

CREATING MORE SUSTAINABLE SOCIAL HOUSING IN SERBIA: A CONCEPTUAL FRAMEWORK FOR ARCHITECTURAL AND URBAN DESIGN

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Abstract. *The basic research problem is the insufficient application of sustainability criteria in urban and architectural programs and projects for social housing in post-socialist Serbia, which may lead to inadequate and low-quality new housing stock. This paper emphasizes the importance of considering social, economic and environmental sustainability aspects integrally in the further development of the existing, highly residual social housing model, with a focus on improving guidelines, rules and parameters in the design domain. Relevant criteria in the architectural and urban design of sustainable social housing were identified, systematized and interpreted, based on the analysis of scientific knowledge, applicable models and international recommendations. A conceptual multicriteria framework was designed with the aim of contributing to the improvement of methodological approaches in the design and evaluation of social housing settlements and buildings in Serbia, as well as in related housing systems.*

Key words: *social housing, sustainability, architectural and urban design, conceptual multicriteria framework, Serbia*

1. INTRODUCTION

As a public policy aimed at reducing social inequalities in the field of housing, social housing is related in essence to the concept of sustainable development. The importance of this sector for sustainable urban development, especially regarding its contribution to social cohesion, has been recognized and confirmed in United Nations documents and guidelines for housing policies and programs [1, 2, 3, 4]. The motive for promoting and

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affirming sustainability principles in social housing policies can be attributed, on the one hand, to the inherited socio-spatial problems of mass social housing from the second half of the 20th century, such as spatial segregation, high population density, monotonous and uniform architecture, and a high concentration of poverty [5, 6, 7, 8]. On the other hand, it is believed that the paradigm of sustainable development offers an appropriate framework for a holistic approach to future housing development, which is in itself complex and contains ecological, economic, social and cultural dimensions [9, 10]. According to Reeves, sustainability is the vital content of any form of social housing, and its essence is in understanding human needs and aspirations, and designing in accordance with them [10]. Milić believes that all goals in the field of social housing start from one general goal, which is “to provide conditions for everyone to have a decent apartment” and recognizes the goals and criteria of sustainable development as a value-based and conceptual framework for urban and architectural practice [11].

Residualization, which is a pervasive trend in contemporary social housing policies and practices, is considered to be the greatest challenge to achieving the goals of social cohesion and sustainability of neighborhoods [3]. Reducing investment in social housing, building it in cheaper, peripheral locations and targeting the most vulnerable social categories, means increasing the risk of segregation, ghettoization, crime, permanent unemployment, and physical degradation of the housing stock. In addition, the negative externalities of social housing residualization require additional government investment in housing maintenance (or demolition and new construction programs), while increasing costs in other public sectors (e.g., the security and health sectors) [3]. Although “generalist in writing” the post-socialist social housing allocation model in Serbia is extremely “residual in practice”, according to the criteria: share of social rented apartments in the total housing (0.9%), target groups of beneficiaries (vulnerable and special groups – mainly refugees, displaced persons and Roma), and the fact that the new housing policy is in the early stages of implementation [12, 3]. Unlike the socialist period of state-funded housing construction, in the current system of housing support, the funding of which primarily relies on international sources and donations, the provision of social housing is based mainly on “quantitative criteria”, which poses a great challenge to achieving an appropriate level of quality and sustainability of new housing estates.

The current legal and strategic framework for the development of social housing in Serbia is based on respecting the values and goals of sustainable development and promoting the right to adequate housing for all citizens [13, 14, 15, 16], but the implementation of these policy commitments in practice is rather limited. This is shown by the results of several empirical studies on completed housing projects, which testify to numerous shortcomings in the field of national housing regulations, the implementation of programs and projects, the quality of building construction, and also the management sector of this housing stock [17, 18, 19, 20].

Creating the preconditions for sustainable housing development and providing adequate housing for Serbian citizens includes the priority of improving all the capacities (institutional, organizational, financial, legal, etc.) necessary for the effective implementation of housing policy at all levels, which is recognized by the Draft National Housing Strategy 2020 to 2030 [15]. For the purpose of sustainable development of the national social housing system, it is also necessary to formalize a special methodological framework with guidelines and parameters for the level of urban planning and design, in accordance with international guidelines and national specifics [21]. The importance of implementing sustainability criteria in the domain of planning and designing social housing in Serbia is indicated by a relatively

recent analysis and systematizations within scientific research – from integral criteria [11, 22], to those dealing only with energy efficiency [23] or socio-spatial themes [24].

The goal of this paper is to define, systematize and explain the criteria relevant to sustainable social housing, which are important for architectural and urban design, based on a review of international and domestic literature. It results in an applicable conceptual multicriteria framework which might contribute to existing scientific and professional knowledge in this field, as well as to improving regulations and methodological approaches in the design and evaluation of social housing settlements and buildings in Serbia, and other countries with developing housing systems.

2. CONCEPTUALIZING SUSTAINABLE SOCIAL HOUSING WITHIN THE FRAMEWORK OF URBAN PLANNING AND DESIGN

As a basis for the conceptualization of sustainable social housing within the area of urban planning and design, we used the principles of sustainable housing and sustainable communities while respecting the normative starting points, goals and contemporary challenges of social housing. According to Larsen's model [25], sustainability is seen as a complex that integrates social, environmental and economic values, with the cultural aspect viewed as part of the extended social dimension of sustainability. Based on several sources [4, 9, 26, 27, 28, 29, 30, 31], the sustainability of housing and communities in a broader sense can be defined through the following guidelines within the three dimensions of sustainability:

- 1) Socio-cultural sustainability: equality (in the distribution and use of housing resources), social interaction/social networks within the community, pride/sense of attachment to the place, safety, accessibility, acceptable quality of housing and its environment, cultural adequacy and opportunity for change;
- 2) Environmental sustainability: reducing the need for energy, reducing the need for other environmental resources (water, raw materials, materials), improving efficiency in the use of energy and resources, preventing environmental threats, and the environmentally sustainable behavior of users;
- 3) Economic sustainability: encouraging economic development by providing adequate accommodation, encouraging technological development in order to mitigate negative environmental impacts, benefit to investors (financial/sociopolitical), development of the local construction industry and efficient management and maintenance.

Sustainable social housing in a broader sense implies considering all aspects of poverty and not just the lack of housing or a "roof over one's head". Its basic goals include:

- 1) responsibility for the needs of present and future generations;
- 2) providing housing of appropriate quality for all; and
- 3) enabling vulnerable social groups to actively participate in the socio-economic life of the community.

It is also a multifaceted value complex with environmental, socio-cultural and economic dimensions, which implies their integral consideration and consistent implementation at all levels of social housing provision. The general position in determining the goals of sustainable social housing in urban planning and design is that this practice should not further deprive poor households, but should provide them with decent and quality housing conditions in accordance with the requirements of affordability. Based on previous conceptual starting points, as well as the interpretation of sustainable social housing in the literature [1, 2, 10, 11, 20], we define the goals of sustainable social housing in urban planning and design, where:

- Socio-cultural goals include: 1) adaptation to the residents' needs; 2) adaptation to the changing needs of tenants; 3) encouraging the social integration and interaction of tenants; 4) diversity; 5) safety; and 6) cultural adequacy;
- Environmental goals include: 1) efficient use of land and compactness of the urban form; 2) reduction of car use; 3) efficient use of energy; 4) efficient use of water, materials and resources; 5) environmental safety and reduction of pollution; and 6) preventing the heat island effect;
- Economic goals include: 1) encouraging local economic development; 2) lower land acquisition costs; 3) lower costs of landscaping, equipping, construction and adaptation, 4) lower costs of maintenance, and 5) economic strengthening of the community and lower costs of housing.

Further conceptualization of sustainable social housing in urban planning and design implies the determination of a comprehensive multicriteria framework, that is, a system of general and special criteria of "desirable characteristics" of the spatial-physical patterns of this type of housing. The development of this model is based on methods of content analysis, critical and comparative analysis and interpretation of primary sources (international and national documents – laws, strategies, recommendations, reports from conferences and workshops, standards, resolutions) [e.g. 1, 2, 3, 4, 13, 14, 31, 45] and secondary sources (scientific and professional research) [e.g. 8, 9, 10, 11, 19, 20, 23, 28, 30, 32, 37, 39, 40, 43, 47]. The applied methodological procedure is shown schematically in Figure 1 and was elaborated in detail in the author's previous research [17]. It included the following steps:

- Identifying appropriate general criteria in the domain of socio-cultural, environmental and economic sustainability, in accordance with the previously presented conceptual starting points and goals;
- Preliminary analysis of the criteria and determining the possibility of their direct application at three spatial decision-making levels in urban planning and design, which include: identification of sites, site planning and urban and architectural design of social housing complexes, buildings and apartments;
- Checking and ranking general criteria in terms of their potential impact on the achievement of socio-cultural, environmental and economic goals; and finally,
- Interpreting each criterion and defining its specific criteria within all three conceptual multi-criteria frameworks.

In this paper we will only address relevant criteria in the domain of architectural and urban design, which in certain segments overlap or are directly conditioned by urban planning criteria, but they will not be specifically mentioned or considered.

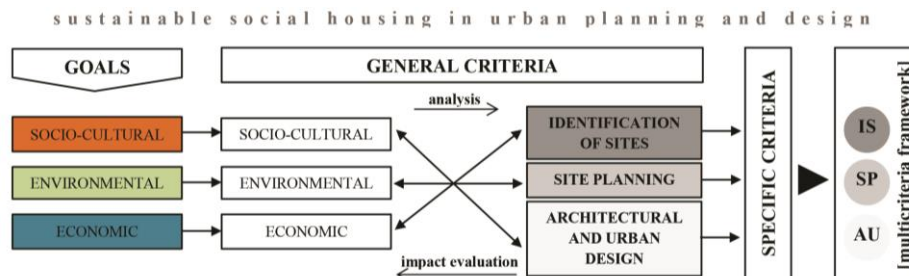


Fig. 1 Procedure of creating a comprehensive multicriteria framework in urban planning and design of sustainable social housing

3. SUSTAINABILITY CRITERIA IN THE ARCHITECTURAL AND URBAN DESIGN OF SOCIAL HOUSING

In accordance with the conceptual starting points and goals of sustainable social housing in urban planning and design (sociocultural, environmental and economic), in this section we identify and interpret general criteria relevant to the domain of urban and architectural design. Besides the already mentioned international literature on sustainable housing and social housing, some of the relevant studies by Serbian authors who have analyzed these concepts were especially considered [11, 20, 23, 32].

As the key sustainability criteria in the architectural and urban design of social housing, the following can be distinguished:

- *Flexibility of the architectural design and construction system*
- *Spatial and functional comfort and healthy housing conditions*
- *Application of energy efficiency measures*
- *Sustainability of materials*
- *Open spaces designed to foster social integration and interaction between tenants*
- *Designing in accordance with the needs and cultural habits of special social groups*
- *Permanence and fostering a sense of belonging*
- *An architectural and landscape layout that enables monitoring and control*
- *Typological diversity*
- *Visual diversity and a tenure blind design*
- *Contextuality*
- *Environmentally and climate-responsible design*
- *Interior common spaces intended for the social integration of tenants*
- *Rationality and cost-effectiveness of the architectural structure and construction system*

The selection and the proposed order of the criteria is the result of the analyses of their contribution to achieving multiple sustainability goals and their dominant impact on these goals (+ positive; - negative; +- partially positive/partially negative; o neutral), as seen in Figure 2.

3.1. Flexibility of the architectural design and construction system

Adaptation of housing patterns to the varied and changing needs of users is considered one of the key factors of sustainable social housing. Flexible housing is defined as housing that is designed for choice, both in terms of social use and construction, or designed for change over its lifetime [33]. This characteristic is of special importance for the users of social housing, because in this sector the possibility of choice generally does not exist. The flexibility of the architectural assembly encompasses two levels: the functional level, i.e., the purpose and physical level related to the structural system, infill and envelope. This principle of design and construction is based on the idea that a flexible system in technical terms provides a socially flexible result. From a structural point of view, flexibility requires separating elements that are fixed and those that are subject to change and variation.

Two constructive systems which provide a high level of flexibility are the “open building” system, which completely separates the support level from the infill level of the building [34], and contemporary, advanced modular systems. Freedom in the use of modularly defined spaces is based on the potential functional neutrality and polyvalence of the modules, and the possibilities of their mutual combination, variation and transformation.

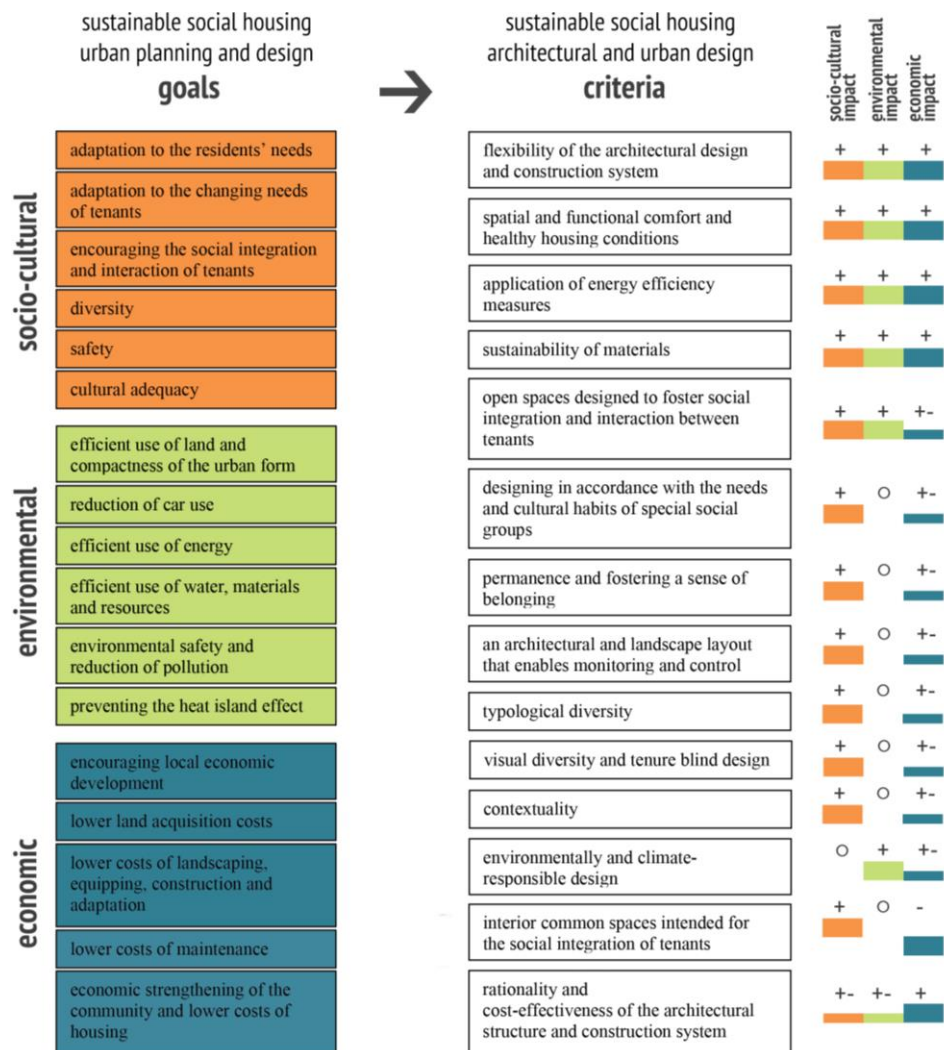


Fig. 2 Sustainable social housing criteria in architectural and urban design

Depending on the capacity of adaptation, modular systems can be static or dynamic [32]. Open building and the “dynamic” modular system usually require the application of prefabricated construction methods; hence their use depends on the degree of industrialization in construction in a given country. In conventional constructive systems, flexibility is achieved by considering favorable assemblies and functional schemes that will allow the easy division or interconnection of housing units. The flexibility of social housing units is especially important due to the reduced mobility of social tenants, i.e., the impossibility of simply replacing their apartment at a time when the structure of their families changes [10]. In this regard, social housing should be designed to allow easy transformation and use throughout the tenants’ lifetime, without the need for their relocation. Intensified use of an apartment’s area

through the superposition of functions and its flexible use can be achieved by improving the technical equipment (movable partitions, sliding doors, movable furniture) [35]. The creation of neutral living spaces, suitable for different forms of use and lifestyles, is also important from the aspect of cultural sustainability [1]. The principle of flexibility generally contains the potential to encourage the participation of tenants in the design, construction and functional organization of a dwelling. This criterion also anticipates potential future changes in the common parts of the building in order to achieve higher quality housing, such as the subsequent installation of elevators, addition of common areas, etc.

Flexibility is also important from the aspect of economic sustainability, because it contributes to the overall longevity of physical structures, reducing the need for their renewal and reconstruction, which is especially important in the public sector. In this sense, it also contributes to environment protection by reducing the use of resources and amount of waste generated. It is of specific ecological importance that physical structures are created with flexibility for the immediate or subsequent implementation of new energy efficient systems, as well as for the expected future effects of climate change.

3.2. Spatial and functional comfort and healthy housing conditions

Having an appropriate level of spatial and functional comfort and healthy residential conditions involves fulfilling the relevant requirements of housing quality (at the level of apartments, residential buildings and apartment complexes), which are defined through technical regulations, i.e., regulations and standards in the field of housing design and construction [18].

Among the basic indicators of the quality of housing are (minimum) standards with regard to the use of space (crowding level), namely “1 room per person” and an available area in the apartment per household member that is not less than 10m², or more complex and rigorous indicators such as those used by Eurostat, which take into account the structure and characteristics of households. In addition to these basic standards, adequate housing includes the design of sanitary facilities, and ancillary and open spaces in housing units, which ensure that the basic housing needs of users are met. In order to rationalize the size of social housing apartments, and yet still provide conditions for encouraging interaction between tenants, auxiliary rooms such as laundry and storage can be planned as common areas in residential buildings. It is desirable to design social housing with at least minimal kitchen storage, particularly for the purpose of physical accessibility for users with reduced mobility (the elderly and people with disabilities). Preferably, the apartments should be designed with external spaces (balconies, terraces, loggias) or associated gardens on the ground floor level, as long as these spaces provide appropriate accessibility, privacy and security. Healthy living conditions include meeting the requirements for air, lighting, thermal and acoustic comfort within the apartments, which are achieved by means of applying measures and standards in design and construction [36].

With regard to all aspects of housing comfort, social housing should meet the appropriate minimum established standards, in order to prevent the occurrence of housing deprivation, which endangers the health of tenants and reproduces poverty caused by inadequate housing. Indicators used by Eurostat to examine the quality of housing and housing deprivation within the EU-SILC methodology can be considered as minimum conditions of housing comfort. International recommendations indicate that social housing standards should not be lower than the average national housing standards, in order to avoid problems of social segregation and stigmatization [1].

3.3. Application of energy efficiency measures

In social housing design, energy efficiency means promoting systems and design measures that reduce energy consumption from conventional sources, which are economically viable in terms of investment and maintenance costs and which provide optimal comfort with minimal household energy costs (energy poverty prevention) [37]. Given that social housing is under the direct responsibility of the public sector, it can be a testing ground for promoting energy-efficient solutions and encouraging local market development in the field of energy-efficient construction techniques and technologies. Preconditions for the application of these measures in the design phase are partly determined by the selection and urban planning of locations, i.e., by applying bioclimatic urban planning principles and anticipating an efficient heating system [23].

Design in accordance with the requirements of energy efficiency includes rules concerning the positioning, design, functional organization, materialization, technological equipment, and the operation and maintenance of buildings, which are prescribed by appropriate technical regulations in order to achieve a satisfactory level of environmental and energy sustainability (energy class/annual energy consumption indicator). In social housing projects, one should generally strive for cheaper low-energy solutions and the passive use of solar energy, and if there are economic possibilities, passive-house solutions and the use of active solar and other sophisticated energy systems are desirable. Technical criteria in the field of energy efficient design which should be taken into account include: optimal orientation and functional organization; shape and compactness (shape factor); adequate thermal zoning; proper use of natural light and sunshine; optimization of natural ventilation systems; optimization of the building structure (thermal mass, thermal insulation, avoidance of thermal bridges, type and color of materials); creating conditions for the use of passive and active solar systems; and analysis of the possibility of using water for heating and cooling. Most of these energy efficiency criteria are compatible with the preconditions of economic design and construction as well as social sustainability requirements, since they improve residential comfort.

The criterion of form compactness is especially important for social housing design, because a simpler building form implies lower consumption of materials and labor, as well as lower maintenance costs. In terms of compactness criteria, heat losses are lower in multi-family residential buildings (especially in double-tract buildings), while in single-family housing the shape factor is more favorable in rows of buildings than in free-standing ones [38]. The total envelope area of the building and the level of the heat losses directly depend on the compactness/jaggedness of the building floor plan. Therefore, in addition to proper insulation of all elements of the building envelope (facade walls, windows and doors, ground floor and roof surfaces) and their design in accordance with the requirements of residential comfort (adequate lighting, protection from direct sunlight, natural ventilation), it is necessary to reduce its total surface area in order to reduce heat losses and increase the efficiency of the heating system. The open spaces of apartments (balconies, terraces, loggias) should be designed in such a way as to minimize the surface area of the building envelope and to avoid the problems of thermal bridges. An important precondition for energy saving in apartments is a regulated central heating system (central and local regulation) with measured energy consumption for heating.

3.4. Sustainability of materials

The materialization of social housing dwellings should simultaneously address the issue of price, performance, durability, maintenance and environmental impact. Basic recommendations in this category include the use of environmentally friendly and healthy, durable and locally available materials (and labor), the use of recycling, and the use of materials from naturally renewable sources (e.g., wood, soil). The use of materials bought locally implies lower total costs in construction and maintenance, as well as reduced need for transport, which is significant from the aspect of considering energy consumption throughout the entire life cycle of buildings. It is important that the materials used are durable, in order to reduce any additional costs to owners and tenants associated with maintenance or replacement. Recycling has numerous advantages in environmental protection, primarily in terms of the reduced use of natural resources, and energy savings in the production of materials, thus also in terms of reducing pollution. The recycling strategy includes both the use of recycled materials in construction and enabling new buildings to be recyclable at the end of their life cycle (e.g., wood, brick, metal, glass).

By choosing appropriate materials for construction and landscaping, comfort of the housing can be improved and the occurrence of “heat islands” in a residential area prevented [39]. The energy efficient and climate-responsible materialization of roof coverings involves the use of green and cold roofs. The advantage of green roofs is their environmental efficiency, since they retain and filter atmospheric water, and also reduce air pollution. Cold roofs are a cheaper alternative and easier to build, and they can be used on both sloping and flat roofs. They have a high degree of solar reflectivity and heat emission, and in addition to white, they can have a wide range of other colors. The landscape design should envisage cold paving of the largest possible share of solid open surfaces, using materials with a high albedo, i.e., a high degree of reflectivity of solar energy. Instead of conventional asphalt and concrete, the use of permeable materials is recommended, such as gravel and other aggregates, porous concrete and asphalt, or specially designed permeable paving elements.

3.5. Open spaces designed to foster social integration and interaction between tenants

Open areas within social housing sites should be planned in accordance with the goal of encouraging the social integration of poor and vulnerable social groups, as well as their mutual interaction and community building. The spatial context for fostering informal interactions, mutual observation and socializing includes common spaces such as green areas, landscaped courtyards for tenants to gather (paved surfaces equipped with benches, tables and canopies, gardens, areas for board games, recreation, etc.), arranged and equipped children’s playgrounds, pedestrian and bicycle paths, etc. The design of these facilities at a location depends first of all on its spatial capacity, then the rules of arrangement and construction, but also the typology of the social housing construction (individual buildings or complexes).

Well-designed green spaces are important not only as a context for children’s play, recreation and interaction between tenants, but also because they contribute to the quality and ecological sustainability of the housing environment. Walking and cycling increase the possibility of spontaneous chance encounters in the neighborhood, since they provide opportunity for greeting and communication, while at the same time representing a form of environmentally sustainable movement [40]. Designing children’s playgrounds is of particular importance as the integration of children is considered a key element in building social networks at the neighborhood level. It is equally important to organize them in a way

that enables surveillance without interfering with the privacy and peace of residents on the ground floor, where elderly people and those with disabilities usually live.

Where possible, the open spaces in residential complexes can be planned for urban agriculture, to enable food production for the tenants' own needs, and possibly for the local market. This form of activating common areas could contribute to the goal of economic strengthening of the community and reducing housing costs, as recognized in some urban design proposals for social housing in Serbia [41].

3.6. Designing in accordance with special social groups' needs and cultural habits

This criterion is one of the key requirements of socio-cultural sustainability in social housing design and construction and it involves the consideration of its spatial and functional characteristics in accordance with the needs of target groups. Beneficiaries of social housing mainly include lower-income households, as well as groups with special or specific housing needs, such as persons with disabilities, the elderly, single parents, families with multiple children, members of certain ethnic, minority or discriminated communities, etc. Housing units, common areas of buildings and open spaces should be planned in accordance with accessibility requirements, preferably at the level of the entire social housing project, and not just a smaller part of it (e.g., the ground floor of buildings). The concept of "universal design", also known as "inclusive design", involves adapting the built environment to all users, especially the elderly and disabled [42, 43, 44]. This needs to be kept in mind considering the trend of an aging population, and various forms of disability common among the elderly. An example of universal design principles in practice is the British Lifetime Homes Standards, intended specifically for social housing associations. According to Reeves, designing and building social housing dwellings to ensure that they can be used throughout the lifecycle, so-called "Lifecycle sustainability", is especially considered important in those countries where this sector is underdeveloped and tenants' mobility is minimal [10]. Universal design generally requires appropriate equipment and sizing of apartments, communication spaces (approaches – ramps, entrances, windshields, elevators, stairs and handrails, corridors), as well as open spaces (parking, paths, etc.) in accordance with accessibility standards, which can be adapted for wheelchair users and other housing needs. This criterion also means taking into account the preferences and lifestyles of different age groups and avoiding conflicts in the use of common spaces through appropriate functional zoning (e.g., apartments for the elderly and children's playgrounds) [45].

When social housing is targeted to ethnic groups with characteristic cultural habits special attention should be paid to assessing their needs, in order to avoid creating culturally inadequate housing patterns. Respecting cultural and lifestyle differences for the purpose of socially integrating ethnic groups involves designing flexible or open building systems, communication zones without barriers, special rooms for tenants to gather and neutral rooms within apartments [1]. The general profile of the future residents should be preferably known already in the programming and design phase, in order to enable their participation in these processes.

3.7. Permanence and fostering a sense of belonging

In order to encourage the social inclusion and integration of vulnerable social groups into the community, social housing should be designed to encourage their identification with the housing environment and to give them the impression that it is safe and sustainable.

The more pronounced the feeling of attachment and belonging to the housing environment among the tenants, the better the preconditions for building social networks, and thus for the successful maintenance and preservation of the apartments and common spaces. Although housing in the social rented sector is faced with fluctuations in the structure of its users, the potential “temporary use” does not imply a “temporary character” of residential buildings. In order to ensure the physical sustainability of social housing construction, it is necessary to provide quality construction materials and an adequate level of craftsmanship, both for buildings and open areas. The quality and durability of materials can affect the cost of construction, but contributes to the long-term economic viability of the project, as it reduces maintenance costs borne by the owner (public sector), as well as those borne by the social tenants. The attractiveness of the architecture can contribute to the feeling of belonging to a residential area, which is directly related to the criterion of visual diversity. One of the important measures to meet this criterion is to enable the participation of tenants in the design of the buildings and landscaping, and the use of culturally specific elements of architectural and urban design.

3.8. An architectural and landscape layout that enables monitoring and control

In order to increase the level of security or defensibility of common spaces in social housing buildings, architectural layouts should be created with a minimal number of apartments per each entry to the building (lamella). A greater number of units sharing a common entrance results in an increased public access to corridors, elevators and staircases, which reduces the possibility of monitoring and control, i.e., distinguishing tenants from visitors. It also reduces the mutual agreement between neighbors on the maintenance and control of these parts of the building. Having fewer apartments per building entry makes it easier to get to know the tenants, and thus develop a natural form of protection. Measures for designing safer architectural layouts include, first of all, dividing residential buildings vertically or horizontally into segments, avoiding long access galleries and unlit corridors, avoiding potential hiding places on all floors, especially on the ground floor (passages, spaces with undefined purpose), and planning common areas in secured areas over which tenants have control [8]. As an additional security measure, it is desirable to equip buildings with an intercom and surveillance system, but to prevent abuse, it is not recommended to allow tenants to monitor common areas in the building via television [46]. The supervision should be preferably performed by the person in charge of maintaining the building, for whom a special housing unit on the ground floor should be provided (apartment for the janitor).

In the case of landscape design, safety measures are primarily related to enabling the control of parking areas and children’s playgrounds, having vegetation that will not interfere with visibility, and adequate lighting in all open areas. As a rule, parking should be as close as possible to the building in order to allow spontaneous monitoring, while garages with a common entrance and controlled access are considered the safest solution. Greenery near pedestrian paths and sidewalks should be as low as possible (not more than 1 m), since tall trees hinder surveillance and artificial lighting. Planning appropriate outdoor lighting (location, type, intensity) prevents accidents, helps orientation and contributes to the overall safety. In general, it involves providing uniform illumination for open areas, especially pedestrian paths and parking lots.

When choosing urban and architectural typologies and structures, it is considered that those solutions with a higher degree of privacy of open spaces have a higher level of security, because they provide better monitoring and control over public areas (street, sidewalk and parking lots) [8]. Regarding the disposition and orientation of buildings and planning communal areas, the possibility of natural surveillance for parking spaces, as well as children's play areas, which should be kept small and not be too close to the residential dwellings, should be taken into account [46]. Designing garden apartments on the ground floor contributes to the overall security of the scheme, but in order to preserve the sense of security and privacy of the tenants, gardens should be designed with appropriate protection from the outside and from neighbors (fences, partitions, canopies, etc.).

3.9. Typological diversity

The typological diversity of housing is directly connected with its social diversity, and it can be achieved either by mixed housing-type developments or by the infilling of new types of development, on vacant parcels or through overbuilding [47]. In this context, the diversity of housing types primarily relates to different tenures (social renting and ownership), different housing typologies in terms of form and size (from single-family to multi-family), diversity in terms of the housing stock age, and policy support to sustain a mix of affordability levels [47]. When planning social housing complexes and buildings, it is especially desirable to combine different types of housing units (in terms of size and structure), in order to meet the different preferences of households (from singles to families with multiple children) and their changing needs, without the need to move to another neighborhood. In order to achieve the typological diversity of social housing through urban and architectural design, it is necessary to support it with appropriate housing policy measures and urban planning rules and regulations.

Mixing different forms of housing tenure with the aim of fostering social integration at the neighborhood level has been recognized as a preferred model in Serbia, although without successful implementation in housing policy, urban planning and housing development practice [48]. Unlike homogeneous social or private housing, this model carries financial risk, due to the potential negative impact of social renting on the prices of the private apartments, as well as possible additional maintenance costs to social tenants for the higher quality housing.

3.10. Visual diversity and a tenure blind design

Visual diversity is directly related to the criterion of typological diversity, but it refers primarily to the aspect of architectural expression, i.e., to the design characteristics and artistic elements of the building facades, as well as to the elements of landscape design. While typological diversity is directly related to the goal of social integration and interaction between different social groups, visual diversity can contribute to preventing or eliminating the problem of stigma, that is the negative labeling of social housing, caused by monotonous, uniform and "poor" architecture. Emphasizing the importance of suggestive and expressive architecture for social housing, Milić points out that there is no a special "architectural style" suitable for social housing, but there is a need to socialize this type of housing within the wider community and urban environment [11]. It is desirable that the buildings in larger social housing complexes are visually different, in order to encourage a sense of belonging and identification of the tenants with the housing environment. Visual diversity can be achieved through the design, materialization, use of color and details in

finishing, and equipment, while observing the requirements of energy efficiency of the building envelope and rationality, i.e., cost-effectiveness of the construction.

The criterion of unrecognizable housing types (tenure blind) is also related to preventing the “negative image” of social housing, and is applicable in the case of designing mixed tenure communities with social and private housing units [40]. It involves avoiding the visual identification of social differences through architecture, and is considered to increase the possibility of selling private housing units, in addition to preventing the stigmatization of social rented units. However, tenure blindness does not imply visual uniformity, which would be contrary to the criterion of diversity, but rather the application of uniform standards in defining the external appearance of a residential complex, primarily in terms of the design and quality of the facades and exterior equipment (doors, windows, fences, canopies, etc.). Consistent and long-term implementation of this principle requires the application of the same maintenance standards, as well as the adjustment of the costs to social tenants’ financial situations.

3.11. Contextuality

In accordance with cultural sustainability goals, the social housing design should meet two basic prerequisites – compliance with the local tradition of housing patterns [11] and respecting the urban and architectural characteristics of existing housing in the given setting. According to Milić, “physical models of social housing should not deviate from local traditionally established housing models – single-family or multi-family, but should take into account the financial rationality of projects” [11]. In addition to financial rationality, the requirement for the technological improvement of traditional models in accordance with modern needs for energy optimization of housing should certainly be considered. Selection of the appropriate housing typology is largely conditioned by the prescribed urban planning rules and regulations for a particular area. Respecting the urban and architectural value of the existing housing in the vicinity of the location (if such value exists) is desirable in order to avoid the alienation and stigmatization of social housing, disruption of the ambient features, or possible conflicts in the use of space. The contextuality of the new social housing development could also help tenants to integrate more easily into the local environment and social community.

3.12. Environmentally and climate-responsible design

This criterion refers to undertaking various measures in the urban and architectural design of social housing which are aimed at environmental protection and the prevention of climate change, and which are outside the scope of the energy efficiency measures for residential buildings. An environmentally responsible design encompasses considerations with regard to reducing pollution and minimal consumption of energy, water, materials and resources throughout the life cycle of a building, and not only in the phase of its service. Special criteria and indicators include measurements of annual CO₂ emissions, the use of renewable energy sources and materials, the application of recycling principles, the reduction of waste production, and the use of equipment that enables water saving in facilities, etc. These design measures can increase the cost of construction if they involve the application of sophisticated technological solutions for construction and equipment, while some of them can reduce maintenance and housing costs, or other costs related to the end-of-life phase of a residential building.

3.13. Interior common spaces intended for the social integration of tenants

Common spaces in social housing buildings should be designed with the aim of enabling formal and informal ways of meeting and communication among the tenants, in order to encourage their social integration and a feeling of community. Depending on the spatial capacity of the residential building, one or more rooms should be intended for different forms of gatherings or activities involving the tenants (tenants' meetings, education, counseling, celebrations, etc.). It is desirable to design these premises on the ground floor of the building and in direct connection with the open common areas, in order to provide physical accessibility for all tenants, as well as their multipurpose use. Circulations in the building (corridors, stairs, spaces in front of elevators) can also be planned with the idea of enabling tenants to meet informally, requiring appropriate sizing, design, good natural lighting and equipment (e.g., benches).

3.14. Rationality and cost-effectiveness of architectural structure and construction system

Rational and low-cost design and construction in social housing require a reduction in investment construction costs within the total price of the apartment, but not to the detriment of minimum standards of "decent housing" in the given environment [11]. According to Milić, two basic approaches under the economic rationality requirement are: 1) uniform rationalization at all spatial levels (from apartment to residential area) and 2) compensation of savings in one spatial level by achieving higher quality at another level, where the first approach is more appropriate in environments with lower quality social housing construction [11].

This criterion signifies rationalization of the urban and architectural design in terms of form and spatial and functional characteristics, as well as the application of economical and affordable construction techniques and technologies. One of the key requirements for achieving investment and energy savings through design is compactness of the architectural form and the building envelope. Designing in accordance with the maximum permitted urban parameters in order to provide more housing units can contribute to the cost-effectiveness of the project, if the increase in housing density does not jeopardize its social sustainability (especially safety), and the long-term cost-effectiveness of maintaining such buildings and complexes. Savings can be achieved by applying the minimum spatial standards for social housing, both at the level of housing units and in the sizing of common parts of the building. If these standards are not defined, the rationalization of residential areas is achieved by applying minimum space standards for apartment, but not lower than 10m² per person. In order to reduce the living space to enable decent living conditions, the principles of surface intensification can be applied, but to the extent of the functional use and hygienic optimum [35]. Reducing the area of common parts of the building in accordance with the minimum regulations must not affect the aspects of accessibility (for the elderly and people with disabilities), safety and functionality.

The cost-effectiveness of the construction system implies the application of locally available and less expensive construction techniques and construction materials, which can refer either to the application of prefabricated or conventional systems, depending on the conditions of the local construction market.

4. DISCUSSION

Summarizing the results of the criteria analysis, a conceptual multi-criteria framework with general and specific criteria in architectural and urban design of sustainable social housing is proposed (Table 1). We may point out that urban and architectural design can noticeably contribute to improving the quality and affordability of social housing in Serbia, but only if this practice is based on the comprehensive consideration of relevant sustainability criteria, which should be formally established and consistently implemented in all the phases of a project. While some of the identified criteria could be considered relevant to housing in general, regardless of the form of ownership, other have a specific importance exclusively in the domain of social housing.

The first group includes, for example, criteria related to flexibility, spatial and functional comfort, energy efficiency, sustainability of materials, contextuality and environmentally conscious design. Given that social tenants generally do not have an option of making a residential choice, unlike owner-occupiers or even private renters, neglecting these criteria through lowering standards for social housing design and construction can additionally contribute to material and housing deprivation and social exclusion of target users in this sector. Through the measures of sustainable urban and architectural design of complexes and buildings for social housing, it is possible to improve the conditions of residential comfort and the health of social tenants, and to prevent the emergence of energy poverty issues.

The second group of criteria from which the social housing sector and its end users benefit primarily, refers to principles and approaches in designing residential buildings and open spaces with the aim to encourage social integration and inclusion of tenants, their sense of belonging and safety, while respecting the requirements of rationality. Appropriate design is crucial from the aspect of the social and cultural adaptation of housing to the current and future needs of users, and it is considered important for fostering a sense of community, as well as preventing any stigma caused by unattractive architecture. The diversification of typological forms of social housing has been found necessary in national practice, both in terms of introducing innovative and socially viable physical patterns to satisfy the different needs of target social groups and of encouraging mixed forms of housing tenure. The growing trend of an aging population, the need for deinstitutionalization and solving housing issues for persons with disabilities, and the challenges of housing support for the Roma population and the homeless, are some of the key starting points for the scientific and professional elaboration of new, more universal and flexible standards for housing and their implementation in practice. An important issue which can be addressed through design is the level of safety and crime prevention in social housing neighborhoods, but it is necessary to take this into account as early as in the phase of the urban planning of locations for this purpose, in order to prevent creating high density residential areas of concentrated poverty. Decisions made in the design phase can also affect the cost-effectiveness and rationality of a housing project, as well as its long-term environmental sustainability.

Table 1 Sustainability criteria in architectural and urban design of social housing – a conceptual framework

SUSTAINABILITY CRITERIA IN THE ARCHITECTURAL AND URBAN DESIGN OF SOCIAL HOUSING	
GENERAL CRITERIA	SPECIFIC CRITERIA
1. Flexibility of the architectural design and construction system	<ul style="list-style-type: none"> ▪ Open building system ▪ Modular building system ▪ Possibility of merging/dividing housing units ▪ Flexibility of housing units ▪ Possibility of adapting the architectural design for changing needs or higher quality housing
2. Spatial and functional comfort and healthy housing conditions	<ul style="list-style-type: none"> ▪ Appropriate conditions of spatial and functional comfort (in accordance with regulations) ▪ Appropriate conditions of air, lighting, thermal and acoustic comfort (in accordance with regulations) ▪ Appropriate food storage space ▪ Appropriate external spaces (gardens, terraces, loggias, balconies) ▪ Appropriate vertical and horizontal circulation spaces in the building ▪ Appropriate auxiliary and common rooms in the building (pantry, laundry room, etc.) ▪ Compliance with average national standards for the design of residential buildings and apartments
3. Application of energy efficiency measures	<ul style="list-style-type: none"> ▪ Orientation and functional organization ▪ Building form compactness ▪ Optimal thermal zoning ▪ Optimal use of natural light and sunlight ▪ Optimal natural ventilation system ▪ Building structure optimization measures (materialization, thermal insulation, windows...) ▪ Passive/active use of solar energy ▪ Use of the optimal available heating/cooling system ▪ Use of a system for regulation and monitoring of energy consumption ▪ Degree of compliance with national EE standards for housing (energy class)
4. Sustainability of materials	<ul style="list-style-type: none"> ▪ Environmentally safe and healthy materials ▪ Quality and durability of materials ▪ Local and available materials ▪ Renewable materials ▪ Recycled and recyclable materials ▪ Materials that prevent the heat island effect
5. Open spaces designed to foster social integration and interaction between tenants	<ul style="list-style-type: none"> ▪ Landscaped green areas ▪ Designed open spaces for residents to gather and socialize (paved surfaces with benches, tables, canopies, facilities for recreation and entertainment, shared gardens, etc.) ▪ Arranged and equipped children's playgrounds ▪ Pedestrian and biking paths ▪ Designing an underground garage
6. Designing in accordance with the needs and cultural habits of special social groups	<ul style="list-style-type: none"> ▪ Accessibility of buildings and open spaces for tenants with special needs (elderly, people with disabilities, children) ▪ Apartments for people with disabilities on the ground floor ▪ Application of the principles of universal/inclusive design ▪ Adaptation of the urban and architectural design to the cultural habits of the residents ▪ Separation of children's play space from apartments intended for the elderly and persons with disabilities

SUSTAINABILITY CRITERIA IN THE ARCHITECTURAL AND URBAN DESIGN OF SOCIAL HOUSING	
GENERAL CRITERIA	SPECIFIC CRITERIA
	<ul style="list-style-type: none"> ▪ Tenants' participation in the choice of urban-architectural layout and design process
7. Permanence and fostering a sense of belonging	<ul style="list-style-type: none"> ▪ Quality and durability of materials ▪ Quality of craftsmanship and equipment of buildings and open areas ▪ Attractive architecture ▪ Tenants' participation in the choice of urban-architectural layout and design process ▪ Using culturally specific design elements to encourage a sense of belonging
8. An architectural and landscape layout that enables monitoring and control	<ul style="list-style-type: none"> ▪ Housing typologies with private and semi-public courtyards ▪ Fewer apartments per common entrance/floor (division of the building into segments) ▪ Avoiding long, naturally unlit corridors ▪ Avoiding hidden places (passages and functionally undefined parts of the ground floor) ▪ Underground garages with controlled common entrance ▪ Monitoring of open spaces (parking and children's playgrounds) ▪ Appropriate lighting of open spaces ▪ Greenery that does not prevent surveillance (low vegetation along footpaths) ▪ Apartment for a janitor on the ground floor ▪ Equipment for monitoring and access control
9. Typological diversity	<ul style="list-style-type: none"> ▪ Combining different types of housing on the site (single-family/multi-family) ▪ Combining different types of tenure on the site (social renting and ownership) ▪ Combining different types of housing units on site
10. Visual diversity and a tenure blind design	<ul style="list-style-type: none"> ▪ Variety in building facades design (colors, materials, texture, details) ▪ Visual unrecognizability of residential buildings in various forms of tenure (social renting and ownership)
11. Contextuality	<ul style="list-style-type: none"> ▪ Compliance with the local tradition of housing patterns ▪ Respecting the urban and architectural values in context (if any)
12. Environmentally and climate-responsible design	<ul style="list-style-type: none"> ▪ Use of energy and materials from renewable sources ▪ Use of recycling (materials, water, etc.) ▪ Use of active solar systems ▪ Prevention of environmental pollution during all phases of the life cycle of the building ▪ Use of infrastructure and equipment to save energy and water in buildings and open spaces
13. Interior common spaces intended for the social integration of tenants	<ul style="list-style-type: none"> ▪ Common rooms (rooms for meetings, gatherings, education, etc.) ▪ Direct connection between common rooms and courtyard – ground floor level ▪ Circulation areas in the building adapted to the possibilities of communication between residents
14. Rationality and cost-effectiveness of architectural structure and construction system	<ul style="list-style-type: none"> ▪ Compactness and simplicity of the building form and envelope ▪ Design in accordance with the maximum permitted urban parameters ▪ Rationalization of apartment areas ▪ Rationalization of the common areas of the building ▪ Cost-effectiveness of construction techniques and technologies from the aspect of investment and maintenance

5. CONCLUSION

The practice of social housing provision, planning, design and construction in post-socialist Serbia is insufficiently developed and financially constrained, which is an obstacle to achieving the sustainable development goals proclaimed through the national housing policy and planning framework. Until today, the appropriate standards, rules and recommendations for social housing construction have not been adequately elaborated through relevant legislation to support these goals. The focus of this paper was on proposing new methodological bases for the architectural and urban design of sustainable social housing in Serbia, taking into account the scientific and professional reference literature, international guidelines and the results of previous studies on this subject in the national context.

Based on the relevant socio-cultural, environmental and economic goals, a conceptual methodological model with applicable general and specific criteria in architectural and urban design of sustainable social housing was proposed. The criteria were explained and systemized in accordance with their contribution to achieving multiple sustainability goals and in such a way as to enable immediate application in practice. This multicriteria model could be used as a framework for developing technical regulations in the domain of design, and in the evaluation of completed projects, but also for defining the basis of programs and design tasks for urban and architectural competitions for social housing in Serbia.

In future research, the set methodological framework could be used for sustainability assessment of the social housing programs and projects, both in Serbia and in countries with similar housing systems. The defined criteria could be further complemented and evaluated, including potential elaboration through the system of qualitative indicators and in accordance with the characteristics of different housing types and models.

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KREIRANJE ODRŽIVIJEG SOCIJALNOG STANOVANJA U SRBIJI: KONCEPTUALNI OKVIR ZA ARHITEKTONSKO I URBANISTIČKO PROJEKTOVANJE

Osnovni istraživački problem prepoznaje se u nedovoljnoj primeni kriterijuma održivosti u urbanističkoj i arhitektonskoj praksi realizacije programa i projekata za socijalno stanovanje u postsocijalističkoj Srbiji, što može doprineti kreiranju neadekvatnog i nekvalitetnog novog stambenog fonda. U ovom radu naglašava se značaj integralnog razmatranja socijalnog, ekonomskog i ekološkog aspekta održivog razvoja u daljem razvoju postojećeg, izrazito rezidualnog sistema socijalnog stanovanja, sa težištem na unapređenju smernica, pravila i parametara u domenu projektovanja. Na osnovu analize naučnih saznanja, primenljivih modela i međunarodnih preporuka, obavljena je identifikacija, sistematizacija i interpretacija relevantnih kriterijuma u arhitektonskom i urbanističkom projektovanju održivog socijalnog stanovanja. Definisane konceptualnog višekriterijumskog okvira ima za cilj da doprinese unapređenju metodoloških pristupa u projektovanju i evaluaciji naselja i objekata za socijalno stanovanje u Srbiji kao i srodnim stambenim sistemima.

Ključne reči: socijalno stanovanje, održivost, arhitektonsko i urbanističko projektovanje, konceptualni višekriterijumski okvir, Srbija