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TRANSLATED BY Florina TUFESCU

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Applying the concept of sustainability to the field of architecture represents a complex, multidisciplinary process, which has an impact on the qualities of the built environment as well as on mentalities and lifestyles.

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Sustainable architecture. Stages of design and related concepts

Lect. Adrian MOLEAVIN PhD Arch.

Introduction

Global warming, the degradation of ecosystems, the energy crisis, the resource crisis and excessive pollution are some of the issues that sustainable architecture attempts to find answers to, answers related to human needs and to the continuous development of the built environment. This process has brought a range of problems to the attention of architects, problems whose solutions have substantially modified the general outlook with regard to what architectural creation, in particular high-quality architecture, means.

Ever since the impact of human activities on the natural environment has been understood, architecture has become an active, inherent part of the ongoing transformation process of society. The study of the processes subsumed under the building phenomenon, from the extraction of resources to the recycling of buildings, is the first step towards applying the paradigms of complexity to the field of architecture.

It is imperative to understand and put into practice the fact that sustainable architecture is not merely a technical answer to environmental problems but a transformational process in which technical elements are interwoven with conceptual, eco-systemic, biophilic and other aspects. Sustainable architecture does not mean implementing pre-established technical solutions but, essentially, redefining the relationship between human society and its living environment, a process aimed at the creation of sustainable mentalities and lifestyles.

The following pages provide a brief description of the main stages that must be covered in a design process aiming at the creation of a sustainable built environment (UGREEN, 2021). Additionally, a series of freely interpreted ideas and principles are recorded (Heywood, 2012, 2015), which should be taken into account in the course of completing these stages. The presented information is by no means exhaustive, but it does organise a series of key ideas into a comprehensible, easy-to-apply formula for student use.

General considerations

There is only one planet Earth! Sustainability means designing today while thinking about the future. Sustainable design is a method and not a style. The questions to be asked from the beginning of the design process are the following:

_How will the building perform over time?

_What will be its impact on the environment?

_At the end of its lifecycle, how will the building be recycled?

The pillars of sustainability are: the Environment, the Economy, Society.

Sustainable design has 6 dimensions:

_2D = drawing;

_3D = sustainable design + information;

_4D = planning the building;

_5D = construction and maintenance cost analysis;

_6D = maintenance and management.

The environment designates the totality of the elements of the physical and biological world and the connections between them. There are 4 ecosphere elements on the planet (atmosphere, biosphere, hydrosphere and geosphere) that are inherently interconnected, with any influence exerted on any of them affecting all others.

The environment can be analysed at different scales:

_internal (that of the building)

_local (surrounding) – global.

Any local action is subsumed under a global effect (the lighting of a house requires electricity whose production releases CO2 into the atmosphere, thus affecting the local and global quality of the environment). Every building influences the quality of the environment and the global warming process. But, in fact, it is not the buildings that consume energy but their users.

Analysis of the design brief [1]

1.A THE FUNCTION / USE / DEFINING QUALITY OF THE FUTURE BUILDING IS SET

1.B IS THE PROJECT A NEW BUILDING OR AN INTERVENTION ON AN EXISTING BUILDING?

NEW BUILDING? **2.A**

EXISTING CONSTRUCTION? **2.B**

[POTENTIAL SUSTAINABLE QUALITIES THAT HAVE BEEN MISSED]

1A

For biodiversity to prosper, its habitats need to be interconnected; green spaces in the rural and urban environment must make up a continuous green network.

There is a vicious cycle of buildings and towns which must be interrupted:

global warming → climate change → greater
necessity for heating or cooling → higher energy consumption
higher emission of GHG (greenhouse gases) → global warming

A balance between density and human needs has to be struck. A higher density of buildings leaves more room for nature.

The green city is a healthier city. Green spaces must be integrated at all scales: urban forests, green corridors, city parks, green islands, urban farms.

2.A

2.B

1

Site analysis [2]

2.A IS THE SITE CHOSEN OR IMPOSED?

• IMPOSED SITE
[POTENTIAL SUSTAINABLE QUALITIES THAT HAVE BEEN MISSED]

• CHOSEN SITE

2.B IS THE SITE URBAN OR RURAL?

• RURAL SITE
[POTENTIAL SUSTAINABLE QUALITIES THAT HAVE BEEN MISSED]

• URBAN SITE
_HIGH DENSITY (preferable)
_SEARCH FOR PRIORITISED SITES (areas that must be developed/areas that must be recovered: e.g. industrial zones, following decontamination / historical areas with character)
_FUNCTIONAL DIVERSITY
_SUSTAINABLE TRANSPORT (proximity to intermodal transport nodes – for all high-traffic transport of goods and people; sustainable means of transport: electric vehicles, bicycles; opportunities for pedestrian transport)
_BALANCE OF THE BUILT – NATURAL (the destruction of natural habitats inside towns is avoided and the creation of new natural habitats is pursued)

2.C ASSESSMENT

POSITIVE RESULT → **3.A**
NEGATIVE RESULT → **1**

2.A

Analyse all options before building:

_to build

_to expand

_to reduce

_to relocate

_to share (co-living)

_to convert

_to reorganise

_to rethink.

Which option has the smallest impact?

The decision to build has repercussions over a long period of time.

3.A

1

Feasibility study [3]

3.A REQUIREMENTS

_DEFINING THE PROGRAMME
_DETERMINING ALL THE INVOLVED / INTERESTED ACTORS (clients, users, investors, public administration, etc.)
_DEFINING SUSTAINABILITY OBJECTIVES (based on the design brief, site, legal requirements)
_CHOOSING CERTIFICATION (the standard that the building will conform to, e.g. LEED, BREEAM, PASSIVE HOUSE, nZEB)

3.B INITIAL SIMULATION

NEGATIVE RESULT

POSITIVE RESULT

3.C DRAFTING OF THE INITIAL PROJECT DOCUMENTS

_LIST OF CLIENT REQUIREMENTS
_CORRELATION OF CLIENT REQUIREMENTS TO SUSTAINABILITY OBJECTIVES
_CREATION OF A BRIEF, DETAILED BY FIELDS OF EXPERTISE
_CREATION OF A PROJECT DEVELOPMENT TIMELINE
_PRELIMINARY COST ANALYSIS

3.D ASSESSMENT

POSITIVE RESULT → **4.A**

NEGATIVE RESULT → **1**

2.A

2.A

Knowing the features of the local landscape, climate and microclimate is crucial to sustainable design. Work with the forces of nature and not against them!

Use examples from nature – biomimetic architecture.

Use examples from the past – bioclimatic architecture.

Each town has its own climatic environment, which must be known and understood and which is called urban air dome.

The heat island effect that occurs in cities must be counterbalanced through new buildings.

Reducing fuel consumption means reducing CO_2 emissions.

2.A

Sustainable environment requires sustainable transport; transport accounts for 20 to 30% of air pollution (depending on the country).

Site sustainability [4]

2.A

4.A ANALYSIS OF SITE CHARACTERISTICS
CONTAMINATED SITE?

CONTAMINATED SITE (CANNOT BE DECONTAMINATED)

CONTAMINATED SITE (CAN BE DECONTAMINATED)

UNCONTAMINATED SITE

_LANDSCAPE FEATURES
_CARDINAL ORIENTATION
_CLIMATE AND MICROCLIMATE FEATURES
_HABITAT (TO PROTECT OR TO CREATE)
_GREEN AREAS

4.B ASSESSMENT

5.A

POSITIVE RESULT
NEGATIVE RESULT

2.A

Objectives of sustainable design (in general):

_A highly energy-efficient envelope

_Limitation of energy consumption to what the building produces and no emission of carbon dioxide

_Optimised use of resources and of embodied energy

_Minimal use of water and reduction of eliminated waste

_Creation of a healthy, non-polluting environment

_Durability over time and recycling.

Objectives of sustainable design (architecture):

_Durability of the "hard" elements (structure, envelope – materials resistant to UV radiation, careful monitoring of rainwater, a structure resistant to extreme climatic elements – vertical circulations, technical spaces) + "soft", easily replaced elements (partitions, furniture, equipment).

_Spatial flexibility (possibilities of successive conversions – extension, reduction, repurposing, relocation, adaptation to climate changes) + installations that are easy to access, in multiple versions.

_Durable, energy-efficient and adaptable envelope.

To be climate-neutral, buildings must store as much carbon as possible. This is why buildings made of wood are preferable.

5.A

1

Sustainable design [5]

5.A BUILDING

_DESIGN (aesthetics, cultural elements, local atmosphere)
_BIOPHILIA (incorporating natural elements into the project, the possibility of interacting with nature, landscaping – outdoor vegetation, water, indoor vegetation)
_PROVISION OF SAFETY ELEMENTS
_PROVISION OF PARKING SPACES
_ACCESSIBILITY AND ERGONOMICS

5.B FUNCTION

_THE PUBLIC - PRIVATE RELATIONSHIP
_SPATIAL ADAPTABILITY (multifunctionality)
_PROVISION OF OUTDOOR SPACES FOR REST AND RELAXATION
_OPPORTUNITIES FOR SHARED USE OF CERTAIN FACILITIES (e.g. sports hall, showers and changing rooms, temporary storage)

5.C ENVIRONMENT

_REDUCTION OF THE HEAT ISLAND EFFECT (colours, materials, treatment of surfaces, underground, multistorey car parks or rooftop car parks for the reduction of the built surface)
_REDUCTION OF LIGHT POLLUTION
_REDUCTION OF ENVIRONMENTAL NOISE

5.D TRANSPORT

_REDUCTION IN THE NUMBER OF PARKING SPACES
_PARKING SPACES FOR ALTERNATIVE MEANS OF TRANSPORT
_CHARGING STATIONS FOR ELECTRIC VEHICLES
_PARKING SPACES FOR BICYCLES/ SCOOTERS (in addition to showers and changing rooms)

5.E ASSESSMENT

POSITIVE RESULT → **6.A**
NEGATIVE RESULT → **5.A**

Water is a finite resource! Although 70% of the surface of the Earth is covered by water, 97.5% is salt water and 2.492% is water embedded in the soil (in the form of ice). Only 0.008% of the total is fresh water available for human consumption. In this context, the management of water use in buildings becomes very important.

The first rule is to reduce consumption needs!

Use water of different qualities where it is necessary and possible. For example:

_Use filtered grey water (shower, bath and sink) in lavatories, washing machines and for irrigation.

_Collect and use rainwater.

_Recover the residual heat of water.

Very often, water can become a source of renewable energy (microturbines), especially in the rural environment, waves (where possible).

6.A

1

Water use efficiency [6]

6.A WATER QUALITY MONITORING

(testing the initial conditions and proposing a system that ensures the quality of the used water + its periodical testing)

6.B EFFICIENT MANAGEMENT OF WATER USE

(internal – efficient equipment, water heating + external – collection, filtering and use of rainwater and of grey water)

6.C RAINWATER MANAGEMENT

(knowledge of the annual rainfall levels, management of the site, use of native plants, provision of irrigation, collecting and filtering of rain-water)

6.D REDUCTION OF WATER CONSUMPTION

(private and public bathrooms – lavatory, bathtub, shower, washstand + private and public kitchens – sink, dishwasher, ice machine + washing machine)

6.E COMPLETE OR PARTIAL PURIFICATION OF USED WATER

6.F ASSESSMENT

POSITIVE RESULT → **7.A**

NEGATIVE RESULT → **6.A**

1

Buildings (in the course of their construction, use and demolition) consume approximately 50% of the energy produced by the human race.

If possible, buildings should be energetically autonomous (with no use of fossil fuels for electricity or transport) and autonomous in terms of water resources, purification of used water and waste recycling.

First design a passive building and then add active systems!

A sustainable building naturally/passively ensures, throughout the year, environmental conditions that are very close to the ideal level of comfort. This is done by taking into consideration 4 issues:

_site analysis;

_volumetric conformation and cardinal orientation;

_sustainable materials;

_energy performance (passive use of renewable energy sources for heating, cooling and ventilation).

Post-occupancy evaluation (POE) of the building is always required to ensure that the building fulfils all the sustainability requirements that it has been designed to meet.

7.A

Energy efficiency [7]

7.A
ARE CFC USED? (chlorofluorocarbons – compound gases harmful to the ozone layer, e.g. freon, aerosols, refrigerants and solvents)

NO

YES

CAN THEY BE ELIMINATED?

1

NO

YES

7.B
_STUDY OF PRODUCTION - SUPPLY (use of renewable, locally or regionally produced energy preferred)
_RENEWABLE ENERGY (assessing the potential of the site for the collection and use of renewable energy sources in passive or active systems – solar, aeolian, hydro- and geothermal)
_CONSTANT MEASUREMENTS (of production and use of energy, renewable or otherwise, with a view to optimising the entire system)

7.C
_ENERGY PERFORMANCE (STUDY OF CONSUMPTION)
For any building, a complete simulation is carried out, with a view to observing the nZEB standards, different for each country or region (energy-efficient items – lighting, electrical household appliances, high-performing HVAC system; polluting systems and even the mechanical systems of heating and cooling should be avoided, if possible).

7.D
_PASSIVE STRATEGIES (bioclimatic design + systems, e.g. phase-change materials, heat exchangers, etc.)
_ACTIVE STRATEGIES (mechanical systems for the collection and use of renewable energy)
_CONSTANT MEASUREMENTS (of the production and use of energy, renewable or otherwise, with a view to optimising the entire system).

7.E ASSESSMENT

8.A

POSITIVE RESULT
NEGATIVE RESULT

7.A

A sustainable philosophy for the minimisation of the impact of the consumption of resources, materials, water and energy in buildings has 4, strictly ordered, steps:

reduction – re-use – recovery – recycling.

There is no waste in nature. The waste that results from human activities must be fully recycled and transformed into resources.

All building materials are of and from the Earth.

Some are renewable and others are not; some are recyclable and others are not.

In choosing building materials, one should apply above all the principle of economising resources and the principle of the use of renewable, recyclable materials that are produced with a low consumption of energy and require the shortest possible transport.

Economising resources means doing more with less. Here are some examples:

_Optimisation of design to reduce the quantity of used material and the losses

_Modular, efficient, prefabricated design

_Multifunctionality of constructive elements (floor = thermal mass, envelope = thermal and acoustic protection, ventilation, aesthetics)

_Preference for lightweight buildings which require reduced foundations and thus have a small footprint on the site.

Sustainable materials [8]

8.A SEARCH FOR SUSTAINABLE MATERIALS
(re-used or recycled materials are preferred; materials extracted or produced as close to the site as possible are preferred; materials with environmental impact certificates for their extraction and production and materials with ecological components are sought; natural or renewable materials such as wood are preferred)

_USE OF EASILY CLEANED MATERIALS (this reduces the use of detergents and other chemical pollutants).
_REDUCED USE OF HARMFUL MATERIALS (which contain compounds detrimental to human health – materials that contain mercury, lead, cadmium, copper, asbestos, volatile additives)
_REDUCED USE OF COMBUSTIBLE MATERIALS

8.B REDUCTION OF THE ENVIRONMENTAL IMPACT OF THE ENTIRE LIFECYCLE OF BUILDINGS (new buildings – a Life Cycle Assessment, LCA, is carried out; old buildings – re-using the existing buildings or at least their materials is preferred)

8.C CREATION OF A MANAGEMENT PLAN FOR RECYCLABLE AND NON-RECYCLABLE WASTE

8.D ASSESSMENT

9.A
POSITIVE RESULT
NEGATIVE RESULT
8.A

Exceptional attention must be paid to the quality of indoor air. The causes of reduced air quality can be:

_inadequate ventilation

_infiltration of pollutants (microorganisms, carbon monoxide)

_VOC emissions (volatile organic compounds – paints, synthetic resins, insulating materials, varnishes, etc).

High temperatures and increased humidity have a negative impact on the quality of indoor air.

Ensure that the control of the parameters of the indoor environment is as individualised as possible.

The building is not sustainable if the low maintenance cost cannot be kept for its entire period of use.

The quantity of energy required for the maintenance of the building (in use) is 10 times higher than that required for its construction.

Indoor environmental quality [9]

9.A LIGHT (daylight and sunlight assessment, local simulations with a view to obtaining as even a distribution of light as possible, avoidance of very bright areas)

9.B LIGHTING (efficient, low-consumption systems, correct positioning, locally adapted intensity with the highest possible CRI – Colouring Rendering Index, ensuring a high degree of localised control, adaptable to multiple uses)

9.C AIR QUALITY (provision of natural, artificial or mixed ventilation systems + monitoring of air quality, purification if required + use of materials with low emissions of harmful substances – paints, synthetic resin, varnish, silicone, composite materials)

9.D THERMAL COMFORT (ensuring thermal comfort according to the standards + provision of a high degree of localised control, adaptable to multiple uses)

9.E ACOUSTIC COMFORT (ensuring environmental noise reduction by complying with the standards on the acoustic properties of the envelope, the floors and the partitions, reducing the reverberation effect, reducing the noise produced by installations – in particular HVAC)

9.F ASSESSMENT

10.A

POSITIVE RESULT
NEGATIVE RESULT

9.A

The waste that results from the building process should be eliminated.

Design and specifications:

_Use standard dimensions to minimise loss of materials (unless they are easy to recycle);

_Employ re-used or recycled materials;

_Design also from the perspective of the recycling of the building.

Fabrication and distribution:

_Modular design and prefabrication;

_Optimised use of resources;

_Volume minimisation in transport.

Construction site:

_Careful manoeuvring of equipment and appropriate storage of materials/sub-assemblies;

_Re-use and recycling of packaging used in transport;

_Re-use and recycling on the construction site where possible.

10.A

Sustainable construction [10]

10.A CREATING A GUIDE OF THE BUILDING PROCESS

10.B CHOOSING CERTIFIED CONTRACTORS AND SUBCONTRACTORS
_CARRYING OUT PERFORMANCE TESTS (for the envelope, the installation systems, etc).

10.C MONITORING AIR QUALITY ON THE CONSTRUCTION SITE (detecting mould, bacteria or viruses, volatile organic substances (VOC), noise, vibration)
_PREVENTING THE POLLUTION RELATED TO THE BUILDING PROCESS (dust, erosion, sedimentation, site pollution by waste and harmful substances)

_REDUCING CO_2 EMISSIONS (stemming from the use of building equipment)

10.D ASSESSMENT

11.A

POSITIVE RESULT
NEGATIVE RESULT

10.A

The purpose of a building is to satisfy all the requirements and demands of its users (with regard to function, comfort, safety and health).

The total amount of costs resulting from the energy and resource needs and the impact of the building on the environment over the entire period of its use is greater than the costs for its production and building.

The use of a building can be quantified in operational costs.

The estimated (planned) operational costs have an impact on the initial value of the building.

Reducing the operational costs of a building can also be achieved through maximal accumulation of functions per square metre.

Over the period of use, there is a series of successive cycles of use and renovation or conversion.

11.A

Use and maintenance [11]

11.A A CREATION OF A USE AND MAINTENANCE GUIDE (for users)

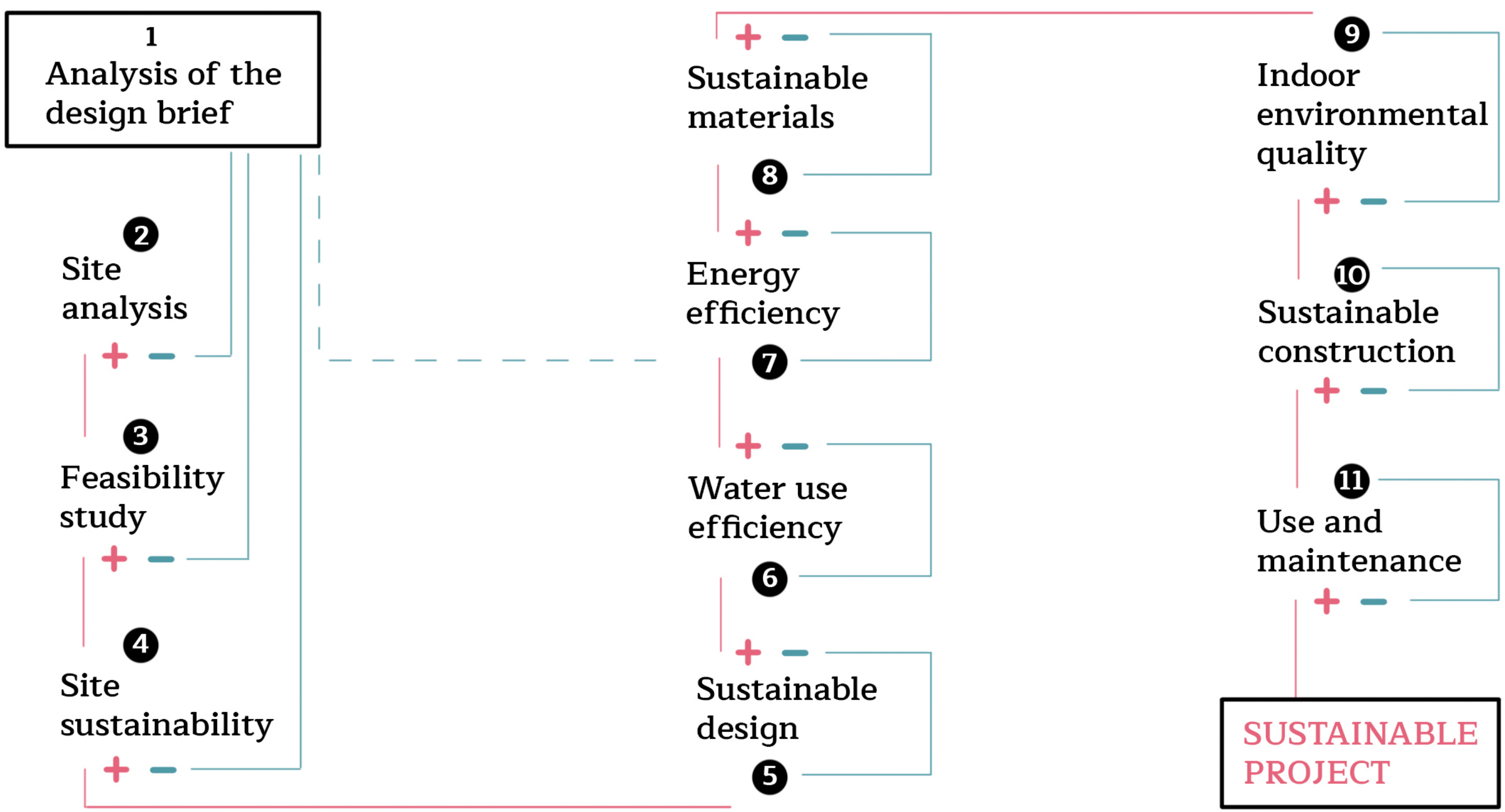
11.B CREATION OF A MONITORING AND MAINTENANCE PLAN (for the investor / administrator)

_MONITORING OF PERFORMANCE PARAMETERS (maintenance of building systems, constant adjustment to new technologies, constant monitoring of user requirements and control of systems to fulfil needs at a minimal operational cost)
_PROVISION OF INDOOR AND OUTDOOR CLEANING (use of sustainable, ecological and biodegradable products, cleaning of installation filters, appropriate storage of chemical products)

11.C CREATION OF A POST-OCCUPANCY MONITORING PLAN (monitoring the parameters of thermal and acoustic comfort, of light and lighting, of space and furniture ergonomics with the aim of improving them or of adapting them for multiple uses)

11.D ASSESSMENT

POSITIVE RESULT → SUSTAINABLE PROJECT
NEGATIVE RESULT → **11.A**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References

Heywood, H. (2012). *101 Rules of Thumb for Low-Energy Architecture*, RIBA Publishing.

Heywood, H. (2015). *101 Rules of Thumb for Sustainable Buildings and Cities*, RIBA Publishing.

UGREEN - Escola Online de Construções Sutentáveis (2021) The course *Sustainable architecture week* / https://www.ugreen.com.br/sustainable-week/