

VITRUVIO
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The architectural design in time of crisis

A research of "roots" to support the development

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ABSTRACT

Vitruvius wrote the first treatise of Architecture and in it we find the fundamental recommendations for a good design. In the past 50 years it seems, instead, that each of these directions had been lost and there is today the need of promoting a new design paradigm that is attentive to nowadays criticalities and directed to sustainable development.

The term sustainability starts to configure the quality of human actions since the 80's following reflections on the resources limit (raw materials and fossil fuels) and the environment capacity limit of absorbing emissions and waste.

The concept of sustainable development was elaborated in 1987 in the Brundtland report according to the need of distinguishing it from the concept of growth, that is to say with the goal of tending simultaneously toward the quality verification of programs in the environmental, social and economic dimensions.

All that invited the whole society to reconsider its "lifestyle" that, in the specific field of architecture, meant finding a new design approach geared to a lower consumption and greater caution and responsibility in the choices.

The configuration of a new design paradigm can trace their roots in the study of history and can proceed to evaluate the actions in a broad context of skills to ensure the quality of the products.

KEYWORDS

project culture; sustainability; evaluation

1. SHORT ANALYSIS OF THE CRISIS

The architectural design in this era of 'crisis' needs a deep reflection that encompasses from the origins of the reasons of the project to those of the current crisis and is able to announce a 'recap' of the fundamental principles, underlying the 'choices', not only for technicians but also for the formation of future designers. (Raiteri, 2014) It is evident the accelerated transformation of the studies and practice of making architecture in conjunction of structural and technological innovations: to free themselves from the weight of the structures, towards more "dematerialized" and light systems and at the same time ignoring the problems of the cold or the heat in homes, because they are entrusted to a technical plant design always more sophisticated and efficient, it released the designer by a series of "strings" of the project, this meant the illusion of an extreme freedom in the definition of a "drawing" only subject to laws of formal composition.

For these reasons materials and systems deemed to be obsolete and/or not economic convenient were abandoned: they have been using no more massive structures but lighter skeletons able to guarantee structural efficiency with minimal material consumption and wide availability in the management of empty space in walls and plants. The offer of new technical plants, also, contributed to the possibility to minimize the thickness and to assume total openings.

The challenges relating to the objectives of minimizing the structures and maximizing the comfort can not be the only reference parameters; for example, the overall quantity of energy required for configuration of indoor comfort must be evaluated; not only that directly used to cool the environments but also that needed to get structural materials

more advanced which must be added a further consumption for the numerous transportation-always more considerable as it related to a centralized production that do not consider the relations with the territory.

The energetic issues and the environmental emergency shall not be dealt separately because they placed/are putting in crisis even the current development model.

At the origins of 'crisis' there are complex reasons and choices aimed at rapid improvements of 'wellbeing', poorly evaluated in outcomes over the long term. (Carson, 1962)

For Italy, it is unnecessary to remember the link between the mid-century energy policy (abandonment of researches on renewable energies which also had a role in the 30's) and petrochemical development; the economic boom and the growth of manufacturing industry; the displacement of populations from the countryside to the city with the change of agricultural work/mechanized and connected to the chemical production of fertilizers and pesticides. (Bevilacqua, 1996). We are referring to about fifty years, in which the new culture was consolidated (disposable) focused on the boundless trust in the progress of science and technology, able to solve problems and create an artificial reality hypothesized better than the natural.

It is configured a crisis of development model woven with ecological-environmental crisis now very advanced and certainly caused and aggravated by the type of development. (Bevilacqua, 2006).

Many responsibility are also found in the field of architectural design; indeed, the architect activity has consequences on the environment and on the energy consumption right from the approach to the project and the resulting modalities of execution of works.

It would suffice to consider that over 35% of energy consumption is found in the civil sector (for building 100 square meters are used about 100 ton of waste materials; the 40% of waste is to imply to construction and demolition operations; about the 20% of emissions come from the construction industry).

The construction sector, therefore, is strongly responsible for both soil consumption, energy and materials and production of waste as well as of emissions, at all stages of the process.

The 'data', which can be determined by the sites of ministerial and official bodies responsible, highlight therefore a growing shortage of resources (the 80% of the used energy is still of fossil origin; the energy prices in the last 15 years have quintupled), a conspicuous use of materials (raised of 80% over the last 10 years with a rise in prices that have tripled), excessive land use (which continues without being stopped) and a still uncontrolled emission of CO₂ (falling with consequent climate change).

All that promises extremely critical situations of water stress, famine, climate migrations, epidemics, poverty, and determines the need of developing 'new challenges' for the overall governance of the territory and to meet additional needs in specific projects.

2. METHODOLOGY AND PROJECT CHECKLIST

The notes below summarize the way towards the development of a more appropriate methodology underlying the sustainable and environmentally conscious project; in other words, we want to highlight a project approach innovated in the field of technological design that emphasizes, methodological and quality

issues.

For the "technological design of architecture" the general methodological dimension refers to the 'systemic logic' understood as a corpus of concepts, principles and applications according to interactive and interdisciplinary modalities.

The pursuit of quality and the introduction of the concept of evaluation of the project-process, before of the architecture-product come from a need-performance setting and return, more markedly, to the project act responsibility.

An ethics recall of making architecture regains importance that today knows more serious implications than all previous eras.

I recall the problems that generally have been invested, since the industrial revolution, the 'making architecture' and mainly the events which, starting from the last three decades of the '900, gave new responsibility to the architect: the energy crisis (from the 70's) and thereafter the environmental crisis (from the 80's) showed consistent problems - raised by the consciousness of resource limitations (materials and energy) closely related to questions of construction-which never had emerged with so much weight and did not fit in the concerns of the designer for too long.

At the end of the 60's many intellectuals took a critical attitude toward that technology that was identified in the construction of the contemporary city where the skyscraper took on the value of symbol of economic power. The "dispute" was manifested with countercultural communities, which resulted as real laboratories of alternative research; it contributed to alternative technologies, based primarily on the research on renewable energies as opposed

to conventional fossil materials, such as solar and wind. The research informed of local peculiarities and the rediscovery of local cultures led then to deal with the problems of the third world, has always been considered the natural market and the expansion field of building production that appeared in those years, even more foreign to the culture of the dwelling of places, to climate and local resources.

So "poor" or "intermediate" technologies were proposed to improve the quality of the actions in the D.C.; these technologies were used for interventions in areas unrelated to western culture, capable of enhancing the characters of the traditions of the places, considered cultural heritage representative of the specific identity as opposed to the processes of cultural and environmental flattening. (Norberg-Schultz, 1979).

The philosophy behind this different way of understanding the technology, attentive to the needs of users, in other words, but even more aware of the environmental criticality, local resources and renewable energy, in the 80's, led to the theory of appropriate technology that also today are intervening instrument useful to retain the identity of European world, characterized by historical presence, landscape values and environmental resources of particular richness and complexity.

Appropriate technologies began to confront the tradition and take on the task of promoting and enhancing urban pre-existences, preserving the identity of existing geographical areas that have great landscape value.

Currently they include also highly innovative instruments provided that the solutions appear congruent with the demands of high quality and limited transformation. The tasks are essentially the management and the coordination.

The path of technology, since the contestation and rebellion to the enslavement of the technique and its use as a means of headless representation of power, arrived finally to identify two ways of understanding the possibilities of technology and science:

a) an scout attitude, identifying the research always more aimed towards new goals of science and technology, which sets no limits to the exploration of knowledge and tools whose innovative content can also be destructive for the habitat; the technological challenge is configured, in this way, tense to produce large and sophisticated techniques, structures with high-cost of construction and management, buildings in which the offer of comfort is increasingly mechanized and artificial;

b) an attitude characterized by a long and patient revision work of the equipment of the industrial era that configure technologies considered means of environmental quality control, operating within individual reality and expressing themselves through "intelligent" management of resources, in order to propose environmental systems not serial and strongly identifiable. The latter aims to build a liveable and environmentally controlled habitat and are often called to repair faults produced by uncontrolled innovations. (Gangemi, 1985).

Re-reading the treatises and these buildings handed down by tradition with a specific attention to comprehensive process of design-construction become a first step to reconnect the roots of knowledge and of practices for the solutions of actual critical issue. (Emery, 2007). Reflections, in particular, on rereading the "Treatise" by Vitruvius, identify significant contact points with the present problems in the current cultural debate. I mean the crisis of building culture: the criticism that diffusely is directed to some 'attitudes' in architectural design, extremely oriented to formal wills, overlooking the actual answers to the needs which determine; the need to govern a complex and interdisciplinary framework that often escapes, or is subject to uncritical proxies; the urgency to reconsider context problems too long ignored on account of a possible relocation of 'products'.

3. SINCE THE FORMATION OF ARCHITECT

Vitruvius maybe was the first architect who felt the need to write a «systematic treatment on architecture»; it is for technicians, but also collects information for the professional architect (Book I, I), an issue closely connected to and projected towards the future; a first part of the training considers that it must be necessarily broad and interdisciplinary.

«In the forming of the preparation of the architect contribute cultural contributions of many sciences and the experience of other arts. There is, indeed, a practice and a theory of the architecture. The practice involves continual exercise of a manual activity in respect of any material, to form it into shape. The theory is,

however, that technical and methodological capacity that concrete itself in the design of the work. [...] He should be competent in the field of literature and especially of history, skilled in design and good mathematician; he should be cure his philosophical and musical preparation; he shouldn't ignore the medicine, he should know the law and the rules governing the motions of the heavenly bodies.» p. 8-9

The preparation in letters, history and philosophy means as fundamental to the 'cultured' configuration of the project that, with the drawing, make it transmissible, able to be transcribed and outcome of 'knowledge', of "thinking", of the buildings handed down from history; but it must not fail math, under the double aspect of geometry and arithmetic: the first as a work tool, the second as practice for the economic management of the project; still highlighted the medical science, comparable to the knowledge of the 'environmental' issues (the picture is completed by the knowledge of the movement of the stars) and jurisprudence; for these latest is subsequently clarified the aim for the determination of healthiness of places and the capacity to proceed in accordance with the laws and regulations.

«in order to know the elements that may be helpful or harmful to the health of man: the influences of climate, the characteristics of the air in the place, of water. Disregarding these factors we can not build any healthy house. Legal knowledge to control disputes, the astronomy for their clear laws relating to orientation and weather» p. 11

The reference to the interdisciplinary preparation is therefore more timely than ever; even more urgent it is the need to configure the discipline

of 'project' from "information for building" to "consultation between the protagonists of the same" is determinate, where the protagonists are the leaders of all the considered skills. It is promoting a careful and responsible planning where an important feature, often not disclosed, outcome of a long and laborious research, of a punctual knowledge of the technical solution and of handed down story, is highlighted; on the contrary it often leaves too much space to 'creative', understood as spontaneous and sudden inspiration.

It is reported the story of Dinocrate that proposes suitable projects to glorify Alessandro when he came to power; the architect Dinocrate had «conceived the design of carve Monte Athos in the figure of a man, with his left hand holding the broad perimeter of the walls of a big city and with the right hand a so large patera to catch the water of all the rivers that came down from the mountain and then pass them into the sea. The project appealed to Alessandro who immediately asked if around the city were fairly extensive campaigns to provide wheat needs of the inhabitants. When he was told that for the supply it would have been necessary to use the import by sea, he said: "Dinocrate, I admire your artwork and I welcome this, but I think that the foundation of a colony in that place is a project to disapprove. As an infant can not feed themselves and grow without milk of the mercy, so a city can not arise if it is not surrounded by fields that provide their products, and can not have a large population without a wide availability of food to sustain it.» Book II, Preface p. 30-31

4. EXIGENCIES-PERFORMANCE METHODOLOGY

Together with an interdisciplinary work the systemic- performance approach must be evaluated, as a guarantor of the weight and balance control posts at stake by the choices of the project compared to the quality of the product and the protection of the environment. (Spadolini, 1974).

The consideration of the basic needs (security, well-being, usability, appearance, management, environment protection) can become the reference, the guide to design consciously taking into account, in a balanced manner, and by testing, compared to every need, the choices more appropriate and sustainable.

The so recommended sustainability becomes the responsibility of the architect-builder for realizing the project.

(The) « buildings must have strength requirements, utilities and beauty. They will have strength when the foundation, built with carefully chosen materials and without greed, will deeply and firmly on the ground below; utilities when deployment of interior space of each building of any kind will be corrected and practice for use; beauty finally when the aspect of opera will be nice thanks to harmonious proportion of the parts that is achieved with the shrewd calculation of symmetries.» Book I, III, Parts of architecture p. 17-18

But if the sustainability must bring together all projects, the knowledge of local peculiarities (material and immaterial) is the effective implementation of this recommendation and it is, therefore, from the knowledge of historical experiences and tradition that can start a fruitful cultural mending operation between past and future. (Davey, 1965).

(Men have the chance) [...] «to handle easily with fingers any object, began [...] to build huts covered with branches, who dig caverns beneath the mountains, who, also, to build with mud and branches of the shelters under which shelters, imitating the construction technique of the nests of swallows. [...] when therefore with the daily activities, the men increased their manual ability in fabricate [...] and when they noticed many materials offered by nature [...] through their work were able to do more pleasant and comfortable life, which the art made more refined. I will talk so about these materials useful for the fabrication, describing features and advantages. » Book II, I, The origins of construction art p. 32-34

5. THE 'ENVIRONMENTAL' QUESTION

«For a proper positioning of the buildings, first of all, we must consider in which areas and under what latitude should be built. We can't indeed assume that a single architectural model is suitable for all regions [...]. It is necessary to remedy with art to the drawbacks of nature. Also in other regions it is necessary to try to improve environmental conditions, using appropriate criteria according to the different latitudes. [...] because, therefore, different climatic conditions characterise various regions [...] I didn't hesitate to indicate a different type of buildings according to various characteristics [...]. » Book VI, Influences of climate on the architecture p. 109-111

«Now I say in which orientation should have each environment to be functional.

The winter triclinia and bathrooms look inwards west winter, perch need to be exposed to the light of afternoon [...]. The bedrooms and the libraries are instead directed to the east, as it is

for them more than useful a morning lighting. [...] Spring and autumn triclinia have to see in the East: the direct exposure to the Sun, which rises from the East in the sky to seek west, will mitigate the temperature in those hours of the day when it is usually used. The summer ones have instead to face the north, because this region is not in the days more hot of the summer like the others; [...] Always in the North picture galleries, workshops for weaving and embroidering of tissues and studies of painters must also arise, for these is needed a constant lighting, it maintains unchanged the hue colours during processing the work. » Book VI, IV, Orientation of the house 115-116 p.

I want to propose a way of tackling the project aware of cultural roots, attentive to environmental issues, needs of users and able to provide a "sustainable" development in the full sense of the term. (Tiezzi, 1992).

The design must therefore pay close attention to all stages of the process to the implications of each of them on the environment; in short, we must strive to realize the "project" in the difficult balance between the choices that involve the entire 'package of needs' without indulging in favouring one aspect (structural, aesthetic, functional, ...) at the expense of others.

The systemic approach and the requirements-performance assessment -attentive to environmental impact-in the configuration of the design choices thus becomes a "way" that can guarantee the best results in any activity of transformation.

To exit from actual economic and environmental crisis, we must review the cultural paradigm of development and, in particular, of dwelling. (Illich, 1973).

We must have the perception of the natural limits of growth and rethink the territory and

exploitation of local resources (tangible and intangible). (Ruzzenenti, 2011).

To think, then, on the new complexity coming from the paradigm of sustainability (consumption, emissions, waste) and the introduction of further study relation (declination of environmental protection); the need, in essence, to switch from a linear to a cyclical method in which the concept of "evaluation" emerges as a reference. (Donolo, 2007).

The setting of the project in terms of life cycle requires a special attention to the choice of materials, and, as consequence of the building systems, to climatic and resource usage for the comfort quality; these "attentions" impose a constant reference to the local situation, knowledge of "place", the most extensive and thorough as possible, like introduced by "appropriate technologies" and today recalled and updated as a strategy to meet the demands of sustainability.

The methodology of work is based on interdisciplinary collaboration for the development of excellence available locally (cultural and productive level); this is to provide adequate support for commissioning to qualify the question and make it compliant with 'real needs' by spreading and sharing the culture of sustainability, new forms of economy and of living necessarily flexible and adaptable to new requests.

The goal is the innovation of the 'model' according to the parameters of ecology: cycles closing by the reclamation, the regeneration and the renewal of the existing, material and spatial, heritage.

6. NEW CHALLENGES OLD PARAMETERS

The new challenges are: air, climate protection, water and food; without those elements there is chance to enjoy anything else. We are in a situation already at risk in different parts of the world. (Friedman, 1978).

It seems necessary, therefore, to move from these elements to rethink the project in a holistic approach, so as to ensure at least the survival of the human species:

- the quality of the air recalls, for the planners, the question of mobility to rethink along with appropriate means and energy production, at the same time should be posed the problem of reduction of mobility increasing the possibility of virtual communication (a system of interconnected cycles, of actions and involvement of different sectors is determinate, where is fundamental the trans-disciplinarily and a plan together);
- the climate protection calls into question the use of energy, from savings to change of resource at its management; the goal should be aimed not so much at the new buildings, but especially at the historical heritage and in a recent optical of renewal- regeneration connected to the 'zero land use' objective; in this sense it is necessary not only re-designed the buildings but also the cities and the territories (to produce effects of mitigation and reduction of demand); setting up a holistic design process that moves from use of materials (procurement and production), connects to the problems of the construction and its management up to configure end-of-life scenarios (even in this case there are many crucial policy choices to favour skills and virtuous paths); (Butera, 2007).

- the quality and quantity of water are closely connected to the land use and become a discriminating factor in the management and the project of plants at the building, neighbourhood and territory scale (also the water may contribute to climate change mitigation as well the production of food);
- the food is the essential element connected to the ground, as the vegetation and biodiversity; for it is necessary to plan a productive symbiotic integration. (Bocchi, 2015).
« Pythagoras [...] claimed that four key elements are: air, fire, earth, water; their association arise the various aspects of nature and the different property which distinguish species of beings. We can, yet, observe that these elements not only give rise to all living beings, but that without these principles, they could not even eat, grow, be preserved. Indeed the bodies could not live without breathing air, [...] If a body was missing right quantity of the heat, would lose the vital spirit [...]. Similarly, if the limbs do not feed with the foods of the earth, the body would lose that force that is conferred by the presence in its composition of this element. All animated beings that were finally deprived of the presence of water, bled and sucked dry of liquid element, withered.[...] The power of the sun and the fire are ready to provide heat to make life safer. The earth, for its part, feeds and nourishes the living, sating them always with the huge quantity of fruits which provides them as food. Even the water is a great gift for the man, as it not only satisfies his need, including the drinking, but also offers numerous conveniences to his life. »
Book VIII, Preface p. 148-149

There are therefore old challenges and each of them involves a political choice, clear communication and a share by inhabitants, a trans-disciplinary project that can have a

director in the skills of 'technologists', which has always formed on a need-performance systems approach. (Sinopoli, 1997).

The project and planning (of regeneration), therefore, should include:

1. the control of air, starting from the detecting of the pollution sources (specifically territorial system) to intervene in mitigate/eliminate emissions
 - 1.1 to check the industrial production and to assess possible remedial action;
 - 1.2 to promote traffic reduction and the change of the vehicles types;
2. a control of the used energy able to go towards the consumption reduction and the change of sources
 - 2.1 to analyse the data and program the actions starting from public buildings as autonomous and efficient;
 - 2.2 to assess local resources and to design the innovation and the self-sufficiency;
3. the management of water and fluids to reduce waste input level (drinking water) and outputs (waste)
 - 3.1 to analyse the data and program interventions at neighbourhood level, urban and territorial;
 - 3.2 to innovate the role also in terms of energy (active and passive);
4. the primary sector and food production (the specific characteristics of the territory) as an integrated system
 - 4.1 the management of survival food
 - 4.2 the symbiotic management of water and wastewater systems (for irrigation and fertilizing), energy production and industrial waste (in particular construction).

evaluation methods	scope/scale of application	definitions and objectives
ECOLOGICAL FOOTPRINT (W. Rees; M. Wackernagel)	territory, city	To evaluate the impact that a population exerts on the 'environment; the total area of terrestrial and aquatic ecosystems needed to provide all the resources and to absorb all emissions is calculated, whereas sustainable modalities.
ENERGETIC ANALYSIS (H.T. Odum)	territory, services	city, To assess the sustainability and the environmental impact of various systems, ensuring in the long term, a project/plan of sustainable use of resources; all streams, input and output, are aligned to the common denominator defined by solar energy. The energetic analysis, through the environmental impact report, allows to configure 'maps' of territorial sustainability.
CO2 BUDGET (commission IPCC)	territories, industries, air pollution	To evaluate, with respect to the absorption capacity of environment, the quantity of anthropogenic emissions of carbon dioxide and other greenhouse gases of a place; to track and to summarize, in the full year, CO ₂ emission sources (direct and indirect) and "tanks"(structures able to absorb and store CO ₂) available.
LIFE CYCLE ASSESSMENT (SETAC Society of Environmental Toxicology And Chemistry)	material, product, process	LCA is a process that allows to evaluate the environmental impacts associated with a product, process or activity through the identification and quantification of material and energy consumption and emissions in the environment and the identification and assessment of opportunity to decrease these impacts. The analysis concerns the entire life cycle of the product ("from cradle to grave"); from extracting and processing of raw materials, production, transport and distribution of the product, its use, reuse and maintenance, until final placement product recycling and after the use.

7. FROM 'RECAPITULATION' TO INNOVATION: ACTIONS ASSESSMENT

It is to foreshadow a scenario of common development, to know its operation and provide methods of evaluation of different actions/ programs that must rotate; crux is the rules transfer to different situations that constitute the peculiarities of our territory, at natural and human level.

In the construction industry, the need of addressing sustainable development issues in scientific terms and aiming to set up balanced situations of sustainability, without sending them back in time and space (referring to 'remedies' as the buying and selling of shares of sustainability: emissions trading) leads to a methodology that moves from the knowledge of the level of local sustainability to indicate strategies in the construction industry.

Near the refinement increasingly sophisticated of bio-climatic systems and the attention for the energetic and ecological efficiency of buildings that-rightly-have affected the researches in our field, we have to face- among the fields of interest of research- the control of the materials choice (from sourcing, processing, and recycling) in relation to the performance requirements (environmental, structural and technical) and territorial resources.

We must tend to guide activities, affecting a specific territory, toward a best use of the resources, trying, at the same time, to maintain or improve the "health" of the system.

The necessary tools to understand and evaluate those domains are complex and multiple such as the concept of sustainability. Therefore it is necessary to resort to interdisciplinary scholars.

The attitude of 'balance' in the draft of the construction-architecture, which seems to be

discounted and entrusted to a natural common sense, is instead characterized by a particular complexity when it is unavoidable that it figures in a rich system of interactions where economic, social and cultural factors retain considerable influence. So the need to hire a new behaviour emerges, it is the same as that outlined in 'to make sustainable' (starting from Vitruvius).

The sustainability calls therefore questioned the special aspects of recently "architecture" and therefore even the current indications for the project: the knowledge of the history of the building and its theories can constitute then an interpretation and a tool to operate in a substantial 'continuity' which can take, at the same time, the significance of sustainable action.

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