

SUSTAINABLE DESIGN – ANALYSIS OF THE SELECTED EXAMPLES

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Summary

Contemporary vision of the housing environment is based upon an idea of the “ideal city”, which puts the needs of its residents as a priority. One of them is pro-health character of the residential environment shaped according to the principles of sustainable development and sustainable design, expressed, inter alia, by the respect for human rights and the natural environment.

Growing threats such as: reduction of biologically active areas or air and water pollution triggers the need for corrective actions in architecture and urban planning, but also in other scientific disciplines, based on the principles of harmony and care for the environment, but also including the needs of future generations.

This paper presents the contemporary architectural objects created in accordance to the principles of sustainable design. Among other things, the paper will introduce an analysis of the residential complex in Almere, and Bo01 which is a residential-service district in Malmo, Sweden.

These are great examples of applying sustainable solutions in architecture. Both principles of social and environmental balance were taken into account during the design of the surroundings, as well as the objects themselves. It should be emphasized that the inhabitants of Almere complex and Bo01 district were involved in the process of shaping living environment. In order to maintain biodiversity (in Malmö) they have committed themselves to placing home boxes for birds and establishing habitat for bats.

Keywords: sustainable development, friendly environment, health, high quality

1 Introduction

Modern trends in the design are based increasingly on the principles of sustainable development, expressed, among others, by the respect for the human and natural resources. There are not only eco-friendly single objects created, but also concepts of healthy cities remaining in harmony with the environment and natural assets.

Sustainable design resists environmental degradation for the sake of the health of the user, and environmental conditions. It also supports the Vitruvian principles relating to the durability of objects (Firmitas) their usefulness (Utilitas) and beauty (Venustas).

Sustainable development, as well as sustainable design, includes social issues affecting both mental and psychological well-being and sense of social coherence. LivingBuilding Challenge is an idea particularly important for social development. It is not limited to the concept of a single object, but also embraces the immediate surroundings. It generates an opportunity to create man friendly environment, with which he has the desire

and opportunity to identify. That in turn shapes the culture of the place, notion also supported by the principles of sustainable development.

Creating common spaces providing the opportunity to communicate with other people, facilitates social ties. This is particularly important in the area of multi-family housing complexes, where all the residents are, to a large extent, responsible for the state of the inhabited area and ensure its development.

Also, the vision of the twenty-first century city, presented by the European Council of Town Planners in the New Athens Charter (2003) formulates guidelines stimulating proper development of the city – an ideal city, where following factors are of particular importance: – public spaces: streets, squares, boulevards, walking routes integrating city – corrective actions responsible for rehabilitation of the degraded areas – measures to foster a sense of security,

- creation of urban landscape taking into account individual, cultural values,
- protection of nature and cultural heritage – harmony between urban and natural environment.

European Council of Town Planners has undertaken also the issue of social sustainability and social engagement in shaping a healthy living environment – a high quality living environment that promotes healthy lifestyles, proximity to nature and safety.

In order to raise public awareness of the development of high-quality living environment, continuous education is necessary. It is however, a difficult and lengthy process, not able to bring immediate results. Yet it seems to be the most important step in the investigation into the concept of sustainable housing environment, which shapes positive social relationships and behaviors.

Satisfaction connected with the area of residence provides the desire of common effort in aspects such as management and co-deciding about the living environment. It is important, however not always possible due to the varying degrees of mental preparation of the society. Hence the necessary process of education mentioned before¹.

2 Analysis of the selected examples

The idea of sustainable design applies to residential objects, those of public utility with various functions, but also to the concept of a city. The idea of sustainable design applies to residential objects, those of public utility with various functions, but also to the concept of a city designed according to the rules of sustainable development. One of the indicators of sustainable development is a high quality living environment. Research on the quality of the living environment were carried out by the author in all of the small towns of Podkarpacie (south-eastern region of Poland). One of the utilized techniques included urban analysis. Based on its results, the author was able to assess conditions supporting physical and mental health, as well as sense of social cohesion.

Although small towns of Podkarpacie face a number of problems including also economic ones, they are able to provide its residents with the closeness of the elements of nature, security, privacy and tranquility. This region supports pro-health conditions;

¹As proved by the author's research, residents of the small towns in Podkarpackie voivodeship do not appreciate the opportunity of managing their own living environment. Results of the research carried out by J. Kobylarczyk were published in [1].

contamination of water and air is considerably low. However, mental preparation of the citizens, who do not feel the need to look after common goods, is a problem .

Urban research analyzed, inter alia, the size of the social space, access to green spaces and services, the distance between objects and the scale of development. The results of the research carried out in the center of one of the cities – Jarosław, are presented in Table 1.

Tab. 1 *Indicators, elements and factors determining a healthy character of Area I in the Jarosław central zone*

Physical health	Psychological and mental well-being	Sense of social cohesion
+ presence of biologically active areas – a lot of green areas + easy access to public green areas – areas of recreation and sports – distance to a park – 230 m +- moderately easy access to a sports hall (800 m) +- moderately easy access to a playground	– multi-family development + large distances between buildings -+ small amount of greenery, convenient terrain configuration	+ clear delimitation of private, community and public space

Outside the cities who have existed for centuries, new urban centers or their fragments are being created.

Project of a district located north of Logrono in Spain is a great example of the implementation of the assumptions of sustainable development. Work prepared by the design firm MVRDV and GRAS, and selected in a competition, proposed residential social objects with a form fitting into the surrounding landscape.

Buildings forming dense, terraced houses give the impression of "growing out" of the picturesque hills on which wind turbines are located. The project also provides a development of the center of research and implementation of technologies for obtaining energy from natural sources, situated on one of those hills. A characteristic feature of the conception are green terraces bordering vast eco – park, highlighting various species of green. In its range, photovoltaic cells producing thermal energy were localized. It should be noted that it is the first project of this kind in Europe on such a large scale. The region of La Rioja plan to spend 388 million euros to implement its assumptions.

Another example is the Masdaru project – the city of Abu Dhabi in the Arabian Peninsula. Planned center is to serve as a medium for the development of technology related to sustainable development, and it is aimed to bring together companies and other entities engaged in the subject.

One of the most respected architectural firm: Foster & Partners designed a massive platform dividing the city into two parts. The first (top) accessible to pedestrians, and the second (lower) for people moving through the PRT system – Personal Rapid Transportation, which consists of an automated, four-person electric vehicles. A separate system is to be created by a public transport and the connection between airport and Abu Dhabi. The city with orthogonal system of narrow streets refers to the traditional urban layout. On the other hand, the use of advanced technologies shapes its modern image. The city will be completed in 2015 as an important center of research on technologies related to sustainable development and will be designed for about 50 thousand. residents.

Vincent Callebaut Lilypad presented another interesting concept of the future city. Floating city resembles the leaf of *Victoria amazonica*. Municipalities grows from a horizontal platform – an artificial island floating on the ocean. Each city has its own task.

One serves as a place of work, others as a shopping center, entertainment center etc. Regardless of the function, nature is an essential element of each platform. Flats with green terraces are located over the services and objects are linked by streets reminiscent of the freely propagated plant vines.

Rules distinctive for sustainable development were implemented not only because of the close contact with the elements of nature, but also because of the use of modern technology. The project of floating cities utilizes wind turbines and photovoltaic cells that continuously produce electricity. In addition, the outer layer coated with a special Lilypad substance absorbs impurities from the air when in contact with UV. Moreover, pool in the form of crater, submerged 100 meters below the surface of the water collects rainwater, which, after purification and treatment, is introduced into the general circulation. Underwater farms and fish tanks constitute the main source of food for inhabitants of the cities. [4]

Concepts of the cities of the future in various ways implement the principles of sustainable development, which emphasize the role of human being. Although at this stage of the development of science and technology, many of these concepts are still impossible to achieve, or the cost of their implementation would be too high, the sole way of thinking about the city can bring us closer to creating a real notion of the ideal city – a city friendly to man and nature.

Principles of sustainable development are also used at various stages of the design of residential areas. This applies to both single family homes and multi-family housing complexes.

Housing unit in Almere (fig. 1), designer in 2001 by UN studio is yet another example of their implication. The housing complex consisting of forty-eight floating villas impresses not only with its attractive architecture, but also with the spatial assumptions that provide its residents close contact with the elements of nature: water and variously formed countryside. It exists not only in the common spaces, but also in private gardens and terraces. Feeling of intimacy with the natural elements is compounded by glazings in buildings' facades. Homes consist of fixed modules (6 m high, 10 m deep and 3 m in high), which may be shaped in any way – divided or multiplied. Due to the strong integration with the landscape and communication restrictions, assumptions of the project meet the requirements of sustainable design. Moreover, they are reinforced by properly landscaped common areas and public participation in the development of the living environment.

Nature is a particularly attractive element of the living environment in Almere. Complex of villas creates a possibility of contact with the nature – water, a individually shaped green areas. The contrast between the sole architectural form of the houses and their immediate surroundings is indeed surprising. Simple geometric objects coexist with organic forms of nature elements creating a human-friendly living environment surrounded by lakes, gardens and green, open spaces.

Yet another great example of the implication of sustainable development rules is housing development Bo01 in Malmö (fig. 2), Sweden, created by Klas Tham. Anchor Park was designed by the SLA. The concept was developed in 2001 and presented at the International Exhibition of Housing. It is one of the first to utilize principles of sustainable design. The choice of location refers to the principle – "the re-use of land." The housing complex was built on VastråHamnen, which used to serve as loading port and yard. The former industrial areas include nowadays residential area, as well as service and recreational ones. There are, among others: homes, offices, and two parks – Anchor Park and Denmark Park. Sustainable solutions concern social and environmental balance. In terms of social sustainability, various types of housing were taken into account: single-family houses and

multifamily buildings. It allows to adapt to the preferences of citizens and their economic abilities. Residential development creates opportunities for flexible and unrestricted adaptation of residential interiors that are in permanent contact with the natural elements. It is manifested by opening to the sea, access to green spaces and common areas, such as small squares and courtyards, as well as playgrounds. Among other facilities included in the area of residential buildings we can distinguish: shops, restaurants, offices and public transport stops. There is also a boardwalk, amphitheater, as well as already mentioned parks. These areas integrate local community contributing positively to health and mental well-being of the inhabitants. In terms of balance of the environmental functioning of the residential- service area, thermal energy from geothermal sources (85 %) and solar energy harvested by solar panels have been used. Electricity is produced by a windmill located just 3 km away from the complex. Obtained wind energy operates households, heat pumps and charging stations for vehicles. In order to minimize the cost of maintaining the unit, photovoltaic cells and appropriate building materials were applied during the construction process. Thereby, grid and heat were connected to local urban networks. Owing to that factor, Bo01 can use the energy of urban resources in the winter, which returns in the summer when there is a surplus of energy production. With this solution, it is not necessary to store the energy, which requires large amounts of money. In addition, rain water collected on green roofs and water tanks in the courtyards and squares is also utilized. It is used for irrigation of green areas. Excess water is transported to the sea through the open system of channels. Another mode applied in the complex employs vacuum system which removes food waste and converts it into biogas, used to produce electricity. Waste is composted and used to fertilize green areas. Permanent and important part of the assumption is greenery, introduced also in houses and terraces. For the sake of biodiversity, residents were required to install boxes for birds and bats to create habitats.

Caring for the environment is the most valuable and indisputable value of the assumption. Also a huge commitment of the inhabitants themselves, who are able to look with the concern for the common goods, shapes exemplary attitude worthy to be followed by residents of many other cities, including Polish cities located in Podkarpackie.

An interesting effect of the concept is the clash of modernity and tradition. Many parts of the complex evokes small-town atmosphere – colorful houses, low scale, charming squares, etc. Being in the middle of the assumptions, once feels as if time was to stop, life was slower and less hectic.



Fig. 1 Floating houses in Almere



Fig. 2 Living complex in Malmo



Fig. 3 Floating houses in Almere



Fig. 4 Complex in Almere



Fig. 5 Housing unit in Malmo

3 Conclusion.

Sustainable development is increasingly popular also in the design. This is particularly important for the quality of the living environment, with which man identifies more and more [5]. Aware of their needs to a greater extent, people expect their living environment to be comfortable, which correlates with a number of factors supporting physical health of the residents (mainly proximity to recreational areas or sports facilities), mental well-being (above all by maintaining appropriate distance between the buildings, creating the possibility of contact with green spaces, etc.), and a sense of social unity (by creating appropriately developed common areas).

The results and conclusions from the research conducted by the author in small towns of Podkarpacie (eastern part of Poland) have shown that:

Small towns Podkarpacie meet high quality living environment. On the basis of urban analysis it can be concluded that they provide their residents with the close contact with nature, meet the expectations of privacy and tranquility. The basic form of building are detached houses with private gardens, making the distance between the objects convenient, and it also provides an opportunity of arranging private green spaces.

Based on the interviews it can be concluded that the lack of ability to use the natural resources is a problem. For example, the citizens do not perceive the riverine areas as recreation, leisure or sport zones. Moreover do not feel the need to take care of common areas – social spaces.

People tend to appreciate privacy, peace of mind, safety, closeness to the countryside and easy access to medical centers and pharmacies. Sustainable design meets all of these requirements at the same time creating a "healthy living environment", ensuring that its residents remain in close contact with the elements of nature.

Analyzed residential complexes remain in harmony with the landscape in accordance with the principle of respect for the land, and most of all, for a human being. Appropriate usage of shared spaces has a positive effect on the sense of privacy and peace, and fosters a sense of desired security. It applies to both private terraces, green roofs, gardens, playgrounds, as well as courtyards utilized by residents as meeting places to exchange views and experiences between people. More frequently first conceptions of the cities of the future are created – cities which remain self-sufficient, in symbiosis with the nature, pursuing sustainable development objectives.

Based on the analyzed examples and personal research it can be concluded that the residential areas which are used to implement sustainable design practices, meet the requirements of modern man and the requirements of high-quality residential environment. They benefit to physical and mental well-being of the residents, remaining in harmony with the elements of the nature.

References

- [1] Kobylarczyk, J. *Residential quality in central zones of Podkarpakie towns*, Lap Lambert Academic Publishing, Saarbrücken 2010.
- [2] Sikora, M. *Ekopolis – Citi of the future*, Green, Kraków 2009, pp. 11–20.
- [3] Schneider-Skalska, G. *Shaping of the healthy living environment. Selected issues*, Politechnika Krakowska, Kraków 2004.
- [4] Sikora, M. *Ekopolis – miasto przyszłości w: Green*, ISSN 1689-9407, Kraków 2009.
- [5] Schneider-Skalska G. *Kształtowanie zdrowego środowiska mieszkaniowego. Wybrane zagadnienia*, Politechnika Krakowska, Kraków 2004.