

ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XIX INTERNATIONAL FORUM

Le Vie dei
Mercanti



World Heritage and Design for Health

ARCHITECTURE | CULTURE | HEALTH | LANDSCAPE | DESIGN |
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Carmine Gambardella
WORLD HERITAGE and DESIGN FOR HEALTH
Le Vie dei Mercanti
XIX International Forum

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Peer review

Scholars has been invited to submit researches on theoretical and methodological aspects related to Smart Design, Planning and Technologies, and show real applications and experiences carried out on this themes. Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected. Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

Conference report

300 abstracts and 550 authors from 40 countries:

Albania, Arizona, Australia, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Greece, India, Italy, Japan, Jordan, Lebanon, Malta, Massachusetts, Michigan, Montenegro, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

WORLD HERITAGE and DESIGN for HEALTH

The innocent eye sees nothing (Ernst Gombrich)

In this particular time characterized by a pandemic due to the expansion of the Covid-19 virus throughout a globalized world, the destinies of everybody have suddenly changed behavior, lifestyles, interpersonal relationships, production methods as well as the governing of the territory; the priority of investing in the healthcare sector has become increasingly urgent and indifferent with reference to a political management of the communities that prevents and does not suffer, as unprepared, the emergencies that increasingly afflict the community. Furthermore, in these months of “quarantine”, the Planet has shown a Resilience that makes us hope for the future. A response to the Culture of Emergency, which finds its generative ground not only in the healthcare sector but also in the governance of the territory, relates to the hydrogeological aspects, pollution of soils, air, water, illegal construction, the exploitation of energy resources faced with the use of the integral of scientific and managerial skills based on meritocracy. The XIX International Forum of Study ‘World Heritage and Design for Health’ addresses the issues related to the global pandemic in a multidisciplinary and systemic logic, as indicated by the UNESCO and the United Nations 2030 Agenda for the definition of projects and concrete actions that include the Welfare and Health of the Community. Therefore, the Forum aims to create a transversal critical dialogue, open to cultural contamination and ‘without limits’, in a logic of integration between skills that extends, and is not limited to, the following disciplines: Architecture, Culture, Environment, Agriculture, Health, Landscape, Design, Territorial Governance, Archeology, Economy, History, Sociology, Security, e-Learning. The Scientific Community of the Forum is composed of about seven thousand Professors and Researchers from one hundred Universities and Research Centers in the world, from institutional representatives, from the business sector and from the representatives of the 830 UNESCO Chairs (UNITWIN Program) thanks to the WebGIS created and managed by the UNESCO Chair at the Benecon University Consortium. The location of the Forum is of excellence. Campania Region with six World Heritage Properties, two Unesco Man and Biospheres, three assets registered on the Intangible Heritage List is one of the richest Regions in the world for cultural and landscape heritage, particularly ‘contaminated’ by Mediterranean cultures. No coincidence that the Forum takes place in Naples and Capri, with site visits and presentations of scientific research and operational projects by the Benecon University

Consortium, consisting of five Italian Universities, head office of my UNESCO Chair on Landscape, Cultural Heritage and Territorial Governance. The papers, selected by the Forum's Scientific Committee, will be published in the Proceedings of international relevance (candidate to be indexed Isi Web of Science). Furthermore, the most innovative research and projects will be published in the 'Quaderni' of the A Class international magazine 'Abitare la Terra / Dwelling on Earth'.

Prof. Carmine Gambardella
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President and CEO of the Benecon University Consortium
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and Territorial Governance

WORLD HERITAGE and DESIGN for HEALTH

The innocent eye sees nothing (Ernst Gombrich)

In questo particolare tempo connotato da una pandemia dovuta dall'espansione del virus Covid-19 in un mondo globalizzato, i destini delle Persone improvvisamente sono stati modificati nei comportamenti, negli stili di vita, nei rapporti interpersonali, nei modi di produzione, nel governo del territorio; le priorità degli investimenti nel comparto Salute, diventa sempre più urgente e indifferibile con riferimento a una gestione politica delle Comunità che prevenga e non subisca, in quanto impreparata, le emergenze che sempre più affliggono la Collettività. Inoltre, in questi mesi di "quarantena", il Pianeta ha dimostrato una capacità di Resilienza che ci fa bene sperare per il futuro. Una risposta alla Cultura dell'Emergenza che trova il suo terreno generativo non solo nel campo della Salute ma nel governo del territorio per quanto riguarda gli aspetti idrogeologici, l'inquinamento dei suoli, dell'aria, dell'acqua, l'abusivismo edilizio, lo sfruttamento delle risorse energetiche affrontato con l'utilizzo dell'integrale delle competenze scientifiche e gestionali fondate sulla meritocrazia.

Il XIX Forum Internazionale di Studi World Heritage and Design for Health affronta le problematiche legate alla pandemia globale in una logica pluridisciplinare e di sistema, così come indicato dall'UNESCO e dall'Agenda 2030 delle Nazioni Unite per la definizione di progetti e azioni concrete che includano il Benessere e la Salute della Collettività. Il Forum si propone quindi di creare un dialogo critico trasversale, aperto alle contaminazioni culturali e 'senza limiti', in una logica di integrazione fra le competenze che si estende, e non si limita, alle seguenti discipline: Architecture, Culture, Environment, Agriculture, Health, Landscape, Design, Territorial Governance, Archeology, Economy, History, Sociology, Security, e-Learning.

La Comunità Scientifica del Forum è costituita da circa settanta Docenti e Ricercatori di cento Università e Centri di Ricerca nel mondo, da rappresentanti istituzionali, del settore dell'impresa e dai referenti delle 830 Cattedre UNESCO (UNITWIN Programme) grazie al WebGIS realizzato e gestito dalla Cattedra UNESCO incardinata al Consorzio Universitario Benecon.

La location del Forum è d'eccezione. La Campania con sei siti iscritti nella lista del Patrimonio Mondiale, due Man and Biospheres UNESCO, tre beni iscritti nella Lista del Patrimonio immateriale è una delle regioni più ricche al mondo per beni culturali e paesaggistici, particolarmente 'contaminata' delle culture del Mediterraneo. Non a caso il Forum si svolge a Napoli e Capri, con sopralluoghi e presentazioni di ricerche scientifiche

e progetti operativi a cura della Consorzio Universitario Benecon, costituito da cinque Atenei italiani, sede della Cattedra Unesco su Paesaggio, Beni Culturali e Governo del Territorio. I paper, selezionati dal Comitato Scientifico del Forum, saranno pubblicati negli Atti di rilevanza internazionale (candidati all'indicizzazione Isi Web of Science). Inoltre, le ricerche e i progetti più innovativi saranno pubblicati nei 'Quaderni' della Rivista internazionale di Classe A 'Abitare la Terra/Dwelling on Earth'.

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World Heritage and
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Digitalization strategies as a methodology for knowledge and management of cultural heritage. The “Unfinished” church of Brendola as a reference case study.

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Abstract

The paper aims to analyse the case study of the "Unfinished" church of Brendola, designed by the engineer-architect Fausto Franco in the early thirties of the twentieth century. Economic problems led to the interruption of the church's construction, during the 1950's, and left the church in an unfinished situation that today we recognize as a ruin. The church's study seeks to delineate a new methodology of analysis for abandoned cultural heritage based on data digitization and creation of a knowledge system that concerns the building's conservation status. The push towards digitization, which emerged during the pandemic, plays a fundamental role in the domain of application possibilities, from the survey to the mechanisms for conservation and management of cultural heritage. From this perspective, according to shared procedures, effectively organizing the collected data in an open repository linked to an interoperable Hbim model becomes a helpful digital tool to develop valorisation strategies based on the interoperability and the possibility to share the knowledge efficiently between the actors involved in the conservation process and the community.

Keywords: unfinished architecture, digitalization of cultural heritage, material and intangible cultural heritage, cultural heritage documentation and conservation, theory criticism and history of conservation

1. Object and objectives of the research project.

This paper presents a part of the dissemination of research activities carried out on the church of Brendola dedicated to St Michael the Archangel, today known as the “Unfinished” church (Fig. 1). The church, which has never been completed, appears in conditions of neglect and in ruins, and this identifies it as an urban fragment [1] “suspended” as it was in 1941, the year in which the building activity started to be neglected. After the Municipality of Brendola reported the severe conditions of the building, a Memorandum of Understanding was signed between the Università Iuav di Venezia and the municipal administration, to promote the knowledge and valorisation of the building.

The Memorandum of Understanding (inventory ref. No 77/2020 prot. No 1476 of 20/01/2020) promotes – by means of a financed research contract – the drafting of a programme aimed to identify possible strategies for preserving and valorising the church, by identifying a methodology to study and analyse architectural and landscape heritage of significant cultural interest in conditions of neglect. This research project aims to build a knowledge system of the building, allowing to identify conservation and valorisation strategies that may be shared with the entities in charge of heritage protection and the community of Brendola.



Fig. 1: Overview of the “Unfinished” church of Brendola.

2. The “Unfinished” church of Brendola.

The “unfinished” [2] and “neglected” status makes Brendola an interesting case study, caught between “memory and time”, in which the features of “being unfinished” and “ruined” play a role in redefining the image of one of the first works by the then young engineer-architect Fausto Franco. The building of the church dedicated to St Michael the Archangel, patron Saint of the town, was promoted by the archpriest of Brendola at that time, Father Francesco Cecchin, with the aim to gather the neighbouring communities all in a single place. Set in an important landscape, on a hilly area developing at the foot of the Berici Hills, the church has connections with the Rocca dei Vescovi (Fortress of the Bishops), the old church of Brendola, and with the built-up area around it, as well as with local villas (Fig. 2). It is one of the landmarks of the area called “the gateway to the Berici Hills”.

The commitment to building a new place of worship had a significant social impact for the community of Brendola [3], proved not only by the participation to the creation of the building site, but also by the use of the community’s economic resources. During the construction activities, economic problems arising from the difficult historical period between two world wars, led to modifications of the original project, and eventually, the building site was abandoned. In 1997 the municipal administration of Brendola became the owner of the building and committed to using it for social or cultural purposes, and for public benefit.

Currently, the church has been declared of notable cultural interest, under art. 12 of the Legislative Decree of 22nd January 2004, N. 42 (Code of Cultural Heritage) as the “unique testament of the activity of an architect with an original and eclectic personality, included with full rights in the Italian culture of the 1930’s, and particularly in the architectural debate that was taking shape after the important archaeological campaigns in Africa and Asia”.

2.1 The importance of Fausto Franco in the Italian architectural scene.

The project for the construction of the new church “complying with the noblest ecclesiastic traditions” was assigned on 14th January 1928 to Fausto Franco (1899-1968) who, after getting his degree in Engineering at the University of Padua in 1921, had just obtained his second degree in architecture, in 1927 at the age of 28, at the Royal School of Architecture of Rome headed by Gustavo Giovannoni [4]. Fausto Franco, who is described by Piero Gazzola as eccentric and altruistic [5], was in full rights part of the generation of historians and experts who started to work on behalf of the State in a difficult historical context, marked by the destruction and damaging of monuments due to the tragic events of World War II [6]. The experiences made in his training period as a young architect contributed



Fig. 2: Relationship between the "Unfinished" church of Brendola and the surrounding landscape

to forging a personality with great technical skills and knowledge. In his professional life, Franco was to be engaged in many different activities, such as a career as public officer, teacher, and his works as a scholar [7]. In the period between his University Degree and his entry in protective associations and authorities, Franco worked both as teacher, in the School of Architecture of Veniceⁱ, and as a professional in several construction sites in the Veneto region and in Venezia Giulia, including the construction site for the new church of Brendola. The teachings of his study period at the Padua University and the School of Architecture of Rome with Giovannoni, along with further studies and publications on the history of architecture, became - for the San Michele Arcangelo church of Brendola – a tool to design a complex framework of building techniques. Such techniques were the result of a cultivated experimentation, not referable to a local context. After finishing his university studies, between 1928 and 1933, while Franco was drafting the project for the church of Brendola, one of his first assignments as a teacher was the Direction of the School of Arts and Crafts of the Accademia Olimpica of Vicenza. There, he gave an important contribution to the renewal of teaching methods, by introducing studies based on real life drawing. After being admitted to the courses of classical architecture of the Regia Scuola Archeologica Italiana (Royal Archaeological School) of Athens, Franco got to know important persons in the Italian archaeological scene, including Alessandro Seta, Luigi Pernier, and Giuseppe Gerola. Franco also had the opportunity to participate in many archaeological excavation and restoration campaigns with Professor Carlo Anti. In 1930 he was appointed Royal Honorary Superintendent for Vicenza Monuments; in Vicenza, along with his activity as an archaeologist, he started to study the works by Andrea Palladio, a master who was to play an important role in Franco's studies. In 1933 he started to work in the Department for Antiquities and Fine Arts, being assigned to the Superintendence of Medieval and Modern Arts of Milan. After a short period of time, he was assigned to the Superintendence of Venice, headed by Ferdinando Forlati; in 1939 Franco was appointed Director of the Superintendence for works of Antiquity and Arts of Venezia Giulia and Friuli, where he stayed until 1952. Franco's experience in the archaeological sector, his professional activity during the post-war reconstruction, and the work carried out at the Authority of Trieste, where he is still remembered as the "Superintendent of the difficult years" [8], along with the Ministerial recognition of his comparative merits, earned Franco the appointment as First-class Director and he was relocated to the Superintendence for Monuments of Venice, in June 1952. Along with his professional activity, Franco also worked as a teacher; the following are only some of his most important activities: in 1937 he held a chair in stylistic and construction characters of monuments [9] at the Università luav di Venezia (1937-1967). Finally, in 1958-59 he qualified as lecturer in Monument Restoration, and in 1960 he qualified as lecturer in Restoration.

ⁱ In 1926 Giovanni Bordiga founds the "Scuola superiore di architettura" as a branch of the Accademia delle Belle Arti di Venezia. In 1936, ten years after the school foundation, under the direction of the rector Guido Cirilli (1929-1943), Fausto Franco with the chair in "Caratteri Stilistici e Costruttivi dei Monumenti" (Stylistic and constructive characters of monuments) was one of the first teachers of the school.

2.2 The project. Between architectural hybridisation and historicist eclecticism.

The general look for the new church of Brendola is that of a Romanesque-style architecture, whose classical features are very likely influenced by the many archaeological campaigns the architect carried out in those years. From Franco's project (Fig. 3), it is possible to note that his intention was to build an imposing structure, with proportions that recalled the Roman-Imperial Basilicas, marked by a strong symmetry and a clear tripartition of the main façade. The preparatory drawings for studying the various project proposals show a strong tripartition of the façade; the architect works on the composition of openings, and wonders about the positioning of the bell tower. In the perspective view of the final proposal drafted by the architect, we may easily recognise that the façade is enhanced by wide, symmetrical window openings, by the positioning of the bell tower on the western side of the building. The monumental nature of the church is also expressed in the ratio between the body of the building and the bell tower, whose height is double the one of the church body, and in the presence of big lunette windows on the sides. The planimetric definition of spaces refers to an area of 53,5m x 22,5m described by three symmetric naves, with barrel-vaulted ceilings, ending on semi-circular apses. The space in the central nave, whose width is double the width of the side aisles, is marked by a series of columns on pedestals, made of Vicenza stone, topped by round arches.

Due to economic problems, the original project was reduced; the sacristy area, one of the chapels, and the bell tower were left unfinished. The abandoning of the construction site also resulted in the interruption of the stone and plaster finishing of surfaces, easily recognisable in the absence of flooring and of a clear distinction between the northern and southern part of the church. Making a comparison with Franco's project, we may observe a different arrangement of covering structures, no longer resembling a pavilion, but rather a roof with two pitches. During the construction phase, it is also possible to note the elimination of the openings in the third tier of masonry of the central nave and of the apses. Such a choice may have been influenced by the need to make the church more affordable and easier to build, important elements for the final cost of the work.

Due to its unfinished and ruined conditions, the church currently introduces to a new evocative ability of spaces [10], which create a new relation with the zenith light coming from the original covering.

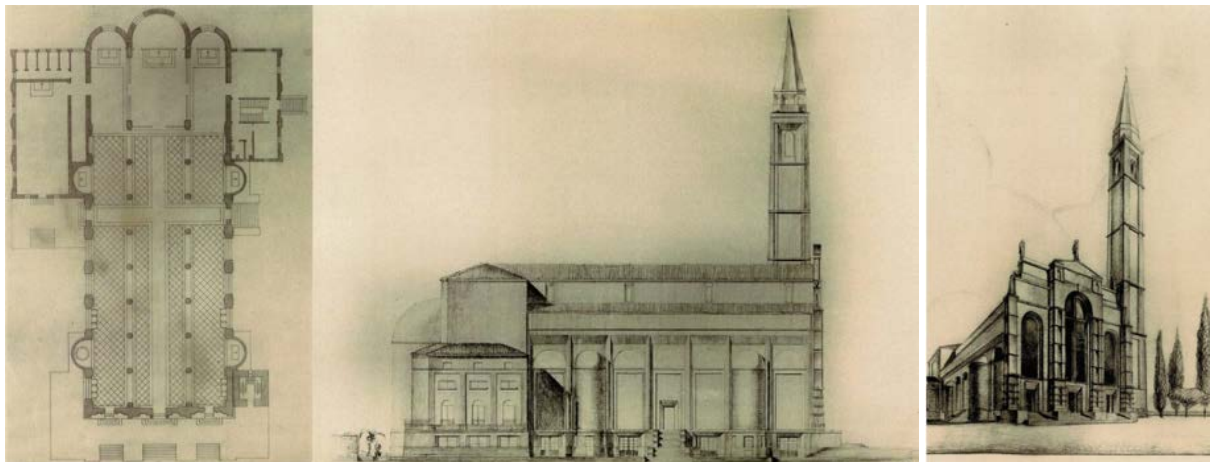


Fig. 3: Fausto Franco project's for the new church of Brendola.

2.3 Notes on the construction site of San Michele Arcangelo church.

It is possible to reconstruct the events related to the church construction thanks to the writings [11] [12] of the archpriest, who took up residence in the parish on 29th May 1921. Not only did he promote the building of the new church, but he also collected, in his writings, the historical events and the construction stages. The construction site of the San Michele Arcangelo church, set in the architectural scene of the 1930's, was officially inaugurated with the ceremony (laying of the stone) on 3rd October 1931, but the works only started in May 1932.

The building activity was carried out in a historic context marked by architectural and technical experimentation; historicist eclecticism was combined with a construction hybridization that was visible in a complex framework of construction techniques and in the use of construction materials considered "modern" or experimental [13], combined with techniques stemming from local tradition. The main construction material was the stone from Vicenza, used as a load-bearing structure and for finishing. The studies and the analyses on the churchⁱⁱ show that the building structure is based on solid rubble masonry, 110-120cm thick, on which reinforced concrete frames are laid, accompanied by rubble

ⁱⁱ Between 2011 and 2012, the Municipality of Brendola carried out instrumental analyses on the church's constructive elements to identify the building's static behaviour.

masonry with concrete elements. The surface walls of the first part of the building, whose realisation began in 1932, feature an irregular stonework, 40cm thick, made of stones of different sizes. Though the cross connection is ensured by concrete elements with a constant thickness, set in the whole section at a centre-to-centre distance of about 2.80m, the endoscopic and geophysical surveys carried out show there are voids, which may be considered as discontinuity elements in stonework. Externally, the surface walls are lined with San Gottardo white stone ashlar, around 10cm thick. The frame structure of the church is enhanced on the external sides by half pilasters made of Berici yellow stone ashlar and by four semi-circular niches, made of concrete blocks and lined in stone, which give monumentality and plasticity to the composition.

In the realisation of the central nave, we find again the frame structure made of columns supported by pedestals. At the foot of the structures, a 95cm, square concrete base is located, about 1m tall, supporting columns made of stone from Vicenza, three stone drums that presumably have a concrete core. The column shaft ends with a capital, where the vaulted concrete structures are set, to support the wall surface on top. The latter is also made of rubble masonry with concrete elements. Reading the archpriest's notes, we find out that in May 1934 the structures had reached 6m in height. The year 1934 was a breakthrough for the construction site, marked by economic problems that eventually led to suspending work. Five years later, on 20th March 1939, the bishop authorized the resumption of works, but with limited resources, not enough to finish the works. Though with some difficulties, works continued to realise the stonework, where it is possible to recognise – in the top of the masonry of the central nave – the introduction of a new building technique. We note a regular brickwork, made using hollow bricks laid horizontally in regular courses, 22cm thick. This is quite an unusual choice, probably made bearing in mind affordability and simplicity of realisation. In 1940, the architect Fausto Franco advocated work resumption: he turned to the bishop and highlighted the problems that would have emerged in case of work interruption, underlining that a missing cover would have jeopardised the works carried out until then. Despite economic difficulties, in October 1940 the bishop authorized the works for covering the building. The nave space is therefore described by a series of trusses of reinforced concrete, alternated with arches made of bricks, originally designed to support a barrel-vaulted false ceiling. Due to the precarious conservation status, the latter was demolished in 2012 during an intervention aimed at safety assurance. The realisation of covering structures is marked by the introduction of “modern” construction techniques, namely structures without provisional reinforcement (S.A.P.) [14]. This patented slab technology, with prefabricated beams of brick and reinforced concrete, was introduced in the building sector in the same period in which the church was built. The composing elements are prepared in the construction site, with bricks laid as headers, joined by steel rods set in flutings and fixed with cement mortar. After seasoning, the beams laid side by side are completed by pouring concrete between the interstices and where the elements lean against the perimeter walls, where the joint with the perimeter walls of the church is ensured by bending the irons sealed in a perimeter kerb.

Unlike the side aisles - made using a system without provisional reinforcement and with thrusting configuration – the structures covering the central nave are realised with a CIREXⁱⁱⁱ system, outlined as a series of purlins laid on a system of reinforced concrete trusses, so that the system appears to be a non-pusher structure. The making of the covering structures of the side aisles, of the central nave and of the apses ended in 1941. The completion of covering structures and the impossibility to receive new funds led to another period of work suspension in the construction site, which was abandoned definitively when Father Cecchin passed away, on 18th May 1949. The role of the reinforced bricks in the building process of the church is particularly interesting: on the one hand, they granted new performance qualities, such as the lightening of the slabs and the rationalization of materials, while on the other hand, they made construction easier in the site, managing to curb the costs of materials and manpower.

3. Knowledge processes and methods.

Choosing the “Unfinished” church of Brendola as a case study, with its unfinished and ruined condition, enables to examine the construction dimension and the project choices, which led Franco to combine different construction techniques with traditional architectural elements. The methodological proposal for the valorisation of the “Unfinished” church of Brendola starts from the definition contained in art. 6 of the Code of Cultural Heritage and Landscape [15], which reads: “Valorisation consists in the exercise of the functions and in the regulation of the activities aimed to promote the knowledge of cultural heritage, and in the guarantee of the best conditions for use and public fruition of the heritage. This also includes promoting and supporting interventions for the conservation of cultural heritage”. From these introductory words we can infer that the first purpose of the valorisation action is the promotion of the knowledge of cultural heritage. The proposed study method, which includes techniques and cultural humanism, explains the decision to structure the information on the church into a knowledge system (Fig. 4) that interacts with a HBIM model. This promotes the safeguard and knowledge of the asset in a

ⁱⁱⁱ Variant of the patented structures without provisional reinforcement construction system (S.A.P.). In the CIREX system, the structural bricks elements are distanced from interposed brick blocks.

way that is interoperable and may be shared by the various public stakeholders, such as local and national institutions, as well as communities [16].

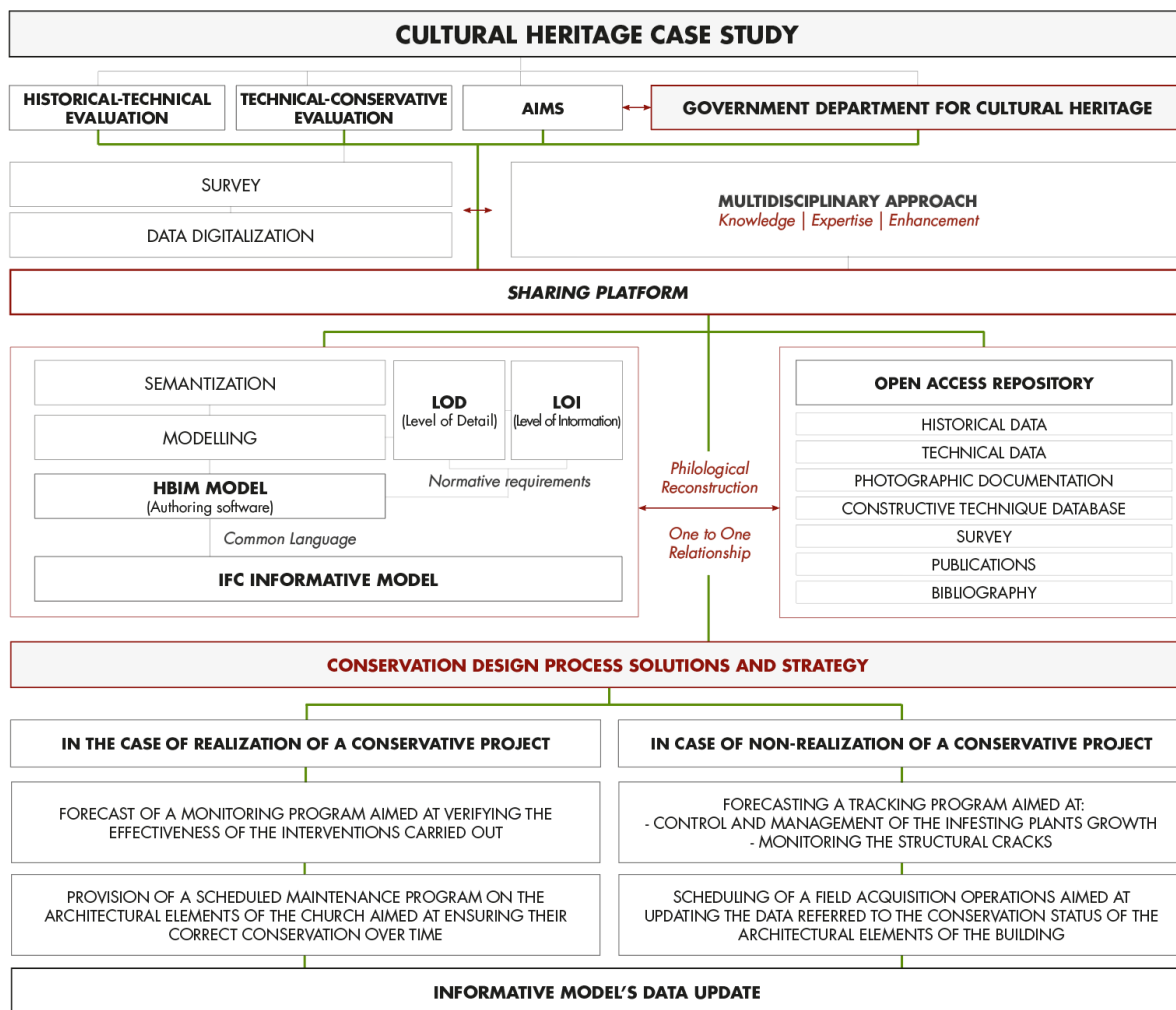


Fig. 4: Scheme of the workflow proposal for the digital research activities on cultural heritage.

3.1 Digitalization and creation of a repository of sources.

The documentation related to the “Unfinished” church of Brendola refers to many topics, ranging from the first debates on building the new church, to the construction and economic-management aspects of the construction site, to the last analyses carried out on construction elements. With this premise, the research activity was aimed at identifying the information that allows retracing the construction phases, testifying to its architectural value. The information obtained from the preliminary investigation phase was collected in an accessible format in an open-access repository [17], which enables to clearly identify all items within a directory structure. As for the database of the Unfinished church, the following structure of the main directories was identified: bibliography, database of techniques, deliberations and acts, photographic documentation, historical documentation, technical documentation, events, HBIM, maintenance, exhibitions, projects, publications, and evaluations. Whenever possible, the documents obtained and entered in the database underwent OCR (optical character recognition), so they became digital and therefore searchable using IT devices.

3.2 Interpolation of historic data with architectural data.

The unfinished conditions and the interruption of construction enable to recognize the San Michele Arcangelo church of Brendola as a ruin, in which the action of time has affected the degradation of the construction elements and the growth of vegetation and weeds (Fig. 5). Over the years, these conditions led to a subsequent damaging of structures, with a loss of their load-bearing capacity. The main vulnerabilities of the building may be seen in the collapse of some portions of covering structure, which triggered a rapid deterioration of the overall conservation status. Exposure to the weather favoured water infiltration in the structure, with a subsequent redistribution of the balance of forces and rotational actions outside the level of surface walls. The precarious conservation status of some portions of the

church, along with the danger of falling elements from a height, represented criticalities for the description of architecture and the ongoing disarray. From this point of view, surveys played a fundamental role as a basis for the construction of the knowledge system of the building. The data acquisition campaign, led by the CIRCE photogrammetry laboratory of the Università luav di Venezia, concerned the internal and external spaces of the building, and was carried out using different methodologies, linked to specific theoretical and operational procedures.



Fig. 5: Some photos referred to the conservation status of the architectural elements of the church.

The instruments and methodologies [18] needed were assessed considering the complexity of the building and the representation scale envisaged for the ensuing multidisciplinary analyses. The operations were carried out through the implementation of topographical, laser scanner and photogrammetric surveys, planned according to an efficient data acquisition campaign.

To analyse and catalogue in charts the materials and construction techniques used to build the San Michele Arcangelo church, the research group resorted to a series of photographic surveys, with the use of digital cameras and RPAS (Remotely Piloted Aircraft Systems). The use of high-resolution digital cameras allowed to obtain an in-depth knowledge and to document the materials used and their degradation and/or alteration. The use of RPAS also enabled to inspect the structures that are not visible from the ground, if no scaffolds or lifting platforms are used.

The complexity of the church is summarised by a series of point clouds (Fig. 6) and orthorectified images (Fig. 7) resulting from the processing of data collected during the survey campaign. Their use allowed to assess the real geometry [19] of the building's components, identifying deviations from the level of surface walls, or subsidence that - with the use of such survey techniques - are described by a continuity of points and not by a discretization operation carried out by the operator. They also allow a significant reduction of acquisition times and the possibility of error. The "unfinished" status and the use of advanced survey techniques also allowed for a reliable mapping of the cracks and the position of scaffolding holes, whose evaluation proved to be useful in the reconstruction of the construction phases of the building site. The high quality of final outputs, besides recognising the signs and transformations of the building over the years, also defines the foundations for a specific computation of materials and construction techniques, resulting in an operational instrument in the definition of aspects related to the building site and the management of the asset.



Fig. 6: Points Clouds resulting from survey operations with laser scanner and photogrammetric techniques.



Fig. 6: Some of the orthorectified images resulting from the elaboration of the survey's data.

3.3 Building a relational database of the church.

The final aim of the research activity was reaching a definition of a knowledge system of the asset, that, through an information model developed in the IFC scheme, allowed to obtain a biunivocal correspondence between the information contained in the model and the repository of sources. The digital reconstruction of the church was designed by breaking up the architectural elements according to the building logics of a construction site (Fig. 8) and associating for each architectural element the identity information through synthetic attributes. The associated information enables to query the model and to interact with the repository, where, through dynamic links, it is possible to reach specific directories in which reference can be made to archive documents.

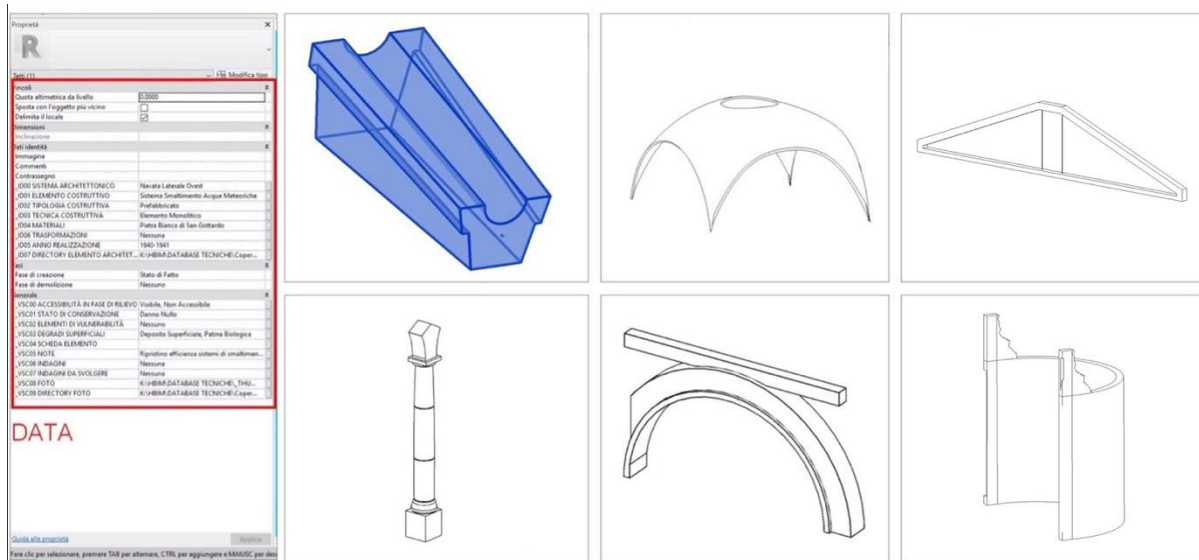


Fig. 8: Reconstruction of the church's architectural elements within the Autodesk Revit environment and association of the information content.

The church information model (Fig. 9) collects the identity data and the vulnerabilities of the construction, thereby becoming an effective tool for outlining guidelines for the recovery and valorisation of the asset. The discretization and semantization operations led to the recognition of 541 architectural elements, which were digitally reproduced [20] within the model, associating for each element the identity information that describes it, as well as the elements aimed to assess its conservation status. A folder in the repository was created for each architectural element identified, having the same denomination given in the HBIM system. This operation enables to obtain a biunivocal correspondence between the model and the repository, ensuring accessibility at various levels of knowledge of the asset [21], freeing the archive documents from applications not attached, but rather connected, so they may be updated in case of a theoretic construction phase, or during future survey and/or maintenance activities.

In building a digital model of the church, the following information attributes were associated: database of the unfinished church, architectural system, construction element, construction typology, construction technique, materials, year of realisation, transformations, directory of architectural elements, accessibility during the survey stage, conservation status, elements of vulnerability, superficial degradations, element sheet, notes, surveys, surveys to be carried out, photos, photo directory, improvement actions.

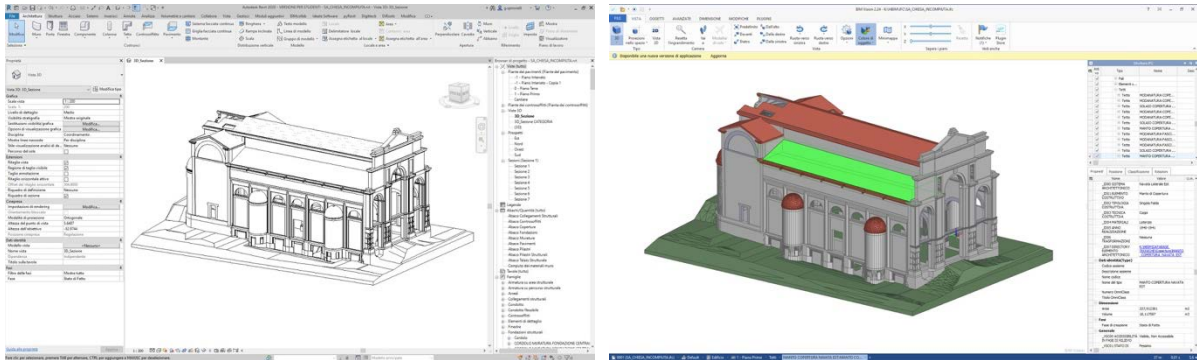


Fig. 9: In the left image, it is possible to recognize the model built within the commercial Autodesk Revit software. In the right image, thanks to the IFC schema, the HBIM model's data are accessible within the open-source BIM Vision application.

4. Conclusions.

The knowledge process on the “Unfinished” church of Brendola allowed to check and implement a survey methodology in which the cross-comparative survey between sources of different nature (direct and indirect) becomes an operational guide for project strategies, in case of studies of buildings in state of neglect or in ruins. The comparison between documentary data and material data enables to visualize and identify the architectural elements, specializing the interventions aimed at conservation. Such method, in case of buildings in ruins, develops a conservative approach aimed to valorise the “non-finished” dimension, in that it describes the assessment of the conservation status of each element, with an attention that evokes the archaeological dimension. The digitalization of the path of knowledge, given its nature as a tool for sharing, also creates a backbone of information that may be interpreted as a model for future management and protection of assets. Indeed, an archaeological approach to historic buildings enables to lay the foundations for shared knowledge, in which material traces and immaterial data are contained in a survey tool that can also be used to reconstruct and share a collective memory of places with the communities.

This methodological prospect thus manages to intercept – through the digitalization of processes – the main activities related to conservation; documentation, protection, maintenance, and the project, condensing (and revealing) the material and immaterial value of ruins, with the aim to disseminate them to future generations.

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