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Keywords

Living-building | Self-sufficiency | Evaluation Matrix |
Ecological Principles | Architecture Teaching

Partner Institutions

Instituto Superior de Engenharia de Lisboa (ISEL) |
Instituto Superior de Agronomia, Universidade de Lisboa (ISA)

Expected Future Partner Institutions

Center for Environmental and Sustainability Research (CENSE-
FCT-NOVA) | University of California Berkeley (UCB)

OBJECTIVES

In general, the objectives of this research will be to rethink the architectural production systems, in light of sustainability principles regarding efficiency, adaptation and adequacy; as well as to advocate for a situation in which the exploitation of endogenous resources leads to a greater cultural autonomy and ecological diversity.

Specifically, we propose to develop a matrix that includes these same principles within both the teaching and design practices, with the aim of developing a self-sufficient, sustainable and participatory architecture, based on the living-building model.

In addition to the potential adoption of a programmatic role in the necessary changes to the teaching of the conceptual methodologies and design project praxis, the development of this matrix will contribute to the definition of objective parameters to be used in the tuning (or construction) of systems for the integration of sustainability in the areas of Architecture and their complements, with a common language.

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Construction of architectural design principles and criteria for sustainability and self-sufficiency based on the living-building model

ABSTRACT + IMAGES

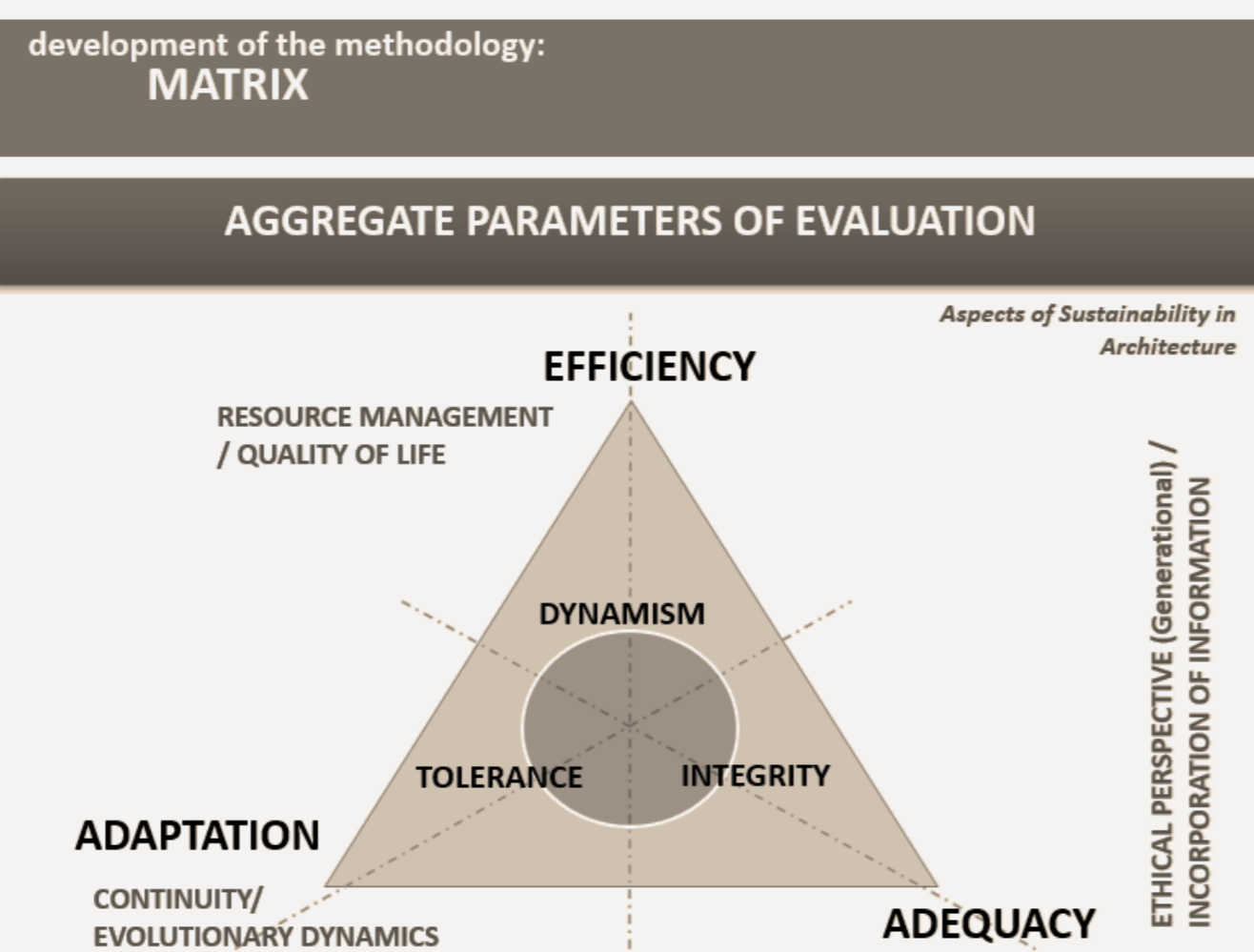
Man lives as a mortal on Earth. And as an organism nestled in a place, his survival depends on the housing conditions that place provides. Man is not an ethereal being; nor submarine; neither aerial nor underground. And yet, he has managed to survive in all these situations. But at what expense? At the expense of artifices that enhanced the capabilities of his own body and mind. This allowed him to settle in territories to which he would not have, at least, physical access.

At the same time, he realized that he could also take advantage of the spontaneous modification processes of the Earth's crust: accelerating or delaying actions or reactions in the environment by displacing beings and altering the properties of the soil, by dissociating or joining materials; by manufacturing objects capable of capturing and, then releasing the energy involved in those processes. All this, in an increasingly artificial way, making him feel powerful.

The awareness of this power convinced him that he could even do something else: remodel the earth's crust in accordance with the image of a world almost totally domesticated: that is, adapted to the type of dwelling of a man who can never be satisfied. The instrument that has allowed him to maintain his ambitions is Architecture. And this instrument is so effective that it has made him forget about his condition as a simple mortal who lives (out) on Earth.

A corresponding design practice is linked to this instrument, guided by the uncritical reproduction of operative routines; accompanied by an industrialization mobilized in favor of the ultimate end of the reproduction of natural capital. In that sense, this capital is viewed as a mere inexhaustible source of resources, and as an unlimited waste receptacle, resulting of predatory artificialization processes of the territory, according to processes which are indifferent to an environmental, social, or political ecosophy (GUATTARI, 2000).

Thus, within the academic ecosystem where such processes originate and are distinguished, we advocate a rethinking of the Architectural design production systems in light of sustainability principles, adjustable to the relative autonomy of local communities. Allowing to justify, from the outset, the inclusion in the conceptual design process of a study of the physical and human appropriation of the territory; and the analysis of the cultural heritage and the biophysical components of the landscape. This rethinking is developed in favor of an assumed resilient condition, referring to a community's ability to maintain its integrity and adapt to a scenario of eventual transformation (MAGALHÃES, 2013; MAGIS, 2010).



In this sense, we propose to question the foundations and current practice of the architectural design project, in terms of applying a matrix of principles for sustainability in architecture, in order to correspond to the three great dimensions listed in the original concept of sustainable development (Figure A, above):

- ↳ EFFICIENCY, comprehended in this context through Recycling, Regulation, Cooperation and Tuning;
- ↳ ADAPTATION, as related to Diversity, Resilience and Self-sufficiency;;
- ↳ ADEQUACY, in regards to Order, Biomimicry, Apperception and Evolution.

development of the methodology: MATRIX structure

Aggregated Parameters	Descriptors	Assessment Scope
EFFICIENCY DYNAMISM	Recycling	Sequential (cyclic) reuse of materials / energy and waste disposal
	Regulation	Automatic natural response capability to sudden environmental changes
	Cooperation	Potential for association of behaviour and organizational interaction
ADAPTATION TOLERANCE	Tuning	Quality of the relationship between objectives / resources / results
	Diversity	Multiplicity of alternative processes and responses
	Resilience	Limits of unruptured response capacity / Self-learning
ADEQUACY INTEGRITY	Self-sufficiency	Independency level of exogenous Energy and Resources
	Order	Coherence, hierarchy and organization between scales, and context insertion
	Biomimicry	Adoption of functional / formal biologically referenced creation logic processes
	Apperception	Incorporating significant information from Place and context
	Evolution	Ability to sustain change and growth

We will be simultaneously addressing the philosophical and methodological foundations that underlie the integrated approach to these aspects (with the aim of improving the resources' management), their continuity and usefulness, as well as our ethical responsibility towards future generations (Figure B, above).

As a reference, we will utilize the *living building model*, which assumes the behavior of the building analogous to that of a living organism – reacting to the variation of stimuli and the environmental parameters of where it is inserted –, having as fundamental characteristics its integrity, self-sufficiency, reactive adaptability, and resilience, as well as the potential for evolution. We will seek to privilege life components and processes, associated with a strong Sustainability concept and with an approach to architecture anchored in its physical and cultural place, instead of strategies predominantly focused on constructive standardization, or instead on technological sophistication and specialization (ROSMANINHO, 2014).

The pretended diagnosis will be related not only to the building construction practice, but also to the landscape management and the objects production, according to an ecosystemic and integrated approach, throughout the different temporal scales (from pre-conception to obsolescence). Complementary, we aim to contribute to the sustainable development of the communities that, in an autonomous and ecologically conscious way, participate in this entire process (CALDAS, 2008).



Figure C: specialization course on "Eco-Architecture and Methodologies of Sustainability" held in collaboration with the Lisbon Municipality and the Support Centre for the Homeless (CASA), totaling 102 hours of theoretical/practical lessons.

As an example of theoretical-practical formation that will serve as the basis for the development of the titular matrix, the CIAUD research group **Sustenta – Laboratory for Sustainable Design** organized, in 2014, a specialization course in Eco-Architecture (Figure C), which resulted in the construction of a living structure (through natural construction techniques), and the cultivation of a vegetable garden for self-subsistence purposes. It involved the academic community, governance entities and partner institutions for social integration. In addition, between 2014 and 2017, this research group developed – within the scope of final master's projects – a preliminary study for a self-sufficient architectural project, for the construction of the Monastery of Nossa Senhora do Rosário (Figure D), within the scope of a protocol between FA-ULisboa and the Congregation of the Nuns of Belém.

At a time when the fragilities of human society have become more visible (through climate change, threats to biological diversity, unregulated urbanization, imbalances in terms of globalization, global geopolitics and health issues) it is imperative to rethink which Architecture (and in which world) we want to teach how to design, to shift from this path of self-destruction to a more sustainable and livable reality.



Figure D: development of a preliminary architectural project within the scope of final master's projects, based on the principles of living-building, through the identification of the relations between (f)actors involved, and the establishment of a methodology of sustainable construction

M.A.P.S Matrix of Architectural Principles for Self-sufficiency

SCIENTIFIC RELEVANCE FOR THE DISCIPLINE

Sustainability has become a widely accepted meta-concept, synonymous with good social and professional awareness – but which for the most part reproduces partial and limited approaches to its essence and operability; in Architecture, sustainability presents an absurd scope that goes from the mega skyscraper to the cabin in the forest, privileging techno-efficiency in the cycles of energy, materials, water and waste, without truly questioning the dwelling model that underlies it.

The proposed research aims to contribute for the change of the current sectorial and autistic paradigm, at the various scales and knowledges of human intervention in the territory (including the so-called sustainable), by: **(1)** developing a set of principles and common languages based on ecosystemic and integrated approaches, of an ecological and environmental nature, **(2)** bringing the human creative process closer to the processes underlying natural evolution and balance; **(3)** bringing a more holistic and operative sustainable awareness to the teaching of Architecture.

The matrix that supports this research is entirely original and has a high associated research potential.

EXPECTED ECONOMIC AND SOCIAL IMPACT

As part of a concerted global effort to reduce the ecological footprint of human constructions and contribute to more favorable scenarios associated with the problem of climate change, the results of this research may contribute to improving synergies between the various actors in the building sector (in particular, architects), with substantial economic gains both in terms of the construction process and its management, maintenance and recycling – in the light of a strong sustainability concept (where the same or better productivity and quality of life can be achieved with less resources and energy, without a significant decrease in natural capital), as well as better integration and participation of local communities in defining their housing environment.

In the context of Portugal's semi-rural, desertified, and impoverished interior territories, the methodological guide and subsequent research could be a useful tool, both for mayors and for communities to revitalize the housing stock and its rural-urban dynamics.

The development of information and the dissemination of new and more sustainable didactics in Architecture teaching will also have a revitalizing effect on the Academy.

RESEARCH PLAN AND TASKS

In the context of this project application (with a duration of **18 months**), we propose to carry out an investigation into the different principles that should be the basis of a so-called sustainability and self-sufficiency in architecture.

This research will be developed every six months (starting in September 2022), divided into **5 ACTIONS**, worked in an interdependent way (some of them even simultaneously), at the various scales of approach (from the territory to the building) and in the different disciplinary areas.

1

The **FIRST ACTION** (to be carried out in the 1st semester of the 2022/2023 academic year) involves THINKING about Self-sufficiency through the organization of a reflection conference on how to process architectural design, from the point of view of its design, praxis, and construction, with several ideas in mind:

- testing interpretive diagnoses for the contextual conditions that frame the contemporary possibility of producing architectural devices;
- the production mechanisms that link nowadays the architectural design activities and the idea of progress;
- the economic and environmental foundations behind the so-called sustainable technological systems, compared to other types of passive constructions linked to local cultures;
- the doctrinal assumptions of traditional construction techniques regarding their application in contemporaneity, as well as the results of research on the theme of low-cost construction;
- the synthesis of operational propositions for the project in development.

As a result of the discussion on the held conference, under the consideration of the invited partner researchers (namely LEAF-ISA-ULISBOA, CENSE-FCT-NOVA, ISEL and UCB), we intend at this stage to conceptualize the idea of "sustainable project" based on an ecosystem (i.e., relational) approach.

2

The **SECOND ACTION** (to be carried out during the 2nd semester of the 2022/2023 academic year) involves ANALYZING a significant corpus of the Lisbon School of Architecture's training output – in the areas of Architecture, Urbanism, and Design –, based on the more recently completed Master's Final Projects, whose theme is related to sustainability and self-sufficiency.

This analysis will focus specifically on the ways of incorporation of the basis variables of this problematization scope within the design projects/research carried out by the master's students.

This task aims to reflect on the teaching of (Sustainable) Architecture in the context of FA-ULisboa and how its research framework is (or isn't) integrated/accompanied by CIAUD's research groups and/or even other Research Centers, in order to improve this principle of academic-research interaction.

3

The **THIRD ACTION** (to be carried out, simultaneously with the previous action, during the 2nd semester of the academic year 2022/2023) involves DESIGNING a preliminary Matrix of Architectural Principles for Self-sufficiency (M.A.P.S), which will intersect (with an analytical predisposition) with the academic results produced at FA-ULisboa.

This Matrix will be based on the three previously named sustainability principles applied to Architecture, namely in terms of EFFICIENCY, ADAPTATION and ADEQUACY. The applicability of these principles will be worked on at the different design scales (urban, architectural and constructive); scopes (for each one of the named concepts); and time periods (before, during, and after the design project).

The titular matrix will consist of tables of multiple entries, with easy-to-read symbols and colors for an integrated interpretation (of a scientific basis, namely ecological), to be used both at the levels of the architectural design project, and of its subsequent and necessary evaluation.

4

The **FOURTH ACTION** (to be implemented in the 1st semester of the 2023/2024 academic year) involves INTRODUCING and TESTING the principles of self-sufficiency in the Project Laboratory VI curricular unit (because of its antecedent and pre-preparatory role to the Final Master Projects).

This integration will naturally constitute a foundational precedence for eventual research derivatives, to be developed by the final year students of the Architecture and/or Urbanism courses.

This task will have as a complementary objective the demonstration of the importance of the introduction of intervention areas and concepts related to Self-sufficiency within the Architectural Design Project teaching at the Lisbon School of Architecture, by counteracting a relative incommunicability between coordinations of different disciplinary teaching and research groups in Architecture/Urbanism.

5

The **FIFTH ACTION** (to be implemented, simultaneously to the previous task and progressively, in the 1st semester of the 2023/2024 academic year) is to EDIT a methodological guide for the integration of Sustainability and Self-sufficiency within the Architectural teaching course and to FORMALIZE an R&D project application for financing through the FCT with the current project proposal (starting in 2024).

This application will have the purpose of making the developed Matrix of Architectural Principles for Self-sufficiency (M.A.P.S) operative in a transdisciplinary scope, through the further involvement of other schools and research centers, in order to obtain comparative knowledge of the proposed principles and criteria; and eventually enable the M.A.P.S application in other architectural teaching institutions.

EXPECTED SCIENTIFIC RESULTS

The work to be developed in this project intends to demonstrate the importance of the complementarity between the so-called divergent formations available in the scientific, didactic, and pedagogical contexts of the architectural school. The aim is the application of these principles in the student formation, leading to the demonstration of an eventual usefulness in the (re)formulation of the architectural studies' strategies.

As a final result, a **methodological guide** will be published for the teaching of self-sufficiency in architecture, with the scientific compilation of the theoretical knowledge researched and discussed in the held events; as well as the practical application of the matrix within the scope of the architectural design project discipline. Since this research will be developed in partnership with some foreign institutions (namely the UCB), this guide should be bilingual and, therefore, more easily disseminated internationally.

Based on the results obtained, an application for an R&D project will be formulated in order to develop a methodology for the production and maintenance of a more sustainable, self-sufficient and participatory architecture, as well as a published article with indexation.

BUDGET: € 7.250,00

a) € 1.000 in **consultants**, namely those who are part of the external team and partner entities.

b) € 5.250 in the **acquisition of goods and services**, namely:

- € 500 in the organization of the reflection day (Stage 1) and the seminar (Stage 5);
- € 500 in the acquisition of editing software (12-month license) as support for the dissemination of events, as well as the edition of the resulting methodological guide;
- € 2.500 for compiling information and editing;
- € 1.500 for the publication;
- € 250 for the translation/grammar support software (18-month license);

c) € 1.000 in the **demonstration, promotion and dissemination** of the project results, through the communication and publication of a scientific paper and by sending copies of the handbook to educational institutions, municipalities and social integration entities.