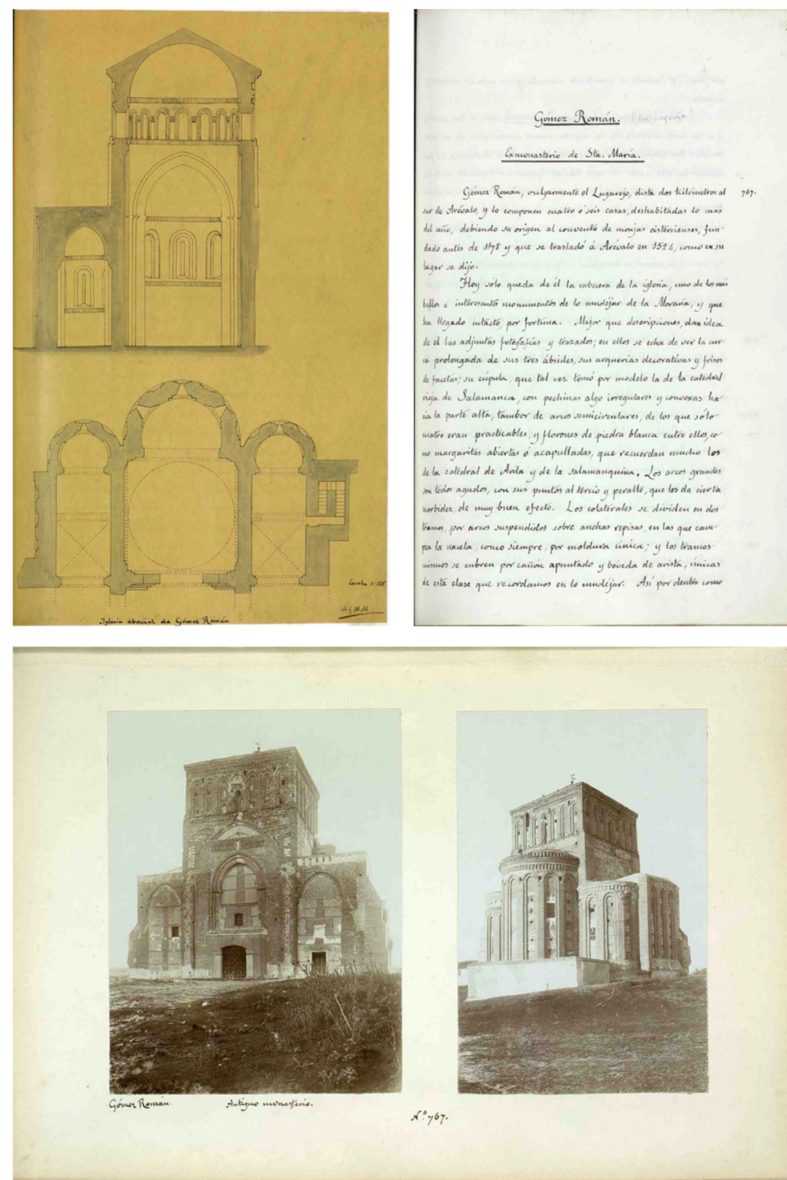


Figure 7. Drawings, text and photography of the former monastery of St. María of Gómez Román (Arévalo). Gómez-Moreno, M; *Catálogo monumental de España [Manuscrito]: provincia de Ávila*; 1901, https://csic-primo.hosted.exlibrisgroup.com/permalink/f/homi3k/34CSIC_ALMA_DS21120975240004201 Accessed on 7 July 2021.

After a period of military conflicts that would severely mark society, trends towards the safeguarding of heritage at an international level began to take shape. Nationally, in 1961 the National Centre for Information on Art, Archaeology and Ethnology was created, and the creation of six new inventories was promoted (Spanish national treasure, architectural inventory, archaeological inventory, Spanish archive census, museum inventory and library census) [26]. At international level, the development in 1966 of the Protective Inventory of the European Cultural Heritage can be considered one of the most noteworthy initiatives of this time, resulting in the unification of criteria at the European level. In the case of Spain, a two-volume inventory was published (Figure 8) containing an expression of desire to set the rules for the development of a systematic policy for the protection of Spain's monumental heritage by preserving the ensemble or the surrounding environment where the monuments are located [31].

SITIOS Y CONJUNTOS HISTORICO-ARTISTICOS	
Ficha mod. A	
ESPAÑA	INVENTARIO DE PROTECCION DEL PATRIMONIO CULTURAL EUROPEO IPCE
MINISTERIO DE EDUCACION Y CIENCIA. DIRECCION GENERAL DE BELLAS ARTES. COMISARIA GENERAL DEL PATRIMONIO ARTISTICO NACIONAL	REFERENCIA
Servicio de información artística, arqueológica y etnológica	IPCE 30009
DENOMINACION SANTIAGO DE COMPOSTELA.- Conjunto histórico-artístico	PROTECCION EXISTENTE
LOCALIZACION Provincia de la Coruña	Declarado C.H.A. día 9 -III- 1940
DESCRIPCION DE LOS SECTORES PROTEGIDOS (Plano al reverso)	PROTECCION PREVISTA
1er. grado.- Sectores que deben ser conservados íntegramente	
Toda la parte antigua de la Ciudad, incluyendo los monasterios próximos y las vías de comunicación con los mismos.	
2º grado.- Sectores que deben ser conservados casi íntegramente	
3er. grado.- Sectores de ordenación urbanística especial	
Los alrededores de la Iglesia de Santa María de Conxo, Los alrededores del Hospital.	
4º grado - Sectores de edificación controlada y limitada en altura	
La parte cuyos límites se señalan en el plano.	
5º grado.- Sectores no edificables o con edificación limitada al volumen permitido en el "suelo rústico" (Ley del suelo)	
Los espacios que se señalan en el plano	
DESCRIPCION	
Ciudad antigua con monumentos de primera importancia desde los siglos XII al XIX.	
	Autor Francisco Pons - Sorolla
	Fecha Julio 1950
	Revisión
	Fecha

PLANOS

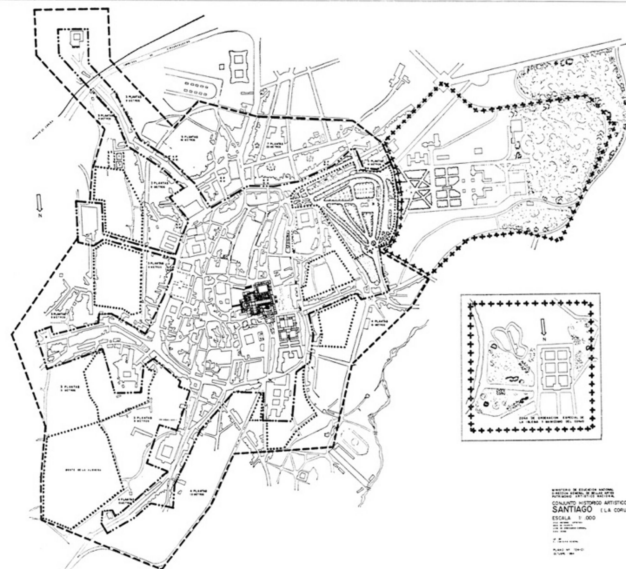


Figure 8. Example of index card for Spain for Protective Inventory of the European Cultural Heritage [31].

After the transition to democracy and the approval of the statutes that divided Spain into new autonomous communities, the regional government held the power over heritage protection, and this included the development of inventories. At a national level, the Instituto del Patrimonio Cultural de España (IPCE) (Institute for Cultural Heritage of Spain), as the heir to the 1933 Junta Superior del Tesoro Artístico (Higher Committee for Artistic Treasures), became responsible for collecting heritage information from the different regions. The first time that index cards were used at national level was in 1979, with the elaboration of an immovable heritage register [32].

Applying the 1985 law of Spanish Historical Heritage as a framework, the different autonomous communities developed their own heritage laws, with the Basque Country was the first to formalize them in 1990. In the case of Andalusia, based on the Statute for Autonomy approved in 1981, the first Historical Heritage Law in Andalusia was passed on 3 June 1991, establishing in article 6: the General Catalogue for Historical Heritage in Andalusia is constituted as an instrument to safeguard the assets thereby listed, for consultation and dissemination. Due to the marked bureaucratic nature of the resulting catalogue, rather than an instrument for dissemination, the inventory serves as an archive for legal reference.

Created in 1989, the Instituto Andaluz de Patrimonio Histórico (IAPH) (Andalusia Institute of Historical Heritage) has been involved in the construction of various CHDBs for Andalusia since 1993 and their later reconfiguration as the Sistema de Información del Patrimonio Histórico de Andalucía (SIPHA) (Andalusia Historical Heritage Information System). At the IAPH, a CHDB for movable heritage was developed prior to addressing built heritage. Towards the end of the 20th century several sectorial CHDBs that attempted to overcome technical limitations were developed. As part of this quest for innovation and evolution, the implementation of GIS in the field of archaeological heritage since 1996 can be highlighted, as well as its extension to other fields, and its consolidation within SIPHA in the 21st century [33]. At the same time, the autonomous community government of Andalusia approved the new heritage law: Ley 14/2007, de 26 de Noviembre, del Patrimonio Histórico de Andalucía, currently in vigour. The IAPH currently offers the Guía Digital del Patrimonio Cultural de Andalucía (Digital Guide to Cultural Heritage in Andalusia) as an online search system to consult this information (<https://guiadigital.iaph.es/> Accessed on 26 July 2021).

3.2. Current Panorama: European Concept of Heritage and Its Protection

A number of different countries began the process of recognizing the historical value of their assets, developing diverse interpretations and approaches to heritage in accordance with their cultural and geographical singularities. The concept of heritage began thus to take nuanced forms and widen in scope. The onset of the contemporary conceptualization of heritage can be traced back to the international congress that culminated in the formulation of the Athens Charter of 1931. In this congress, intellectuals from diverse countries presented their advances and concerns during the conference, seeking to exchange knowledge and reflections. This led to a series of collective agreed-upon key ideas that, meeting a general consensus, reflected a common international concern regarding the safeguarding of heritage assets. Although the Second World War put a stop to this trend, it would subsequently resurface with the post-war emergence of international organizations.

The creation of the United Nations for Education, Scientific and Cultural Organization (UNESCO) in 1945 represents a key action in the defence of heritage at an international level. The development of documents and agreements, mainly under the auspices of UNESCO, such as the 1972 World Heritage Convention, led to the formation of a heritage concept of international acknowledgment. At this point inventories and documentation were consolidated as international tools for heritage management. On the basis of this shared referential framework, different nations set about implementing culture-specific approaches.

Although each country would develop its own system of protection and cataloguing, specific actions among international trends in heritage conservation at an international level include: the Declaration of Amsterdam (1975), and the creation of the UNESCO Thesaurus in 1977, leading to the further establishment of the UNESCO World Heritage List.

The concept of heritage, hitherto habitually framed by the thematic classification and typology proposed by UNESCO, scaled up its sphere of operations, aiming for a comprehensive vision integrating both landscape and territory, with these taking on greater significance vis-à-vis the object. The monument was now no longer considered the sole model of heritage, and diversity became established as a quality of heritage.

At the same time, the rise of sustainable development from the report *Our Common Future* and the ulterior progress that led to the 2030 Agenda for Sustainable Development suppose a foundational change in thoughts towards the future [34,35]. In this context, culture relation with sustainability grows in relevance, even if consideration is not clear [36].

Regardless of its consideration such as the four pillars of sustainable development or a transversal aspect, culture, and accordingly heritage has become a main element in sustainable development as shown the numerous publications abording this idea [37–40]. The resolution 72/229 “reaffirms the role of culture as an enabler of sustainable development” [2]. “From cultural heritage to cultural and creative industries, from sustainable tourism to cultural infrastructure, culture fosters and drives the social, environmental and economic dimensions of sustainable development” [41].

In parallel with the conceptual development of heritage, the advances in IT have led to a new situation where perception, interaction and management of heritage should be understood as linked with the digital environment. Regarding heritage inventories, the development of data bases introduced new methods of cataloguing and heritage characterization allowing for a more complex relational network.

In addition, the potential for the geo-localization of assets via satellite localization systems as well as geographic information systems (GIS), have led to fresh outcomes and allowed for new grounds for reflection. From its early days in the 1960s, with its original focus on environmental management, GISs have since developed their potential in different areas [42], and impacted contemporary systems of protection and cataloguing.

Within the framework set by UNESCO, each country formulates its own systems for managing immovable heritage together with a knowledge network that, influenced by these systems, continues in constant expansion and singularisation at the same time. In this context, countries such as France, Spain, and England, having a longer history of heritage inventories, have become reference points for emerging systems.

Far from reaching full development in the 20th century, the application of systems for heritage catalogues is in constant evolution. The rise of new technologies and their generalized use combined with the constant ongoing development of the contemporary concept of heritage, have been pivotal in raising public concern for heritage and increasing public access to information stored in catalogues and inventories.

The design of heritage catalogues has become an international trend. Heritage inventories list a wide array of items, from the local management of specific areas to large-scale international proposals. More specifically, the immovable cultural heritage data bases (ICHDBs), with their data storage and documentation capacity, stand out as the new tool most used in heritage management. Because of the extension of this field where different approaches, environments and even objectives are developing, only a general and inevitably synthetic review can be provided here.

In seeking to collate results, documentation, and criteria, a number of international standards emerge. Those that are more widespread in the field of heritage include: MIDAS Heritage; ISO 21127:2014; and the core data standard (CDS), developed by the International Committee for Documentation of the International Council of Museums. Despite being designed with a degree of margin for adjustment, and as reference for both new and existing catalogues, none of them have been widely adopted or applied. The varying realities and requirements of ICHDBs and, at times, the circumstances of their development do not always allow systemization and adaptation to a set of international criteria of considerable complexity.

Two main classification criteria can be proposed for current ICHDBs, both using digital index cards as the main tool for searches and the geo-localization of assets.

Firstly, according the functional level, ICHDBs can be simplified into two trends: introspective in character, seeking to manage a specific heritage item and supported by private server platforms and; open in character, allowing public access, configured with a view to increasing public awareness and transference of knowledge and, in certain cases, citizen participation.

Secondly, regarding the method of promotion or development: for individuals or private entities, ICHDBs are normally conceived as systems for raising cultural awareness; while for the public sector, the protection of heritage is established as the main, though not the only, objective. In the case of Europe, these latter ICHDBs of public character have had greater impact.

Before focusing on Europe, three ICHDBs of wide diffusion and global impact should be highlighted: the UNESCO world heritage list (<https://whc.unesco.org/en/list/> Accessed on 26 July 2021), *ArchINFORM* (<https://www.archinform.net/index.htm> Accessed on 26 July 2021), and the Arches Project (<https://www.archesproject.org/> Accessed on 26 July 2021), both of private character. UNESCO created the world heritage list in 1977 and entered the 12 first properties in the second session of the World Heritage Committee of 1978 [43,44]. This list has become the most noticed heritage inventory at an international level including the most relevant cultural or natural sites from the different countries belonging to UNESCO. *ArchINFORM* is a web platform that stands out for its openness and interconnectivity of concepts. The Arches Project, developed jointly by the Getty Conservation Institute y la World Monuments Fund proposes to serve as a programming base for the creation of various catalogues, applying certain key international standards such as MIDAS Heritage.

3.2.1. Institutional Data Bases for Immovable Cultural Heritage

The European continent is the historical epicentre for the protection of heritage, offering a wide range of data bases for its cataloguing and preservation. Each country has, however, created different systems for managing and cataloguing: some countries, such as England, France or Portugal, are organized around a centralized system while others, such as Spain and Germany, manage heritage on a regional basis. In order to gain an understanding of the situation in Europe, a general overview of systems for cataloguing in those countries with the greatest experience is provided. Lastly, there is special mention of Spain, specifically Andalusia, given its prolific production in the field.

In France, management of the CHDBs Architecture et Patrimoine (Architecture and Heritage) is responsibility of the Ministry of Culture. Although the beginnings of cataloguing in this country can be traced back to the French Revolution, the adoption of catalogues as a tool for governing systems dates from André Malraux's 1964 proposal [45]. A public system of cataloguing was put forward, initially as a method for researching heritage that would subsequently acquire significance at government level. The determination of assets is carried out at the regional level while a central commission reviews the inventories as a whole. Two CHDBs were generated from the results, one dedicated to movable assets (Palissy) and the other based on built heritage (Merimée); both were combined into a single online system freely accessible to all (<http://www2.culture.gouv.fr/culture/inventai/patrimoine/> Accessed on 26 July 2021). It offers a wide range of possible searches with links to a media centre mainly consisting of historical images. Regarding the adoption of new tools, a geo-referential system is offered that is supported by the géoportail (<https://www.geoportail.gouv.fr/> Accessed on 26 July 2021) initiative and allows fast searches through maps from a heritage and cultural atlas.

In England, the 1882 *National Heritage List for England* (<https://historicengland.org.uk/listing/the-list/> Accessed on 26 July 2021) is constantly updated and under development by the Department for Digital, Cultural, Media and Sport; linked to Historic England, the public organization responsible for heritage management. Starting out as a list, it transformed into an ICHDB with descriptive index cards as the main tool for free online searches, and also includes an option for citizen participation allowing new assets to be proposed for inclusion (subject to scrutiny before acceptance). In addition, a system of geo-referencing is included that enables searches and the localization of assets through maps. It exists in parallel to the web page managed by Historic England that allows access to historical information and resources related to the different regions and councils (Historic

Environment Record (HER)) compiled from various public sources called Heritage Gateway (<http://www.heritagegateway.org.uk/gateway/default.aspx> Accessed on 26 July 2021).

As previously mentioned, Spain is organized on a regional basis where, despite the existence of the national Registro General de Bienes de Interés Cultural (General Register of Assets of Cultural Interest), promulgated by the 1985 heritage law, it is the autonomous communities' governments that are responsible for developing inventories and protecting their heritage. At state level, the IPCE is the main organization responsible for heritage. At the regional autonomous level, however, organizations and institutions that also produced their own ICHDBs: the Andalusia Institute of Historical Heritage, the Basque Cultural Institute, or the Catalan Institute of Research on Cultural Heritage.

The development of heritage protection at a regional level, while facilitating the control and management of region-specific situations, has also widened the gap between the different regional areas, adding complexity to the state's handling of potential heritage networks. However, private ICHDB initiatives exist, custom-made to suit specific heritage typologies, proposing a peninsular-wide or state reading of heritage, such as the Modern Movement Register of the Fundación DoCoMOMO Ibérico; or the Inventory of Defence Architecture of the Asociación Española de Amigos de los Castillos (AEAC) (Spanish Association of Friends of Castles).

The creation of ICHDBs thus consolidated into a trend in Spanish society, seeking to safeguard heritage as a primary objective. To this end, most ICHDBs offer a rigid system for cataloguing and data input, possibly derived from the necessary organizational character of the former physical catalogues.

The value of heritage cataloguing developed over the last few years in Andalusia using various CHDBs and working in collaboration with international projects such as the *ARCH XX SUDOE* catalogue represent a trend of national and international reference. It is worth noting not only the quality of the consolidated systems but also the critical and constructive approach at the ICHDBs, supporting the continuous evolution and adaptation to the new IT tools.

3.2.2. Trends and Reflections on Immovable Cultural Heritage Data Bases in the 21st Century

The historical analysis showed that, in the countries studied, the creation and use of certain inventories were and are focused on administrative objectives or on financial control. Although necessary, this approach leads to the production of a set of stagnant data of little value to the development of protection. As is commented upon in the *Registro Andaluz de Arquitectura Contemporánea* (Andalusian Register of Contemporary Architecture) review, inventories or registers should never be an end in themselves, but the means to be used by the Administration for the protection and conservation of heritage [46].

ICHDBs respond to varied objectives: most frequently for the purposes of heritage protection and inventories, and, stemming from this, new situations based on universal access have taken shape. Online access to ICHDBs facilitates new uses: such as a search tool, a platform for educational studies in heritage, and even, in the case of the N-340 roadway corridor, as a tool for research and collaborative work [4,47].

Participative systems of assessment and characterization of heritage exemplify direct interaction and identification between citizens and cultural assets. Citizen participation is an achievement at both a social and emotional level and can serve as backup for subsequent institutional developments. In 1904 and during the IV International Congress of Architects in Madrid, the creation of Friends of Monuments Associations was solicited to facilitate the state management of heritage [11].

In Spain, the Association of Friends of Castles created the *Inventario de Arquitectura Defensiva de la AEAC* using the system of crowdsourcing in 2012. In this case, the implementation of a participative model sought to develop ICHDB through the contributions of society as a whole, while fostering a greater sense of social commitment to heritage [48].

The use of IT systems represents a seminal change in the functioning and organization of ICHDBs. Along with the implantation of the SQL system, the use of GISs represents

a turning point in the construction of heritage catalogues. In this context, the diverse functions and capabilities that ICHDBs can encompass the application of standards and the singularisation and adaptation to specific situations convert them into tools that become complex to create, requiring the collaboration of a multi-disciplinary team. To deal with such complexity, the Arches Project presents an open-code base system, applying international standards, which reduces the volume of work required in the process of creating the ICHDB, notwithstanding the computer programming expertise required to be able to build a complete system. However, the application of standards can be challenging when the singularisation and adaptation to a specific situation may be necessary.

Data storage associated with a geo-referenced location, thus connecting graphic and alphanumeric information to the position of the heritage asset, may lead to a paradigmatic change in organization and modalities for searches. The capacities of GISs alongside their potential for analysis and cross-referencing, has ensured that the inclusion of geo-referencing is one of main concerns in the creation of heritage catalogues. However, this system is still far from being open to researchers and the general public: having been produced with a specialized software, it is mostly accessible only to experts [4]. Cartography, or the location of assets, stands out as one of the main characteristics of inventories; most updated ICHDBs allow direct searches via localization, giving an overview of the position of an asset in relation to other heritage assets in the area. At the same time, the inclusion of GPS in mobile phones allows the localization of geo-referenced heritage in real time. The capacity of GISs for analysis and cross-referencing in relation to territory alongside the parallel development of open-access ICHDBs, allows complex searches on heritage to be carried out without too much effort on the part of any user [49].

Alongside the GISs, the use of new systems of representation, such as 3-D imaging and the construction of virtual reality environments, are huge matters for reflection with regard to heritage applications. Three-dimensional scanners, photogrammetry, and point cloud imaging are tools which have resulted in a series of reflections and research lines over the last few years, as seen by published articles and the International Committee for Documentation of Cultural Heritage (ICOM) documentation activities [50–52].

In relation with these new technologies, the Heritage Building Information Modelling (HBIM) stands out as one of the most powerful and promising tools. Several papers discuss about the application of BIM to heritage and according to M. Castellan-Román and F. Pinto-Puerto, three focuses can be identified in relation with HBIM: modelling of historical buildings as a particular case, high geometric accuracy modelling, and analysis and generation of knowledge [53]. In the last years, different articles highlight the potential and application of HBIM mainly used for built heritage but also for movable heritage inside it [54–58]. Other authors, while understanding the impact of HBIM, also mention that this tool does not offer a significative improvement in the field of dissemination of cultural heritage [59].

The development and rise of these digital tools led to an unavoidable reflection regarding their relation with digital heritage. In this field, UNESCO has established different publications and foreseen different actions and needs, “digital file formats, storage media, and systems are ever evolving, jeopardizing the future readability and integrity of digital heritage over much shorter timeframes than does the deterioration of paper and physical objects, and its availability for capture is fleeting” [60]. This guideline recommends that, on long-term preservation, priority should be provided to born digital items and digital or digitized information, leaving the digital representations of physical artefacts in the second line.

3.3. Conceptual Foundation of ICHDB across Time

As research demonstrates, the evolution and development of heritage cataloguing is particular in each country, and even region, requiring thus particularized studies that consider the different ways of addressing heritage and also the differences of the catalogued heritage itself. Despite those specific studies being required, the contribution of the case of

Spain, understood in the general framework developed in the article, has permitted us to extract a set of general results.

Current ICHDBs can be understood as the result of the evolution of the original inventories of heritage and therefore as the main field of reflection to address in the quest for a better future of present heritage cataloguing.

From the dawning of heritage inventories to the irruption and consolidation of ICHDBs, the uses and approaches of cataloguing have been mainly the management and protection of heritage. However, other perspectives such as those aimed at the economic control of the assets of the state, have coexisted. Although they finally did not have a real impact, among the precedents of cataloguing and the first inventories there were initiatives in pursuit to offer heritage to society for education and leisure.

The first inventories, previously mentioned, promoted from the 19th century and whose objectives were the control and record of assets that belonged to the different states, are the base of current ICHDBs of each studied country. From the consideration of monuments and antiquities proposed at the beginning, these catalogues adapted to the evolution and broadening of the concept of heritage, mainly during the last decades.

Regarding catalogue production, the first inventories were created by people individually or in a reduced group. This approach was proven insufficient and poorly effective in the case of the monumental catalogue of 1900 that revealed the need of a team and a methodological framework for its development. At present, progress has been made in the international recognition of the standards and the agreement on transdisciplinary character of the teams for the design and development of catalogues. However, we still have a long way to go in the required participation of non-experts: new systems focused on this new challenge of heritage need to continue developing.

The appearance of new IT tools and the possibilities that emanate from them promoted the substitution of paper catalogues for digital ones. Conceptually, ICHDBs continue the proposal of pre-existing inventories and, sometimes, preserve their character and focus. While this approach can be enriching as in the case of the heritage list for England, that preserves even its original name, it may also result in an unsuited use of new technologies. Heritage stakeholders must support the use of technological developments that improve the relationship with heritage.

New technological tools have a key role in the future of heritage cataloguing and experts must promote their optimization; however, it is imperative to respond to the needs of heritage. The continuous changes in heritage studies, their complexity, and the constant broadening of what we consider heritage, make it difficult to address in a general approach, and requires flexibility and continuous adaptation to the particularities of each heritage.

Inventories, catalogues, and data bases can thus be understood as the evolution of the same tool for the main tasks of documentation and characterization of heritage. Throughout history the inventory of heritage had to adapt its goals that have passed from control and record of a growing heritage to the protection aimed at avoiding its disappearance. Heritage catalogues are flexible tools adaptable to different situations, but responding to a reality where every change has been accelerated, can be a challenge.

As can be observed in historical evolution, graphic documentation has had and still has a main role in relation with heritage cataloguing. The first uses focused on the identification and localization of the assets were surpassed with the appearance of new methods and tools of representation. For its part, graphic documentation pursues new objectives such as the dissemination of knowledge or the implementation of new research processes. In a society where images stand out as one of the main means of communication, their originality and rigour can be challenging. In the same way, in the face of the expansion of social networks, new methods of connection and control must be addressed between scientific data bases and these means of communication.

4. Discussion and Conclusions

After this historical review we can conclude that the development of heritage inventory procedures has three generalised lines: aims, technology and heritage evolution.

Firstly, there has been a change in objectives that transcends the initial control and protection approaches, to the current ones of dissemination, education, and research. From the end of 18th century there have been initiatives linked to cataloguing processes that searched for the relation between heritage and society; however, it was not until the 21st century when catalogues started serving as support for these initiatives.

Secondly, the development of technology has been a catalyst for heritage cataloguing along history. Although technological advances did not imply a direct turning point, their progressive implementation to the discipline caused substantial changes. From the first inventories, where written descriptions and drawings were the main components, the appearance of photography implied a turning point in the documentation system, providing a more objective character. In the same way, changes such as: the creation of relational data bases, the use of GISs associated to heritage, and the implementation of HBIM, imply a technological outbreak that has caused and will cause important modifications in cataloguing tools.

Thirdly, there has been changes in stakeholders and heritage conception. The evolution of the concept of heritage, particularly during the last decades, has caused an expansion towards a more diverse and complex reality. Catalogues construction has evolved from the minor commissions of the 19th century focused on monumental heritage, to collaborative work between multidisciplinary experts and civic participation on emergent heritage.

The construction of immovable heritage catalogues has always shown, since the beginning, an instrumental nature that originally focused on the registration of the newly acquired property by the states for economic purpose. The interest shown in other cultures during the times of the grand tour and romanticism, together with the appearance of the first travel guides, reveals a connection between the cataloguing of heritage and cultural tourism which have become significant today.

Graphical documentation stands out as a fundamental component in heritage cataloguing. The use of maps, plates and drawings for the management and safeguarding of heritage has been a recurrent issue since the 18th century. Through history, the evolution of cataloguing systems has involved an increasing significance of graphical documentation becoming a medium for the identification, definition, and localization of heritage in this field.

In the 19th century, the internationalisation of the protection of cultural heritage began to take shape and, at the same time, there was an opening in the concept of heritage, which would be completed in the following century. The singular object advanced to consideration of an area or surrounding ensemble, and then to an understanding associated with territory. Together with this territorial approach, emerging heritage, such as ethnological, industrial and contemporary heritage, joined monumental heritage. This growing complication was increased by the emergence of technologies such as ITs and GISs: the territorial component and integral values of the different heritage elements mean that immovable heritage catalogues are bound to evolve towards the ICHDBs.

Regardless of the internal or territorial management systems, most countries have ICHDBs, whether public or private, as protection systems. This situation, combined with international standards, projects and inventories such as MIDAS Heritage, Arches Project or the UNESCO world heritage list, shows evidence of a global interest in ICHDBs.

Online availability and use of geo-referencing for assets, stands out as the central trend in the most recent cataloguing systems. As a consequence of this situation, two main changes are perceived that should be considered in light of the development of new systems: universalisation of access to heritage information and establishment of cartography as the main method of viewing and enquiring about assets.

Since the 20th century, the emergence of friends of monuments associations and other social groups committed to heritage have responded to a necessary understanding of her-

itage from the point of view of society and on an individual level. ICHDBs based on active collaborative cataloguing processes such as crowdsourcing or developed individually, should be understood as part of the process of democratising heritage within society.

The potential of the work of GISs in conjunction with fixed localisation intrinsic to immovable heritage, offers the possible implementation of a new organisational paradigm in the construction of the ICHDBs. Thanks to this ITs support, characteristics such as scale, orientation or visibility may become criteria for analysis and active classification, where queries can bring different insights according to the user. The view of heritage linked to territory provides the opportunity to carry out a networked read which, together with the geo-referencing of the historical mapping, may raise new lines of investigation, interpretation, and representation. To take this idea further, even through accessible applications, the relationship between citizens and heritage can be strengthened, not only by means of occasional query capacity, but through the selection and generation of individual interpretations and itineraries.

In the last few years, the outbreak of new technologies and especially the universalisation of digital images and geolocation has fostered the utilization of maps and photography as the main system of dissemination of information. In this context, to achieve a greater impact and extend to the maximum number of people, heritage cataloguing should adapt these new tools and use the graphical documentation not only to store, manage and safeguard heritage but also to spread its knowledge. Nevertheless, this field has risks and must address the future challenges to offer a specific way to leave this digital documentation to next generations [60]. Regarding ICHDBs, digital representation shapes at the same time, as an item with value itself that face an uncertain future, and as a necessary and useful tool.

The fascination brought about by technological advances should be challenged when they cause a conceptual retrogression in the concept of heritage. The surveys, using point clouds in relation to architectural heritage, focused exclusively on capturing buildings, occasionally show evidence of a shift in the concept of monumental heritage, where the relationship with society and surroundings are forgotten. Although the capacity to query and work on virtual models is evident, its inclusion as a characterisation tool must contemplate the current limitations of those processes. Though the future projection is promising, it is important to understand the current situation and be aware of its present limitations.

In view of the instrumental conception for the protection and institutional management of ICHDBs heritage, a necessary reflection on its conceptual construction and the inclusion of new approaches is evident. In pursuit of sustainable development, all catalogues, both new and existing, must address the new heritage reality where versatility, flexibility and interconnection become essential.

Challenges and Needs of ICHDB

Heritage has become a diverse concept in constant evolution where new relations and interpretations are necessary. ICHDBs must meet this need and make it possible to read heritage from different points of view, allowing for building networks and systems of assets relation.

New cataloguing systems must transcend registry function. ICHDBs should become a tool beyond inventory and address new objectives such as education or dissemination. Cataloguing systems can become a tool of relation with heritage at various levels, serving at the same time for research processes and for public consultation.

Due to the importance that graphic documentation has proven to have, ICHDBs should support current different methods of representation. GISs, BIM models, and digital documentation will become an essential part of immovable heritage and therefore should be able to be integrated in heritage cataloguing and management systems.

Cataloguing systems should move away from a specific interpretation of heritage and allow different disciplines and even social groups to bring their perspective. ICHDBs

should address the social and transdisciplinary dimension of heritage, promoting participation of different branches of knowledge as well as non-experts.

From its historical origins through continuous development, cataloguing systems are configured as part of the heritage discourse construct over different periods. ICHDBs can become a system of connection with heritage where experts, institutions and society converge in an accessible and interactive tool. The respect and identification of heritage by society are the pillars that support its socio-cultural sustainability and therefore the ICHDBs must respond to current needs, supporting knowledge, education, and reflection in this field. In order to protect heritage effectively, catalogues must transcend the legal and managerial character and try to help achieve social acknowledgement of heritage.

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References

- Harvey, D.C. Heritage Pasts and Heritage Presents: Temporality, Meaning and the Scope of Heritage Studies. *Int. J. Herit. Stud.* **2001**, *7*, 319–338. [CrossRef]
- United Nation General Assembly. *Resolution 72/229. Culture and Sustainable Development*; United Nation General Assembly: New York, NY, USA, 2017.
- Giaccardi, E.; Palen, L. The Social Production of Heritage through Cross-media Interaction: Making Place for Place-making. *Int. J. Herit. Stud.* **2008**, *14*, 281–297. [CrossRef]
- Loren-Méndez, M.; Pinzón-Ayala, D.; Ruiz, R.; Alonso-Jiménez, R. Mapping Heritage: Geospatial Online Databases of Historic Roads. The Case of the N-340 Roadway Corridor on the Spanish Mediterranean. *ISPRS Int. J. Geo-Inf.* **2018**, *7*, 134. [CrossRef]
- UNESCO. *The Charter of Krakow 2000 Principles for Conservation and Restoration of Built Heritage*; UNESCO: Krakow, Poland, 2000.
- Ridley, R.T. To Protect the Monuments: The Papal Antiquarian 1534–1870. *Xenia Antiq.* **1992**, *1*, 117–154.
- Gámiz Gordo, A. *Alhambra: Imágenes de Ciudad y Paisaje (Hasta 1800)*; Fundacion El Legado Andalusi: Granada, Spain, 2008.
- Bacon, F. Of Travel, 1625. In *Bacon's Essays, and Wisdom of the Ancients*; Little, Brown, and Company: Boston, MA, USA, 1884.
- Murray, J. *A Hand-Book for Travellers on the Continent: Being a Guide through Holland, Belgium, Prussia and Northern Germany, and along the Rhine, from Holland to Switzerland*; John Murray and Son, Albemarle-Street: London, UK, 1836.
- Klein, J.A. *Rheinreise von Mainz Bis Köln*; Koblenz Röbling: Koblenz, Germany, 1828.
- González-Varas, I. *Conservación Del Patrimonio Cultural. Teoría, Historia, Principios y Normas*; Ediciones Cátedra: Madrid, Spain, 2018.
- Choay, F. *L'Allégorie Du Patrimoine*; Seuil: Paris, France, 1992.
- Vicq-d'Azyr, F.; Lindet, T.; Bouquier, G. *Instruction Sur La Manière d'inventorier et de Conserver, Dans Toute l'étendue de La République, Tous Les Objets Qui Peuvent Servir Aux Arts, Aux Sciences et à l'enseignement, Proposée Par La Commission Temporaire Des. Arts, et Adoptée Par Le Comité d'Instruction Publique de la Convention Nationale*; Imprimerie Nationale: Paris, France, 1793.
- Rücker, F. *Les Origines de La Conservation Des. Monuments Historiques En France (1790–1830)*; Jouve & Cie: Paris, France, 1913.
- Heringman, N. *Vetusta Monumenta: An Introduction*. Available online: <https://scalar.missouri.edu/vm/introduction> (accessed on 30 June 2021).
- Gabardón de la Banda, J.F. La Tutela Del Patrimonio Monumental En La España de Carlos III. *Anu. Jurídico Y Económico Escur.* **2017**, *50*, 557–578.
- García Cuetos, M.P. *El Lenguaje de Las Bellas Construcciones*; Universidad de Granada: Granada, Spain, 2016.
- Rodríguez Ruiz, D. *La Memoria Frágil José de Hermosilla y Las Antigüedades Árabes de España*; COAM: Madrid, Spain, 1992.
- Schubert, O. *Historia Del Barroco En España*; Saturnino, C., Ed.; UPR: Madrid, Spain, 1924.
- Maier Allende, J. La Comisión de Antigüedades de La Real Academia de La Historia. In *250 años de arqueología y patrimonio*; Real Academia de la Historia: Madrid, Spain, 2003; pp. 27–51.

21. Vega, J. *Pasado y Tradición: La Construcción Visual Del Imaginario Español En El Siglo XIX*; Polifemo: Madrid, Spain, 2016.
22. Perez Gallardo, H. *Fotografía y Arquitectura En El Siglo XIX: Historia y Representación Monumental*; Cátedra: Madrid, Spain, 2015.
23. Pérez Gallardo, H. La Llegada de La Fotografía a La Real Academia de Bellas Artes de San Fernando. *Anales de Historia del Arte* **2012**, *21*, 147–165. [[CrossRef](#)]
24. Esteban Chaparria, J. *La Conservación Del Patrimonio Español Durante La II República, 1931–1939*; Fundación Caja de Arquitectos: Barcelona, Spain, 2007.
25. López-Yarto Elizalde, A.; Rincón García, W.; Hidalgo Brinquis, M.D.C.; Domingo Fominaya, M. *El Catálogo Monumental de España (1900–1961)*; Ministerio de Cultura: Madrid, Spain, 2012.
26. Muñoz Cosme, A. Catálogos e Inventarios Del Patrimonio En España. In *El Catálogo Monumental de España (1900–1961)*; Ministerio de Cultura: Madrid, Spain, 2012; pp. 15–38.
27. Argerich Fernández, I. La Fotografía En El Catálogo Monumental de España: Procedimientos y Autores. In *El Catálogo Monumental de España (1900–1961)*; Ministerio de Cultura: Madrid, Spain, 2012; pp. 109–126.
28. Ministerio de Instrucción Pública y Bellas Artes. *Real Decreto de 14 de Febrero de 1902*; Ministerio de Instrucción Pública y Bellas Artes: Madrid, Spain, 1902; pp. 734–735.
29. Consejo de Ministros. *Real Decreto Ley Relativo al Tesoro Artístico Nacional Del 9 de Agosto de 1926*; Consejo de Ministros: Madrid, Spain, 1926; pp. 1026–1031.
30. Ministerio de Instrucción Pública y Bellas Artes. *Ley de 13 de Mayo de 1933 Relativa al Patrimonio Artístico Nacional*; Ministerio de Instrucción Pública y Bellas Artes: Madrid, Spain, 1933; pp. 1393–1399.
31. Dirección General de Bellas Artes. *Inventario de Protección Del Patrimonio Cultural Europeo IPCE España: Inventario Resumido*; Dirección General de Bellas Artes: Madrid, Spain, 1967.
32. Pereda, A. Pasado y Presente de Los Inventarios En España. In *Seminario sobre la Planificación de Inventarios en Centroamérica*; Centro Cultural de El Salvador: San Salvador, Spain, 2007.
33. Ladrón Sánchez De Guevara, C. Origen, Evolución y Situación Actual. In *PH Cuadernos. El Sistema de Información del Patrimonio Histórico de Andalucía (SIPHA)*; Instituto Andaluz del Patrimonio Histórico: Sevilla, Spain, 2007; Volume 20, pp. 15–28.
34. United Nation General Assembly; World Commission on Environment and Development. *Our Common Future. Report of the World Commission on Environment and Development*; United Nations: New York, NY, USA, 1987.
35. United Nation General Assembly. *Transforming Our World: The 2030 Agenda for Sustainable Development. Resolution 70/1*; United Nations: New York, NY, USA, 2015.
36. Soini, K.; Birkeland, I. Exploring the Scientific Discourse on Cultural Sustainability. *Geoforum* **2014**, *51*, 213–223. [[CrossRef](#)]
37. Hawkes, J. The Fourth Pillar of Sustainability: Culture’s Essential Role in Public Planning. 2001. Available online: [Humanities.com](https://www.humanities.com) (accessed on 26 July 2021).
38. UNESCO. *The Hangzhou Declaration Placing Culture at the Heart of Sustainable Development Policies*; UNESCO: Hangzhou, China, 2013.
39. UNESCO. *Florence Declaration—4 October 2014. Culture, Creativity and Sustainable Development. Research, Innovation, Opportunities*; UNESCO: Florence, Italy, 2014.
40. United Nation General Assembly. *Resolution 70/214. Culture and Sustainable Development*; United Nation: New York, NY, USA, 2015.
41. United Nation General Assembly; UNESCO. *Report 72/336. Culture and Sustainable Development*; UNESCO: New York, NY, USA, 2017.
42. Mascort-Albea, E.J. Mapas Para El Patrimonio: Caracterización Técnica de Las Iglesias Medievales de Sevilla Mediante Sistemas de Información Geográfica (SIG). Ph.D. Thesis, Universidad de Sevilla, Sevilla, Spain, 6 February 2018. (Unpublished Work). Available online: <https://hdl.handle.net/11441/70745> (accessed on 5 October 2021).
43. UNESCO. *CC-78/CONF.O10/10 Rev. 2nd Session of the World Heritage Committee*; UNESCO: Washington, DC, USA, 1978.
44. UNESCO. *CC-77/CONF.OOI/9. 1st Session of the World Heritage Committee*; UNESCO: Paris, France, 1977.
45. Perrin, J.; Araguas, P. El Inventario Del Patrimonio Histórico En Francia. In *PH Cuadernos. Catalogación del patrimonio histórico*; Editorial Comares; Instituto Andaluz del Patrimonio Histórico: Seville, Spain, 1996; Volume 6, pp. 129–133.
46. Muñoz Cruz, V.; Soro Cañas, S. Estrategias de Documentación Del Patrimonio Arquitectónico Contemporáneo. In *Cien años de arquitectura en Andalucía. El Registro Andaluz de Arquitectura Contemporánea 1900–2000*; IAPH: Sevilla, Spain, 2012; pp. 187–281.
47. Loren-Méndez, M.; Mata-Olmo, R.; Ruiz, R.; Pinzón-Ayala, D. An Interdisciplinary Methodology for the Characterization and Visualization of the Heritage of Roadway Corridors. *Geogr. Rev.* **2016**, *106*, 489–515. [[CrossRef](#)]
48. Schnell Quiertant, P. El Inventario de Arquitectura Defensiva de La AEAC, Un Ejemplo de Ciencia Ciudadana En España. In *Patrimonio Cultural de España*; IPCE: Madrid, Spain, 2014; pp. 81–94.
49. Korro Bañuelos, J.; Rodríguez Miranda, Á.; Valle-Melón, J.M.; Zornoza-Indart, A.; Castellano-Román, M.; Angulo-Fornos, R.; Pinto-Puerto, F.; Acosta Ibáñez, P.; Ferreira-Lopes, P. The Role of Information Management for the Sustainable Conservation of Cultural Heritage. *Sustainability* **2021**, *13*, 4325. [[CrossRef](#)]
50. Angulo Fornos, R. Digital Models Applied to the Analysis, Intervention and Management of Architectural Heritage. *WIT Transactions on the Built Environment* **2015**, *149*, 407–418. [[CrossRef](#)]
51. Piquer-Cases, J.C.; Capilla-Tamborero, E.; Molina-Siles, P. La Reconstrucción Virtual Del Patrimonio Arquitectónico y Su Aplicación Metodológica. *Revista de EGA* **2015**, *20*, 258–267. [[CrossRef](#)]

52. Pinto-Puerto, F. La Tutela Sostenible Del Patrimonio Cultural a Través de Modelos Digitales BIM y SIG Como Contribución al Conocimiento e Innovación Social. *Revista PH* **2018**, *26*, 27–29. [[CrossRef](#)]
53. Castellano-Román, M.; Pinto-Puerto, F. Dimensions and Levels of Knowledge in Heritage Building Information Modelling, HBIM: The Model of the Charterhouse of Jerez (Cádiz, Spain). *Digit. Appl. Archaeol. Cult. Herit.* **2019**, *14*, e00110. [[CrossRef](#)]
54. Angulo-Fornos, R.; Castellano-Román, M.; Pinto-Puerto, F. Estrategias de Modelado Patrimonial En HBIM, Aplicación a La Lectura Estratigráfica Del Muro de Fachada Del Cuadrante Renacentista de La Catedral de Sevilla* Heritage Modelling Strategies in HBIM, Application to the Stratigraphic Reading of the Façade of the Renaissance Quadrant of the Cathedral of Seville. *Arqueología de la Arquitectura* **2021**, *18*, e109. [[CrossRef](#)]
55. Alshawabkeh, Y.; Baik, A.; Miky, Y.; Kainz, W.; Malinverni, E.S. Geo-Information Integration of Laser Scanner and Photogrammetry for Heritage BIM Enhancement. *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 316. [[CrossRef](#)]
56. Gargaro, S.; del Giudice, M.; Ruffino, P.A. Towards a Multi-Functional HBIM Model. *Sci. Res. Inf. Technol.* **2019**, *8*, 49–58. [[CrossRef](#)]
57. Nieto-Julián, J.E.; Lara, L.; Moyano, J. Implementation of a Teamwork-Hbim for the Management and Sustainability of Architectural Heritage. *Sustainability* **2021**, *13*, 2161. [[CrossRef](#)]
58. López, F.J.; Leronés, P.M.; Llamas, J.; Gómez-García-Bermejo, J.; Zalama, E. A Review of Heritage Building Information Modeling (H-BIM). *Multimodal Technol. Interact.* **2018**, *2*, 21. [[CrossRef](#)]
59. Martín Talaverano, R.; Murillo Fragero, J.I.; de lo Utrero Agudo, M.Á. Reflexiones y Criterios Relativos a La Creación de Modelos BIM de Edificios Históricos. *Arqueología Arquitectura* **2021**, *18*, e113. [[CrossRef](#)]
60. Choy, S.C.; Crofts, N.; Fisher, R.; Choh, N.L.; Nickel, S.; Oury, C.; Šlaska, K. The UNESCO/PERSIST Guidelines for the Selection of Digital Heritage for Longterm Preservation; UNESCO/PERSIST Content Task Force. 2016. Available online: <https://repository.ifla.org/handle/123456789/1218> (accessed on 5 October 2021).