

From architectural data integration to digital twinning

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Framework

Driving Urban Transitions >
Dilemma-based approach >
Mission oriented

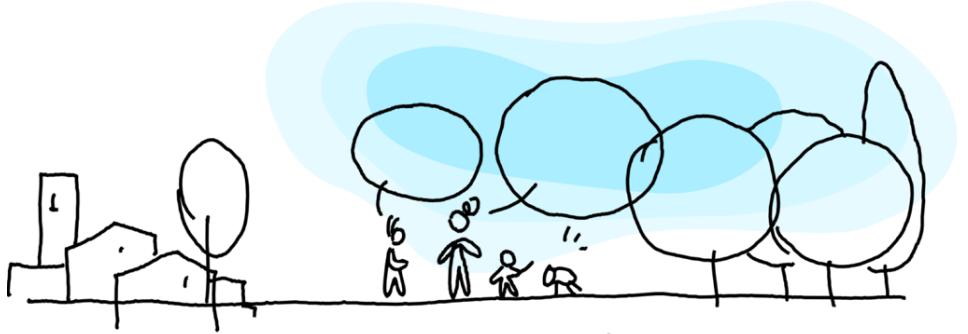
Missions are:

- Linking activities across different disciplines, research and innovation;
- Making it easier for citizens to understand the value of sustainable urban management /cultural heritage.



Carlucci, S., Lange, M., Artopoulos, G., et al. (2022). Report of the Task Force on the Built Environment. Eastern Mediterranean and Middle East Climate Change Initiative, The Cyprus Institute and the Republic of Cyprus.





New European Bauhaus
beautiful | sustainable | together

NEB Lab: NEB Stewardship Lab

Project team coordination

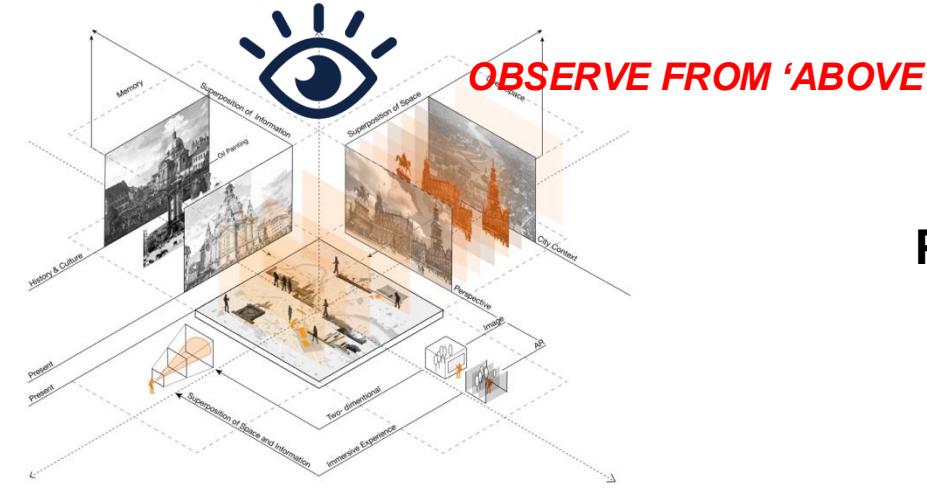
- [Metropolia University of Applied Sciences](#)  , New European Bauhaus partner
- [IADE - Universidade Europeia](#)  , New European Bauhaus partner
- [La Nuova Accademia di Belle Arti \(NABA\)](#)  , New European Bauhaus partner
- [University of Turin](#) , New European Bauhaus partner
- [Cyprus Institute](#) , New European Bauhaus partner
- [Green Growth Generation](#) , New European Bauhaus partner
- [Amsterdam University of Applied Sciences](#) 

Cultural Heritage plays a central role in **integrated urban development** and increase of cities' resilience.

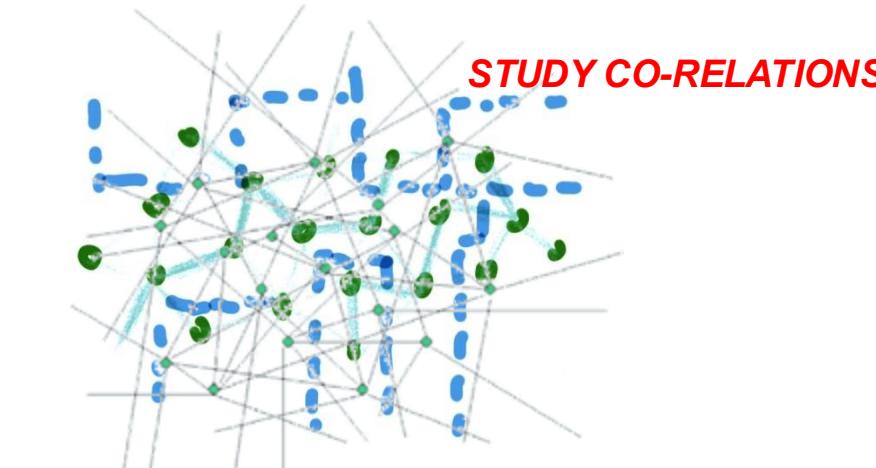
CH can proactively **address climate action and bridge the past and the future**.

CH an important driver for **sustainable economic development & innovation**.

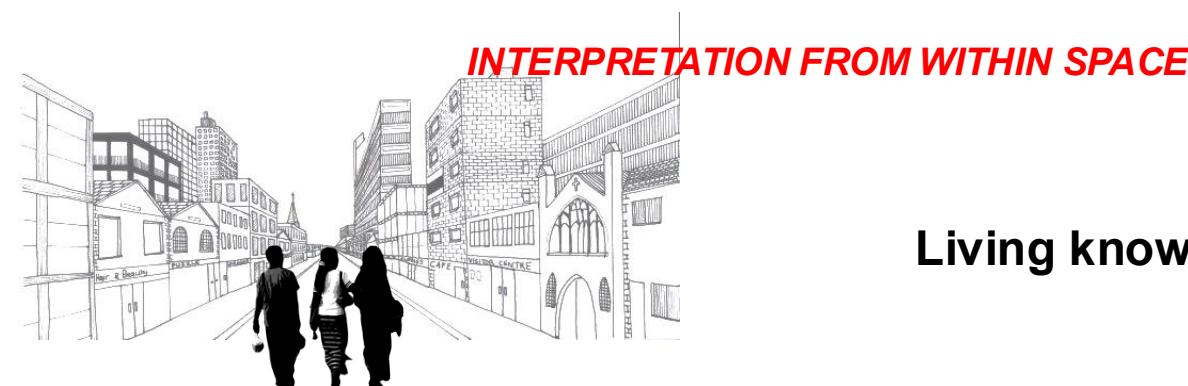
DIGITAL METHODS . AGENCY



Palimpsest – urban fabric



Culturally identified landscapes
– identities assigned in places
through activities performed



Living knowledge – local experiences

DIGITAL METHODS .by AGENCY & SCALE

VeLAB
virtual environments

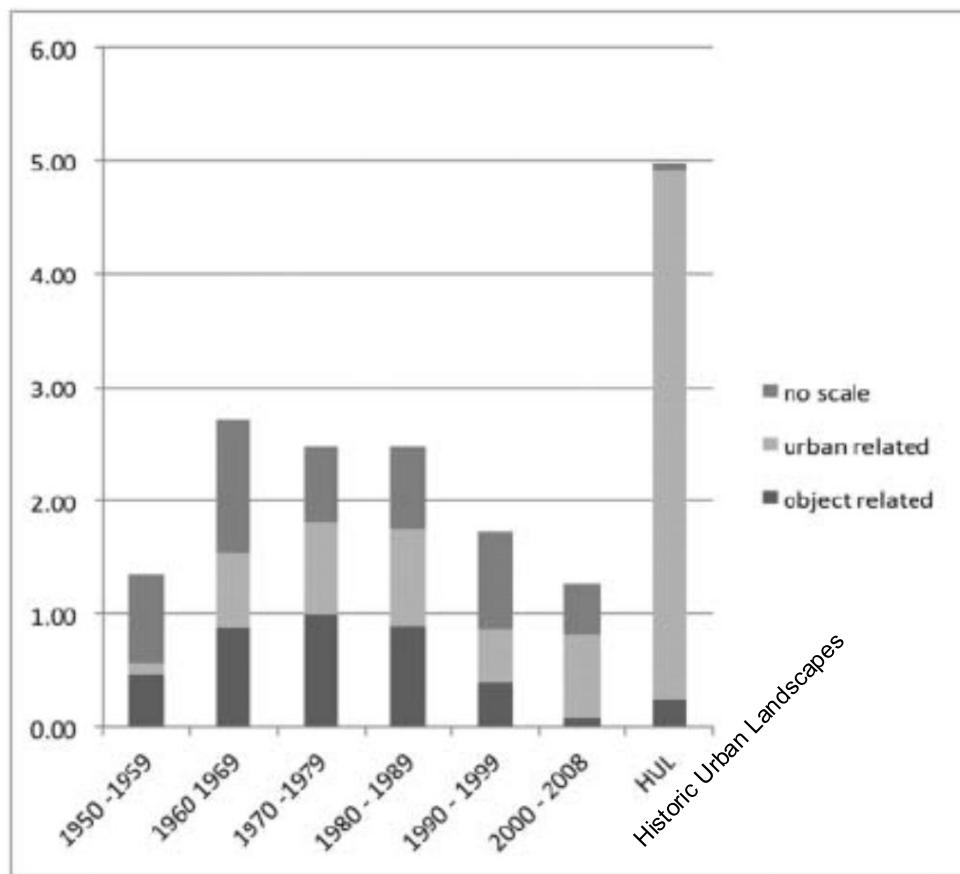
Built heritage

- . Multiscale observation (top-down)
- . On-site participation (bottom-up)
- . (Virtual) on-site co-design (Urban Lab)

Intangible cultural heritage

DIGITAL METHODS .by AGENCY & SCALE

- . Multiscale observation (top-down)

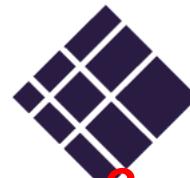


Percentage of object versus urban-related terms
in international cultural heritage policy
documents.

Veldpaus, Loes. (2015). *Historic urban landscapes: framing the integration of urban and heritage planning in multilevel governance.*



Information about scale relationships, environmental conditions in the area, links with other locales of historical connection, orientation, visual connectivity and so on, is intimately tied to our perception of physical objects, buildings and sites.



Digital platforms focus on 3D modelling and real-time simulation of urban environments, integrating georeferenced information.

REPORT ON A EUROPEAN COLLABORATIVE CLOUD FOR CULTURAL HERITAGE

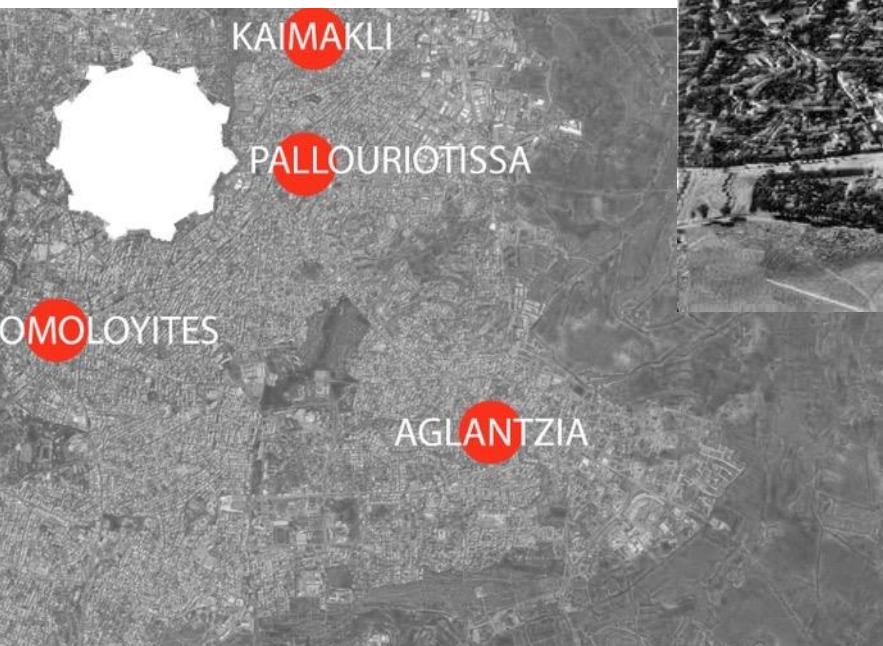
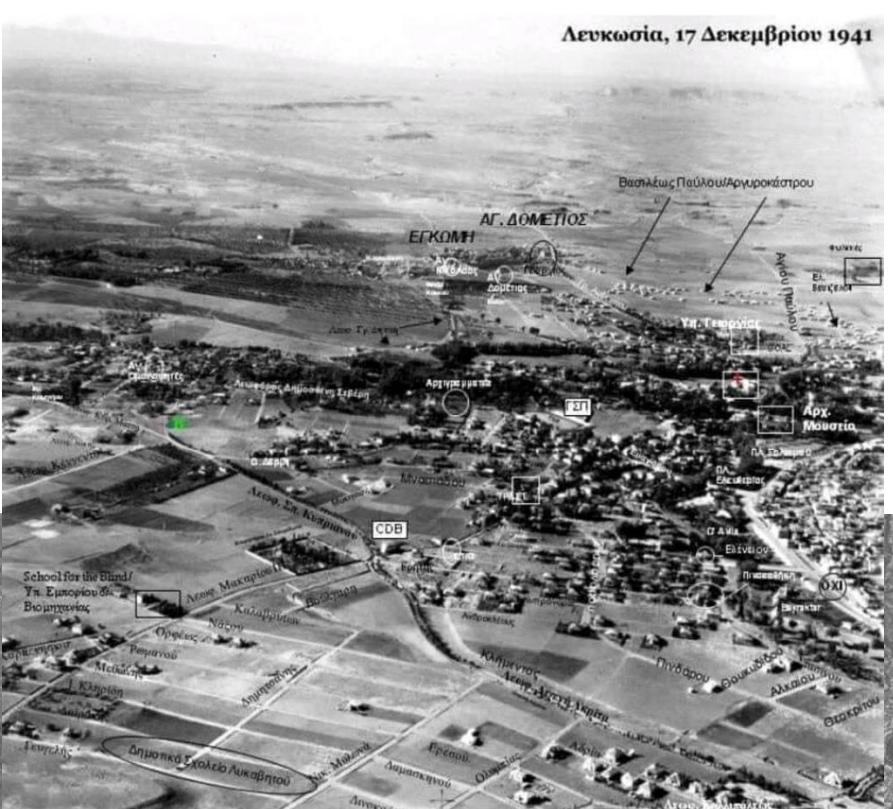
EX-ANTE IMPACT ASSESSMENT

PREPARED FOR
EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR RESEARCH AND INNOVATION

PERE BRUNET
LIVIO DE LUCA
EERO HYÖNEN
ADELINE JOFFRES
PETER PLASSMEYER
MARTIJN PRONK
ROBERTO SCOPIGNO
GÁBOR SONKOLY



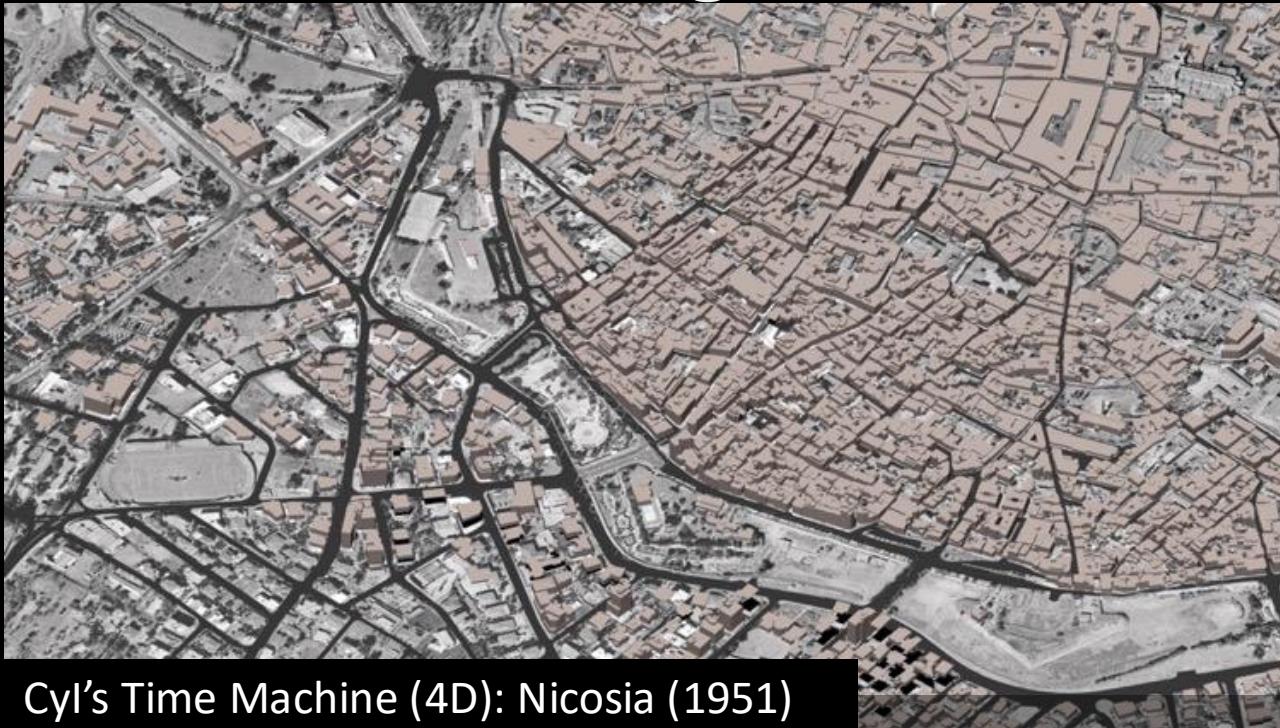
Λευκωσία, 17 Δεκεμβρίου 1941



Urban sprawl challenges built heritage

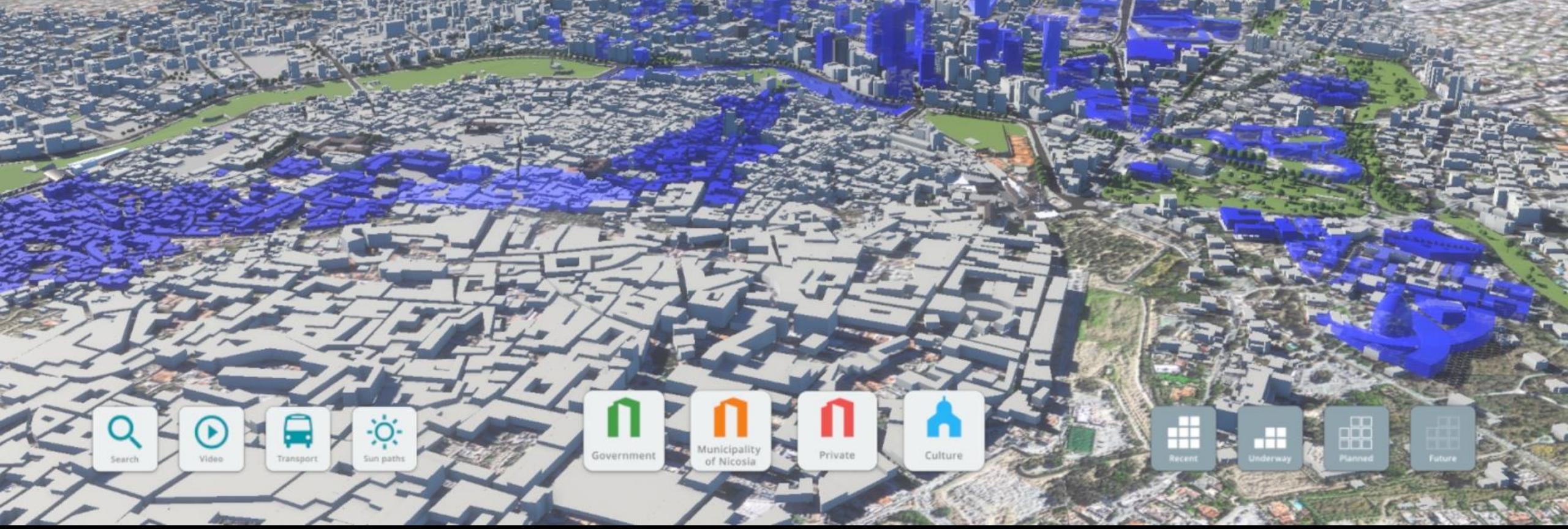
LAKATAMEIA

Digital Twin of historic neighbourhoods



The project PERIsCOPE INTEGRATED/0918/0034 is co-financed by the European Regional Development Fund and the Republic of Cyprus through the Research Innovation Foundation .





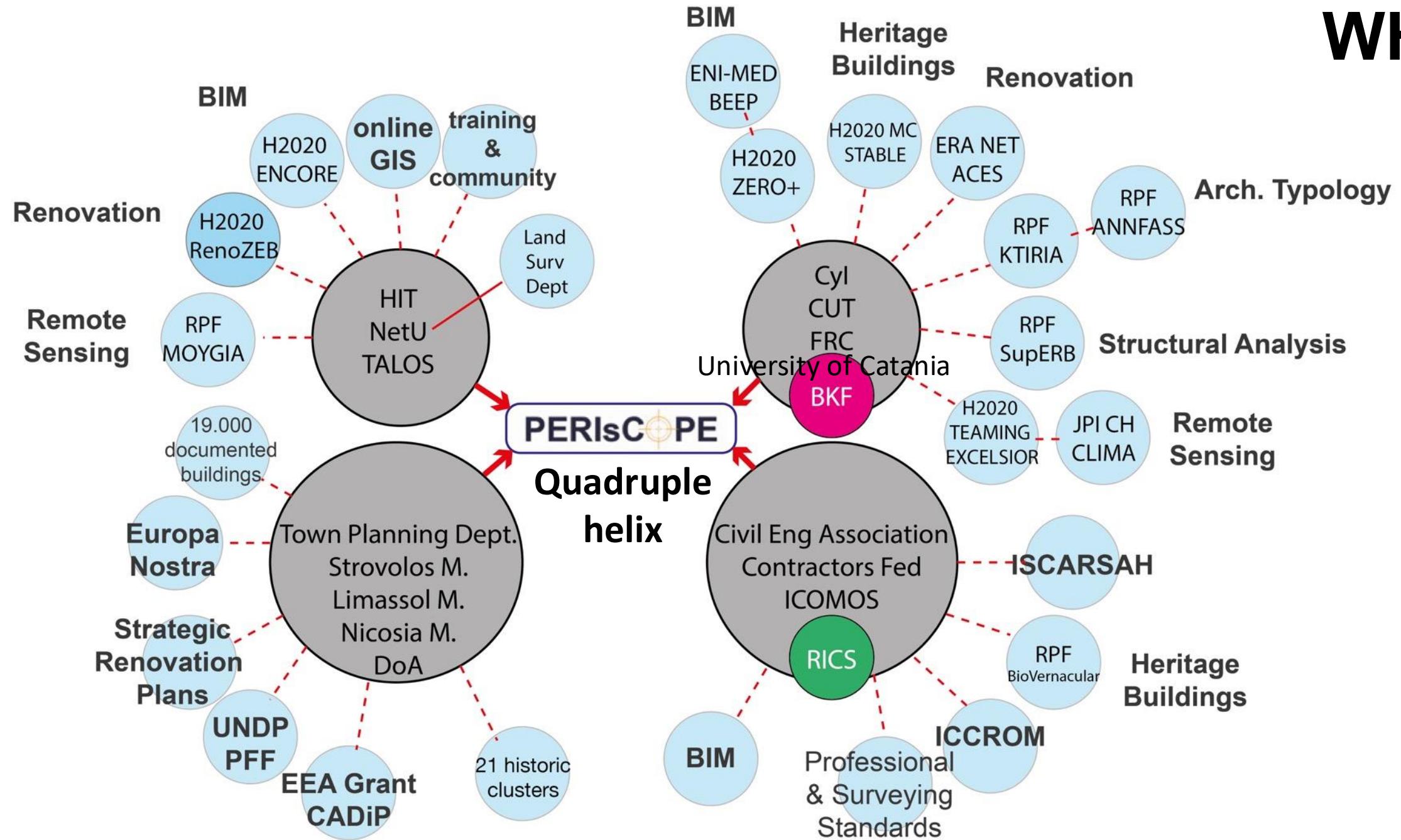
The building as a database of interlinked data structures and related information representations accessible through a Common Data Environment:

- Survey
- GIS
- Engineering
- Conservation
- Simulation
- Design intervention scenarios

Giraud, I., Artopoulos, G., (2023). 'A data-enabled participatory application towards better engagement and neighborhood accessibility'. In De Luca, F., Lykouras, I., Wurzer, G. *Regenerating the City. Performance-driven and Simulation-based Computational Design for Sustainable Cities and Communities*, Proceedings of the 9th eCAADe Regional International Symposium RIS 2023, eCAADe (Education and research in Computer Aided Architectural Design in Europe). [CUMINCAD database](#)

- Integrating multi-discipline datasets and information for online access and remote collaboration;
- Building provenance for conservation state analysis and renovation in re-use;
- Data standardization;
- Define data generation procedures, documentation, instructions to comply in the workflow;
- Assign object identifiers and provide access to a dataset repository.

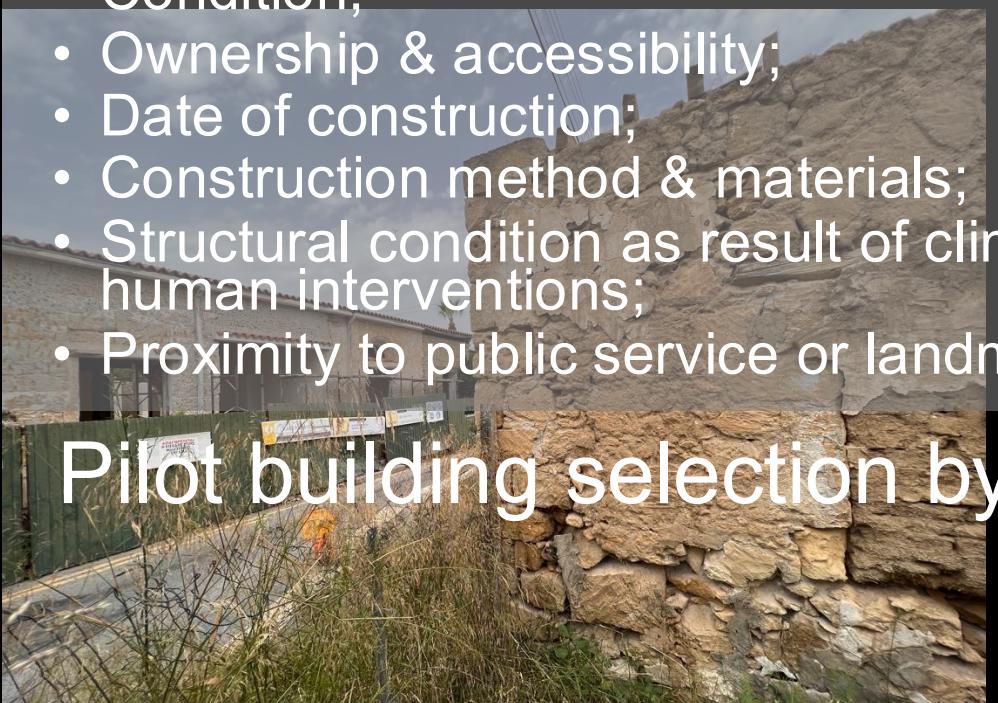




List of criteria includes

- Architectural value;
- Historical / cultural value;
- Location;
- Typology;
- Condition;
- Ownership & accessibility;
- Date of construction;
- Construction method & materials;
- Structural condition as result of climate, time wear and human interventions;
- Proximity to public service or landmark.

Pilot building selection by expert panel



Artopoulos, G., Maria I. Maslioukova, Christina Zavou, Melinos Averkiou, Andreas C. Andreou, Marissia Deligiorgi (2023). 'An artificial neural network framework for classifying the style of cyprriot hybrid examples of built heritage in 3D'. *Journal of Cultural Heritage*, Vol. 63, 135-147. <https://doi.org/10.1016/j.culher.2023.07.016>

A digital twin of historic neighbourhoods that provides user-friendly access to an online repository of heritage buildings' deep documentation and analysis via Heritage-Building Information Modelling, and an open to the public time machine of the urban fabric for city monitoring by the authorities.



WHAT

The screenshot displays a 3D city model of Strovolos, Limassol, and surrounding areas. The interface includes a navigation bar with Home, Search, Inventory, Monitoring, Help, and Sign In buttons. A sidebar on the left lists layers: Periscope_Buildings, Strovolos, Limassol, Building Blocks, and Administrative Boundaries. A legend at the bottom right indicates 'No legend'. On the right, a panel shows historical orthophotos from 1963, 1993, and 2019, with the 2019 photo highlighted. The URL in the browser is uperiscope.hpcf.cyi.ac.cy.



Nicosia (2019)



Nicosia (2019)



Nicosia (2019)

CHALLENGES

Urban sprawl adds pressure to heritage and old neighbourhoods (against the 15' city principles, as promoted by the **DUT** programming).

Loss of heritage buildings by human neglect, climate change and international real-estate pressures, which impacts city sustainability and communities' resilience as identified by the **New European Bauhaus**.

Identified need for renovation (energy improvement) to achieve **EU Green Deal** goals (*M. Economidou, P. Zangheri, D. Paci, Long-term strategy for mobilizing investments for renovating Cyprus national building stock, European Commission 2017*).

Authorities lack access to data and tools for urban monitoring — at least in 2nd- & 3rd-tier historic cities which do not have the resources.

Professionals lack of access to building & urban data (knowhow, cost, labour to produce data).

Scalability and sustainability: tools must be user-enabling in everyday operations.

User acceptance of digital tools can be challenging due to a lack of awareness, training, and technical expertise, as well as concerns over data ownership, privacy, and security.



New European Bauhaus
beautiful | sustainable | together

HOW DID WE OVERCOME THE CHALLENGES?

Created restoration and renovation requirements, policies, pool of examples & step-by-step guidelines for users.

Classification of architectural typology and architectonic features with a 3D precision documentation workflow (UAV, photogrammetry, TLS, etc.) for QUALITY DATA, as promoted by **EU DG Connect**.

Documentation of building structural condition (NDT) and environmental impact (LCA of heritage).

Monitoring of built environment at neighbourhood scale, time machine (2013-2022).

Platform co-developed through workshops for community building, training of target groups of users and user feedback collection.





Ευρωπαϊκή Ένωση
Ευρωπαϊκό Ταμείο
Περιφερειακής Ανάπτυξης



Κυπριακή Δημοκρατία



Διοικητική Ταμια
της Ευρωπαϊκής Ένωσης στην Κύπρο



THE CYPRUS
INSTITUTE
KYPRIAKI INNOVATION FOUNDATION

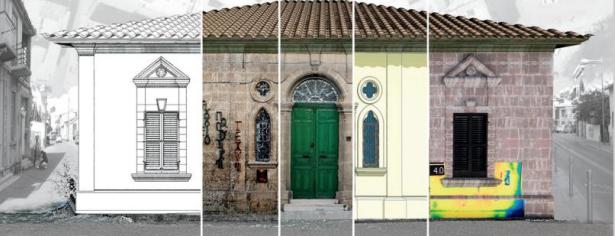


ΙΑΡΥΜΑ ΕΡΕΥΝΑΣ ΚΑΙ
ΚΑΙΝΟΤΟΜΙΑΣ
RESTART SEARCH
INTERDISCIPLINARY RESEARCH FOUNDATION



PORTRAL FOR HERITAGE BUILDINGS' INTEGRATION INTO THE CONTEMPORARY BUILT ENVIRONMENT

Guidebook for the preplanning and development of Heritage BIM models



The project PERiSCOPE INTEGRATED/0918/0034 is co-financed by the European Regional Development Fund and the Republic of Cyprus through the Research Innovation Foundation.

Online HBIM-supported platform with user-friendly CMS for maintenance.
New approaches to conservation state analysis of built heritage.
Built Environment Change Detection with Machine Learning.
Good practices offered to the community.
Town Planning & Housing Department of the Republic of Cyprus to adopt our methodology for an HBIM database of built heritage, contributing to SDG 11 (Sustainable Cities & Communities).

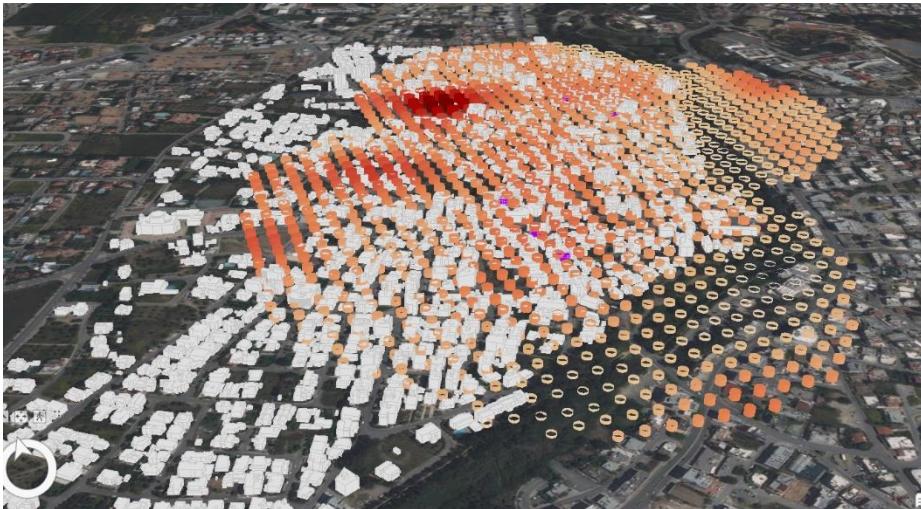
RESULTS

11 SUSTAINABLE CITIES
AND COMMUNITIES



VISUALISATION: multiple modes of visualisation help for the better interpretation of complex urban conditions.

Dynamic exploration of surface temperatures in 3D GIS.



Artopoulos, G., Agapiou, A., Lysandrou, V., Fokaides, P., Deligiorgi, M., Sabatakos, P. (2023). Data-driven multi-scale study of historic urban environments by accessing earth observation and non-destructive testing information via an HBIM-supported platform. *International Journal of Architectural Heritage*. DOI: 10.1080/15583058.2023.2199408

LESSONS LEARNT

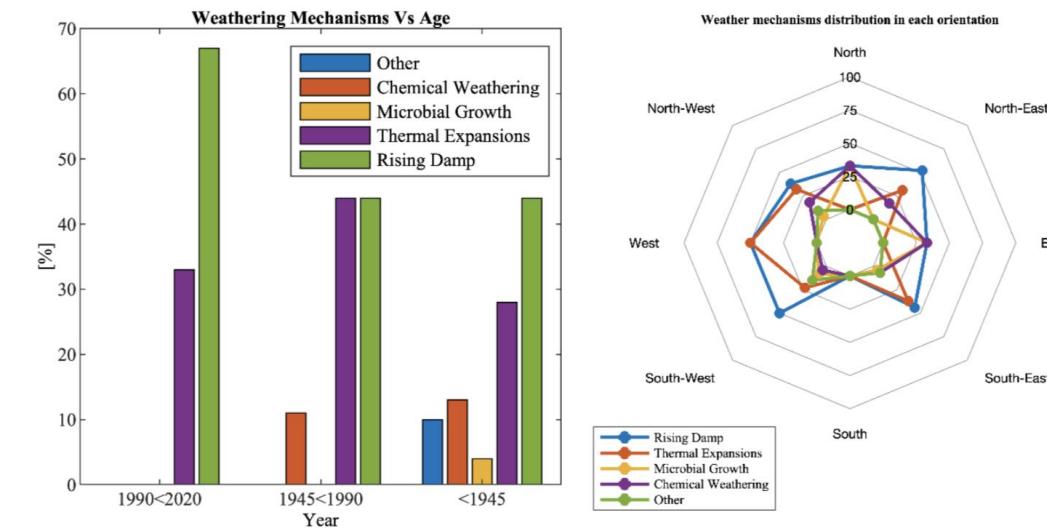
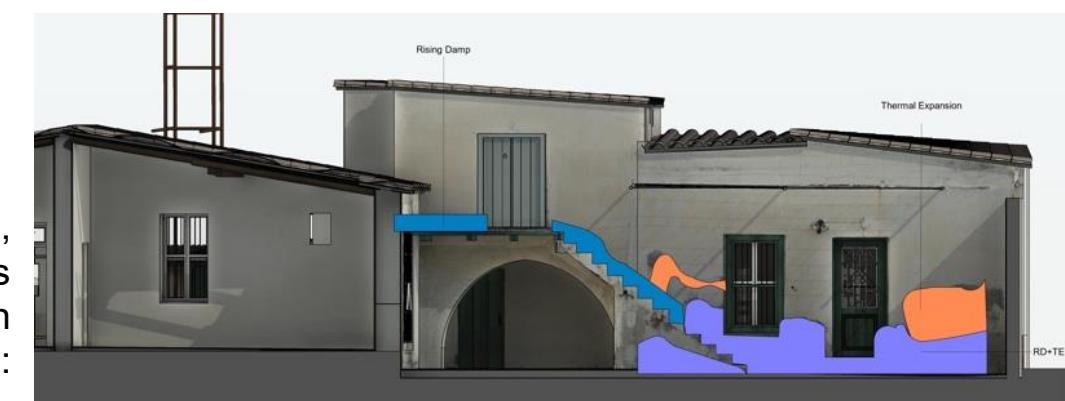


Figure 14. Indicative data analytics of information related to weathering mechanisms affecting heritage buildings per age (left) and per orientation of the building element (right).



3.2. Strovolos – Plot 217
3.2.1. Building Information - General

General Information					
District	Nicosia	Address	Megalou Alexandrou 21		
Municipality	Strovolos	Name of owner	Pamporides Pavlos & Zivkovic Maja		
Congregation	Chryseleousa	Date of inspection	15.11.2020		
Topographic data	Altitude 172m	Time of inspection	10:00 am		
Plot number	217	Name of inspector	Antri Panayidou, Nikolas Afxentiou		
Type of use	<input checked="" type="checkbox"/> Commercial	<input type="checkbox"/> Public			
Building unit type	<input type="checkbox"/> Detached	<input type="checkbox"/> Terraced	<input type="checkbox"/> Semi-detached	<input checked="" type="checkbox"/>	
Building age class	<input type="checkbox"/> <1945	<input checked="" type="checkbox"/> 1946-1970	<input type="checkbox"/> 1971-1990	<input type="checkbox"/> 1991-2006	<input type="checkbox"/>

Floors					
Ground floor	<input type="checkbox"/>	Two floors	<input checked="" type="checkbox"/>	Three floors	<input type="checkbox"/>

Accessibility (select as many as required)			
North	<input type="checkbox"/>	South	<input type="checkbox"/>
East	<input type="checkbox"/>	West	<input type="checkbox"/>
Northeast	<input checked="" type="checkbox"/>	Southeast	<input type="checkbox"/>
Northwest	<input type="checkbox"/>	Southwest	<input type="checkbox"/>

Number of building zones (Description)

Photos	
Comments The building appears to be in good condition. The building consists of a ground floor parallel with the road and a new addition with two floors in the back yard. The structure of the roof is renovated, and also the walls are recently painted.	

3.2.2.3. Building Element-Inspection

Building Element			
Wall	<input checked="" type="checkbox"/>	Floor	<input type="checkbox"/>
Ceiling	<input type="checkbox"/>	Window	<input checked="" type="checkbox"/>
Door	<input checked="" type="checkbox"/>		

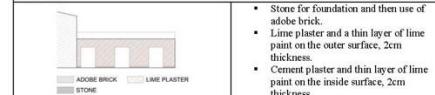
Photos

Comments (please specify shape and size of building element)

- Masonry with 3 wooden balcony doors, facing the internal yard and having Southwest orientation.

Building Material – Cross Section Drawing

Stone	<input checked="" type="checkbox"/>	Cement plaster	<input checked="" type="checkbox"/>	EPS / XPS	<input type="checkbox"/>	Matting	<input type="checkbox"/>
Adobe Brick	<input checked="" type="checkbox"/>	Lime plaster	<input type="checkbox"/>	Rock wool	<input type="checkbox"/>	Canes	<input type="checkbox"/>
Clay brick	<input type="checkbox"/>	Gypsum plaster	<input type="checkbox"/>	LDPE	<input type="checkbox"/>	Leaves/Twigs	<input type="checkbox"/>
Solid clay brick	<input type="checkbox"/>	Paint	<input type="checkbox"/>	PVC	<input type="checkbox"/>	Clay with twigs	<input type="checkbox"/>
Timber	<input type="checkbox"/>	Gypsum board	<input type="checkbox"/>	Steel	<input type="checkbox"/>	Clay soil	<input type="checkbox"/>
Reinforced concrete	<input checked="" type="checkbox"/>	OSB	<input type="checkbox"/>	Aluminum	<input type="checkbox"/>	Clay roof tiles	<input type="checkbox"/>
Concrete	<input type="checkbox"/>	Plywood	<input type="checkbox"/>	Copper	<input type="checkbox"/>	Limestones	<input type="checkbox"/>
Cement	<input type="checkbox"/>	Glass	<input type="checkbox"/>	Planks	<input type="checkbox"/>	Bitruminous waterproofing	<input type="checkbox"/>

Comments

Building element's orientation (select up to 2)

North Facing	<input type="checkbox"/>	South Facing	<input type="checkbox"/>	East Facing	<input type="checkbox"/>	West Facing	<input type="checkbox"/>
Northeast Facing	<input type="checkbox"/>	Southeast Facing	<input checked="" type="checkbox"/>	Northwest Facing	<input type="checkbox"/>	Southwest Facing	<input type="checkbox"/>

3.2.2.1. Building Element-Inspection

Building Element			
Wall	<input checked="" type="checkbox"/>	Floor	<input type="checkbox"/>
Ceiling	<input type="checkbox"/>	Window	<input checked="" type="checkbox"/>
Door	<input checked="" type="checkbox"/>		

Photos

Comments

- Facade of the house with Northeast orientation.
- The wall abutting the street.

Building Material – Cross Section Drawing

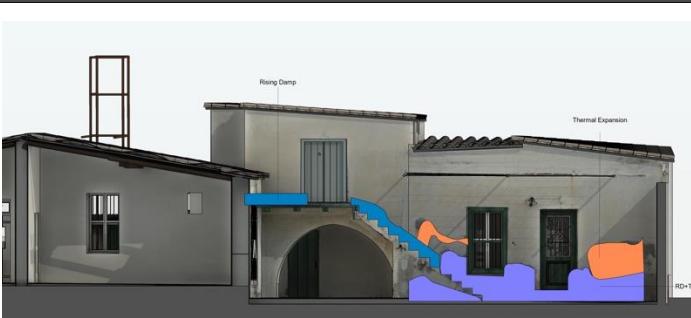
Stone	<input checked="" type="checkbox"/>	Cement plaster	<input checked="" type="checkbox"/>	EPS / XPS	<input type="checkbox"/>	Matting	<input type="checkbox"/>
Adobe Brick	<input checked="" type="checkbox"/>	Lime plaster	<input type="checkbox"/>	Rock wool	<input type="checkbox"/>	Canes	<input type="checkbox"/>
Clay brick	<input type="checkbox"/>	Gypsum plaster	<input type="checkbox"/>	LDPE	<input type="checkbox"/>	Leaves/Twigs	<input type="checkbox"/>
Solid clay brick	<input type="checkbox"/>	Paint	<input type="checkbox"/>	PVC	<input type="checkbox"/>	Clay with twigs	<input type="checkbox"/>
Timber	<input type="checkbox"/>	Gypsum board	<input type="checkbox"/>	Steel	<input type="checkbox"/>	Clay soil	<input type="checkbox"/>
Reinforced concrete	<input type="checkbox"/>	OSB	<input type="checkbox"/>	Aluminum	<input type="checkbox"/>	Clay roof tiles	<input type="checkbox"/>
Concrete	<input type="checkbox"/>	Plywood	<input type="checkbox"/>	Copper	<input type="checkbox"/>	Limestones	<input type="checkbox"/>
Cement	<input type="checkbox"/>	Glass	<input type="checkbox"/>	Planks	<input type="checkbox"/>	Bitruminous waterproofing	<input type="checkbox"/>

Comments

- The base structure of the wall is made out of stone and the rest of it is out of adobe brick.
- There is a high probability that the wall contains stone columns that serve as supports of the internal area.
- Lime plaster on the entire outer surface and lime paint, 2cm thickness.
- Cement plaster on the inside surface and lime paint, 2cm thickness.
- Wall of thickness 4.5cm.

Building element's orientation (select up to 2)

North Facing	<input type="checkbox"/>	South Facing	<input type="checkbox"/>	East Facing	<input type="checkbox"/>	West Facing	<input type="checkbox"/>
Northeast Facing	<input type="checkbox"/>	Southeast Facing	<input checked="" type="checkbox"/>	Northwest Facing	<input type="checkbox"/>	Southwest Facing	<input type="checkbox"/>



Building element's orientation

North Facing	<input type="checkbox"/>	South Facing	<input type="checkbox"/>	East Facing	<input type="checkbox"/>	West Facing	<input type="checkbox"/>
Northeast Facing	<input type="checkbox"/>	Southeast Facing	<input type="checkbox"/>	Northwest Facing	<input type="checkbox"/>	Southwest Facing	<input checked="" type="checkbox"/>

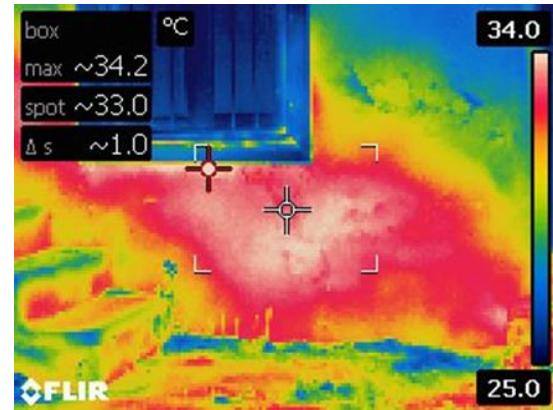
Comments



- Solar exposed (sunset to sunrise)
- Partly shaded (after midday) due to neighbouring building.
- Arch under the wide staircase partly shaded due to cantilever and ladder.

Visible voids and cracks

Photos



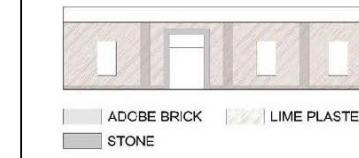
Comments

- Significant wear on the cement and lime finish layer below window.
- Potential cause is the absorbed humidity through the window frame into the wall.



Building Material – Cross Section Drawing							
Stone	<input checked="" type="checkbox"/>	Cement plaster	<input checked="" type="checkbox"/>	EPS / XPS	<input type="checkbox"/>	Matting	<input type="checkbox"/>
Adobe Brick	<input checked="" type="checkbox"/>	Lime plaster	<input checked="" type="checkbox"/>	Rock wool	<input type="checkbox"/>	Canes	<input type="checkbox"/>
Clay brick	<input type="checkbox"/>	Gypsum plaster	<input type="checkbox"/>	LDPE	<input type="checkbox"/>	Leaves/Twigs	<input type="checkbox"/>
Solid clay brick	<input type="checkbox"/>	Paint	<input checked="" type="checkbox"/>	PVC	<input type="checkbox"/>	Clay with twigs	<input type="checkbox"/>
Timber	<input type="checkbox"/>	Gypsum board	<input type="checkbox"/>	Steel	<input type="checkbox"/>	Clay soil	<input type="checkbox"/>
Reinforced concrete	<input type="checkbox"/>	OSB	<input type="checkbox"/>	Aluminum	<input type="checkbox"/>	Clay roof tiles	<input type="checkbox"/>
Concrete	<input type="checkbox"/>	Plywood	<input type="checkbox"/>	Copper	<input type="checkbox"/>	Limestones	<input type="checkbox"/>
Cement	<input type="checkbox"/>	Glass	<input type="checkbox"/>	Planks	<input type="checkbox"/>	Bituminous waterproofing	<input type="checkbox"/>

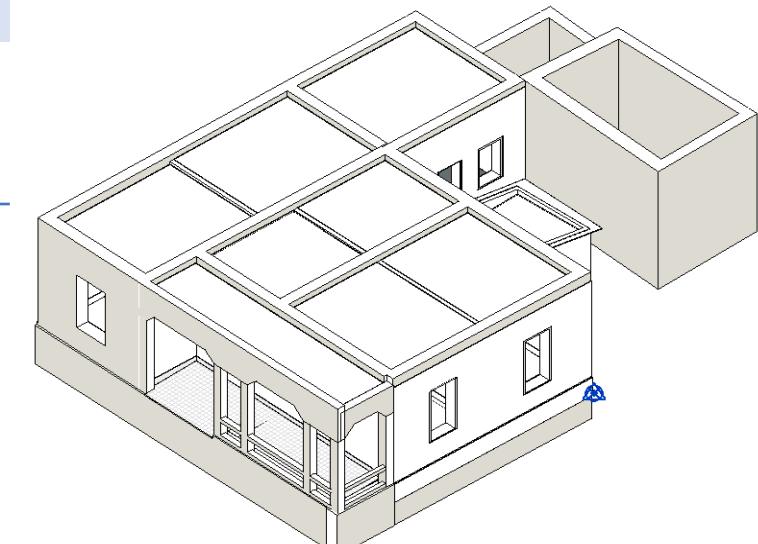
Comments



- The base structure of the wall is made out of stone and the rest of it is out of adobe brick.
- There is a high probability that the wall contains stone columns that serve as the supports of the internal arcs.
- Lime plaster on the entire outer surface and lime paint, 2cm thickness.
- Cement plaster on the inside surface and lime paint, 2cm thickness.
- Wall of thickness 45cm.

Building element's orientation (select up to 2)

North Facing	<input type="checkbox"/>	South Facing	<input type="checkbox"/>	East Facing	<input type="checkbox"/>	West Facing	<input type="checkbox"/>
Northeast Facing	<input checked="" type="checkbox"/>	Southeast Facing	<input type="checkbox"/>	Northwest Facing	<input type="checkbox"/>	Southwest Facing	<input type="checkbox"/>



Environmental sustainability aspects of the tools

	Result category	Global warming kg CO ₂ e	Biogenic carbon storage kg CO ₂ e bio	Ozone depletion potential kg CFC11e	Acidification kg SO ₂ e	Eutrophication kg PO ₄ e	Formation of ozone of lower atmosphere kg Ethenee	Abiotic depletion potential for non fossil resources kg Sbe	Abiotic depletion potential for fossil resources MJ
A1-A3	Construction Materials	1,1E5	1,54E4	1,2E-3	3,99E2	3,92E1	3,18E1	8,1E0	1,79E6
A4	Transportation to site	3,2E3		6,29E-4	1,42E1	3,1E0	2,03E-1	2,24E1	8,99E4
A5	Construction/installation process	6,99E3		9,76E-5	2,4E1	2,7E0	2,36E0	1,02E0	1,03E5
B1	Use Phase								
B3	Repair	0E0		0E0	0E0	0E0	0E0	0E0	
B4-B5	Material replacement and refurbishment	0E0		0E0	0E0	0E0	0E0	0E0	
B6	Energy use								
B7	Water use								
C1-C4	End of life	3,54E3		3,72E-5	1,76E1	3,7E0	1,66E0	1,18E0	4,29E4
	Total	1,24E5	1,54E4	1,96E-3	4,55E2	4,87E1	3,6E1	3,27E1	2,03E6

- Environmental indicators results for all life stages of the building (Level(s) Standard)

	Result category	Use of renewable primary energy resources as raw materials MJ	Total use of primary energy ex. raw materials MJ	Total use of renewable primary energy MJ	Total use of non renewable primary energy MJ	Use of net fresh water m ³
A1-A3	Construction Materials	1,39E5	2,01E6	1,09E6	1,07E6	2,25E3
A4	Transportation to site	0E0	8,99E4	2,47E2	8,96E4	7,09E-2
A5	Construction/installation process	2,48E4	1,17E5	7,67E4	6,68E4	2,14E2
B1	Use Phase					
B3	Repair	0E0	0E0	0E0	0E0	0E0
B4-B5	Material replacement and refurbishment	0E0	0E0	0E0	0E0	0E0
B6	Energy use					
B7	Water use					
C1-C4	End of life	0E0	4,97E4	4,04E3	4,57E4	5,93E1
	Total	1,64E5	2,26E6	1,17E6	1,27E6	2,52E3

- Indicators describing the usage of primary energy and water

Environmental sustainability aspects of the tools

	Global warming kg CO ₂ e	Biogenic carbon storage kg CO ₂ e bio	Ozone depletion potential kg CFC11e	Acidification kg SO ₂ e	Eutrophication kg PO ₄ e	Formation of ozone of lower atmosphere kg Ethenee	Abiotic depletion potential for non fossil resources kg Sbe	Abiotic depletion potential for fossil resources MJ
Building materials > Vertical structures and facade > External walls and façade								
Section total	9,06E4	1,47E2	1,93E-4	2,82E2	2,37E1	1,67E1	1,14E-1	1,51E6
Building materials > Vertical structures and facade > Columns and load-bearing vertical structures								
Section total	1,63E2	6,47E2	2,47E-5	1,36E0	1,41E-1	5,81E-2	8,58E-5	2,1E3
Building materials > Horizontal structures: beams, floors and roofs > Floor slabs, ceilings, roofing decks, beams and roof								
Section total	7,72E3	5,06E3	3,05E-4	3,72E1	5,42E0	5,34E0	5,45E0	8,24E4
Building materials > Other structures and materials > Other structures and materials								
Section total	2,49E3	5,23E3	2,94E-5	1,33E1	1,83E0	2,48E0	1,21E-3	3,41E4
Building materials > Other structures and materials > Windows and doors								
Section total	9,57E3	4,34E3	6,44E-4	6,46E1	8,07E0	7,24E0	2,53E0	1,58E5

- Indicators describing building elements environmental impact.

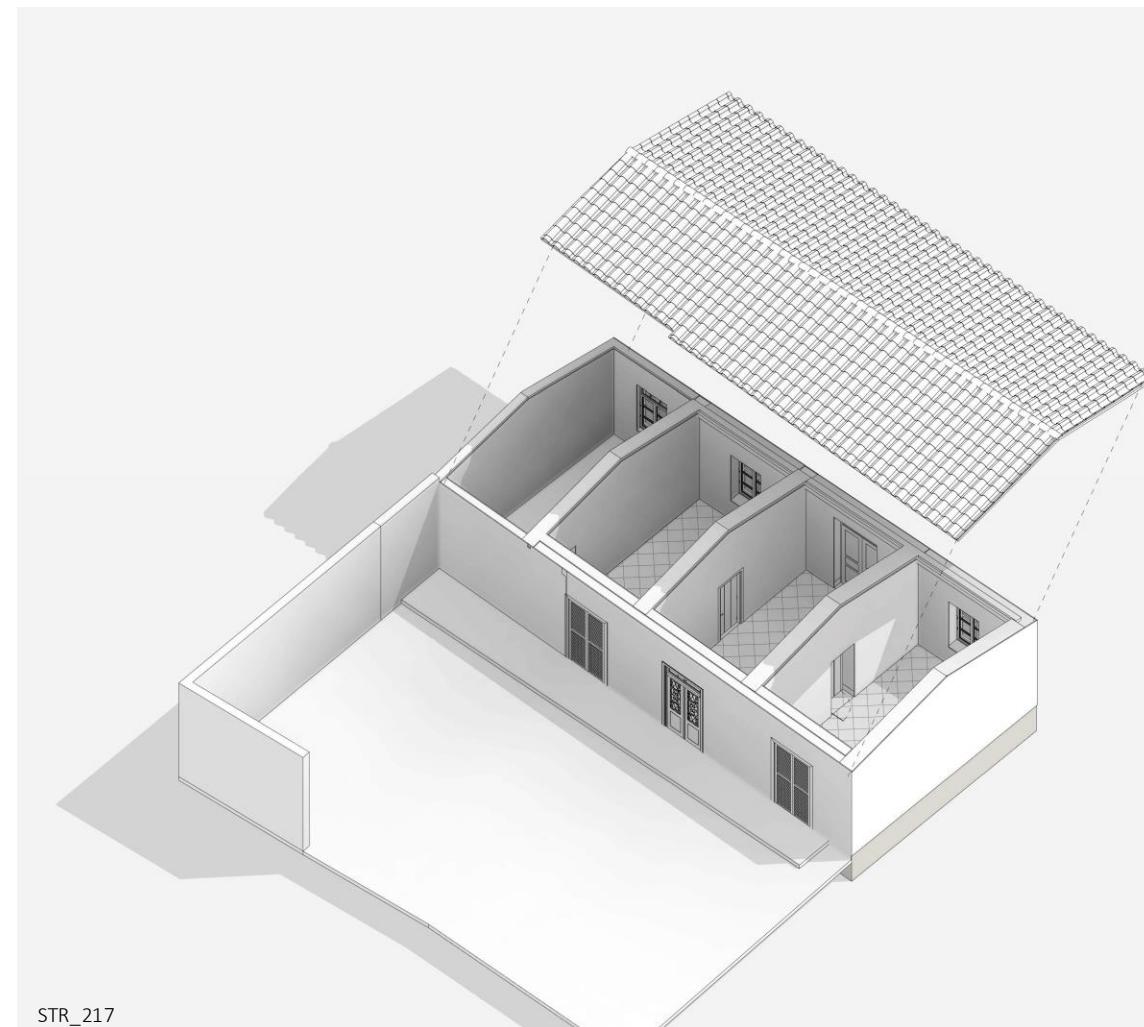
Category	Limestone façade panels and wall cladding	Adobe	Plaster mortar, reinforcement plaster	Lime paint, whitewash	Hardwood plank flooring (oak)	Dried timber, conifer	Wooden frame window	Fresh sawn timber	Clay soil, loose wet density	Float glass, single pane, generic	Ready-mix concrete, normal-strength, generic	Other items
GWP	54.97	13.23		5.75	7.65	5.16	1.11	3.29	0.41	1.27	0.96	1.73 4.47
Bio-CO ₂ storage	0.00	0.00		0.00	0.00	49.95	22.49	10.42	17.14	0.00	0.00	0.00 0.00
ODP	16.19	3.32		11.03	2.91	5.18	8.19	13.94	0.25	15.14	7.41	8.08 8.38
AP	62.32	3.18		4.02	2.29	7.81	2.00	5.91	0.34	2.09	2.36	1.71 5.98
EP	53.02	3.13		5.00	1.89	11.41	2.07	9.35	0.51	4.42	1.54	1.58 6.09
POCP	44.64	3.87		3.97	1.25	23.24	1.12	14.90	0.22	0.54	1.04	0.83 4.39
ADPE	35.73	6.82		1.47	6.06	0.75	0.48	8.64	0.54	33.82	0.48	3.17 2.03
ADPF	59.70	16.45		3.83	4.80	3.82	0.73	3.97	0.17	1.71	0.74	0.83 3.27
PERM	0.00	0.00		0.00	0.00	54.71	25.91	0.00	19.22	0.00	0.00	0.00 0.16
Total use of primary energy ex. raw materials	66.74	8.41		3.50	2.73	6.58	0.83	5.73	0.15	1.53	0.44	0.62 2.76
PERT	71.19	0.75		0.71	0.45	14.33	4.74	4.35	2.74	0.01	0.02	0.05 0.66
PENRT	53.90	14.24		5.97	4.43	5.67	0.43	6.18	0.22	2.70	0.75	1.06 4.45
FW	56.48	1.92		0.01	0.57	1.80	36.30	0.75	0.51	0.05	0.18	0.55 0.88

- Environmental indicators results for heritage building materials
- According to these results, an investigation is developing on Heritage building materials in order to verify their environmental footprint.

LESSONS LEARNT

VISUALISATION: multiple modes of visualisation help for the better interpretation of complex urban conditions.

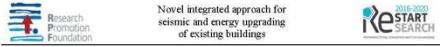
4D Simulations | Phasing



LESSONS LEARNT

VISUALISATION: multiple modes of visualisation help for the better interpretation of complex urban conditions.

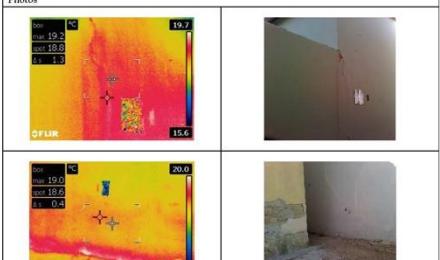
Integration & access to Non-Destructive Testing



Comments (please specify the number of hours and timeframe the building element gets influencing sunlight)
<ul style="list-style-type: none"> Exposed to solar radiation during sunrise only on a small surface of the wall. Exposed to solar radiation the entire wall approximately at 11 in the morning for about 1 hour. Mostly shaded due to proximity with neighbouring building.

Visible voids and cracks

Photos



Comments (please specify location on building element, type, shape and size of void/crack)

- Moisture build up can be observed at the lower part of the wall, similar to the rest of the building's walls.
- Crack at the joining point between building's wall and fence wall.

Properties

Property	Value
Surface temperature of building element [°C]	
Ambient Temperature [°C]	
Indoor Temperature [°C]	
Humidity levels of building room [%]	
Emissivity of building element [°C]	
Reflected temperature of building room [°C]	
Negative pressure (YES/NO)	
Conditions (hour, solar exposure)	

Comments (if yes, please specify the conditions under it is created and the differential pressure in [Pa])





The screenshot shows a 3D BIM (Building Information Modeling) application. At the top, there is a navigation bar with icons for Models, Objects, Classes, and Storeys. Below this is a toolbar with various icons. On the left, a sidebar displays a tree view of selected objects, including 'STR_547' (selected), 'IfcSite', 'STR_547', and 'CL +4.70'. The main area shows a detailed 3D model of a building's exterior, focusing on the roof and facade. The roof is covered with grey tiles, and the facade features a red door and windows. A small 3D coordinate system is visible near the bottom right of the model. The background is a light gray.

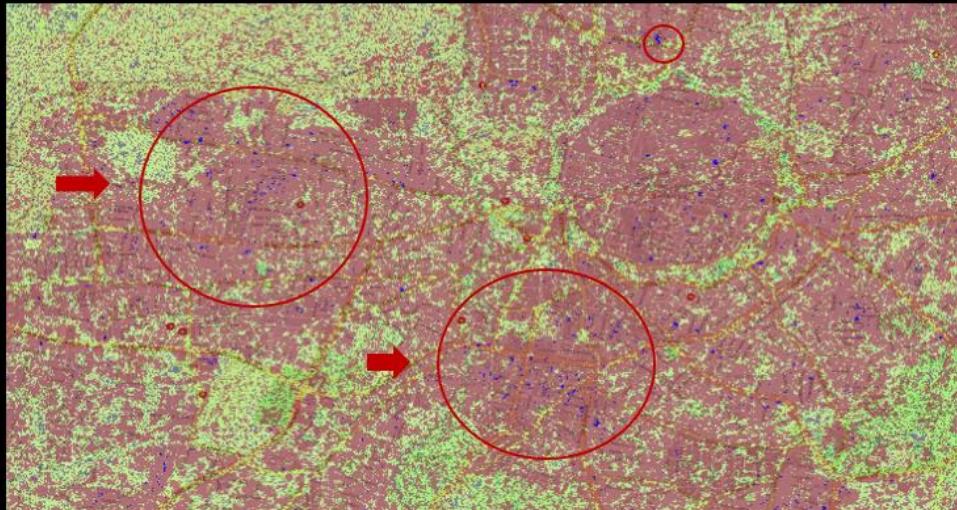


LESSONS LEARNT

TIME: interactive visualisation and 'time machine' function enable deeper understanding of complex phenomena and interactions between the many variables that are at play in urban landscapes of historic neighbourhoods.

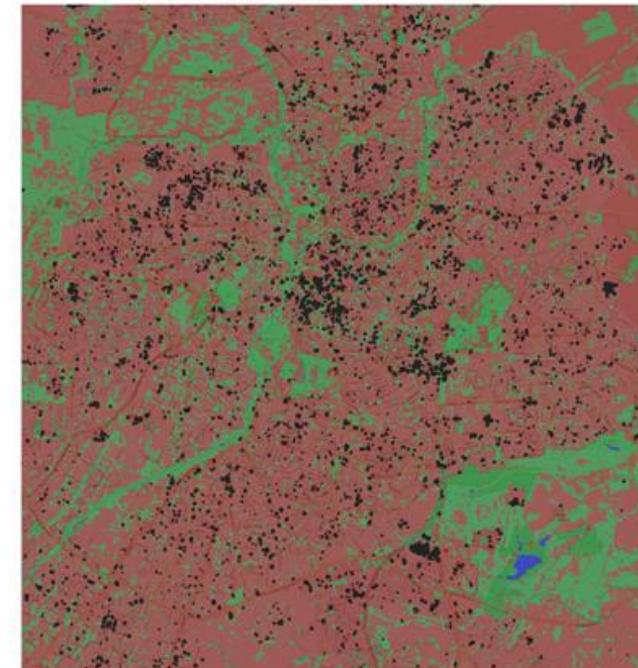
Change Detection

Visualization of Changes in QGIS



Most of the changes in the center of Nicosia are detected in the category of buildings.

Change Detection Map - Nicosia



Legend

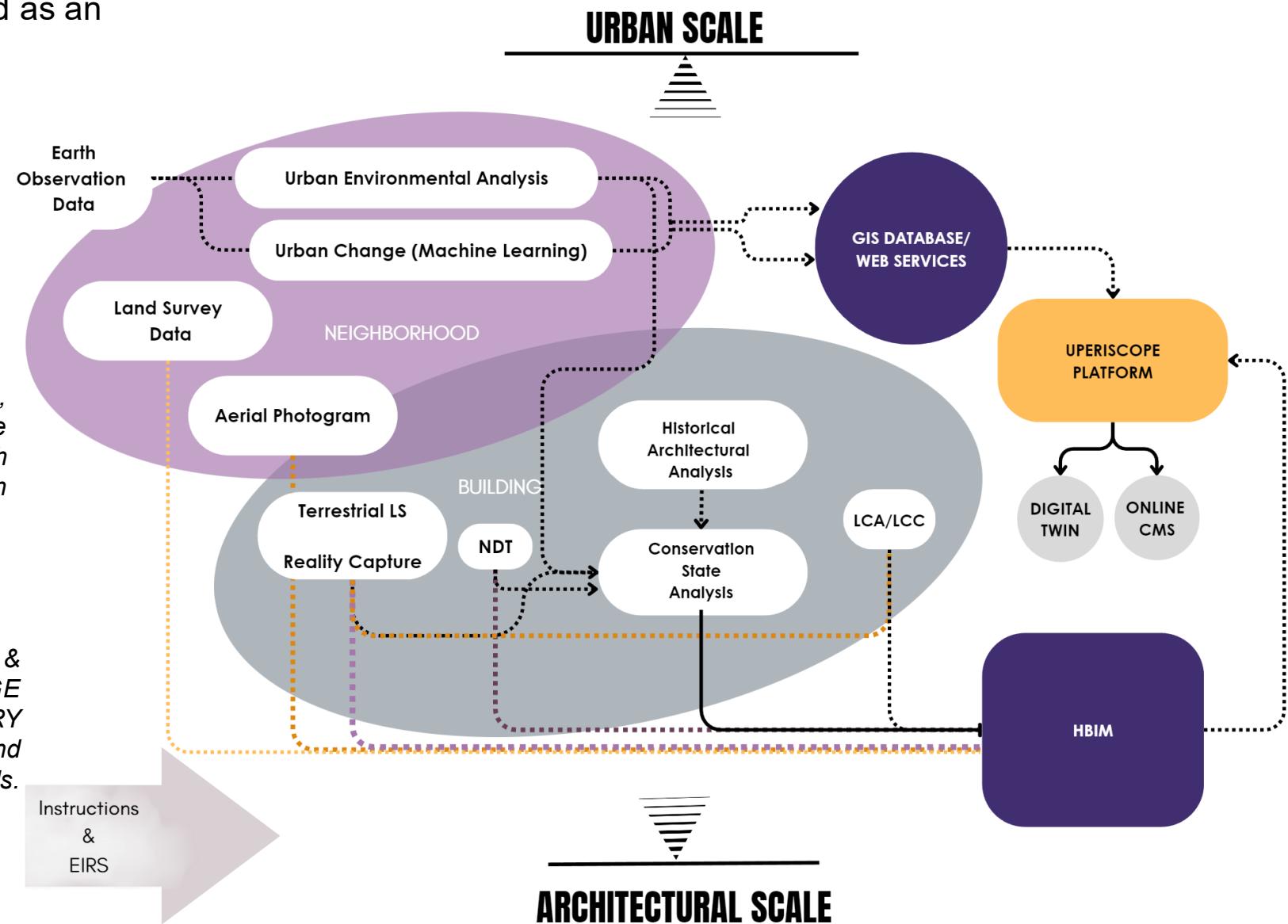
■	changes
■	Land cover
■	buildings
■	green/open spaces
■	water

Tzima, S., Agapiou, A., Lysandrou, V., Artopoulos, G., Fokaides, P. and Chrysostomou, C. (2023). "An Application of Machine Learning Algorithms by Synergetic Use of SAR and Optical Data for Monitoring Historic Clusters in Cypriot Cities" *Energies* 16, no. 8: 3461. <https://doi.org/10.3390/en16083461>

Tzima, M.S., Agapiou, A., Lysandrou, V., Artopoulos, G., Fokaides, P., Chrysostomou, C. (2022). An application of Machine Learning methods in Earth Observation datasets for monitoring historic clusters in Cypriot cities, *Proceedings of the 14th Conference on Sustainable Development of Energy, Water, and Environment Systems, SEE.SDEWES2022*. 0196, 1-14.

LESSONS LEARNT

SCALE: change detection of heritage buildings is better monitored in urban scale and not to be studied as an autonomous object.



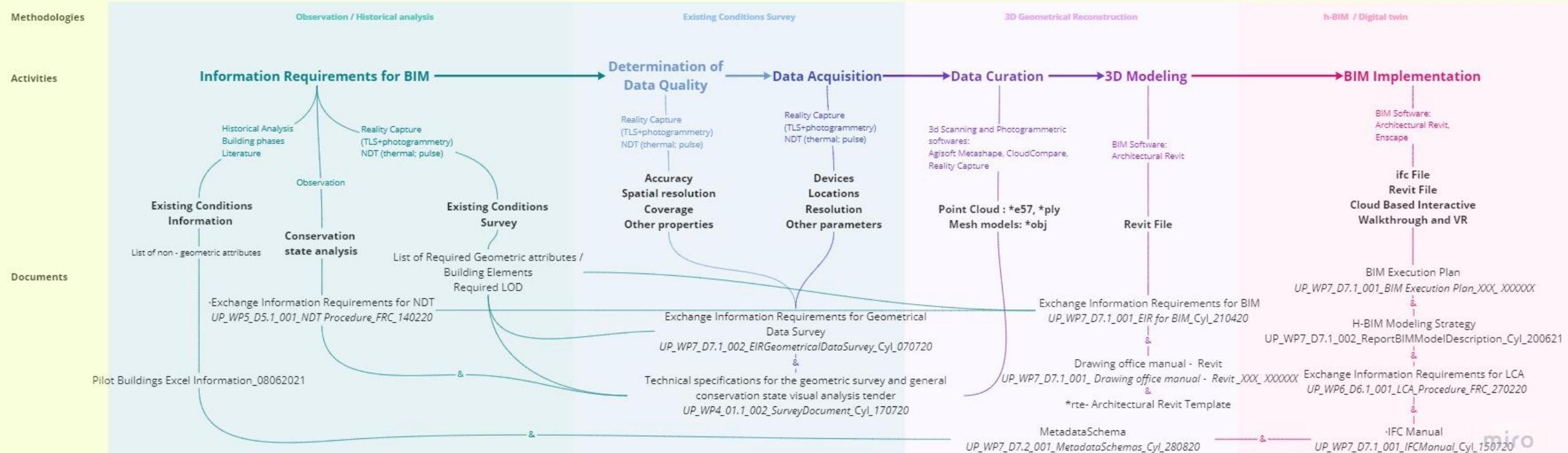
Artopoulos, G., Agapiou, A., Lysandrou, V., Fokaides, P., Deligiorgi, M., Sabatakos, P. (2023). *Data-driven multi-scale study of historic urban environments by accessing earth observation and non-destructive testing information via an HBIM-supported platform*.

International Journal of Architectural Heritage.
DOI: 10.1080/15583058.2023.2199408

Artopoulos, G., Deligiorgi Marissa, Georgiou Regas, & Alexandrou Kristis. (2023). *PORTAL FOR HERITAGE BUILDINGS' INTEGRATION INTO THE CONTEMPORARY BUILT ENVIRONMENT. Guidebook for the preplanning and development of Heritage BIM models*. Zenodo. <https://doi.org/10.5281/zenodo.8190485>



NDT at Strovolos pilot building. TLS 3D documentation. Aerial documentation of pilot building block at Strovolos. Surface temperatures over Limassol and Strovolos pilot areas



Level I	Level II	Level III	Level IV	File type	Download
Map	2D	-	-	-	-
	3D (point cloud and mesh)	-	-	-	-
Inventory	Filters	-	-	-	-
	Results	-	-	-	-
Item page	Existing conditions information	Historical data	Listed tab	jpeg, tiff, png	-
			Building description	word	-
			Identity data	excel	-
			Drawings	jpeg, tiff, png	-
			Photographs of existing conditions	jpeg, tiff, png	-
		Conservation State Analysis			pdf, word and jpeg, tiff, png (separate files)
		Existing Conditions Survey	Elevations and 3D views	jpeg, tiff, png	-
			Pointcloud	laz	-
	H-BIM	3D geometrical Reconstruction	3D views	jpeg, tiff, png	-
			3D model	fbx	-
		h-BIM model	Bill of quantities	Excel	excel
			2D drawings: Planviews, Elevations, sections & 3D views	jpeg, tiff, png & excel	pdf
			h-BIM families	excel and rfa	rfa
		Bill of Quantities	Excel	-	excel
	LCA	LCA report	-	word	pdf
	NDT	NTD report	-	jpeg, tiff, png, word	-
		Thermography photos	-	jpeg, tiff, png	pdf
		3D model	-	fbx	pdf
	Interactive visualisation	Scan	-	jpeg, tiff, png	-
		Browser link	-	external	exe
		Download	-	jpeg, tiff, png	exe
		Photographs of visualisation	-	-	-
Help	HBIM library	Omniclass Classification	-	-	excel
		Materials	Construction materials	-	excel
			Finishes	-	-
		Components	-	excel, rfa	rfa
	HBIM implementation	Observation / Historical analysis	-	word	pdf
		Existing conditions	-	word	pdf
		3D Geometrical Reconstruction	-	word	pdf
		H-BIM / Digital twin	-	word	pdf
Profile	Resources	Renovation Policies	-	-	-
		Pool of examples	-	-	-
	Personal info				
	Upload	GIS	-	-	-
		Environmentak	-	-	-
		3D pointcloud	-	-	-
		IFC	-	-	-
		NDT	-	-	-
		LCA	-	-	-
		resources (word, pdf, etc.)	-	-	-

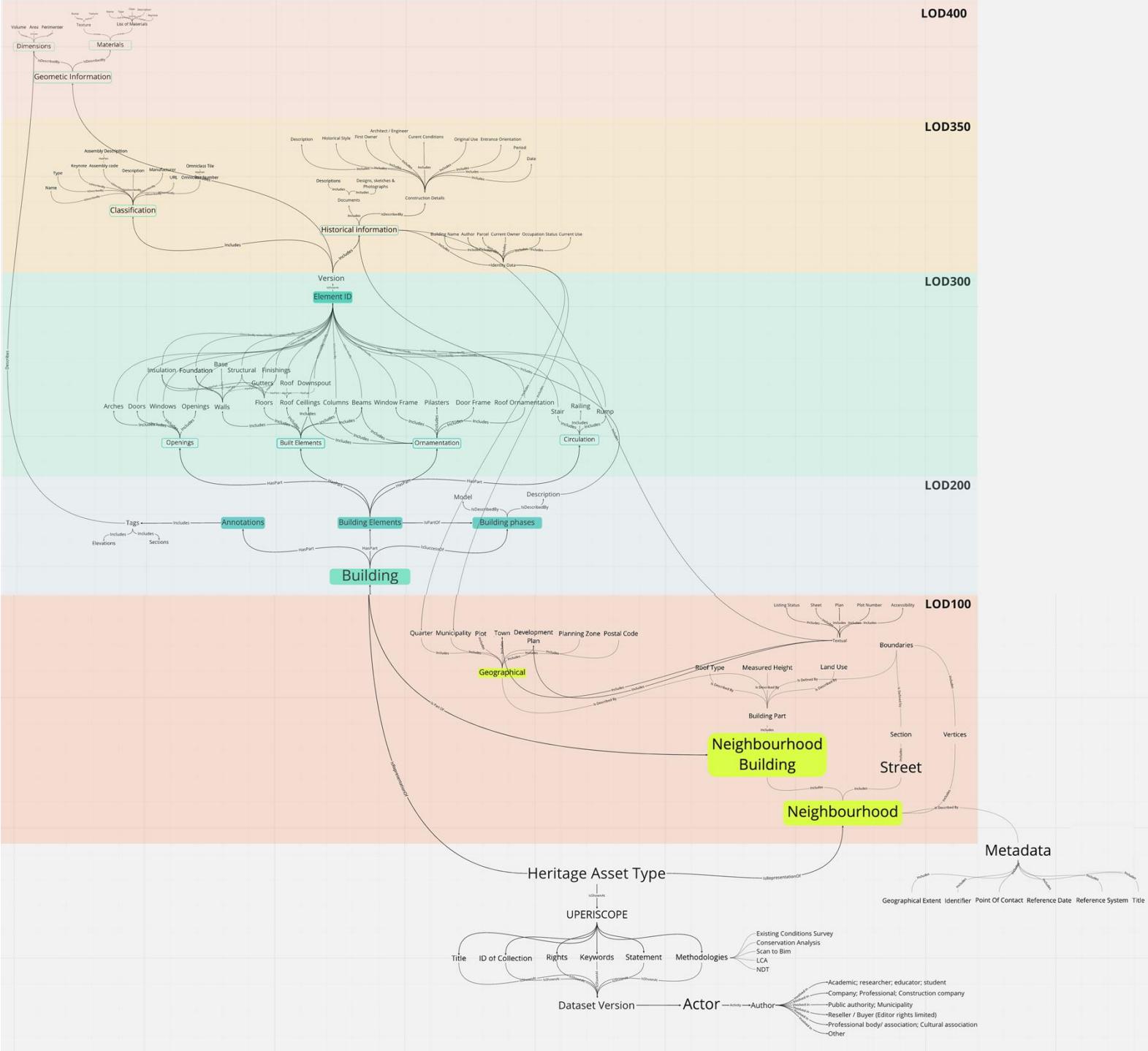
METADATA

The neighbourhood and architectural datasets/collections can be grouped:

- Land registry identifier of neighbourhood/district,
- environmental parameters,
- information about identification of the asset,
- information about the asset and its location,
- data about documentations and source of the asset – methods used for its representation,
- information about the structure of the building and its component parts,
- information about activities occurred at the moment of the survey,
- information about its provenance,
- information about storage of asset (reference, repository)
restrictions of use,
- administrative information.

Results: A new metadata schema about “Architectural Heritage in the Built Environment”

Process graph to structure and enable the integration of multiple datasets on the UP platform



Municipality

- Strovolos
- Limassol

Period

- interwar
- unknown

Historical Style

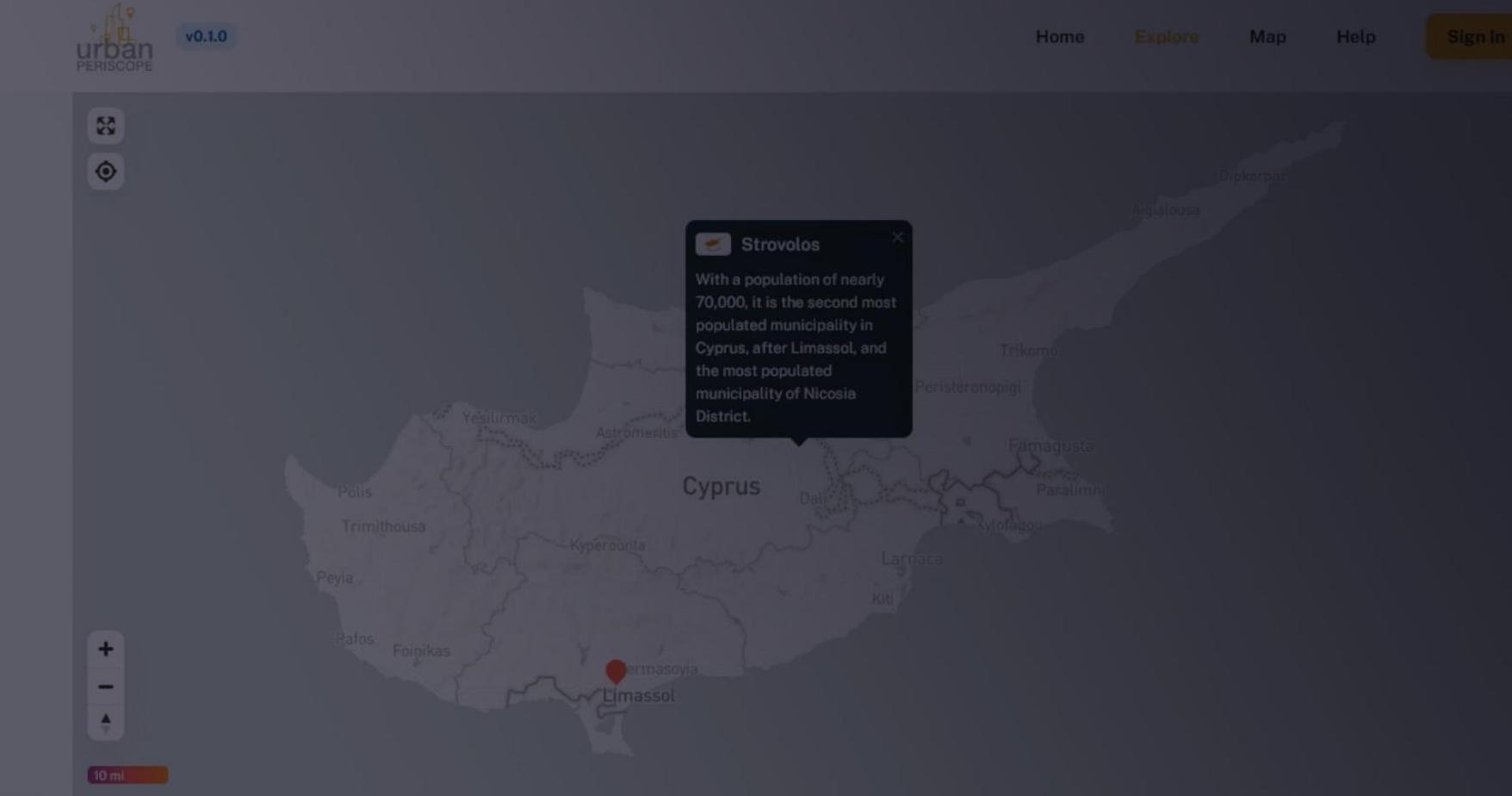
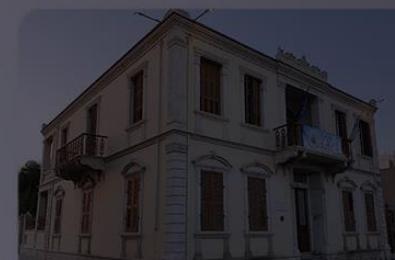
- neoclassical
- rural Cypriot architecture
- traditional

Main Material

- adobe
- sandstone
- stone
- timber

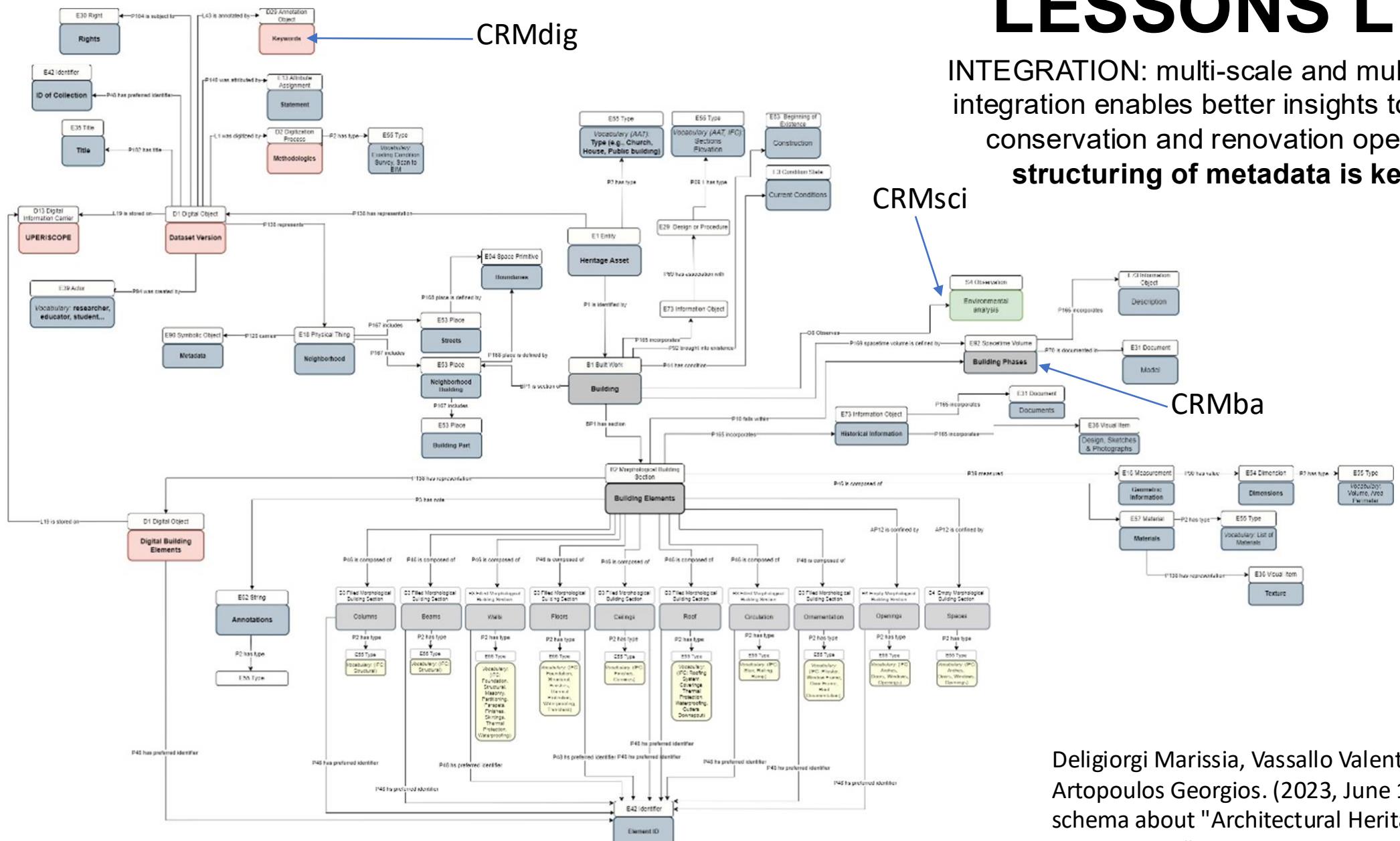
Original Use

- residential
- school

[≡ Clear All](#) Search building...Filters  Sort By: Featured 

LESSONS LEARNT

INTEGRATION: multi-scale and multi disciplinary data integration enables better insights to heritage building conservation and renovation operations. **Semantic structuring of metadata is key for integration.**



CIDOC CRM alignment

LESSONS LEARNT

USER-FRIENDLINESS: digital tools and online repositories/building databases addressing the needs of professionals and authorities need to be co-developed together with their target users and not in-vitro by researchers. **Easy finding of information and future-proofing of tools via dataset onboarding are key.**



Community building training workshops

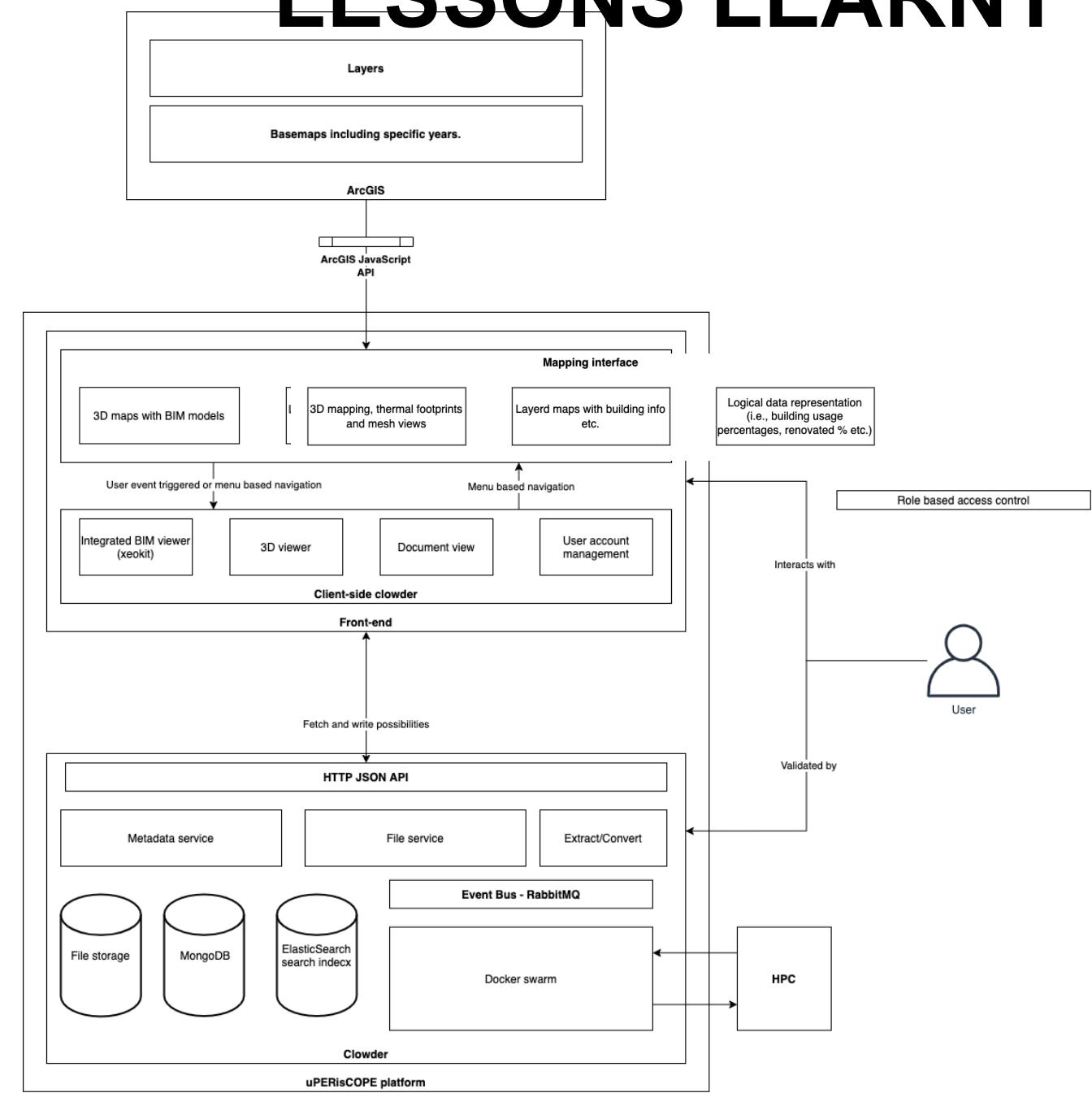
PERIsCOPE STAKEHOLDERS MAP		
1	TAKEDOWN	MANAGEMENT TEAM / COMMUNITY
2	policy makers	UNDP technical committee
3	scientific community	Department of Environment and Energy, Cyprus
4	other relevant projects	Cyprus Association of Civil Engineers
5	Public authorities	Municipality of Aglantzia
6	Public authorities	Strovolos Municipality
7	Public authorities	Limassol Municipality
8	Public authorities	Municipality of Nicosia
9	Public authorities	Engomi Municipality
10	Public authorities	Ayios Dometios Municipality
11	Public authorities	Latsia Municipality
12	Public authorities	Lakatamia Municipality
13	Public authorities	Department of Antiquities
14	Public authorities	Department of Antiquities
15	Public authorities	Municipality of Pafos
16	scientific community	Cyprus Architects Association
17	scientific community	Cyprus Civil Engineers & Architects Association
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32	policy makers	Workshops feedback & Platform release life cycle
33	other relevant projects	UNDP technical committee
34	scientific community	Department of Environment and Energy, Cyprus
35	other relevant projects	Cyprus Association of Civil Engineers
36	scientific community	Cyprus Mechanical Engineers Association
37	other relevant projects	Federation of Associations of Building Contractors Cyprus
38	other relevant projects	Federation of Environmental Organisations of Cyprus
39	other relevant projects	Ms Elpida Christou/ European Office Cyprus
40	Public authorities	Union of Cyprus Communities
41	Public authorities	Ms Panayota Hadjiona/Sewage Board Nicosia
42	scientific community	The Union of Cyprus Municipalities
43	policy makers	Town Planning & Housing
44	professionals	WIRE FS company http://www.wire-fs.com/
45	Public authorities	Department of Antiquities
46	Public authorities	Department of Public Works
47	Public authorities	Department of Antiquities
48	Public authorities	Department of Antiquities
49	Public authorities	Department of Antiquities
50	Public authorities	Tyghia Xiroximtrias & Xiroximbas
51	Public authorities	Yπουρεία Διαχείρισης Τ/Κ Περιοχών Αεγαύου και Κεντρικής Μέσης Επαρχίας Αεγαύου και Αιγαίων (κεντριά)
52	Public authorities	Tyghia Δημοσίων Έργων

Features and functionalities

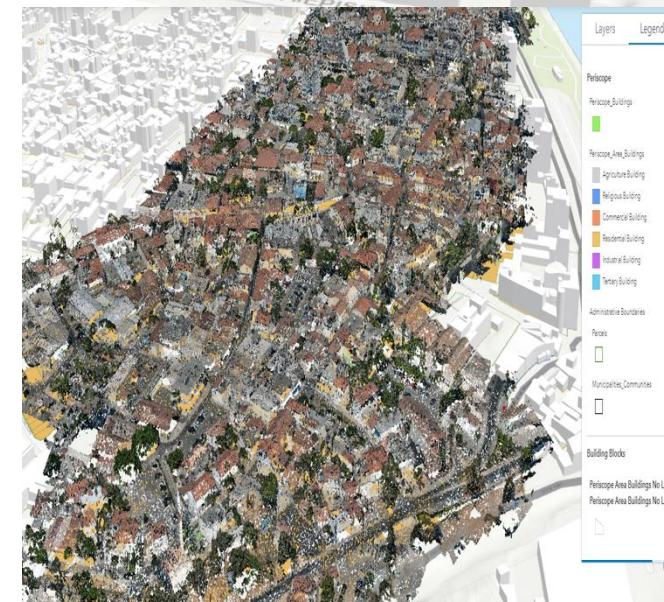
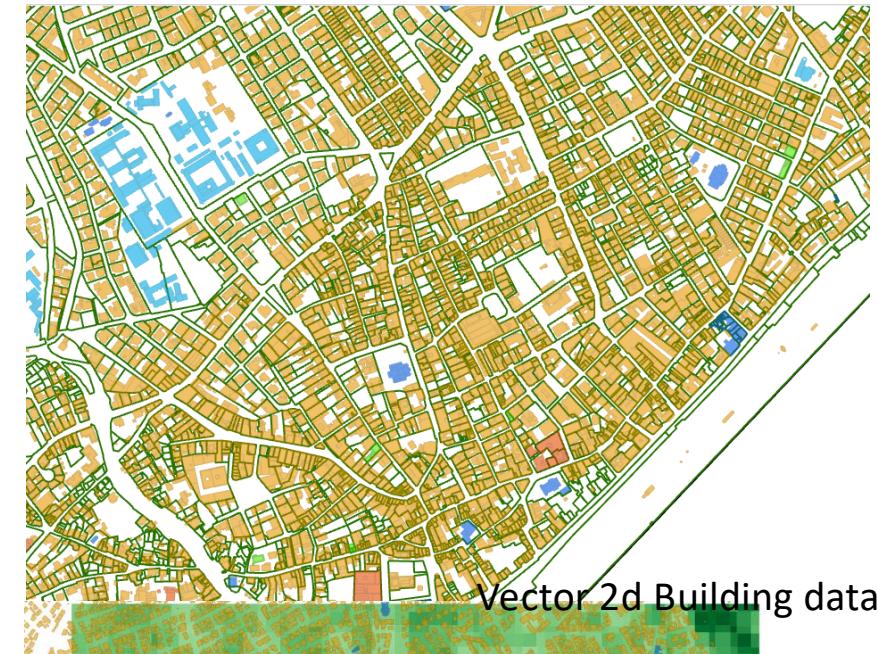
- ▶ **Building Catalogue**, showcasing the buildings hosted on the platform along with their specific details.
- ▶ **Interactive 3D Visualizations**, where users can explore the interactive Historic Building Information Modelling (HBIM) model visualization as well as the interactive 3D building visualization.
- ▶ **Monitoring**, as the platform offers environmental data presented in 3D form. Users can access various layers showing the mean temperature of different areas, each with a different visibility range.
- ▶ **Information Resources**, gathered during the project. This page serves as a reference point for users to optimize their utilization of the platform.
- ▶ **Administrative Environment**, to manage the platform's resources, including creating new buildings and gaining insights into implementation and management aspects.

LESSONS LEARNT

SUSTAINABILITY: the development of tools, platforms and databases should invest resources in ensuring future maintenance and sustainability. **FAIR principles and data interoperability are key.**



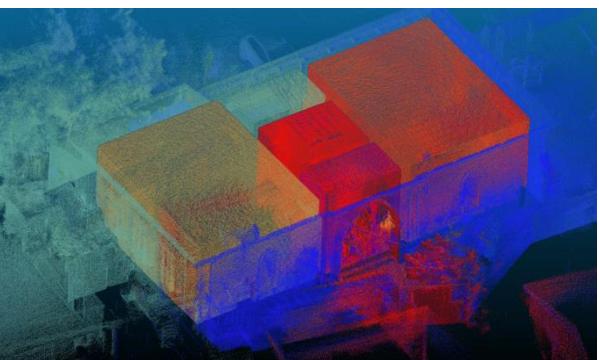
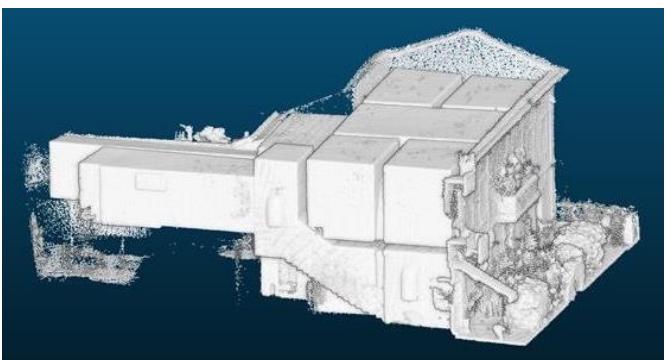
Data integration in 3D GIS web services



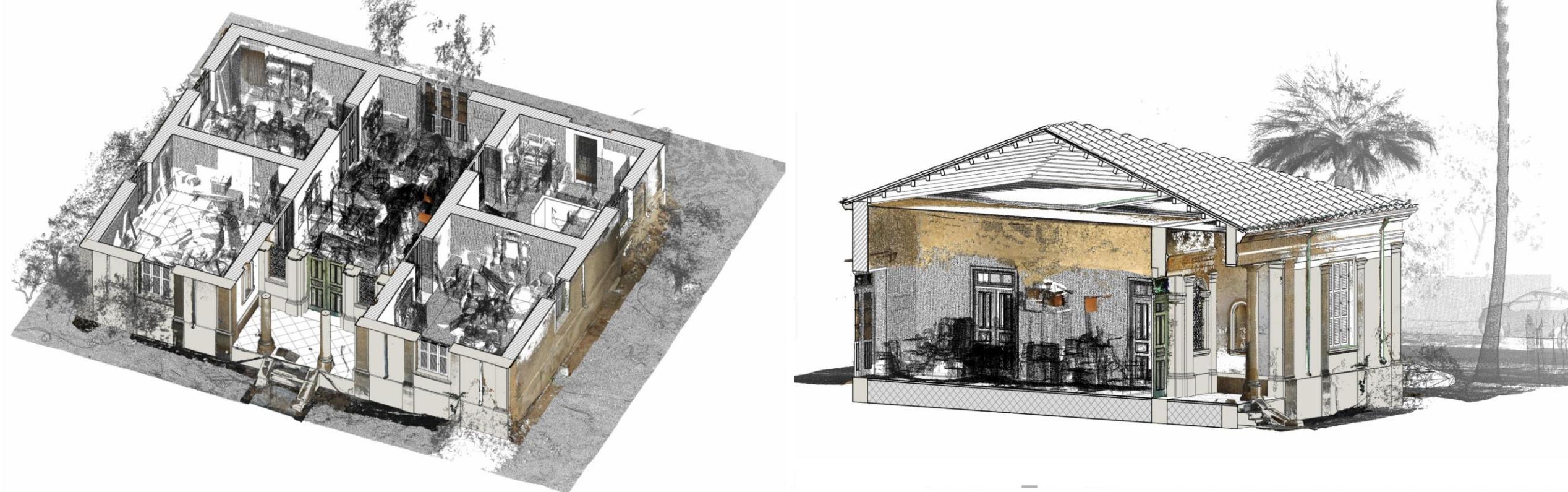
- Pilot buildings' GIS data
- Neighbourhood Point Cloud data
- Area environmental data / Temperature data

Multi-scale 3D documentation

- LOD1 polyhedral building models on urban scale
- LOD2-compliant building models on neighborhood scale
- LOD3-compliant building models on building scale



H-BIM models and 4D simulation The 3D representations of the pilot buildings selected to function as testbeds for the development of the UP platform. The use of interactive visualization to visualize and assist in the interpretation of complex information about the materiality of the building, in 'as-built' condition.



BIM Implementation (4 Templates, 8 Documents)

[1] Building Identity Data , [2] List of Geometric Attributes, [3] BIM template [4] BIM Sheet List

[1] Naming Convention, [2] BIM Execution Plan, [3] Exchange Information Requirements for Geometrical Data Survey, [4] BIM Data Check List, [5] Scan-to-BIM diagram, [6] Exchange Information Requirements for BIM, [7] IFC Manual, [8] UP Metadata Schema.

LESSONS LEARNT

SUSTAINABILITY: the development of tools, platforms and databases should invest resources in ensuring future maintenance and sustainability. **FAIR principles and data interoperability are key.**

The screenshot shows the Zenodo search interface with the query "Urban PERISCOPE". The results page displays 15 items, all categorized as "Project deliverable" and "Open Access". The results are sorted by "Most recent" (asc.).

- Technical specifications for the geometric survey and general conservation state visual analysis tender**
Georgios Artopoulos; Marissia Deligiorgi;
The purpose of the Exchange Information requirements is to provide support and to serve as requirements guide in all designs of the 20 buildings selected (10 buildings in the Old Strovolos core district, Nicosia and 10 buildings in the Cami Cedit and Arnaut districts, Limassol) to function as testbe
Uploaded on July 17, 2023
1 more version(s) exist for this record
- BIM Data Delivery Checklist**
Georgios Artopoulos; Marissia Deligiorgi;
This document presents the way the BIM data integrated into the 3d model must be exported and organised in order to be uploaded properly in the UP Platform.
Uploaded on July 17, 2023
- Name Convention**
Georgios Artopoulos; Marissia Deligiorgi;
Within the UP project, the naming convention follows the requirements specified in BS1192: 2007 (Collaborative production of architectural, engineering and construction information – Code of practice) and will be used to name all kinds of FILES referring to the HBIM models, namely 3D BIM model
Uploaded on July 17, 2023
- Metadata Schemas**
Georgios Artopoulos; Marissia Deligiorgi;

DIGITAL METHODS .by AGENCY & SCALE

- . On-site participation (bottom-up)

CyberParks - Fostering knowledge about the relationship between Information and Communication Technologies and Public Spaces supported by strategies to improve their use and attractiveness.

COST ActionTU 1306 - <http://www.cost.eu/COST Actions/tud/TU1306>



COST is supported by the EU Framework Programme for Research and Innovation Horizon 2020



This work has been supported by the DARIAH ERIC.

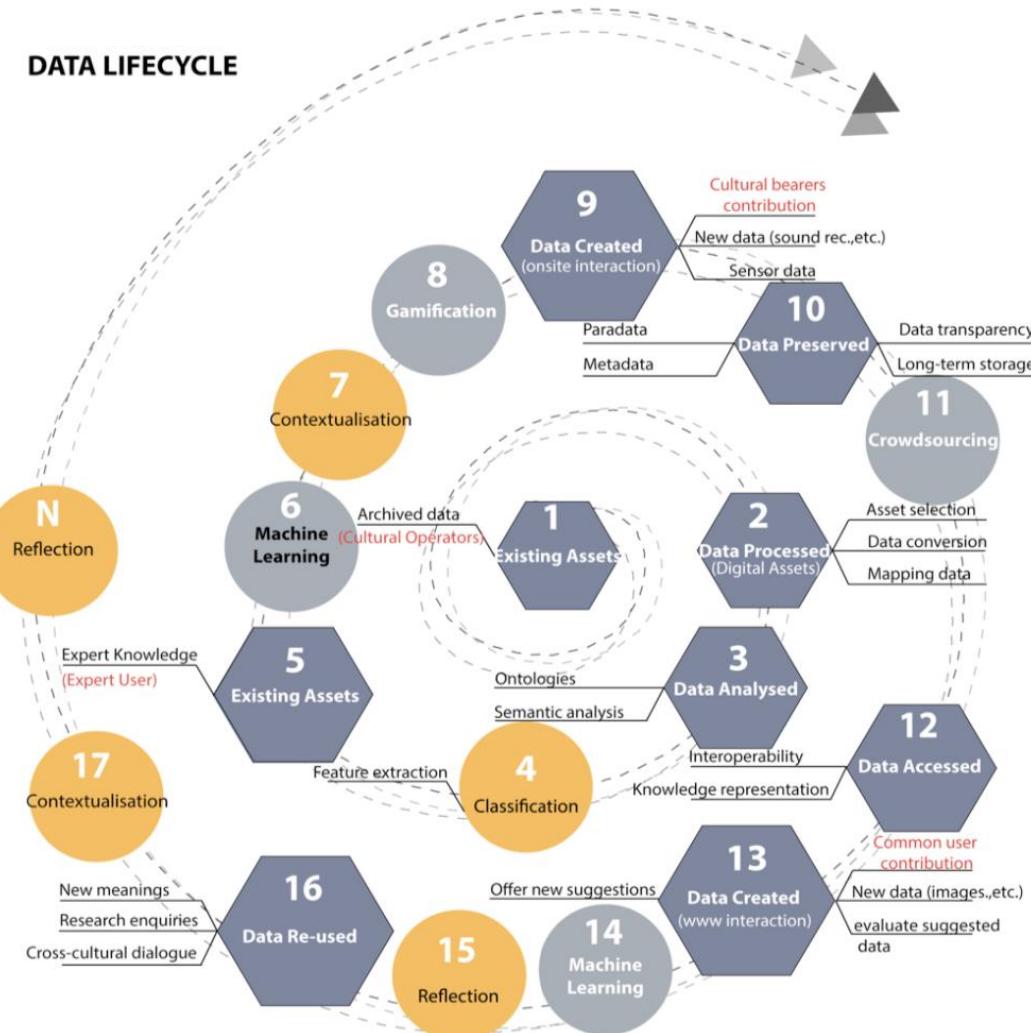


Kultur und Informatik: Hybrid Systems

Multimedia

vwh

Artopoulos, G., Synnes, Kåre, Bahillo, Alfonso, Smaniotti Costa, Carlos, Rebernig, Nataša 2018. "Use of Data Analytics for Enriching Public Spaces with Unique Experiences of Localised Cultural Heritage Content." In Carsten Busch, Christian Kassung & Jürgen Sieck (Eds). *Kultur und Informatik: Hybrid Systems*. Glückstadt: VWG: 99-112.



Data Lifecycle. The exponentially iterative process of user engagement-collection-digestion-semantic classification-automated suggestion loops facilitates the enrichment of data collections and reflecting on them, and thus promotes dialogue between user communities.

Built heritage

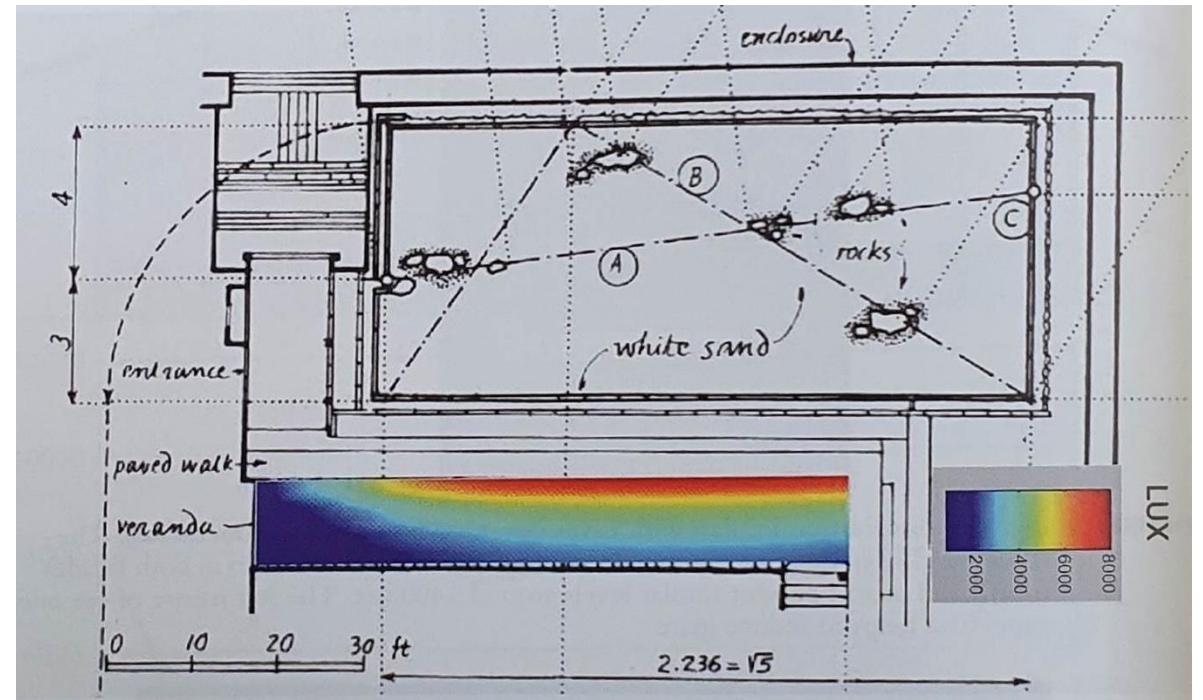


Intangible cultural heritage: festival of Patios





Data collection for quantitative analysis



Qualitative analysis

A mind map created by a resident of a Patio in Cordoba. Through this method, the project will collect feedback on the under-study ICH, its associated spaces and linked memories of their inhabitants that participate in the project.



**My favourite Patio
is...**

EL MAPA SOCIAL DE CÓRDOBA.

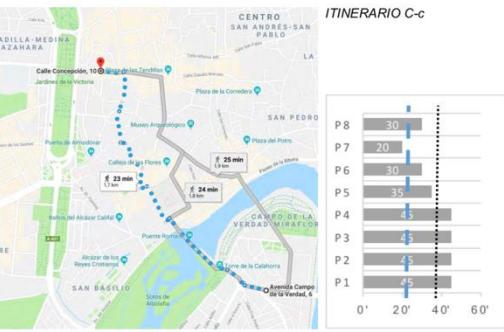
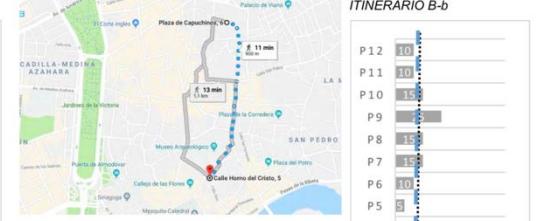
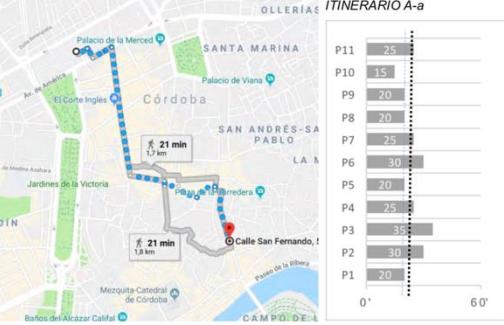
12+1 EJERCICIOS DE MEDICIÓN DE
LA CIUDAD DE CÓRDOBA

28 NOV. 2.017 - 07 ENE. 2018

CENTRO DE CREACIÓN CONTEMPORÁNEA DE ANDALUCÍA



Centro Andaluz de Arte Contemporáneo
CONSEJERÍA DE CULTURA



Smaniotto Costa, C., García-Esparza, Juan, Artopoulos, G., Wehmeier, C. & Rafat-Saleh, M. (Chapter 5) (2024). Heritage-based storytelling and narratives. The added value of engagement in placemaking and heritage communication. In Smaniotto, Costa, Carlos, Ed. (2024). Dynamics of Placemaking, Volume 3: The Future of Placemaking and Digitization – Emerging Challenges and Research Agenda. BRILL



PAX - Patios Axerquía
@patiosaxerquia

You might like

- Palacio de Congreso... @PCongresosCordoba
- C3A Centro de Crea... @C3A_Arquitectura
- Mind Body Baby @MindBodyBabyGyp

Trends for you

- Politics Trending Ukraine
- Politics Trending Nigerians
- Politics Trending Russia

10:00: Workshop internacional y paseo patrimonial #JornadasEuropeasPatrimonio entre #patios. #PAX organiza con @IAPHpatrimonio #Catedravivienda @ETSASevilla @in_uco @Univcordoba @imdeec @DARIAHeu @CyprusInstitute @ULusofona Inscripción: jornadaspatrimonio.iaph@juntadeandalucia.es

10:25 AM · Oct 5, 2022

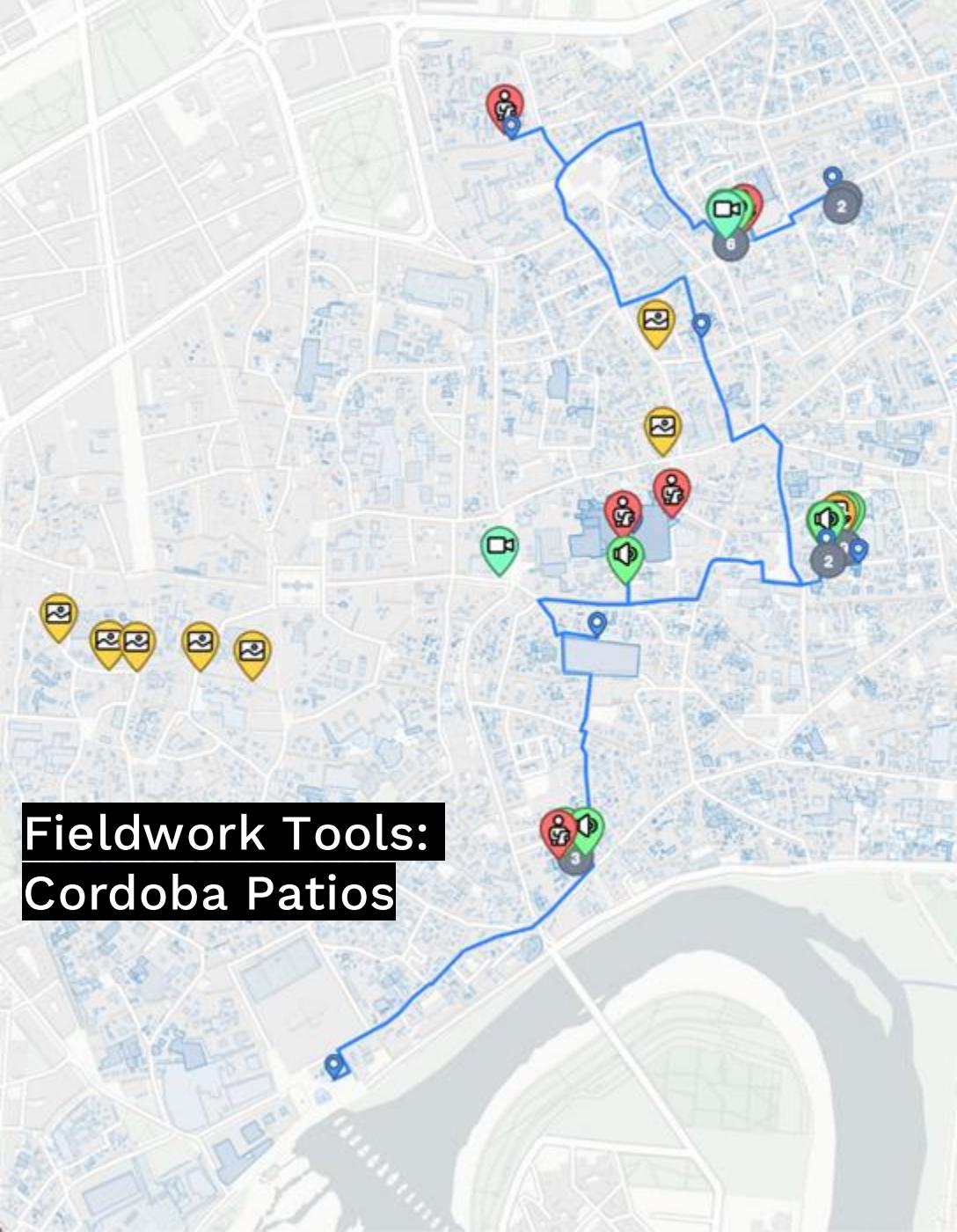
6 Retweets 13 Likes

[Tweet your reply](#) [Reply](#)



PAX-Patios de la Axerquía, Instituto Andaluz del Patrimonio Histórico, Universities of Seville and Córdoba, DARIAH EU.

Fieldwork Tools: Cordoba Patios



dariah.cloud
workshop aggregator

Resumen
PASEO PATRIMONIAL: comparteando el patrimonio material e inmaterial con Córdoba a través de una herramienta digital.

¿QUÉ NOS CUENTAS SOBRE LAS CASAS-PATIO DE CÓRDOBA?
Participa en la recopilación de información sobre las casas-patio de Córdoba y comparte historias sobre este rico patrimonio durante el paseo patrimonial del día 07/10/2022.

Herramientas del taller

- Cuestionario
- Publicación
- Mapa

Logout | Perfil | General user | Log out | Términos de servicio | Política de privacidad

public dissemination

lived experiences

Córdoba
INFORMATION COLLECTED ON CÓRDOBA'S PATIO HOUSES

We're sharing stories, images, and sounds about the patio houses gathered with the help of participants from the heritage walk that took place on 07.10.2022 as part of the European Heritage Days, with the aim of understanding the situation of the material and immaterial heritage of Axerquía.

'PATIO WALK': USING ICT TO INVESTIGATE THE HERITAGE VALUE OF COLLECTIVE HOUSING.

The heritage walk has already taken place, but you can continue to explore Córdoba's material and immaterial heritage through this digital tool.

HOW TO USE THE TOOL

To view the information associated with a post, click on the corresponding marker on the map.

CÓRDOBA COURT GAME

Click [here](#) to visit an additional interactive social game inspired by the survey.

Click [here](#) to view the game's summary.

Survey Results

Submit Date (UTC): 2022-10-07 19:35:08

¿Le gustaría recibir actualizaciones sobre los resultados del proyecto a través de su correo electrónico?: 1

¿Cuál es tu edad?: 46-59

¿Cuál es tu profesión/ocupación?: Periodista

relacion con cordoba:

Soy residente, vivo aquí + Trabajo aquí + Conozco a alguien que vive aquí

location-tag:

Casa-patio, calle Montero 12,

¿Quién vive en la casa patio actualmente?: 14

¿Cómo se vivía antes en esta casa-patio? ¿Consideras que ha cambiado mucho?: Antes de compartirían espacios comunes mucho más reducidos , las viviendas eran más reducidas. Actualmente se han aglutinado viviendas para conformar las de ahora

¿Qué tipo de relaciones hay, se genera entre los residentes de la casa-patio?: Los residentes son socios de una cooperativa de viviendas con una cesión en uso. Cada uno posee un porcentaje de zona privada y las zonas de uso común

¿Cómo piensas que se puede preservar este patrimonio que es la casa patio a nivel individual y colectivo?:

Media Post

2022-10-07 23:59:12



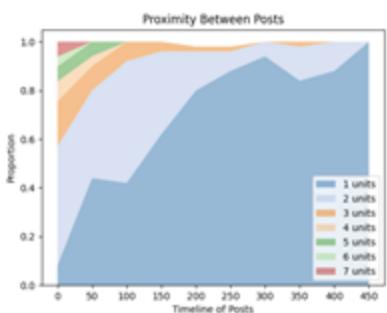
immersive environment

mass collaboration



spatial-temporal behaviour analysis

Neighborness: Do posters cluster together or spread out?



We measured the distance between each newly placed object and its closest neighbor at the time of posting. We call this a neighborly proximity - or 'neighborness'. Posts that are 1-2 units away from an existing post are said to be neighborly. We can think of general 'neighborness' as a measurement of preference for either clustering, or spreading out as we co-occupy space.

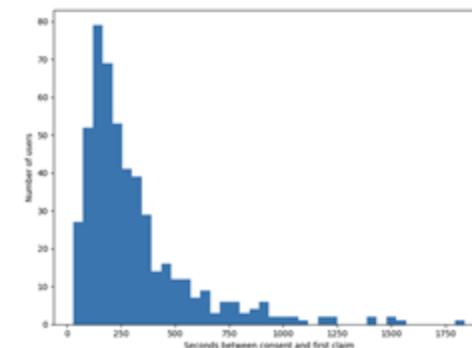
Visualizing Dropouts, Posts, and Returns



This sankey diagram shows every gameplay session, where we group session events like post or did not post into buckets, to see how that session develops and where behaviors are distributed.

Wehmeier, C. and Artopoulos, G. (2023). MetaFraming: A Methodology for Democratizing Heritage Interpretation Through Wiki Surveys. In Proceedings of the 20th International Conference on Culture and Computer Science: Code and Materiality (KUI '23). Association for Computing Machinery, New York, NY, USA, Article 4, 1–9. <https://doi.org/10.1145/3623462.3623465>

How long did participants read before posting?



Input
User Name: Alex
Location: Seattle
Message: thx the floral gifts I hope we all take turns watering them every day keep them alive no dead plants next year

item_id: 21655d1787bd1c63dde143aea25d4834

Output
Conviviality: 4
Sincerity: 3
Effort: 3
Location: North America
Mode: expression
Topics: floral gifts, watering, plants
Affiliation: []
Tone: grateful, hopeful, cautious
Persona: real identity
Orientation: present
Experience: {"floral gifts":4,"watering":3,"plants":3}



OpenAI

Public Open Space

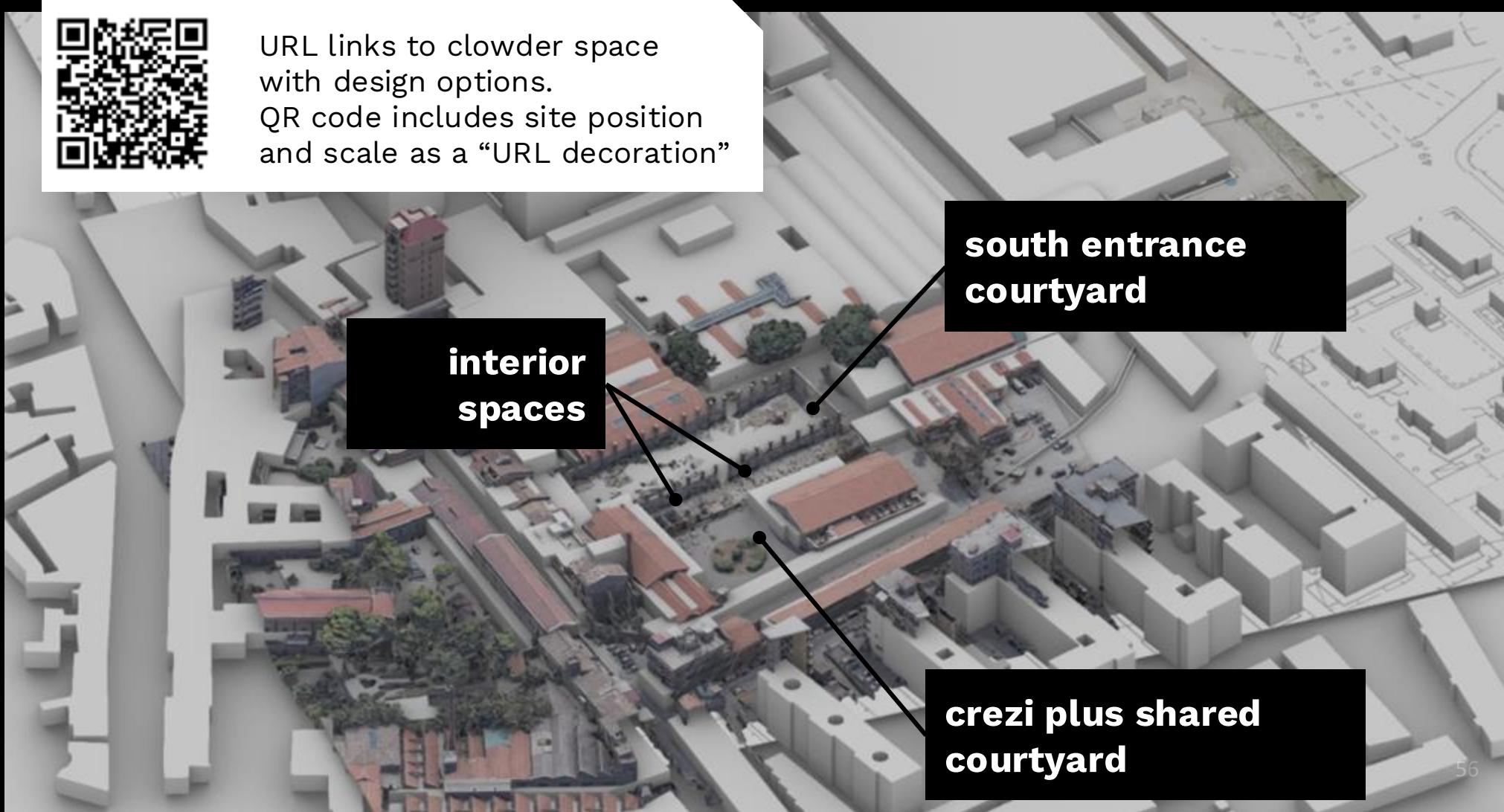


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Strategic Development Scenarios Proposal Visualization, 1:1



URL links to clowder space
with design options.
QR code includes site position
and scale as a “URL decoration”



Strategic Development Scenarios Proposal Visualization, 1:500



Users scan a QR code and select between available plans, seen at 1:500 scale over a printed site plan.



Strategic Development Scenarios

Proposal B (Radical scenario)







ATRIUM

Advancing Frontier Research
in the Arts and Humanities



**ARChitectural HEritage
Thesaurus through
Integrated digital
Procedures and Open data
(ARCHETIPO)**



**Facilitating access to digital research infrastructures and
advancing frontier knowledge in the arts and humanities
– across disciplines, languages and media.**

Expected Outcomes

- Improved **metadata** quality of existing catalogues and repositories
- Consolidated **service portfolio**
- **Workflows** and **demonstrators** highlighting the **composability** of services
- Promotion of **standards** and **FAIR** principles



Scope of the project: both deep and wide

- Facilitating access to a wide array of essential **text, image, 3D, sound-based, and geospatial** services that benefit a number of other disciplines within the arts and humanities, and covering all phases of the research data lifecycle.



**Thank you
for your attention**

