

Original scientific paper

UDC: 551.588:551.506

DOI: 10.7251/afts.2017.0917.079S

COBISS.RS-ID 6820888

SUSTAINABLE URBAN ENVIRONMENT AND CONFLICT OF RESOURCES MANAGEMENT

Stevović Svetlana¹, Mirjanić Slađana², Đurić Neđo³

¹*Inovacioni Centar Mašinskog fakulteta u Beogradu, Kraljice Marije 16, Beograd, Srbija, svetlanas123@gmail.com*

²*Prirodno-matematički fakultet, Univerzitet u Banjoj Luci, Republika Srpska, Bosna i Hercegovina*

³*Tehnički institut Bijeljina, Bijeljina, Republika Srpska, Bosna i Hercegovina*

ABSTRACT

Urban areas are formed aiming to satisfy multiple expectations of their citizens. Among the most significant expectations are resources availability, related to existential needs, efficiency in communication and satisfaction of other contemporary civilization and cultural needs. However, pursuance to create conditions for those needs satisfaction necessarily leads to high level of urban area construction. Thus, sort of paradox appears: aspiration to improvement of living conditions leads to negative effects which jeopardize the health and lives of urban population. This fact requires holistic approach, i.e. consideration of all aspects of life's needs of urban population in order to provide their long term sustainability. This paper aims to consider some aspects of urban areas sustainability relative to blue green cities philosophy.

Key words: *urban areas, sustainability, efficiency, blue green cities, complexity.*

INTRODUCTION

The question of sustainable development in the few last years is posed as a crucial question in almost every area of human activities. The sustainable development as scientific and practical approach upon planning the activities necessary for satisfying the needs of modern man is the manifestation of the responsibility both towards the present and the future [1]. The responsibility illustrated in the approach of sustainable development is based on the necessity of the modern man to develop the system of his own needs, respecting the system of needs of the future generations with the ever-present conscience of nonrenewable resources finiteness and the renewal of the limited capacities of renewable resources.

The modern city urban areas surely present significant scientific-technological civilization and engineering accomplishment which is the fundamental condition for satisfying the needs of the modern man. Commercial, cultural, scientific, technological and other modern activity would develop with great difficulty outside the concentrated urban areas or their efficacy would be greatly lowered.

The tendency of the modern man to increase the efficiency of his activities (to get bigger results with less efforts) with the tendency to accomplish max efficacy (reaching the goals) at the moment dominates upon planning and designing the urban areas [2]. Thereby, the tendency for accomplishing certain goals inevitably leads to lowered effectiveness of other goals, that is, because of the existence

of certain conflict among the goals, it is almost impossible to realize one goal without endangering the other. The simplest example is the rapport between the traffic and the noise in the cities; if the traffic that enables efficient actualization of one goal group is increased (fast and efficient passenger and goods transport with the purpose of supplying), the reduction of noise in urban areas cannot be expected (in modern-day level of vehicle's development). The similar correlation can also be established between other variables within one urban area [3].

The conflict of the goals in the urban areas is usually solved by maximizing the groups of the civilization and commercial goals while endangering the group of goals connected to basic human needs. The basic human needs are presented as the environment which provides the specific level of air quality, water, food and the absence of sound, light and other kinds of living space pollution. Generally, it can be concluded that the civilization advancement within the urban area endangers the group of basic human needs, that is, reduces the quality of the environment.

If the given logic is followed, which generally applies to all urban areas, then it can be unambiguously concluded that the development of one significant group of needs of the modern man hides within the risk of endangering his own survival in the environment designed and formed for satisfying those needs. In those circumstances, the sustainable development is not possible both on the level of one generation and in the perspective of the future generations.

Upon this condition of the goals conflict, the basic question is imposed: "Is it possible to resolve the described conflict of the basic groups of goals of the modern man in urban areas without endangering the principles of sustainable development?" This question has its base in a couple of important facts [4]. The first one is that the urban areas came into existence as a result of significant economic and professional efforts of the whole society and as such they have to be preserved and improved. The second fact is based on the urban areas as the most significant factor of the cultural, educational and economic development capacity of a society and that deceleration and decline of its development rate can have negative consequences on the whole society.

Other facts, such as historical, social and other forms of urban area importance also indicate the necessity for finding the solutions for the goals conflict above mentioned. Figure no.1 symbolically illustrates the relation between the group of civilization and basic human needs in the urban areas: upon constant resources, spending resources on one goal group inevitably leads to resource decline for the other group of goals. This is also the case when resources are not constant but their renewal is slower than their use.

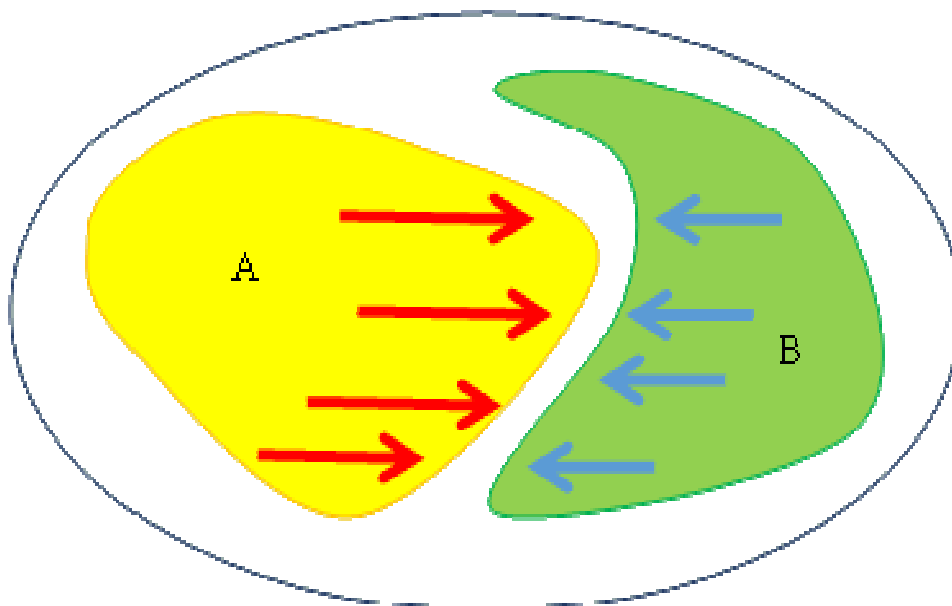


Figure 1. Relationship between resources and conflicted goals

Mathematical expression of this concept could be explained by following formula:

$$C = A + B + \Delta \quad \dots (1)$$

where:

- C – overall resources of the urban area;
- A – resources necessary for satisfying civilization needs;
- B – resources for satisfying the basic human needs and
- Δ – resources originating from the environment and the resources that rise due to the mechanism for their renewal, or reducing the other negative influences within an urban area

Based on the formula (1), it can be concluded that it is possible to act upon resources for satisfying civilization needs if they are constrained, increasing the resource capacities for satisfying basic human needs and increasing mechanism capacity for resource renewal within the urban areas. Thereby, the variable Δ can be decomposed into two components:

$$\Delta = \Delta_{\pi} + \Delta_o \quad \dots (2)$$

where:

- Δ_{π} – resources coming from the environment (which are hard to influence) and
- Δ_o – resources which arise from mechanism impact for their renewal or the decrease of the negative influences (which can be significantly influenced).

Further decomposing of specific components onto their factors is possible and necessary upon detailed analysis of concrete urban areas but detailed development of that method would surpass the goals of this paper.

Upon finding the solutions for conflict of civilization and elementary goals, the quality research of problematic of the urban areas is necessary, based on:

- The research of the causes which endanger the group of basic human needs and
- The research of the relations between the cause and the state of environment.

When the causes and the relations are established, it is necessary to execute their analysis from the aspect of sustainable development and then approach the solution analysis. In this paper, the solution for sustainability of the urban areas is examined through philosophy and approach of blue green cities. The philosophy of blue green cities points onto general solution of conflict of goals while, through the approach of blue green cities, the procedures are concretized and reduced to concrete activities which can lead to the solutions for the conflict of goals for a specific level of compromise.

CITY URBAN AREAS – FUNCTIONS AND CHARACTERISTICS

The city urban areas, first of all, have as their goal the satisfaction of the cultural, educational, economic and other civilization human needs. The civilization growth through history is followed and accelerated by the development of the cities. This historic fact is the result of knowledge concentration, capital, work and other necessary elements on small space. Big concentration of above mentioned resources on small space reduced the time of idea, goods and experience exchange which accelerated the development of the civilization. The expenses of the civilization development have also been reduced which increased the attractiveness of urban areas.

The increase in human concentration on small spaces also carried specific risks which reflected, first of all, in easier transport of different diseases and attracting the conquerors that often ravaged them. However, the fact that the cities, as the civilization inheritance, because of these phenomena were not abandoned as a structure of organization of human community through whole modern history, shows that they have significant values for human population. According to today's trends of the increase of

the urban areas and the prognosis that those increases with time will only accelerate, it can be conducted that the urban areas will have even bigger significance. The significance of urban areas as well as their further growth implies the growth of population's economic strength. The growth of economic strength should be related to investment possibilities in solutions of the conflicts of mentioned goals which means the knowledge about the conflict of the goals should be increased and in front of scientific and in profession there is a challenge of producing the optimal solutions.

Starting from the assumption that the urban areas represent the expression of human ambition and human community to satisfy the specific system of needs and wishes (whose character is, first of all, the civilization type) then it has to be taken into consideration the fact that system is not homogeneous in time and space. That means the system of needs and wishes will change with time and it will depend on location within urban area. If, within this approach, an interest as a specific type of influence on resources of urban area is imported, the general model of urban areas from the aspect of influences, resources, knowledge can be formed. Figure no.2 illustrates symbolically the general model of urban area above mentioned.

Figure 2 implies that the form of urban area is the result of compromise between different influences which cannot always be controlled or be objectively optimized. It has, as a consequence, the divergence of the real form of urban area regarding to the ideal form. Lower performances relate to multiple parameters from the objective quality of life condition up to the perception of urban population about the quality of life in an urban area.

The characteristics of built urban areas are usually boiled down to consequences which are caused by the concentration of diverse materials onto small space, where there were none, in combination with the influence that didn't exist earlier onto the quality of life. For example, constantly present also in the urban areas, extra expressed solar radiation negatively affects the materials from which constructions are built in the urban areas and by that reduces the development basis in the future, because it absorbs the assets for their recovery and sustainability, preventing the investment of these assets into the development. Also significant is the field of research and mutual relation between urban area and its surrounding.

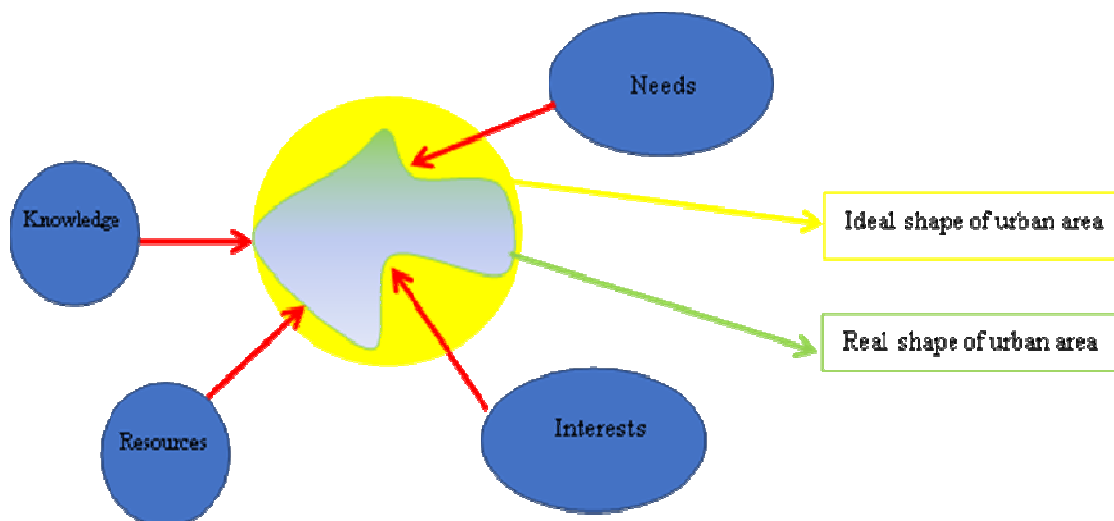


Figure 2. The ratio between different influences on the form of urban area.

In the professional literature, the problematic of urban areas is approached very thoroughly and this problematic is, even with rich knowledge foundation, still in development. The complexity of urban areas and technology development give the opportunities for solving the conflict of goals (or adding them up to an acceptable level) which, with potential economic effects, presents the motif for further intensive research in this field.

The field of research of the urban area includes the quantification of its characteristics connected to climate and other parameters such as:

- Urban influence,
- Climate and its changes;
- Wind and built area;
- Thermal balance and built area;
- Heat islands effect;
- Canyon effect;
- Energetic influence on the built area;
- Shortwave radiation;
- Urban pollution;
- Role of the green spaces;
- Materials of built areas;
- Lightning technology in built areas;
- Active solar systems for built areas;
- Air quality and ventilation in closed spaces of urban areas;
- Urban settlements (place and location, morphology, dynamics and buildings design and
- Other technical possibilities starting from system development for energy conservation, passive solar heating and cooling and etc.

It is obvious that the large number of subjects and the research complexity point to a large number of possibilities for improving the quality of environment with, in the same time, reducing the expenses and increasing the capacity for developing the system of human and civilization needs. However, certain unfavorable climate events (the heat wave in 2003. which overtook the Europe) warn about the significant imperfection of the urban areas and their vulnerability in the basic goals (the survival of inhabitants). The potentially unfavorable climate conditions also indicate the problem with the urban areas sustainability in general [5].

SUSTAINABILITY OF CITY URBAN AREAS

The basic definition of sustainable development states that the current generation has the right to the development under condition that it doesn't jeopardize the same right for the future generations. The other definition states that the future should be more beautiful and happier place than the present. The first one as well as the other one implicitly indicates that the consumption of the existing resources must be limited because of some future quality state of living conditions. That is, the quality of living conditions in the future should grow. This condition is hard to accomplish for a few reasons:

- Certain resources are irrevocably transformed into non-usable forms which means that their quantity is reduced with time;
- Resource transformation from its natural state into state which satisfies a specific system of needs of the current generation demands energy consumption which means that the additional consumption of existing resources is needed and
- Resource transformation from its natural state into state which satisfies a specific system of the needs of the current generation produces harmful by-products which additionally decrease the capacity of available resources as a base for development in the future.

Applied to the urban areas, the principle of sustainable development is also burdened by the reasons for its difficult achievability. The concentration of different materials needed for construction of the urban areas from which many are harmful to health of the population, the traffic which produces exhausts gases whose ingredients are accumulated in the soil and wall pores and then are released due to different influences are just a few of some of the proven influences which endanger "the future as a more beautiful and healthier place than the present" in the urban areas. Economic dimension of

construction and building maintenance, the provision of optimal temperatures for human beings and water supply have to be taken into consideration also when the sustainability of urban areas is examined.

The basic problem of sustainable development of urban areas comes down to the question:” Is it possible to form a self-sustainable system for reducing or elimination of the negative influence of the urban area onto the quality of living conditions?” The self-sustainability of the system for reducing or eliminating of the negative influences onto the quality of the environment refers to the level of the intervention (i.e. the level of effort) which comes from the human being necessary for system functioning. Naturally, the sustainable systems are more desirable that demand less (or in the ideal case zero) efforts. Picture no.3 shows the concept of the system self-sustainability for reducing or eliminating the negative influences of the urban area.

Additional efforts can be made in the direction of material choice for building the urban areas, but also managing the other parameters such as system organization for satisfying the civilization needs. The system for satisfying the civilization needs of urban areas population can be optimized the way that they (for example) minimize the consumption of resources, maximize the contentment of the needs of the population, minimize the negative influence on the quality of the living conditions, reduce or eliminate the influence of the extreme climate events and etc.

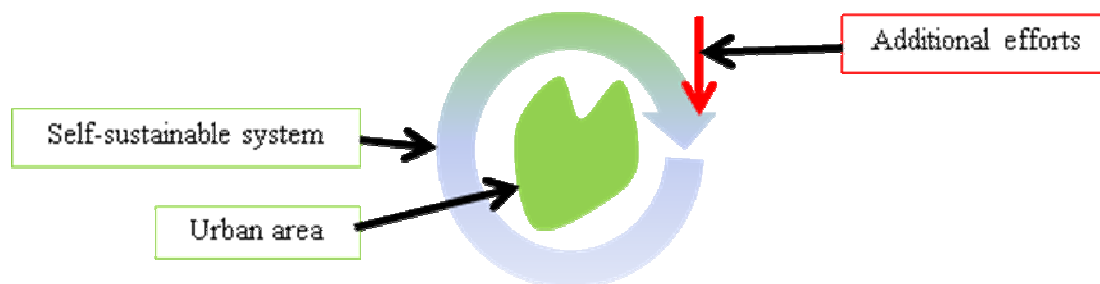


Figure 3. Concept of self-sustainability of living conditions

One of the concepts for forming the self-sustainable systems for reducing the negative influences of the urban areas on the quality of the living conditions (i.e. the quality of basic human needs) is the concept of “the blue green cities” or in the more developed form “blue green dream” [6].

BLUE GREEN CITIES

Blue green cities are based on the idea that already existing “blue” resources with minimal efforts could be transformed into “green” resources within urban areas sufficiently to keep the quality level of the living conditions for population on the high level [7]. The basic idea is the increase of green surfaces wherever that is possible (including rooftops and building walls) and for their sustainability to be used available “blue” resources such as exiting soil and precipitation that occur during the year in the urban area. This approach with the solution of few problems has additional advantage because it would also reduce the problem of the withdrawal of the storm water to some extent which, in the conditions of increased precipitation, can lead to clogging the atmospheric sewers and flooding of the urban area.

For the application of the blue green cities concept it is necessary to consider the capacities of the blue resources within the city, adequacy and possibility for green resources development as well as the necessary additional efforts for sustaining of this system on the level of the functionality necessary [8].

Blue resources can be water, soil, sunlight and the size of the suitable space. The availability of the water can be measured by the average quantity of precipitation during the year and its schedule in the

seasons. The sunlight can be measured by the number of the sun hours by a single exposition of the built area, while the size of suitable space is defined by the space of adequate rooftops and building facades.

Green resources can be the adequate plants for given region and given capacity of the blue resources. The green resources are defined by plants which can survive in the existing “blue” conditions by which the choice of plants can depend of the optimized goal (minimal expenses, maximal effect in reducing the negative influences, minimal efforts for sustaining, maximal resistance to the climate effects and etc.).

Additional efforts can represent the available knowledge and economic resources for establishment of the self-sustainable systems for decreasing or elimination of the negative influence of the urban area on the quality of living conditions.

Figure 4 shows the mutual relation of the sets of the blue and green resources and efforts needed for accomplishing the concept of the blue green city.

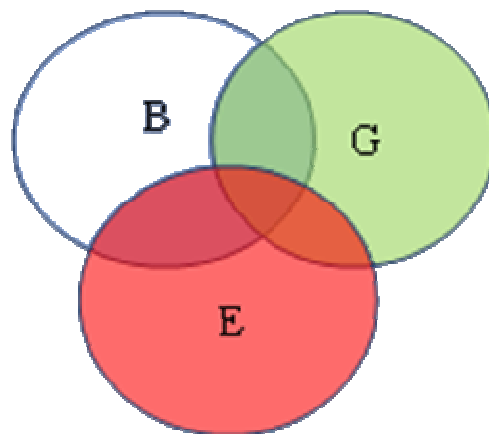


Figure 4. Blue (B), green (G) and economic resources of the urban area

Optimal solution for the blue green concept can be found in the sectional view of the sets of the blue (B), green (G) and economic € capacities. Naturally, some kind of deviations are possible considering the shown concept depending the historic, cultural, cognitive and experiential capacities of some cities, but these three capacities are undoubtedly crucial for implementing the concept of blue green cities.

CASE STUDY

As an example of the possible use of blue green concept, the Palace of Serbia (also known as Palace of Federation and Building of SIV) is considered. The building of Palace of Federation had started in 1947. and finished in 1959. In that period, the building principles which had as their goals to satisfy certain political views and understandings dominated, while the principle of sustainability, energy efficiency [9] and protection of the environment with the tendency to improve the quality of the living conditions were in the second plan. Figure 5 shows the satellite photo of Palace of Serbia. Based on the satellite view it is perceived that the palace is surrounded by the verdure, so, at first sight, can be thought that there is no need for additional efforts towards reducing the negative influences on the quality of the living conditions.

However, looking at the bigger context of the influences on the environment and sustainable development, different conclusions can be reached.



Figure 5. Palace of Serbia – satellite view

If the initial assumptions are:

- The expenses of sustaining the optimal living and working conditions should be lowered (heating in the winter, cooling in the summer for what is usually used the energy acquired by fossil fuels combustion) and
- Extend the maximal lifetime with minimal expenses of construction maintenance that it follows the conclusion that the analysis of use of the blue green concept has justification.

While considering the possibility for use of the blue green concept for the example of Palace of Serbia it is necessary to consider the following questions:

- Are the condition for the usage of the blue green concept in a concrete case existing;
- Do the capacities of the blue and green resources justify the use of the blue green concept
- Would the significant violation of the architectural solution and the object aesthetics occur
- Are the economic gains bigger than the investment and
- Do the other forms of benefits from introducing the blue green concept exist for this object.

Generally speaking, the capacities for development of the green resources are significant because of the big spaces of surfaces which make the placement of the infrastructure possible.

The nearness of Sava and Danube [10] can provide water supply at a relatively small expenses in case of bigger dry periods which allows a selection of plants that demand more water and can provide bigger efficiency in sustaining the optimal living and working conditions.

The basic architectural form would not change but would only be enriched by greenery to the extent which would not lead to endangering the base of architectural solutions.

The economic gains would certainly justify the investment because, with the reduce of fossil fuels expenses for heating and cooling (general benefit), the influences of the solar radiation on the construction would be reduced by what the lifetime of its existence would be prolonged and the expenses of the maintenance would be reduced.

The other gains would be noted, first and foremost, by the effects of positive example and manifestation of responsible behavior of the State authority towards the questions of the conflicts of civilizational and basic human goals in urban areas.

CONCLUSION

Based on the presented, the following can be concluded:

- Urban areas lead to conflict of goals because, by making the conditions for satisfying the civilizational needs of the population, in the same time the negative influence is being done to the quality of basic human goals endangering the basic existential factors;
- Reserves for solving this conflict exist in the form of usage of available resources and by applying the concept of blue green cities;
- Solution for this conflict of goals depends on the available blue, green and economic resources;
- Use of concept of blue green cities does not exclude the use of other concepts but is also compatible with them and
- Positive example towards responsibility can be provided by State institutions by promoting blue green concept on the building of State authorities.

Solving the conflict of the goals in urban areas is the imperative of their sustainable development because, with time passing, the base for future development is reduced. The resources not saved in the urban areas are spent irrevocably (energy acquired by combusting the fossil fuels and converted into heat for sustaining the optimal living and working temperature cannot be turned back into its original form) and thereby some of them have cumulative negative property to living area.

(Received September 2017, accepted October 2017)

LITERATURE

1. Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, MC., Shyamsundar, P., Steffen, W., Glaser, G., Kanie, N., Noble, I. (2013). Policy: Sustainable development goals for people and planet. *Nature* 495(7441):305-307.
2. Vunjak, D., Čeh, A., Đurić, N., Karaman, G., Hegediš, I. (2016). The influence of linear Thermal transmittance of thermal bridges on the energy performance class of buildings—simplified method. *Arhiv za tehničke nauke/Archives for Technical Sciences*, No 14, pp. 73–78.
3. Pecelj, R.M., Lukić, M., Pecelj, M., Đurić, D. ((2017). Application of the menex model in bioclimatic analysis of Novi Sad and environment for the purposes of tourism and recreation. *Arhiv za tehničke nauke/Archives for Technical Sciences*, No 16, pp. 77–84. Thomson Reuters. Emerging Sources Citation Index (ESCI).
4. Holden, E., Linnerud, K., Banister, D. (2017). The imperatives of sustainable development. *Sustainable Development*, 25(3), pp. 213-226.
5. Stevović, S., Markovic, J. (2016). Urban Air Pollutants and Their Impact on Biota. In: *Plant Responses to Air Pollution*. Springer, pp. 21-32.
6. Nikolić, M., Stevović, S. (2015). Family Asteraceae as a sustainable planning tool in phytoremediation and its relevance in urban areas. *Urban Forestry & Urban Greening*, 14(4), pp. 782-789.
7. Barthel, S., Isendahl, C. (2012). Urban gardens, agriculture, and water management: Sources of resilience for long-term food security in cities. *Ecological Economics*, 6:224-234.
8. Nieuwenhuijsen, M.J., Khreis, H., Triguero-Mas, M., Gascon, M., Dadvand, P. (2017). Fifty shades of green: pathway to healthy urban living. *Epidemiology*, 28(1), pp. 63-71.
9. Jovanovic, J., Sun X, Stevovic, S., Chen, J. (2017). Energy-efficiency gain by combination of PV modules and Trombe wall in the low-energy building design. *Energy and buildings*.
10. Stevovic, I., Jovanovic J., Stevovic, S. (2017). Sustainable management of Danube renewable resources in the region of Iron Gate: Djerdap 1, 2 and 3 case study. *Management of Environmental Quality: An International Journal*, 28(5) pp. 664-680.

