

SUSTAINABLE ARCHITECTURE

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Abstract

Since the UNO World Conference on Environment and Development held in Rio de Janeiro in 1992 the issues of sustainable development became studied thoroughly in all the branches of science and technology. Architecture and construction soon followed this trend. The International Council for Building Research (CIB) organized the first international symposium on sustainable construction in Tampa (Florida) in 1994, and there a first tentative definition of sustainable construction had been coined by Kilbert (USA) as ‘creation and responsible management of a healthy built environment on resource efficient and ecological principles’. Outstanding issues delivered from these principles are: the quality of indoor air, the amount of energy used for heating and air-conditioning of buildings, waste management, durable and “environment-friendly” building materials, housing for the poor, etc.

Keywords: sustainable development, architecture, construction industry, energy used for heating, waste management, construction costs, building materials, building research

The environmental problems of humankind appear with an exceptionally dramatic effect at the scene of the meeting and merging point of natural and built environment: at human settlements, cities and villages. That fact came to be realised as early as the 60s of the previous century, when people first began to be really conscious of environmental problems. It was following the end of that decade that in the volume titled ‘The Challenge for Survival – Earth, Air and Water for the Man of the Megalopolis’ edited by Pierre Dansereau, Columbia University Press, published the text of twelve lectures delivered at a 1968 New York symposium of the same title. At that time it was already undeniable that while environmental problems threatened the whole mankind, the first disasters – the ones that were analysed at the symposium mentioned above – afflict masses of the population of megalopolises and even today it is the citizens of great cities who are subjected to the greatest danger, especially if they live in one of the giant cities of developing countries.

1. International Cooperation in the Field of Sustainable Architecture

Those facts were paid special attention in the course of the first international effort to analyse environmental problems at governmental level, the findings of which were

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published in English in 1987 under the title 'Our Common Future' and one year later it was also published in Hungarian by Mezőgazdasági Kiadó. In professional circles that work has been referred to as the Brundtland Report after the name of the prime minister of Norway at that time, who also acted as the chairwoman of the international committee working on the report. According to the Brundtland Report in developing countries few municipal governments possess the necessary amount of energy, resources and qualified staff to supply the rapidly increasing population with the services and utilities indispensable to a decent human life. Consequently, illegal settlements spring up everywhere with increasing over-population and raging diseases arising from the unhealthy environment. At the same time the Brundtland Report pointed out that several cities in industrialised countries also faced acute problems: the deterioration of the infrastructure and the environment as well as the decay of internal districts of the city.

It was the Brundtland Report that prompted the organisation and served as a basis of the UNO Environment and Development World Conference which was held in Rio de Janeiro in 1992 in the presence of prime ministers and heads of states. The achievements of this conference as well as the Rio Declaration have been published under the title 'Tasks for the 21st Century' and it was this volume which opened new vistas by giving the world the guiding notion of 'sustainable development'. The Rio Conference demonstrated that the implementation of sustainable development was an extremely complex objective, which required the participation of all professions, fields of science and the various sectors of economy and society. For that reason nearly all professions set out in the years following the conference to clarify the tasks to be solved in their own field for the sake of sustainable development. A similar effort has been made in the field of architecture and construction technology, all the more so, since the text of the Rio Conference provided special incentive for that in Chapter 7 of the publication, which highlighted the construction of residential houses and other related activities in the building industry under the heading 'The Promotion of the Sustainable Development of Settlements'. Two non-governmental world organisations, the International Union of Architects (UIA) and the International Council for Building Research (CIB) played key-role in the detailed study of the tasks of sustainable architecture and sustainable construction. In the following we are going to outline the tasks of sustainable architecture and sustainable construction mainly on the basis of the proceedings of CIB, but also to some extent on the achievements of UIA.

CIB organised the First International Symposium of Sustainable Construction in Tampa, Florida in 1994. An attempt was made in the course of the meeting to find a concise definition for the notion of sustainable construction and it was Kibert's wording that came to be almost unanimously accepted as a first approximation. Kibert from the USA defined sustainable construction as the creation and responsible management of a healthy built environment on resource efficient and ecological principles.

CIB repeatedly emphasised the usefulness of Kibert's definition in 1999 in its publication titled AGENDA 21 but they noted at the same time that while in the beginning researchers, government offices and entrepreneurs focused mainly on the

so-called 'hard' technological problems, in the recent years 'soft' social issues, as special as the question of the preservation of architectural cultural heritage, have come more and more to the foreground. Although we stress that a part of the related social problems may justifiably be classified as 'hard' indeed, we still aim to base our following outline of the requirements of sustainable architecture and construction on the principles of 'healthiness', 'energy-efficiency', 'ecologicalness' and 'high social and cultural standard' referred to in Kibert's definition and CIB's AGENDA 21.

2. The 'Healthy Building'

The definition of 'the healthy built environment' incorporates both the urban environment outdoors and the indoor surroundings. While in highly developed countries the pollution of the urban environment brings to mind the traffic and most of all the air-pollution caused by motor traffic, in developing countries the most distressing issue is the infection of drinking water. Whereas architects have very few means to solve the latter problem, they may have greater influence on the reduction of urban air-pollution as it is largely the duty of the architects responsible for settlement design to ensure the proper ventilation of cities. Still, the combat of urban air-pollution is predominantly a question of transport technology and transport policy. The situation is different, however, for the quality of the environment inside buildings, as it falls to a large extent into the competence of architects and the experts they call in. This latter issue has been the subject of intensive international research for a decade as a result of which the notion of 'the healthy building' evolved to signify the objectives architects and their experts must strive for. The following fields are listed as part of this notion:

- the quality of indoor air
- thermal comfort
- acoustic comfort
- visual comfort
- functional comfort

The quality of indoor air is satisfactory if it is free of all sorts of vapours, gases, microorganisms and radiation, the presence of which beyond a certain limit value endangers health of people making use of the space. Various kinds of paints, adhesives, heating and electrical equipment, cosmetics and mildew can cause such an unwelcome effect. Thermal comfort consists mainly in the guaranteeing of suitable temperature, humidity and air-movement, acoustic comfort requires keeping the effect of external and internal noise sources below a certain level, visual comfort is achievable through appropriate natural and/or artificial lighting and psychologically favourable colour effects, and finally functional comfort means the unhindered use of internal spaces and their equipment. A special issue within the latter component of comfort is the empathy which is expressed by taking into account the life standard of the disabled.

3. Efficient Utilisation of Resources: Energy- and Material-Saving Construction

Dangers of the remarkably fast increasing energy demand of humankind have already been dramatically highlighted in the Brundtland Report. One part of the threat is the exhaustion of non-renewable sources of energy, another part is the danger of a disastrous change in the climate as a consequence of the carbon-dioxide emission involved in the use of certain sources of energy. It is therefore the universal interest of humankind that compels architects to radically decrease the energy consumption of buildings and to rely on the renewable sources of energy, and most especially on solar energy, to the greatest possible extent. It is called 'energy-conscious architecture', which most eminently strives for those objectives and they have many means to achieve their goals. Their most important methods include the (nearly) optimal thermal insulation of buildings and the 'passive' architectural utilisation of solar energy for instance by the appropriate orientation of buildings, the correct formation of the architectural mass, the suitable sizing and placing of apertures, and other structural means such as incorporating traps for the heat in the construction, with the aid of which the entry of external heat can be significantly reduced in the summer and the dissipation of heating energy can be minimised in the winter. An equally wide range of more expensive "active" means (through the application of installations) is available for the utilisation of solar energy, for example the production of hot water for domestic use by sun collectors, the application of heat-pumps and other devices (most notably solar cells) for the direct exploitation of the sun's capacity for the generation of energy. These days the expression 'solar architecture' is widely used for the school that is altering even the appearance of cities through the application of means like the ones mentioned above.

The more efficient use of building materials consists mainly in the increase of their durability and resistance to fire but the options for repair, renovation, reconstruction and replacement also play an important role. Tendencies like the improvement of the quality of building materials and the construction of slender structures made of those, as well as the evolution of right dimensioning methods may make us more optimistic. The reduction of water consumption of buildings, especially of 'water-related rooms' can also be seen as an example of the sparing use of materials. Life cycle analysis (LCA) is an important means of making architectural design more cost-efficient, by enforcing in the comparison of various designs the principle of taking into account not only the costs of implementation but all the expenses arising during the useful life of a building including the costs of a possible demolition.

4. Construction Ecology

Needless to say, many of the objectives discussed so far are also significant from the ecological point of view. Such aims are for instance the ones of constructional

energetics, which have already been emphasised with regard to climate change. The need for the reduction of water consumption and the need for the economical use of building materials are also essential from the ecological point of view since the production of many building materials (e.g.: bricks, cement, glass and steel) requires a great amount of thermal energy, which may add considerably to the probability of a potential climate change.

No reference has been made yet, however, to two other construction-related ecological issues: the treatment and reutilisation of waste materials as well as the highlighting of 'environment-friendly' materials. The enormous amount of solid and liquid waste generated as a by-product of the daily life of the population causes a very serious ecological problem. The comprehensive solution of this problem is largely beyond the scope of architecture or construction technology, nevertheless, there are a number of things a designing architect may do, for instance by creating functionally and hygienically adequate facilities for the collection, storage and transportation of solid waste from buildings. The question of what should happen to the debris left after the demolition of buildings is another issue of utmost importance. The regulations in many countries require the recovery and recycling of steel from reinforced concrete and the portion of the debris that can function as rubble must be used again – after the appropriate processing – as aggregate in the production of concrete.

The application of 'environment-friendly' building materials to the highest possible extent, as well as the evasion of other materials have become central objectives of construction ecology. An important characteristic of environment-friendly building materials is that they are easily reutilised or destroyed after the demolition of the building. Wood is an outstandingly environment-friendly building material, whereas concrete qualifies poorly in that respect. The healthiness of internal spaces is believed to be considerably influenced by the fact whether the masonry materials have at least a minimal air permeability – referred to as the 'breathing' of walls – or they act as a hermetic barrier to the external environment, which is harmful from the ecological point of view.

5. Social and Cultural Requirements

The UNO Centre of Human Settlements (HABITAT) is especially devoted to the fight against accepting the term 'sustainable' to describe the construction activities of countries which cannot provide healthy and suitable dwelling for each of their citizens. At the same time it is a well-known fact that the meeting of that requirement is hindered all around the world by extreme economic difficulties. A further issue is the justifiable fear of the critics of globalisation that a wide range of countries, regions and cities would lose their identity. Architecture has a key-role in the preservation of identity, which partly requires the careful protection of our monuments and the refusal of architecture which has no message for the mind, no motivation of spirit.

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