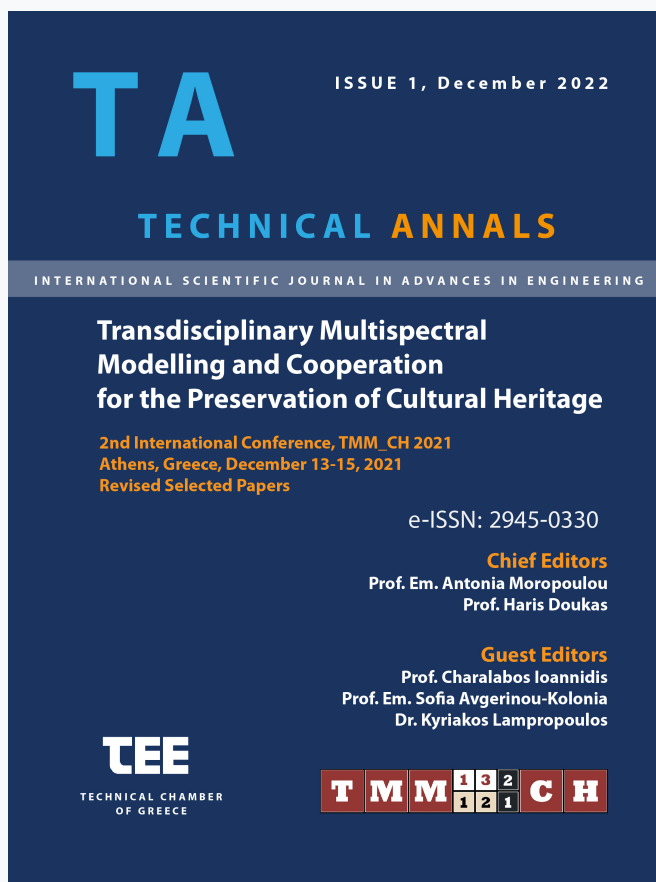


Technical Annals

Vol 1, No 1 (2022)

Technical Annals



Documentation of Historic Buildings For Their 3D Reconstruction In A Digital Cultural Heritage Management System

Athina Chroni, Andreas Georgopoulos

doi: [10.12681/ta.32164](https://doi.org/10.12681/ta.32164)

Copyright © 2022, Technical Annals



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0](https://creativecommons.org/licenses/by-sa/4.0/).

To cite this article:

Chroni, A., & Georgopoulos, A. (2022). Documentation of Historic Buildings For Their 3D Reconstruction In A Digital Cultural Heritage Management System. *Technical Annals*, 1(1), 1–12. <https://doi.org/10.12681/ta.32164>

Documentation of Historic Buildings For Their 3D Reconstruction In A Digital Cultural Heritage Management System.

Athina Chroni ¹[0000-0002-2797-5014], and Andreas Georgopoulos ²[0000-0001-6520-9954]

¹ Hellenic Ministry of Culture and Sports-General Directorate of Antiquities and Cultural Heritage, Postdoctoral Research Associate-National Technical University of Athens, 20, Paramithias st., 10435 Athens, Greece
athina.chroni@gmail.com

² Laboratory of Photogrammetry-National Technical University of Athens 9, Iroon Polytechniou st., 15780 Athens, Greece
drag@central.ntua.gr

Abstract. Being at the crossway of trade routes, Ioannina, in northwestern Greece, has known overtime an economic and spiritual flourishing reflected in the city's urban web, which has, unfortunately, undergone major alterations.

Focusing on the city's Post-Byzantine period, starting in 1430, for tracing its pluralistic physiognomy, studying the osmosis of its three cultures, Christian, Jewish and Muslim, and figuring out the related cultural palimpsest, still surviving in the collective memory of the city, has been the great challenge of *IASIS* Postdoctoral Research Project.¹

Extensive documentation of various origin, dynamic and combined interpretation and processing of multiple data, cross-checking of the detected information, have formed the basic principles of *IASIS* project development.

The specific paper forms the first part of Hagia Paraskevi Christian Byzantine Monastery-Namaz Giyah Muslim Mosque-Perifereia Hellenic State Administrative Building cultural landmarks' integrated management, i.e., the part on the landmarks' integrated documentation in the framework of *IASIS* Postdoctoral Research Project. [35, 36]

Keywords: Cultural Heritage, Documentation, Digitization, GIS, Photogrammetry, 3-D Modelling, Open Sources, Ioannina.

¹ Implemented by Athina Chroni, Dr. Archaeologist, supervised by Professor Andreas Georgopoulos, Laboratory of Photogrammetry-National Technical University of Athens

1 Introduction

The historian Prokopios, in his work *On Buildings*² is the first one to report the “founding”³ of Ioannina (under the name New Evria⁴) by the emperor Justinian I 528 AD. [8] For the first time the city of the Castle is cited as Ioannina in the Proceedings of the Synod in Constantinople, of the year 879, Zacharias cited as the Bishop of Ioannina. [8] Until 1020 Ioannina is still a small diocese, under the Archdiocese of Ohrid. [28] The Fall of Constantinople in April 1204 by the Crusaders, decisively influenced the development of the city of Ioannina where Michael A’ Komnenos Doukas giving shelter and organizing cores of resistance, reinhabits the city, radically renovates its Castle and establishes the Despotate of Epirus. [1, 16, 20, 28] During the following period, Ioannina flourished, developed and in 1285 the Diocese of Ioannina was promoted to a Metropolis. [19, 28]⁵ Until 1430, the city of Ioannina has a strong aristocracy. [28]

On October 9, 1430, during the reign of Charles B’ Tocco, the city of Ioannina was handed over to the Ottomans. [15] The terms of the surrender being determined by Sinan Pasha Decree, [2, 3] according to which the Ottomans were committed to respect certain privileges of the inhabitants, mainly property and religion, a fact having contributed to ensuring the development of Ioannina. After 1430, the merchants maintained a privileged position in the social web of the city and enjoyed the favor of the Ottoman ruling class, as they were the means of increasing its income. [13]

In 1611 a failed uprising of the Christians, will cause their violent expulsion from the Castle, the widespread destruction of Christian churches and monasteries and a general change of balance in the city. [13, 22, 28]

In 1913 the city was handed over to the Hellenic State.

2 Selection of Landmarks-Reasoning

In the framework of the specific paper, the following landmarks have been selected to be presented, as representative case study concerning IASIS Project:

- *Hagia Paraskevi* Byzantine Monastery. Status: destroyed.
- *Namaz Giyah* Muslim Mosque. Status: destroyed
- *Perifereia* [of Epirus]⁶ Hellenic State Administrative Building. Status: existing.

In the aforementioned landmarks’ case study it is observed:

² *Περί Κτισμάτων*.

³ Rather “re-inhabiting”, as Procopius’ citation has not been confirmed, [16] given that, according to archaeological findings, the city already existed before the times of Justinian. [24]

⁴ *Νέα Εύροια*.

⁵ However, certain scholars consider the year 1318 or 1319 to be the most probable for the promotion of the Diocese of Ioannina to a Metropolis. [4, 16, 33] In the specific research project we will accept the data cited in the synodic act of 1345, i.e., the upgrading of the Diocese of Ioannina to a Metropolis in the year 1285.

⁶ “Perifereia” is the Greek word for “Region”.

- Uninterrupted identical use of the same site as a religious one, until the end of the Post-Byzantine/Ottoman period of Ioannina.
- Successive construction of religious buildings of different religions, during the Post-Byzantine period of Ioannina.
- Construction of a state administrative building in modern times.



Fig. 1. Screenshot from GIS developed for IASIS project. Layering of the ortho imagery 2015 with the urban plan of Ioannina/1915/Approved and signed by Angelopoulos. The green coloured area indicating the site represented in detail images, as parts of the urban plan of Ioannina/1915/Approved and signed by Angelopoulos (bottom right corner) and the urban plan proposal of Ioannina/1919/Implemented by Hébrard (up left corner). [Imagery source: © 41, © 31, © 29] Digital processing by Athina Chroni.

All the buildings are located at the same site, [Fig. 1] outside the Castle of Ioannina, in the suburbs of the former Byzantine, later on Post-Byzantine city of Ioannina, nowadays the center of the modern town, forming a stratigraphic and cultural palimpsest, thus reflecting the respective political and social alterations, revealing the pluralistic physiognomy of the city.

The most challenging goals of the specific part of the research project have been:

- Figuring out Hagia Paraskevi Byzantine Monastery's dating, location and form, in relation to Namaz Giyah Muslim Mosque, as depicted, mainly, in Mellirrytos (& Christides) urban plan⁷ of Ioannina, dated in 1916-1918, and to Perifereia Hellenic State Administrative Building, since only fragmentary bibliographic data have survived.
- Detailed documentation and 3D digital approach of Namaz Giyah mosque's prayer hall⁸ and cemetery to the east.

⁷ Urban plan for “Διάγραμμα ρυμοτομίας” in Greek. [29]

⁸ A building still being officially under “preservation status”, although already destroyed.

3 Methodology

Perifereia State Administrative Building has been the starting point for the location of the two religious buildings and their respective cemeteries, the urban plan of Mellirrytos (& Christides), dated in 1916-1918, forming the link between Perifereia and Namaz Giyah buildings, since the mosque's plan view is depicted in the aforementioned cartographic datum, forming thus, chronologically, the mosque's last optical, official, trace.

Furthermore, additional cartographic data and artistic depictions of the 19th c. and the beginning of the 20th c., postal cards and photographs of the first quarter of the 20th c. as well as an air photograph of the year 1944 and a color ortho photo of the year 2015, have furnished further data for crosschecking the research's results, thus supporting the location of the Muslim mosque and the hypothetic location of the former Byzantine monastery's katholikon, as well as both of the religious buildings' respective cemeteries.

Moreover, the research study has been strengthened by making use the following documentation data:

- Historical data on the city of Ioannina, as shortly outlined in the specific paper's "Introduction" Paragraph.
- Bibliographic reports-testimonies-fragmentary archaeological findings.
- Typological data on Byzantine Christian monasteries' as well as on Muslim mosques' architecture.

4 Hagia Paraskevi Christian Monastery, Namaz Giyah Muslim Mosque and Perifereia State Administrative Building: Location and Dating

4.1 Location

Bibliographic references, archaeological findings and testimonies, under intensive cross-examined study, lead to the safe conclusion that:

The Byzantine monastery of Hagia Paraskevi, a nun's monastery [28], as derived from the memoire of 1584, [5, 28] situated outside the Castle, probably a construction of the Early Byzantine period, was still standing until 1431. [33] In the years 1431-1584 it had been transformed to a metzit⁹ according to the memoire of 1584 as cited by Athenagoras,¹⁰ [5, 28] and to the Holy Metropolis of Ioannina official citation.

⁹ Fulfilling the need for a praying site for the conquerors.

¹⁰ According to the *1584 memoire*, as cited by Athenagoras [5] the religious building of Hagia Paraskevi was not a church as cited by Aravantinos [3] but a monastery, from which the holy icon of Virgin Mary had been taken away to be saved, when the Monastery was occupied by the Ottomans. Nevertheless, it is not clear whether the nun *Parthenia*, commemorated in the *memoire* might be the one to have taken away the holy icon a few years before 1584 or the holy icon had already been saved long before Parthenia, who was, finally, the one to dedicate it to Saint Nicolas Christian monastery, located on the island of Ioannina Lake. We will make the

[33] The replacement of Hagia Paraskevi Christian monastery by a Muslim metzit is confirmed by Aravantinos' citation. [3]

The former Christian religious building complex, later on a Muslim one, was located at the southwestern entrance-exit of Ioannina, at the highlands of the greater area of the city, as confirmed by Celebi's description of 1670 in Kokolakis, [14] the altitude map curves of Melirrytos (& Christides) urban plan of 1916-1918, and Smyris' citation of an altitude of 500 m for the specific hill, [26] thus providing a panoramic view over the greater area and fulfilling its role as a protective bastion.



Fig. 2. Screenshot from GIS developed for IASIS project. Layering of the map 1811-1815/Implemented by Jean-Denis Barbié du Bocage with the urban plan of Ioannina/1916-1918/Implemented by Melirrytos (& Christides)-Signed by Melirrytos. The green-coloured area indicating the site of Namaz Giyah mosque, former Hagia Paraskevi monastery, and the yellow-coloured area indicating the site of the two, out of three, respective cemeteries. [Imagery source: © 30, © 31] Digital processing by Athina Chroni.

Namaz Giyah Muslim mosque and the respective cemeteries' location apart from various bibliographic citations as by Celebi in Kokolakis, [14] Aravantinos, [3] Lambridis [19] and Athenagoras, [5] is also confirmed by:

- Artistic depictions of the mosque and its surrounding area, one of the three respective cemeteries to the east included, by C.R. Cockerell and J. Smith in 1820, Cockerell and T. Higham in 1832 and Edward Lear in 1849 clearly depicting the existence and form of the mosque. [11, 12, 23, 37]
- The photograph on the postal card Registration Number No. 255-Aspiotis Publications/year of publication 1913, depicting Namaz Giyah mosque from the north side, confirms its existence in the urban web of the city, its form and its condition with most of the damage at the minaret, from which the

assumption that Hagia Paraskevi Christian monastery had been transformed to a metzit approximately in the year 1431, violating *Sinan Pasha decree*, dated in 1430, on the preservation and protection of Christian buildings.

conical roof is absent. [42]

- More postal cards of unknown publisher and publication year, as well as photographs from private collection, further contribute in the documentation of the mosque. The only datum, detected so far, depicting the mosque minaret's conical roof is the photograph on the postal card of unknown date and publisher, as shown in Fig. 3 of the present paper.

Moreover, the mosque is further confirmed by cartographic data of the 19th and the 20th c., [Fig. 2] as following:

- Jean Denis Barbié Du Bocage's map¹¹ dated in 1811-1815, according to Kanetakis,¹² [13] dated in 1820, according to Bibliothèque Nationale de France, scaled 1:9000. [30]
- Italo Bernasconi's city plan, dated in 1895, scaled 1:2000, proposing a new city planning. The original map is lost: an exact copy of it dated in 1904,¹³ in the Greek and the Ottoman language, had been confirmed as accurately depicting the current state of the city by the Municipal Committee of the Hellenic State in 1916. [29]
- A map by unknown author, dated in 1905-1908, scaled 1:2000, in the French language, based on the aforementioned Bernasconi map of the city. [29]
- Melirrytos (& Christides¹⁴) urban plan, dated in 1916-1918, scaled 1:1000, in the Greek language, based on the aforementioned Bernasconi map of the city. [31]
- Hébrard's draft map, dated in 1919, scaled 1:4000, in the French language, confirming the road network of the aforementioned Bernasconi map of the city. [29]

4.2 Dating

Concerning the dating of *Hagia Paraskevi* Byzantine monastery only assumptions should be made. Taking into account the historic framework of the city, there might be two options:

- The years between 528, when Justinian is supposed to "create"¹⁵ the city of Ioannina, [8] and 1020, when Ioannina is cited as a small Diocese under the Archdiocese of Ohrid.
- The years following the conquest of Constantinople by the Crusaders, in 1204, when Ioannina's urban web in the Castle area is strengthened by Michael A' Komnenos Doukas. [6]

In both cases, the establishment of a monastery in the suburbs of the city, delimited at that time, by the Castle wall, is probably revealing an early tendency to expand the city beyond the Castle, in the context of meeting the need for new lands.

¹¹ Bibliothèque Nationale de France (D.C.P.) Ge. F. 14472

¹² According to the Bibliothèque Nationale de France the map is dated in 1820. [30]

¹³ According to an official note in the Ottoman language, certified with signatures and stamps.

¹⁴ Christides D. cooperated in the first year of the urban plan's designing project, i.e., in 1916.

Melirrytos P. was the one to fulfill the specific project for the Municipality of Ioannina. [29]

¹⁵ Rather to **strengthen** the urban fabric, by reinhabitation of the existing city and renovation of its fortification.

An element that might contribute in reducing the aforementioned chronological limits is the citation by Lambridis that the Muslim mosque, successive to the Byzantine monastery, was decorated with four monolithic columns of mixed color, (white and green), about two meters high, of “Byzantine art”. [19] It is likely that the four white and green monolithic columns [28] either come from Pantocrator Byzantine Cathedral¹⁶ located at the southeastern citadel of the Castle [6] or were originally built for Hagia Paraskevi monastery, if we take into account similar examples of other Christian buildings, where we find architectural elements of a similar typology, as is the case of Hagios Demetrius church, dated in 412-413 [10] and Acheropoiitos church, dated in 431-450, [10] both churches located in Thessaloniki, Greece.

If we accept that the four columns originate from Hagia Paraskevi’s *katholikon* and that this monastery reproduces architectural prototypes, i.e., in terms of architectural elements, of the two aforementioned Christian religious buildings of Thessaloniki, then Hagia Paraskevi should be dated after the end of the 5th century, more specifically in the years after 528, when Justinian is supposed to reinhabit the city of Ioannina, as cited by Procopius.

Concluding:

- ✓ Hagia Paraskevi had been transformed to a Muslim religious building complex¹⁷ in the years 1431-1584, without leaving any optical traces, only bibliographic citations. [5, 19, 28, 33]
- ✓ *Namaz Giyah* Muslim Mosque, at the site where the former monastery, [5, 19, 28] a landmark completely destroyed approximately in 1930, [28] had successive construction phases as following:
 - 1431-1584¹⁸: Destruction or reconstruction of the existing Christian monastery, transforming its *katholikon*, first, to a Muslim *metzit*, i.e., a site for praying. [5, 19, 28, 33]
 - 1617: Reconstruction of the Muslim *metzit*, transforming it into a *mosque*, Mustafa Effendi Defterdar, Financial Supervisor from Constantinople, covering the expenses. [19]
 - 1715: A renovation of the mosque in the year 1715 confirms the constant interest of the sponsors. [26]
 - 1773: A second renovation is cited for the year 1773. [26]
 - Demolition of the mosque in the years 1928-1929, according to *Joseph and Esther Ganis* Foundation, [34] or in 1930,¹⁹ according to Vranoussis’ citation. [17, 28]

The case of *Namaz Giyah* mosque is characterized by the following paradox:

- The Greek Government Gazette No 152/A/16-6-1925 declares the mosque as

¹⁶ The second Cathedral of the city, in the Post-Byzantine period, after the destruction of Taxiarchis Archangel Michael Byzantine Cathedral. As estimated, Pantocrator had also been destroyed, approximately in 1612.

¹⁷ *Namaz Giyah* mosque.

¹⁸ The period 1431-1584 might be considered as the period of the transformation of Hagia Paraskevi monastery, considering as period limits the surrender of the city to the Ottomans in 1431 and the *memoire* of 1584. [5, 28]

¹⁹ We will adopt the year 1930, as the mosque’s demolition year.

a *protected monument*, [40] thus, further confirming its existence for the year 1925.

- So far, no Greek Government Gazette has been found declassifying the mosque to a *non-protected monument*. The mosque, standing at a key point of the modern city's center, was in a constant state of risk, finally conceding its spacious open site to the new Hellenic State's Administrative Building and the city's central square, a plan already scheduled from the mid-1910s, as confirmed by the two urban plan proposals, in 1915, approved and signed by Angelopoulos, Deputy General Governor of Epirus [31] and in 1919, proposed by Ernest Hébrard, French architect, archaeologist and urban planner. [29]
- The relevant digital file of Namaz Giyah's Declaration as a *protected archaeological and historical site*, is still posted on the official website of the National Press Office of the Hellenic State/*Permanent List of Declared Archaeological Sites and Monuments*.²⁰ [39]
 - ✓ *Perifereia* Hellenic State Administrative Building, constructed in the years 1935-1970, in successive structural phases, a secular public building, a modern landmark of the contemporary city, built at the site where formerly Namaz Giyah mosque used to stand. Designed by the Ioannite woman architect Eriketi Ioannidou,²¹ is one of the largest buildings of Ioannina, its construction having been adventurous: having been bombed in 1940, during WW II, it remained in ruins for many years after the war. Later on, it was rebuilt, but not completed until 1960. In 1970 a third floor was added. [38]

5 Data Processing

All of the geospatial data detected for the documentation of the two lost religious landmarks, as aforementioned, have formed the basic components for the development of a GIS. Their further study in a georeferenced geospatial digital environment, contributed creatively in their crosschecking, as well as in their interpretation, ending in conclusions derivation, by making use also of the related literary sources. The GIS implementation product has formed the basic element for the development of a web database.

Furthermore, composites of image products as derived from the GIS' multiple layers activation visibility,²² have formed the background image for developing the respective landmark's 3D digital model. Each one of the 3D digital models has been

²⁰ As it is derived from the aforementioned, Namaz Giyah mosque, although destroyed, still belongs to the category of monuments to be protected and preserved, according to the Greek Government Gazette No 152/A/16-6-1925. [40]

²¹ Eriketi Ioannidou (1910-1984): in 1927 Eriketi Ioannidou graduated from the School of Architecture of the National Technical University of Athens. [21]

²² Keeping always visible a layer representing the modern city, under the intention of rendering possible a continuous observation of the hypothetical interaction of the building's structure with the modern urban web

chosen to be rendered in an abstractive way, focusing on its basic architectural elements, under the perspective of implying the building's form and not imposing the researcher's point of view. Figuring out the alterations of the urban fabric and awakening the city's collective memory as well, have formed the basic axis of the scientific procedure.

At a next stage of work, integrating the 3D digital models' .mp4s in an online virtual museum, as well as additional information, has been chosen as the most user-friendly medium to communicate the digital product to the public. Furthermore, QR codes set at the specific sites, where the landmark buildings used to stand and have been now 3D digitally developed, under the intention to achieve more interaction of the project with the local community, fulfill their role of active portals to *IASIS* virtual environment, as composed by the related website, the virtual museum and an online routes platform proposing cultural walks in the city.

Given that the number of digital images that are freely available online today has reached unprecedented levels, fruitfully making use of the specific data for developing 3D digital models through the implementation of significant breakthroughs such as the *Structure from Motion* algorithm which creates 3D models of objects using their 2D photographs [18] and "since the footprint of time sometimes imposes terrible consequences on cultural heritage, it often becomes necessary to not only recover the memory of original features of historical buildings, urban and landscape environments, but also understand its likely evolution", [25] the 4D digital model development and, furthermore, upgrading the digital model by incorporating the description of additional semantic metadata information, thus rendering a 5D digital model [9] might form another *IASIS* project's milestone in the future.

6 Conclusion

All places have hidden secrets, revealed when the cultural palimpsest goes under a decomposition procedure by tracing and revealing its structural elements. Ioannina being a city with a long Byzantine past, should have the chance to reveal its hidden Byzantine secrets, given that "each place is a distinctive autonomous entity, as a unique idea, which has spiritual power and emotional content, expressed through the collective, overall and perpetual consciousness of its people." [7, 27]

Concerning cultural heritage, the year 1830 is a turning point. According to the Greek Law 3028/2002, Art. No 2: "(aa) As ancient monuments or ancient relics are considered all cultural goods belonging to Prehistoric, Ancient, Byzantine and Post-Byzantine times and are dated up to the year 1830, subject to the provisions of Article 20 ... bb) As newer monuments are considered cultural goods that are dated later than the year 1830 and whose protection is imposed due to their historical, artistic or of scientific significance, under the regulations of Articles 6 and 20." [32]

The case of the successive destruction of a Christian monastery, initially, and a Muslim mosque later on, calls for an urgent plan, globally, for saving cultural heritage and strengthening collective memory. [Fig. 3]



Fig. 3. Namaz Giyah Muslim mosque. View from the northeast. The specific photograph constitutes the only datum, detected so far, depicting the mosque minaret's conical roof. Postal card of unknown date and publisher. [Imagery source: Private collection]

References

1. Apokafkou, I.: Note on Site Settlement. Codex Hierosolymitanus 276.
2. Aravantinos, P.: Description of Epirus. Ioannina (1866). Reprint: Aravantinos, P.: Description of Epirus. Part II, Ed. Nikolaidou E.I., Publications of the Society for Epirotic Studies, Ioannina (1984).
3. Aravantinos, P.: Chronography of Epirus. Volume II. Vlastos S.K. Publications, Athens (1856). Reprint: Kouloura Publications, Athens (2004).
4. Assonitis S.: Observations on the problem of dating the promotion of the Diocese of Ioannina to a Metropolis, Vyzantiaka Magazine-Scientific Journal of the Hellenic Historical Society, Volume 15, Vanias Publications, Thessaloniki, (1995).
5. Athenagoras.: Neos Kouvaras. Epirotic Chronicles Magazine, Issue 4, Ioannina (1929).
6. Chroni, A. & Georgopoulos, A.: Documentation and 3D Digital Modelling-The Case of a Byzantine Christian Temple and an Ottoman Muslim Mosque in Ioannina City, Greece. Proceedings of the 8th International Euro-Mediterranean Conference on Digital Heritage, ©Springer Nature Switzerland Nicosia, Cyprus (2020) <https://www.springer.com/us/book/9783030730420>
7. Chroni, A.: Syros Virtual Museum-The tangible and the intangible element- Integrated cultural heritage management and new museological approaches- Standard data models and controlled vocabularies for cultural goods documentation. Postgraduate Thesis, University of Piraeus, Division of IT and Technical Services, Faculty of IT, Athens (2019), <http://dione.lib.unipi.gr/xmlui/handle/unipi/12029>
8. Dakaris, S.: Ioannina, New Evroia. Monthly Inspection "Epirotiki Estia", Year A', Issue Nr 6-October, Ioannina (1952).

9. Doulamis, A. et al.: 5D Modelling: An Efficient Approach For Creating Spatio-temporal Predictive 3d Maps Of Large-Scale Cultural Resources. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume II-5/W3, Taipei, Taiwan, pp. 61-68 (2015).
10. Drandakis, N.: Byzantine Archeology, Volume I-Early Christian art up to the architecture of the years of Justinian, Issue II-The architecture of the 5th and 6th c. Publications "To Philologikon" Bookstore-V.G. Vassiliou, Athens (1976).
11. Finden B., Landscape and portrait illustrations to the Life and Works of Lord Byron, Vol. II. Published by John Murray, London (December 31, 1832).
12. Hughes, T.S.: Travels in Sicily, Greece and Albania, Printed for J. Mawman, London (1820).
13. Kanetakis G.: The Castle: Contribution to the Urban History of Ioannina. Doctoral Thesis, Published by the Technical Chamber of Greece, Athens (1994).
14. Kokolakis, M.: Evliya Celebi in Ioannina. Skoufas Magazine, Issue HD-1991/1, Ioannina, (1991).
15. Konstantios, D.: The Castle of Ioannina. Ministry of Culture and Sports, Fund for Archaeological Resources and Expropriations (now as Organization for the Management and Development of Cultural Resources), Athens (2006).
16. Kordosis, M.: The Byzantine Ioannina. Athens, (2003).
17. Koulidas K.: The Muslim vakif of the city of Ioannina. Publications of the Society on Epirotic Studies, Ioannina, (2004).
18. Kyriakaki, G. et al.: 4D Reconstruction of Tangible Cultural Heritage Objects from Web-Retrieved Images. International Journal of Heritage in the Digital Era, Vol. 3, Number 2, pp. 431-451 (2014).
19. Lambridis, I.: Epirotic Studies. Volume II-Issue A': Description of the city of Ioannina. Vlastos-Varvarrigos Publications, Athens (1887). Reprint: Publications of the Society on Epirotic Studies, Ioannina (1993).
20. Orlandos, A.: The Paregoritissa Church at Arta. Publications of The Archaeological Society at Athens, No 52, Athens (1963).
21. Pantouli, O.: Life stories of Greek scientists: their evolution in the fields of Physics, Mathematics, Engineering and Technology. Doctoral Thesis, Aristotle University of Thessaloniki-School of Philosophy-Department of Philosophy and Pedagogy-Department of Pedagogy, Thessaloniki (2014), <http://ikee.lib.auth.gr/record/134537/files/pantouliteliko.pdf>
22. Papadopoulos St.: Liberation struggles of the Greeks during the Turkish occupation. Issue A' (1453-1669), University Lectures, University of Ioannina Publications, Thessaloniki, (1982).
23. Papastavros, A.: Ioannina of the 19th c. Dodoni-Odysseas Publications, Ioannina (2005).
24. Pliakou, G.: The basin of Ioannina and the wider area of Molossia in Central Epirus-Archaeological remains, residential organization and economy. Doctoral Thesis, Thessaloniki (2007).
25. Rodríguez-González P. et al.: 4D reconstruction and visualization of cultural heritage: analyzing our legacy through time. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XLII- 2/W3, Nafplio (2017).
26. Smyris, G.: The mosques of Ioannina and the urban planning of the Ottoman city. Epirotic Chronicles, Volume 34, Ioannina, (2000).

27. Stefanou, I.: About site and landscape. ARCHITECTS SADAS-PEA Magazine, Volume 49, Jan.-Feb., Athens, (2005).
28. Vranoussis, L.: On historical and topography of the Medieval Castle of Ioannina. Publications of the Society on Epirotic Studies, Ioannina, (1968).
29. Zygouris, Th.: From Bernasconi to Hébrard- "Known" and Unknown urban maps of Ioannina. Municipality of Ioannina-Zosimaia Public Library of Ioannina, Ioannina (2019).
30. Bibliothèque Nationale de France (D.C.P.) Ge. F. 14472. <https://gallica.bnf.fr/ark:/12148/btv1b8492581b/f1.item.r=yanina.zoom>, last accessed 2021/07/10.
31. Directorate of Environment and Urban Planning-Municipality of Ioannina, <https://www.ioannina.gr/>, last accessed 2021/07/10.
32. Hellenic State-Law No 3028/2002, The Greek Government Gazette No 153/A/28- 6-2002, last accessed 2021/07/10. https://www.kodiko.gr/nomologia/download_fek?f=fek/2002/a/fek_a_153_2002.p df&t=3bb1eb7cb8692b8bd76bd3250104103e
33. Holy Metropolis of Ioannina, http://www.imioanninon.gr/main/?page_id=8, last accessed 2021/07/10.
34. Joseph and Esther Ganis Foundation. https://www.facebook.com/photo?fbid=918937971886192&set=ms.c.eJw9UtuRRTEI6mjHZwL9N7ZzNZxPBkRF6WDC2eE86D~%3B~_MK1~%3BuMnFyBz~_~_sNx0J3mDzPNgRMI3mr4zIdp~%3Bvg0PL0buoNxpefo4~%3BG4ow9Kz~%3BzpUSW~%3Bu34lv7t~_pnk5~_KvPHr88g8t8~%3BUJ~_FeMX2rd68XnYe~%3BN5PO~%3Bo~%3BcsH48fWPOHTrzVPYXjVozcPx5snaubxlxfLJ~%3B~_Tj7fJC3nlfzZv3ety5wnVTx6gyX~%3B6wyi~%3Bs366X2~_~%3BVr~%3BYfq77YPd5fknE6OP1A23yce3f2x~%3Bav7n7ar6z9fXh1V~%3BpOXmw9D82~%3B5Xf~%3B3H~%3B1bQ~%3Bdn~%3BEP~_bzllk~.bps.a.918937891886382, last accessed 2021/07/10.
35. IASIS Website, <https://athinachroni.wixsite.com/my-site-1>, last accessed 2021/07/10.
36. IOANNINA 1430-1913 Virtua Museum, <https://www.artsteps.com/view/5feca5afe659e68d58a48c8>, last accessed 2021/07/10.
37. Lear Edward Harvard University-Houghton Library.https://hollisarchives.lib.harvard.edu/repositories/24/digital_objects/24431, last accessed 2021/07/10.
38. Official Travel Guide of Ioannina, <https://www.travelioannina.com/el/node/79>, last accessed 2021/07/10.
39. Permanent List of Declared Archaeological Sites and Monuments of Greece. <http://listedmonuments.culture.gr/monument.php?code=6734>, last accessed 2021/07/10.
40. The Greek Government Gazette No 152/A/16-6-1925. <http://www.et.gr/index.php/anazitisi-fek>, last accessed 2021/07/10.
41. The Hellenic Cadastre, www.ktimatologio.gr, last accessed 2021/07/10.
42. Wikimedia Commons. Postal card Nr. 255. Published by Aspiotis in 1913. Nikos D. Karabelaspostcard collection, Preveza, Greece, https://commons.wikimedia.org/wiki/File:Aspiotis_255.jpg, last accessed 2021/07/10.