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## ARCHITECTURAL PROGRAMMING AND BUILDING QUALITY EVALUATION FOR ENERGY SAVINGS AND SUSTAINABLE DEVELOPMENT OF BUILT ENVIRONMENT

The study is focused on new philosophies of architectural design and urban planning in response to the needs of modern cities which, being built environments, are confronted with many detrimental phenomena. The philosophies discussed have a holistic approach and are based on the processes of continuous quality analyses and decision-making on the grounds of the conclusions (programming). Such novel approach makes it possible to achieve high quality of the built environment in observance of the sustainable development principles.

### 1. INTRODUCTION – DETRIMENTAL PHENOMENA OCCURRING IN THE ENVIRONMENT OF THE CITY

So far many modern cities have not devised a strategy securing their steady and long-term growth in accordance with the principles of sustainable development. Measures undertaken by city authorities are often on short-term bases only, focusing on the technical aspects of urban management. Attempts undertaken to address the detrimental phenomena observed in cities have been unsuccessful and many cities are now facing or will soon have to face the hazards involved in the loss of their functional performance. The most important commonly occurring threats include:

*Migrations to cities.* Since the mid 20<sup>th</sup> century cities have to handle increasing migration. These days the inhabitants of cities constitute 50% of the Earth's total population.

*Degradation of post-industrial areas.* Devastated, abandoned brown fields have spread in cities. In view of the experience of recent years, conventional methods of long-term urban planning, city resources management and promotion-marketing activities on the real estate market seem to have failed.

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*Hegemony of the market forces.* It is the market forces that determine, to an increasingly wider extent, the image of the city. Spatial arrangements have become a side-effect of securing the interests of the richest investors and developers.

*Decrease in the quality of the city environment.* On the one hand, modern cities reveal excessively compact developments and oppressive insufficiency of green areas. On the other one, in recent years the tendency to create the urban tissue consisting of low concentration of *energy-intensive structures* has been manifested especially on the city outskirts and far beyond. This problem has clearly occurred in Poland, especially in the absence of up-to-date local development plans for big cities. New housing structures are mainly located far from the existing public transport network, causing increased traffic congestion. Despite excessive costs of transportation infrastructures incurred by the UE countries, their efficiency keeps falling. Such abnormalities are conducive to the decrease of the quality parameters of the city environment.

## 2. CONCEPT OF SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF THE BUILT ENVIRONMENT

Modern man generally lives in cultural, built surroundings, devoid of permanent contact with the natural environment. Apparently, the quality of human life depends on the quality of the surroundings that man controls. In reality, however, activities based on such a way of reasoning have led to the disturbance of the equilibrium of ecosystems and to the ensuing degradation of the natural environment, which, in turn, exert negative impacts on the quality of the built environment. Further deterioration may be prevented by “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs“ [4], which is the principle of sustainable development. According to the Declaration of “Agenda 21” accepted in 1992 at the UN Conference on “Environment and Development” held in Rio de Janeiro, sustainable development should consider the following requirements:

*Ecological.* All human activities should support the natural environment. If it is impossible to eliminate negative impacts of human activity, they should be minimised and the losses compensated (as far as the built environment is concerned this mainly concerns excessive energy consumption by buildings).

*Economic.* Sustainable development should not generate additional costs, however, it should lead to increased employment.

*Social.* The objective is to maintain the existing social structure and to implement changes promoting the growth of a knowledgeable society.

*Cultural.* The focus is put on maintaining cultural identity, variety and heritage assets of societies.

The Declaration of “Agenda 21” emphasises the impacts from the processes taking place in the whole life cycle of a building on the natural environment, including the

manufacturing of building materials, demolition and reprocessing, as well as strategies for the growth of the construction industry. These statements have initiated the advancement of new quality assessment methods in the building sector and architecture and made way for new design philosophies, based on a holistic approach.

### 3. SUSTAINABLE DEVELOPMENT OF THE CITY ENVIRONMENT

A growing interest in the issues of sustainable development in Europe has been accompanied by increased importance of the concept of the compact city [1]. Constructive qualities that support the sustainable development of cities include among others: the compact nature of the city tissue, consistent policy of revitalising degraded inner city areas, functional differentiation of the city zones, participation of the inhabitants in their city expansion ventures, promotion of public transport, pedestrian and bicycle traffic and high quality of architectural designs and urban planning projects. The city policy is focused on the quality of shared public space and attractiveness of the city to its inhabitants.

The success of cities, measured by their sustainability level, will be determined by the social and economic policy [1]. The task of the first one is to secure the return of public life to the city, to retain its most valuable, creative and educated inhabitants, as well as to attract new dwellers, and, accordingly, to solve the problem of social polarisation. The task of the other one is, first and foremost, to define, on the grounds of the market mechanisms, the conditions attracting investments. The most essential elements of modern city management involve: offering the conditions stimulating the promotion of entrepreneurship, securing the observance of property rights and decentralising the decision-making process [4].

### 4. NEW DESIGN PHILOSOPHIES – PROGRAMMING AND QUALITY ANALYSES IN ARCHITECTURE AND URBAN PLANNING

Quality analyses and functional and spatial programming constitute inseparable elements of new design and urban planning philosophies. Quality assessment is an important element of enhancing quality in any field of human activity, including architecture and urban planning. In the quality-assessment analyses, errors are registered in a scientific and systematic way, thus, making their elimination from the design and implementation practice possible [3]. The following independent trends may be distinguished in modern quality-assessment analyses [2]:

*Functional performance of buildings.* Entailing many different quality-related issues: technical, functional, behavioural, organisational and economic.

*Energy and eco-efficiency.* The analyses are focused on reducing energy consumption in buildings and in the construction sector as well as on reducing the emission of

pollutants into the natural environment.

*Aesthetic quality of the built environment.* Research methods involved in these issues facilitate the adjustment of the look of a new building to the existing cultural context in compliance with the principles of shaping the aesthetic nature of certain areas.

The scope of the next part of the study is the description of investigating the trend of energy and eco-efficiency and the assessment that combines the issues of energy and eco-efficiency with the functional performance of buildings.

#### 4.1. RESEARCH INTO THE TREND OF ENERGY AND ECO-EFFICIENCY OF BUILDINGS

The trend of energy and eco-efficiency is supported by research programme in energy conservation financed and promoted by the International Energy Agency. “Energy Conservation in Buildings and Community Systems Programme” (ECB&CS) has been running under the auspices of the Agency for several years now. New concepts developed for buildings have originated within the trend such as Green Building and Eco-Building. The underlying idea of eco-buildings is the reduction of energy consumption involved in their functioning by utilising natural processes of ventilation and cooling, heat accumulation and by using alternative, renewable energy sources. In the construction of such buildings, special attention is devoted to the issues of reduction of emissions from pollutants generated in the course of their operational life, minimisation of toxicity, energy-intensity and emissions of hazardous substances in the process of manufacturing building materials. Another issue is the recycling or reuse of the building materials after the operational life of the building is over.

#### 4.2. RESEARCH COMBINING THE ISSUES OF ENERGY AND ECO-EFFICIENCY WITH FUNCTIONAL PERFORMANCE OF BUILDINGS

One of the first fully developed methods of assessing the quality of buildings was the Post Occupancy Evaluation (POE) originated in the 1980s [5]. Nowadays POE has become a standard method of analysing the functional performance of buildings. On the basis of the years of experience and conclusions drawn from the quality assessment of functioning buildings another method has been devised to present a new philosophy of architectural design and urban planning.

Building Performance Evaluation (BPE) [6] is an innovative method of analysing buildings at all stages of their life cycle, starting with planning, programming, designing, through constructing and using. It is based on the process of continuous quality assessments and decision making in consideration of the conclusions. BPE provides a systematic combination of the built environment with its users and their environmental

needs. The main objective of the method is to improve the quality of decisions made at all stages of the life cycle of the building, introducing the issues of sustainable development to the processes of design and construction.

According to Susan Roaf [6], there are two mechanisms enabling the assessment of buildings in view of their impact on the natural environment, making use of quality control processes available in the building industry:

*Drafting a directive of sustainability.* Each building would be assessed in accordance with systematised sustainability criteria at the stages of planning, designing, constructing, functioning.

*Employing the BPE method.* The structure of the method makes it possible to implement some key sustainability indices and standards. As this method is becoming a part of the process of management of estates and facilities, it may soon bring about good results.

Other recognised methods of quality assessment that combine the issues of energy and eco-efficiency with functional performance of buildings include [2], [7]: BREEAM (Great Britain), LEED (USA), BEEPAC (Canada), ECO QUANTUM (Holland), ECO-PRO (Germany), ESCALE, EQUER (France), ECOEFFECT (Sweden), ECOPROFILE (Norway), and GBTool (International Green Building Challenge Programme).

## 5. CONCLUSIONS

“To secure continuous and sustainable development, environmental protection must constitute an inseparable part of the processes of growth” (...) [7]. The city, constituting the built environment, is a scene of various conflicts. Development activities undertaken in one field may result in the hazard of reduced quality of other parameters in the life of city inhabitants. A holistic approach put forward in new philosophies of architectural design and urban planning may lead to the improvement of the quality of the built environment, and, at the same time, meet the requirements of sustainable development. Still, an insight into the way in which the city functions and into its external links is essential. The assessments of the quality of the built environment offer invaluable information to city authorities, urban planners and designing architects, especially in complex conditions. In consideration of the conclusions, it may be assumed that the discussed new philosophies of design may help to overcome the obstacles to sustainable development.

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PROGRAMOWANIE I OCENY JAKOŚCI W ARCHITEKTURZE  
JAKO WSPARCIE ENERGOOSZCZĘDNOŚCI  
I ZRÓWNOWAŻONEGO ROZWOJU ŚRODOWISKA ZBUDOWANEGO

W artykule przybliżono nowe filozofie projektowania architektonicznego i urbanistycznego. Są one próbą sprostania potrzebom współczesnego miasta, które stanowi środowisko zbudowane i w którym zachodzi wiele niekorzystnych zjawisk. Filozofie te charakteryzują się holistycznym podejściem i są oparte na procesie ciągłego wykonywania badań jakościowych i podejmowania decyzji na podstawie płynących z nich wniosków (programowanie). Dzięki nowatorskiemu podejściu umożliwiają osiągnięcie wysokiej jakości środowiska zbudowanego i jednocześnie wspierają zrównoważony rozwój.