

Mapping the Landscape of Circular Design Thinking and Practices in Architecture Education in Greece

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Abstract. The present contribution discusses how circular thinking and design-and-build practices are implemented in architectural curricula in Greece. Run simultaneously with a broader survey that seeks to identify the adoption of circular construction in different educational contexts across Europe, this study investigates the features of the Greek paradigm across the seven accredited public schools of architecture in Greece and the one in Cyprus. Both works are situated within the broader scope of the ERASMUS+ project *Crafting Circularity: Rethinking Sustainable Design and Construction in Architecture Education*, aiming in building a methodological framework on project-based learning-through-making methodologies to embed circular thinking in architecture education, eventually resulting in a paradigm shift towards circular design practices. The current mapping assignment is built on the outline of the principal survey, which has three axes: investigating institutional backgrounds, theory courses and design studios, and design-and-build modules in architectural curricula. A modified version was employed to respond to the peculiarities of the Greek paradigm: broadening the scope of the survey under or around the wider sustainability umbrella, adding a fourth axis on elements in-between education and research or informal extra-curricular activities, including an actual mapping component and revising the structure and content of the original survey.

1 Context

1.1 Circular Practice in the Construction Sector

According to major reports worldwide [1, 2, 3], the construction industry is held largely responsible for the environmental crisis of today, exploiting vast quantities of raw materials, producing more than a third of global waste and causing at least 40% of the world's carbon dioxide emissions.

In recent years, an array of R-strategies [4] is discussed within the research community and new models tackling resource scarcity emerge in practice, while education is slowly adjusting. While several earlier models had put the emphasis on RE-cycling, the recent paradigm in the construction sector embraces finer levels of dealing with construction waste. Practitioners and researchers of the built environment suggest RE-use or even RE-duce strategies to put circularity in practice. The reuse of building materials, components or structures, shifting between building layers, is employed for more than a decade in western European countries, such as the Netherlands, Belgium or Denmark; firms like Superuse Studios (NL) [5] and SLA (DK) [6] have been implementing such strategies in several building scales, while a conscious reuse culture in everyday practices is rather embedded in local societal initiatives or small-scale entrepreneurial schemes. The supply chain is transformed as new agents emerge (i.e. material dealers

of salvaged building elements), or older ones expand their focus (i.e. selective demolition companies); Rotor Deconstruction Company (BE) [7] is a large-scale cooperative managing the reuse of construction materials, by dismantling, processing and trading salvaged building components; Van Liemd Sloop (NL) [8] is a well-established demolition company specializing in dismantling and online trading of second-hand building stock. National legislation and local regulations lead, or follow, as policymakers develop directives to encourage or enforce circular economy practices in the construction industry.

As practitioners take the lead, education is slowly transforming to adjust to the trend. Courses on sustainability or environmental issues have been embedded in several engineering disciplines for several decades now, while design studios on circular design strategies, workshops on circular construction, graduate programs in reuse, designated faculty chairs [9] and related research projects or colloquia, appear in architecture education only in recent years, in a structured way or mostly in scattered patterns, as it finds hesitantly its way in the quest to control material flows, *using less (narrow material flows), using longer (slow material flows), and using again (close material flows)* [10]. The Circular Built Environment Hub in TU Delft, a multi-disciplinary platform established in 2017, promotes the development and exchange of knowledge between learners and educators towards a circular built

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environment, enabling the design of future buildings, cities and infrastructures [11].

1.2 Framework: the CIRC-ARCH project

The large range of educational approaches in different cultural contexts reflects the diversity of circular practices in the construction industry, as well as varying degrees of absorption of circular thinking across Europe.

Addressing this very issue, the ERASMUS+ research project *CIRC-ARCH_Crafting Circularity* is an international cross-cultural collaboration on the integration of circular construction in architectural design education [12]. If design is a decisive agent of change towards a sustainable construction industry and architects hold a leading role in this change as moderators of the building environment, the project seeks to redefine sustainable design and construction in architectural curricula, eventually resulting to a paradigm shift towards circular design practices, led by the architects of tomorrow.

Over a period of three years, the five participating universities place the topic of circularity in the center of the discussion, by developing, testing, and consolidating pedagogies on availability-based design, both in design studios and design-and-build modules. The project is a productive platform to share educational objectives, discuss learning methodologies, and revise pedagogical tools towards the integration of circular design thinking in architecture education.

The overarching objectives of the project are:

- (1) to obtain an overview of the meanings of circularity in various European cultural contexts,
- (2) to identify the notions of circularity, missing links or gaps in architectural design studios, and
- (3) to explore the potential of construction education based on availability-based design through design-and-build modules, studios, or workshops.

The overall endeavor consists of several components: a principal series of collectively run design-and-build workshops held in diverse cultural contexts, an array of theory courses and design studios run individually in

local settings, as well as adjacent research, mapping the construction industry landscape and detecting agents and networks of circularity in architecture education and praxis.

If project-based learning-through-making pedagogy is a critical component in transmitting and absorbing construction issues in architecture education, the series of full-scale assignments forms the backbone of the project, allowing to highlight and explore critical issues on circular construction in the most tangible way, while making a case for the relevance of such a pedagogy, building on the expertise of the consortium partners in full-scale workshops and availability-based design [Fig.1]. The partner institutions are:

- (1) Faculty of Design Sciences, University of Antwerp (BE) [leading]
- (2) Amsterdam Academy of Architecture (NL)
- (3) NTNU, Trondheim (NO)
- (4) Department of Architecture, University of Thessaly, Volos (GR)
- (5) Institute for Architecture and Planning, University of Liechtenstein, Vaduz (LI)

1.3 Survey in Architecture Education

One of the principal research components of the project is an international survey across European schools of architecture, set up to gain insight in a local scale: How are the European designers of tomorrow educated to deal with increasing challenges related to the climate crisis, such as scarcity of resources or building waste management?

The survey is deployed in three parts, all to be answered by the program directors replying either to generic open questions or responding to specific questionnaires:

- (1) on the institutional profile and teaching pedagogy
- (2) on the embedding of circular construction issues in theory courses or design studios
- (3) on the incorporation of design-and-build modules in the curriculum



Fig. 1. Design-and-build workshops on availability-based design: a) *Ephemeral Permanence* (Aalborg, 2022) by Univ. of Antwerp [photo by Mario Rinke] and b) *100% tree* (Amsterdam, 2022) by Amsterdam Academy of Architecture [photo by Jonathan Andrew].

2 Methodology

The present study is an early contribution on the findings of the survey across architectural curricula in Greece, built on the outline of the principal survey. Based, however, on a first pilot run, a modified version has been actually employed to respond to the peculiarities of the Greek paradigm, as this unfolds across the seven accredited public schools of architecture in Greece and the one in Cyprus.

2.1 Pilot Run

The pilot run was performed in the form of a desktop review, collecting basic information from the school websites, and reporting it to a MIRO platform for easier juxtaposition of the findings. This first quest yielded input on two levels; the one identifying the items that were strictly matching the definitions of circular construction as defined by the principal survey, and the other looking for items that could eventually be related to circular design practices within a broader scope. Besides, a couple of structural aspects of architecture education in Greece were taken into account, when deciding the modification of the principal survey.

- the 5-year structure of the undergraduate programs in Greece and Cyprus, yielding the Diploma in Architecture Engineering, + the 2-year structure of subsequent post-graduate Professional Master programs, as opposed to the undergraduate 3-year Bachelor + 2-year Master programs in most schools of architecture in Europe.

- the research thesis, tailored as an individual course in the 4th or 5th year of studies often related to the subsequent diploma thesis, yielding a research report of advanced and focused reflection on particular themes, eventually unveiling the students' interests, which cannot be traced otherwise across formal course descriptions or outcomes reported by individual teachers.

2.2 Adapting to the Greek paradigm

The key features of the modification were the following:

- (1) Broadening the scope of the study and including concepts of circularity under or around the wider sustainability umbrella, as the quest on circular construction per se would yield a very narrow, if any, set of results, while the broader quest allows to trace underlying notions of circularity, such as discussion of R-strategies in the design realm across several scales or within a larger spectrum [Fig.2].
- (2) Adding a fourth axis on elements in-between education and research, such as research or diploma theses, that unveil the personal interests of mature students, as well as informal features that run in parallel to curricular education, such as lectures, colloquia, graduate programs, research projects, professional seminars, exhibitions, student initiatives, etc; eventually complementing curricular knowledge and cross-pollinating formal learning outcomes.
- (3) Including an actual mapping component of the survey output to allow for a larger visibility of the results, and, eventually, forge academic networks. ArGIS OnLine tools (Survey123 and Dashboard) are used to gather, analyse, and eventually share data, allowing further layers of information to be added from consequent survey sources in the future.
- (4) Revising the structure of the original survey to facilitate the collection of data, as well as the extraction of both quantitative and qualitative results. Questions were added [Fig.3 in bold] or reordered, to better adapt to the Greek curricula, to enable comparative studies or to assist in future curricular reforms. Besides, the survey is delivered in four individual parts (institution, course, module, research), thus allowing for input from more people from the same school, as the option of one person knowing and coordinating the whole input seemed like a demanding task, especially if the input was to come from several fields of study.

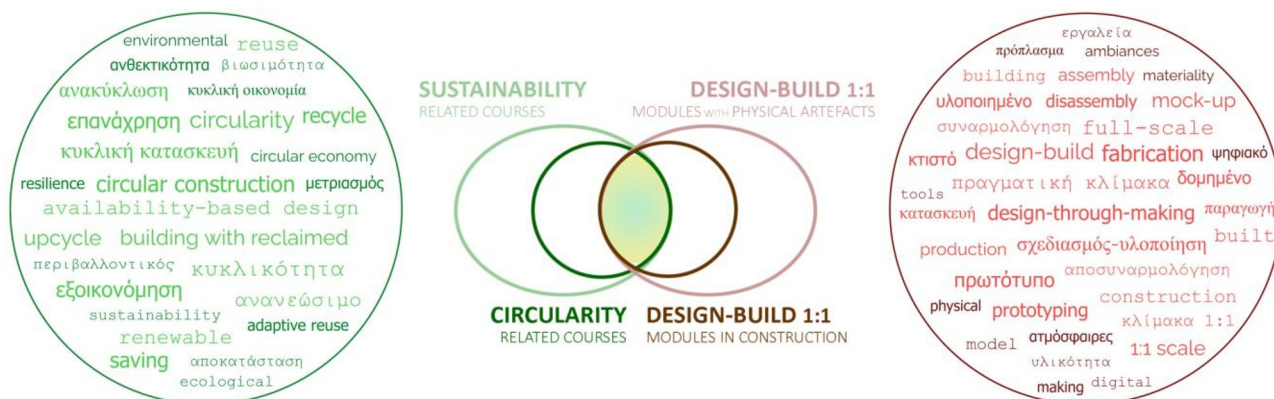


Fig. 2. Broadening the scope: beyond circular construction.

THEORY OR DESIGN STUDIO COURSES

INSTITUTION ID	INSTITUTION NAME	INSTITUTION ADDRESS	YOUR FULL NAME	YOUR E-MAIL ADDRESS								
GENERAL INFORMATION	COURSE NAME	COURSE CODE	RELATED WEB LINKS	RELATED IMAGE	ECTS	COURSE FORMAT	COURSE DURATION	OFFERED IN CURRENT ACADEMIC YEAR	OFFERED IN OTHER ACADEMIC YEARS	FIRST YEAR OFFERED	RECURRING OR ONE-OFF	
SUBJECT MATTER	MANDATORY OR ELECTIVE	THEORY COURSE OR DESIGN STUDIO	SUBJECT AREA	SPECIALIZATION (TECHNOLOGY AREA)	KEYWORDS DIRECTLY RELATED TO COURSE	KEYWORDS SOMEHOW RELATED TO COURSE	EXPLICITLY MENTIONS CIRCULAR CONSTRUCTION					
STUDENTS	NUMBER OF STUDENTS	STUDY CYCLE	STUDY CYCLE (OUTSIDE BOLOGNA PROCESS)	CROSS-REGISTRATION								
TEACHING	COURSE LEADER NAME & WEB-PAGE	COURSE LEADER BACKGROUND	TEACHING TEAM	TEACHING METHODS								
RELATION TO RESEARCH	TYPE OF ACADEMIC RESEARCH	RELATED WEB LINKS	RESEARCHERS ACROSS SCHOOL ELABORATE	RESEARCHERS OUTSIDE ACADEMIA ELABORATE								
RELATION TO PRACTICE	EXTERNAL EXPERTS ELABORATE	EXTERNAL STAKEHOLDERS ELABORATE										

DESIGN & BUILD MODULES

INSTITUTION ID	INSTITUTION NAME	INSTITUTION ADDRESS	YOUR FULL NAME	YOUR E-MAIL ADDRESS								
GENERAL INFORMATION	MODULE NAME	RELATED WEB LINKS	RELATED IMAGE	ECTS	MODULE FORMAT	OFFERED IN CURRENT ACADEMIC YEAR	FIRST YEAR OFFERED	RECURRING OR ONE-OFF				
SUBJECT MATTER	MANDATORY OR ELECTIVE	SUBJECT MATTER	SPECIALIZATION (TECHNOLOGY AREA)	KEYWORDS DIRECTLY RELATED TO MODULE	KEYWORDS SOMEHOW RELATED TO MODULE							
PARTICIPANTS	NUMBER OF STUDENTS	STUDY CYCLE	STUDY CYCLE (OUTSIDE BOLOGNA PROCESS)	CROSS-REGISTRATION								
TEACHING	MODULE LEADER NAME & WEB-PAGE	MODULE LEADER BACKGROUND	TEACHING TEAM NAMES & WEB-PAGES									
RELATION TO RESEARCH	RESEARCHERS ACROSS SCHOOL ELABORATE	RESEARCHERS OUTSIDE ACADEMIA ELABORATE										
RELATION TO PRACTICE	EXTERNAL PARTNERS ELABORATE	EXTERNAL EXPERTS ELABORATE	EXTERNAL STAKEHOLDERS ELABORATE									
ORGANIZATION	ON OR OFF CAMPUS	SPECIFIC LOCATION	DOMESTIC OR FOREIGN CULTURAL CONTEXT ELABORATE	LANGUAGE	FRAMEWORK	FUNDING						
METHODOLOGY	INDIVIDUAL WORK OR IN GROUPS	MODE OF INSTRUCTION	FORMULATED CHALLENGE	COMPETITION OR JOINT DISCUSSIONS	TEACHING MEANS	FACILITIES & TOOLS	DURATION OF PREPARATORY WORKS	DURATION OF BUILDING PROCESS	DURATION OF REFLECTIVE PART			
OUTCOME	BUILT OUTCOME	LEARNING OUTCOME	SCALE SIZE VOLUME WEIGHT COST	AID FROM EXTERNAL PARTIES ELABORATE	DIGITAL DESIGN & FABRICATION	PUBLISHED RESULTS ELABORATE	EUROPEAN DESIGN & BUILD PROJECTS	INSTITUTION NETWORKS ELABORATE				

Fig. 3. The revised structure of the survey (boxes in bold are the added items for the Greek paradigm) [part II (in green): on Theory Courses or Design Studios & part III (in red): on Design-and-Build Modules].

2.3 Survey Structure

Therefore, the survey is designed on four axes, that are set and distributed as individual sub-surveys:

1) Institution; about the institution profile, facts, and teaching pedagogy

2) Theory Courses and Design Studios; about the subject matter and relation to circular concepts, the students' profile, the teachers' profile and teaching methodology, the relation to research and practice [Fig.3 in green]

3) Design-and-Build Modules; about the subject matter and relation to design-and-build concepts, the participants' profile, the teachers' profile and teaching methodology, the relation to research and practice, as well as about the module organization, methodologies and outcomes [Fig.3 in red]

4) Research; about academic elements, such as research or design theses, as well as research or dissemination elements, such as research projects, publications, colloquia, lectures, exhibitions.

The on-going survey is conducted across the seven accredited public schools of architecture in Greece and the one in Cyprus. Namely, the schools are:

1) School of Architecture, National Technical University of Athens

2) School of Architecture, Aristotle University of Thessaloniki

3) Department of Architecture, University of Patras

4) Department of Architecture, University of Thessaly

5) Department of Architecture, Democritus University of Thrace

6) School of Architecture, Technical University of Crete

7) Department of Architecture, University of Ioannina

8) Department of Architecture, University of Cyprus

3 Outcome: selected examples

3.1 Courses and Design Studios

3.1.1 ENVIRONMENTAL DESIGN STUDIO

[A^UTh | instructor: Sakantamis, K.]

A semester-long mandatory design studio, offered since 2014-15, to a class of 180 students of the first cycle, taught by one member of the faculty (architect) supported by one more member of the faculty and one member of the academic staff. Involving research across the school, but not from other disciplines, interacting with external stakeholders and policymakers, but not external experts. The studio investigates a range of environmental tools and strategies pertinent to the interrelation of building and context (optimal orientation, use of solar energy for heating and daylighting, natural ventilation, sustainable materials, efficient water management). The course inscribes within the broader technology area, relating to the fields of building physics, environment/ energy, materials, and structure.

3.1.2 PROGRAMS, MATERIALS, REUSE: ARCHITECTURES OF CARE

[U^Th | instructor: Phocaides, P.]

A semester-long elective design studio, offered since 2021-22, to a class of 30 students of the second cycle, taught by one member of the faculty (architect). Involving research across the school and other disciplines, interacting with external stakeholders and policymakers, but not external experts. The studio adopts the expanded definition of the term 'care' in the field of architectural theory addressing social and environmental challenges through the reuse of significant vacant industrial buildings to enhance urban sustainability and social diversity. Mixed-use programs are discussed, while targeted interventions on the physical building structure are explored, using alternative materials with low environmental impact. The course relates both to theory/ urbanism and materials fields of study.

3.2 Design-and-Build Modules

3.2.1 Architecture School of Commons

[N^TUA | instructor: Anastasopoulos, N.]

A recurring short-term (10 days) module, offered since 2021-22, to students of all levels in architecture or other disciplines, taught by two members of the faculty (architects). The workshop has a strong relationship to practice, involving both external partners (such as companies or designers) and stakeholders or policymakers in teaching. It takes place in a foreign cultural context, in international collaboration with other schools, embedded to and funded by the Erasmus+ framework. The formulated design challenge consists in the combination of reusing common elements (such as air-ducts or bicycle wheels) together with new materials towards new physical configurations. The module expands across the fields of urban studies, urban design, theory and critique, history, construction, materials and environment/ energy.

3.2.2 SPECIAL NATURAL MATERIALS

[T^UC | instructor: Mandalaki, M.]

A recurring semester-long elective module, offered since 2021-22, to students of the second cycle, taught by one member of the faculty (architect). The course has a strong relation to practice and research, involving researchers across the school and other disciplines, as well as external experts, practitioners, stakeholders or policymakers in teaching. It takes place on the campus, with research, university, or self-funding. Inscribing within the technology area, the module has a focus in the fields of construction, environment/ energy, structure and materials, investigating construction materials across full-scale experimentation with an open-end outcome.

3.3 Theses: Individual Student Work

The survey outcomes bring evidence on several concepts of circularity that transcend most architectural curricula in Greece: adaptive reuse, sustainability as energy efficiency, recycling of materials, reuse of salvage building components, reuse strategies. Recurring themes are more evident across individual student work, such as diploma design theses (Table 1) and research theses (Table 2), unveiling circular design thinking rather as an underlying than an overarching trend.

Table 1. Circularity-related Diploma Design Theses (UTh).

a) ADAPTIVE REUSE
School of Architecture in Ioannina. Restoration and reuse of the old University of Ioannina (2020) Mparmpisi, S. (supervisors: Adamakis, K. & Tsangrassoulis, A.)
b) SUSTAINABILITY
<i>Sustainable design for eco-tourism accommodation in Sklithros based on the principles of the circular economy</i> (2022) Mplana, V. (supervisor: Kotionis, Z.) A hospitality lodge, facilitating ‘green’ activities, as a hub of experiential learning and sustainable development
c) RECYCLING MATERIALS
<i>Spolia: Mosaic as a revival of the undesirable</i> (2022) Darzenta, A., Spyrou, Th., Tsilimparis Vallianatos, A. (supervisor: Mitroulias, G.) Investigating the mosaic technique to create new surfaces/ materials reusing solid building waste
<i>Plastic Injection 1:1. Recycling Apparatus</i> (2019) Pantelaïou, E. Papanizou, Ch. (supervisor : Kotionis, Z.)
d) REUSING SALVAGE BUILDING COMPONENTS
<i>Conversion of the tobacco warehouse of N.T.O. into a Collective Multiplex in the city of Volos</i> (2022) Girvalakis, G., Mousias, G. (supervisors: Gavrilou, E. & Mitroulias, G.) Reusing salvaged building components in various building layers (downcycling or upcycling), in a way that minimizes ecological footprint
<i>The remains of Ano-Kato Patissia. Reusing objects and redefining values</i> (2021) Efthimiou, M. (supervisor: Kotionis, Z.) Inspired by the theories of degrowth and the practices of campers, industrial waste is reused for the design of domestic furniture
e) REUSE STRATEGIES
<i>Repairs: Recreating a traditional dockyard</i> (2020) Mpaltoglou, E. (supervisor: Lykourioti, I.) Introducing crafting workshops to engage local fishermen after the dictated by the EU permanent pause of the fishing activity and the destruction of fishing boats in the Aegean Sea

Table 2. Circularity-related Research Theses (UTh).

a) ADAPTIVE REUSE
<i>Stories of Ruins</i> (2022) Mpanou, V. (supervisor: Mitroulias G.) Examining contemporary approaches and ways or reusing

ruins, cultural use being the most typical type of reuse
<i>Hórreo Granaries from Iberian Peninsula: form, function, and adaptive reuse now and then</i> (2022) Tsiampaou, R.-M. (supervisor: Manolidis, K.) A typical granary structure, built in wood and stone, switching use from agriculture to tourism
b) SUSTAINABILITY
<i>Double façade: small-scale office case-study</i> (2022) Soumelidou, E. (supervisor: Tsangrassoulis, A.) The double facade as a critical design strategy for sustainable architecture
c) RECYCLING MATERIALS
<i>Sustainable City. New Recyclable Building Materials</i> (2021) Vasilïou, A. (supervisor: Tsangrassoulis, A.) Exploring recyclable solid waste materials with structural properties
d) REUSING SALVAGE BUILDING COMPONENTS
<i>Recycling Buildings: Reviewing issues of recycling and reusing building materials</i> (2021) Savvidou, S. (supervisor: Mitroulias, G.) Recycling and reuse of salvaged building components as sustainable alternative design strategies
<i>Demolition vs. Creative Reuse</i> (2022) Ketsi, S. (supervisor: Gavrilou, E.) Investigating regulations and criteria of nomination of buildings for preservation and suitability for reuse
e) REUSE STRATEGIES
<i>Remains, flows and depositions of materials</i> (2021) Xenodochidis-Vontas, E. (supervisors: Kotionis, Z. & Kouzoupi, A.) Mapping material flows at the human or non-human domain, to understand forming practices and processes
<i>Redesigning the existing</i> (2021) Gousiopolou, I. (supervisor: Gavrilou, E.) Study on the reuse strategies implemented by Herzog & de Meuron, implementing a persistent experimentation with building materials
<i>Investigation into the design of agricultural products and small-scale building structures under the scope of circular economy transformation</i> (2021) Mplana, V. (supervisor: Kotionis, Z.) Case-studies of practical implementation of circular principles in agricultural settings, carrying through best practices of the past

3.4 Extra-curricular features

A broad spectrum of concepts and practices loosely related to circular construction, yet with strong associations to the whole range of R-strategies, is present in extra-curricular features, relating to formal research or informal activities, such as lectures, colloquia, graduate programs, research projects, student initiatives, etc. Such instances attract student interest and engagement, demonstrating a constant preoccupation with the broader spectrum of sustainability challenges, in particular with the socioeconomic rather than the technological aspects. In this direction, design-and-build modules on the reuse of salvaged building components usually inscribe in the

above framework, focusing on the context and the process, rather than the physical outcome per se [Fig.4].

3.4.1 Research Project

_ OpenUp | UTh _ A four-year long project (2020-2023), co-funded by the Creative Europe programme, aiming to bring to the surface and promote underrepresented artists, designers, craftspeople, and performers in the seven cities of the partner institutions. Across a series of workshops, festivals and exhibitions, the initiative intends to provide the participants with knowledge and training, empowering them in developing their skills, presenting their work, and creating new business model frameworks to establish sustainable art practices.

3.4.2 Research Workshops

_ Domestic Assemblage I & II | UTh _ A learning/ making process, bringing together traditional techniques of manufacturing and digital fabrication technologies in creating low-cost domestic household utility objects, by activating common everyday elements in new configurations, using simple mechanical tools and low-tech processes. Following a methodology of collecting and assembling fragments from the material world around them, participants transform and reuse old materials for new tasks in everyday life, employing out-of-the-box thinking and DIY methodologies.

3.4.3 Colloquium

_ Practices of radicalization of architectural design tools | UTh. 2022. In Docta Spes series (curators: Lykourioti Iris & Manolidis Kostas) _ Introducing a dialogue with radical research plans, such as “degrowth”, “post-growth”, “peer-to-peer production”, “critical zones” etc. to discuss RE-duce, RE-fuse, and, eventually, RE-think strategies for the building environment, as a response to the multiple crises of today (climate, environmental, social, health, ...).

3.4.4 Lectures

_ [TERRAIN] Reuse and Rehabilitation of Quarried Landscapes. Methodologies and examples from the Mediterranean. Kouzoupi, Aspasia

_ [LANDSCAPE] Reuse of the loading dock of the French mines in Lavrion. Efesiou, Irini.

_ [URBAN] Piraeus Port Plaza. Revival of the Papastratos building complex in Piraeus. Tsagkaratos, Spiros.

_ [MONUMENT] Rehabilitation of a protected building monument in Ano Poli, Thessaloniki. Nomikos, Michalis & Doussi, Maria.

_ [BUILDING] The politics of the ruin. Papalampropoulos Leonidas.

_ [STRUCTURE] New cultural space at the ex Public Tobacco Factory. Kafantari, Fani.

_ [SKIN] Megaron Palli, Syntagma Square – National Gallery, Athens. Architectoniki Offices – Grammatopoulos – Panoussakis & Partners

3.4.5 Initiatives

_ A.Y.L.A. | UTh _ An informal research group, of recent UTh architecture graduates, formed during the 2020 lockdown, investigating the vacant industries building stock of the city of Volos and engaging in public talks and initiatives on reuse strategies and participatory practices.

4 Conclusions

4.1 Concepts of Circularity

Concepts of circularity present in architectural curricula:

- 1)The theme of reuse is traditionally associated with adaptive reuse of buildings in stone or eventually timber, in traditional settlements, where regulations usually prescribe the materials or morphologies to be employed. These courses, typically in a set of two (survey/ analysis or existing and proposal/ design of intervention) are a common denominator in several undergraduate programs and some post-graduate programs, usually inscribing in the architectural technology field of study.



Fig. 4. Extra-curricular features.

In recent years, adaptive reuse of buildings in concrete in urban settings is also discussed, following international trends in academia and practice.

2) Aspects of sustainability are embedded in most architectural curricula, usually within the architectural technology field of study in theoretical courses rather than design studios, mostly addressing issues related to energy efficiency, regarding the building envelope, passive energy systems, or building materials with a low environmental impact.

3) Circularity is randomly discussed as such, but the theme or reuse in circular terms is recurring in design studios or workshops, often transcending several scales. Topics include: the reuse of vacant building structures, the reuse of salvaged building components in downcycling or upcycling configurations, the recycling of building materials into new material aggregations or as raw material.

4) Though not formally addressed, the discourse on circular economy in the built environment, is omni-present within a broader context, responding to the scarcity of resources, the excess building waste or the high environmental impact of the construction sector. The environmental crisis is often tackled in socioeconomic terms, placing circularity within or around the wider sustainability spectrum; circular thinking inscribing in the degrowth debate employing reduce, refuse, or, eventually, rethink strategies.

4.2 Future Steps

The results of this round of the survey, although they do not yet allow for any quantitative output, they come to corroborate the early findings of the initial pilot run, confirming at large the preliminary fundamental hypotheses of the overall project: the large diversity of circular construction practices, and, consequently, of educational approaches across different cultural contexts within Europe, and the low absorption of concepts of circularity, and even more of circular construction, in architectural curricula in Greece. Qualitative findings attest to a broad spectrum of concepts and practices, not yet incorporated into formal educational structures.

On the other hand, the low level of responses to the survey suggests a need to reengineer the applied methodology and consider additional layers of inquiry to unfold the particularities of the Greek paradigm, such as a scrupulous second run based on the web presence of each school, an assisted or curated round of the survey, or a study based on a series of interviews on selected case-studies.

Further studies that will investigate the juxtaposition of the findings in architecture education in Greece to their counterparts within other cultural contexts in Europe, as well as to the adoption of circular concepts in other disciplines, in praxis or in societal initiatives, may prove to be a fertile consequent assignment and needs further consideration.

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