PROSTOR

30 [2022] 1 [63]

A SCHOLARLY JOURNAL OF ARCHITECTURE AND URBAN PLANNING
ZNANSTVENI ČASOPIS ZA ARHITEKTURU I URBANIZAM

UNIVERSITY OF ZAGREB, FACULTY OF ARCHITECTURE
SVEUČILIŠTE U ZAGREBU, ARHITEKTONSKI FAKULTET

ISSN 1330-0652
https://doi.org/10.31522/p
CODEN PORREV
UDC 71/72
30 [2022] 1 [63]
1-138
1-6 [2022]

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VOL. 30 [2022] NO. 1 [63]
PAG. | 1-138
MONTHS 1-6 [2022]

Meanings | Značenja

PROSTOR *m* space, room; (*površina*) area; (*zona*) tract; (*prostranstvo*) extent, expanse; (*za kretanje/manevriranje*) elbow-room, playroom, leeway, scope; (*prostorije, smještaj*) premises, accomodation | **životni** ~ living space; **stambeni** ~ housing; **školski** ~ school space; **poslovni** ~ office space/premises; ~ **za noge** legroom; *prema raspoloživom* ~**u** on a space available basis; *fig* **pružati** ~**za** offer/give scope for; **posvetiti (pokloniti)** ~ (*u novinama*) devote (give) space to; **zbog pomanjkanja** ~**a** because of limited space; **radi uštede na** ~**u** to save space; **povreda zračnog** ~**a** violation of airspace, aerosp; **istraživanje** ~**a** space exploration

Željko Bujas (1999.), *Veliki hrvatsko-engleski rječnik | Croatian-English dictionary,*
Nakladni zavod Globus, Zagreb

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EISSN 1333-9117
www.prostor.hr
https://hrcak.srce.hr/prostor

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- PROSTOR is a half-yearly publication (two issues a year). In vol. 1 (1993) and 2 (1994) the journal was published quartarly.
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PROSTOR

A SCHOLARLY JOURNAL OF ARCHITECTURE AND URBAN PLANNING

ZNANSTVENI ČASOPIS ZA ARHITEKTURU I URBANIZAM

Editor's Office Address | Adresa uredništva

PROSTOR
University of Zagreb, Faculty of Architecture
Sveučilište u Zagrebu, Arhitektonski fakultet
HR – 10000 Zagreb, Kačićeva 26
Croatia | Hrvatska
Tel. +385/1 4639 315
Fax. +385/1 4828 079
E-mail: prostor@arhitekt.hr

Founder & Publisher

University of Zagreb, Faculty of Architecture
Sveučilište u Zagrebu, Arhitektonski fakultet
HR – 10000 Zagreb, Kačićeva 26
www.arhitekt.hr

For the Publisher

prof. Bojan Baletić, Ph.D.,
Dean of the Faculty

ISSN 1330-0652
https://doi.org/10.31522/p
UDC 71/72
CODEN PORREV

30 [2022] 1 [63]
1-138
1-6 [2022]

PROSTOR is abstracted or indexed in:

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- Architectural Publications Index [API]
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- Art & Architecture Source
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  Sveučilište u Zagrebu, Sveučilišni računski centar, Zagreb, Hrvatska
- Hrvatska bibliografija: niz B – prilozi u časopisima i zbornicima; niz C – serijske publikacije
  Nacionalna i sveučilišna knjižnica, Zagreb, Hrvatska
- Index Islamicus
  School of Oriental and African Studies, London, United Kingdom
  Instituto de Lenguas y Culturas del Mediterráneo y Oriente Próximo, Madrid, Spain
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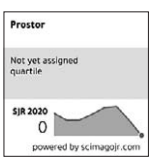

The SCImago Journal & Country Rank

H-index: 5
SJR 2020: >0.109

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Engineering: Architecture [Q3]
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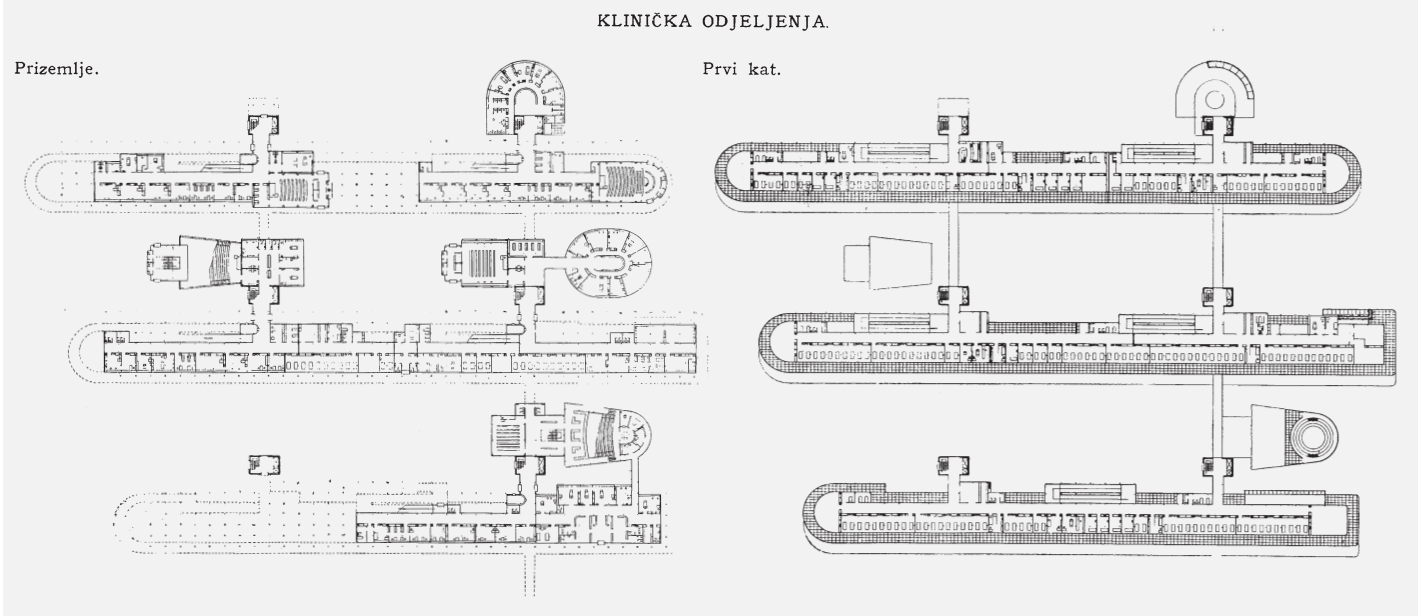

Fig. 1 Ernest Weissmann, Foundation and Clinical Hospital in Zagreb, 1930-1931

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Original Scientific Paper
https://doi.org/10.31522/p.30.1(63).1
UDC 72.03 E.Weissmann "19"
Technical Sciences / Architecture and Urban Planning
2.01.04. – History and Theory of Architecture and Preservation of the Built Heritage
Article Received / Accepted: 3. 5. 2022. / 23. 6. 2022.

Ernest Weissmann's Architectural and Planning Practices

Continuity of Original Concerns of "New Architecture" and Post-war Reconstruction

Ernest Weissmann
International Congress of Modern Architecture [CIAM]
self-help
spatial planning
United Nations Department of Social Affairs [UN DESA]

Architect Ernest Weissmann (1903-1985) dedicated his career to improving the living conditions of the deprived population – before and immediately after World War II in Europe and the United States and, starting from the 1950s and owing to senior positions he held at the United Nations Department of Social Affairs [UN DESA], also in underdeveloped countries in Asia, Africa, and Latin America. The means by which he tried to achieve it were type projects flexible enough to respond to each individual case, education, teamwork, and self-help approach. The latter was thought to strengthen the local communities, their experts, resources, and production. Relying on the research on Weissmann's pre-UN DESA career, this paper argues that Weissmann formulated most of his ideas, in particular self-help, and the above-mentioned methods, and put them into practice and an international perspective, before 1951 thanks, to his collaboration with Le Corbusier, the School of Public Health in Zagreb, the International Congress of Modern Architecture [CIAM], New York-based Structural Study Associates [SSA] group, Board of Warfare, and United Nations Relief and Rehabilitation Administration [UNRRA].

Introduction

During the 1950s, at a time of decolonization and a ubiquitous desire to build a sustainable world after World War II, United Nations departments and specialized organizations played an important role in the modernization of underdeveloped countries of Africa, Asia, and Latin America, including future members of the Non-Aligned Movement. From 1951, the Housing and Town and Country Planning Section of the United Nations Department of Social Affairs (UN DESA) was headed by the Croatian born architect Ernest Weissmann (1903-1985; Fig. 2).[1]

UN DESA was founded with the task of promoting the right of all nations to develop. Weissmann gave his contribution by supporting and developing hundreds of projects aimed to solve the housing crisis, raise the living standard, provide the implementation of economic programs through spatial plans, and relief after natural disasters. His ultimate goal was sustainable, planned, and harmonized development of the economy, society and living environment, cities and villages, whole regions and continents. The means by which he tried to achieve it were type projects flexible enough to respond to each individual case, education, teamwork, and self-help approach already put into practice in UN DESA in the late 1940s.[2]

The latter was thought to strengthen the local communities, their experts, resources, and production. Local communities were not passive recipients of help anymore but rather co-creators of their better future. Among numerous projects supported by Housing and Town and Country Planning Section were the study on Tropical Housing (1952), School of Regional City Planning in Bandung (1959), reconstruction of Skopje after the earthquake (1963), a network of UN centers for regional planning (1965), experimental social housing settlement PREVI in Peru (1968), etc. The pinnacle of Weissmann's UN career was the conference "Habitat on Human Settlements", in Vancouver in 1976. The conference pointed to problems of inequitable economic growth and uncontrolled urbanization calling, among others, for more equitable distribution of development benefits, planning and land use regulation, and for environmental protection. The above mentioned Weissmann's work is mostly reduced to the listing of institutions he has worked for (Galić, 1991) or to sporadic noting of his participation in UN DESA activities at the Global South (Muzaffar, 2007; Shoshkes, 2013).

Relying on the research on Weissmann's pre-UN DESA career, the published one on his work until 1939 (Bjažić Klarin, 2015) and the new one on his engagements within the International Congress of Modern Architecture [CIAM], Structural Study Associates [SSA] group, Board of Warfare, and UNRRA in the 1940s, this paper will argue that Weissmann formulated most of the above-mentioned ideas and methods from the very beginning of his career and tried to put them into international practice. Furthermore, from this position, Weissmann's UN DESA activities in the future research will be reconsidered as a continuity of "original" pre-war values and practices of "new architecture", repeatedly ignored by CIAM, into the post-war construction and development of the Global South. Besides contributing to the knowledge on Weissmann work in the 1940s the paper will also contribute to the knowledge of CIAM and the continuity of pre-war ideas and practices into post-war reconstruction.

The Socially Responsibility of an Architect and the School of Public Health

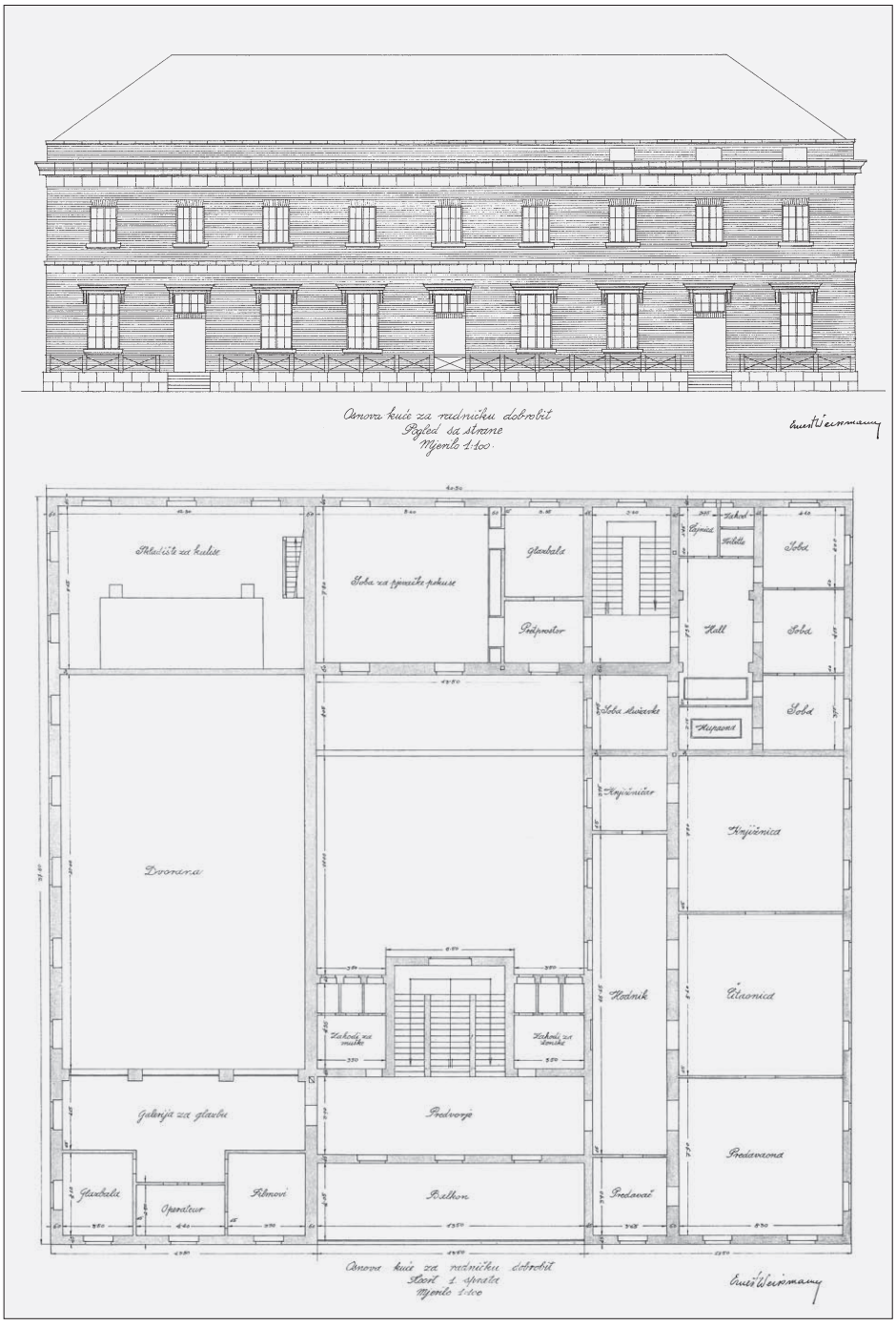
Ernest Weissmann's interest in social issues was already apparent in the early 1920s. His graduate thesis, defended at the Zagreb Polytechnic in 1926 was "A House for Workers' Welfare", a conventional solitary building with an inner courtyard and a brick façade characteristic of industrial buildings (Fig. 3). In the Kingdom of Yugoslavia, Weissmann was well introduced to all the problems of an underdeveloped country – lack of basic infrastructure, poor housing conditions of the predominantly

rural population, and city workers, suffering from infectious diseases and malnutrition. The issue of workers' housing was a common topic in public and professional discourse in Zagreb at the time. In 1920s the city was undergoing transformation into the industrial center of Yugoslavia, which resulted in an acute housing crisis and the emergence of working-class slums. As the social housing built at the time was of insufficient capacity, and substandard, other options such as self-help were reconsidered. In late 1922, a representative of the Vienna municipality, Max Ermers, gave a public lecture in Zagreb on the European examples of workers' housing estates and their construction through "cooperatives", in which the self-help approach played an important role (*** 1922).[3] Self-help had been part of Nordic countries' state housing policies from the early 20th century (Harris, 1999). Authorities, whether state or municipal, offered subsidized land plots, building materials, building design documentation, or interest-free loans. In Zagreb, for example, the "small apartments", i.e. family houses on the Kanal (Držićeva – Grada Vukovara Street) were erected on city land that had been sold to lower-income citizens at a symbolic price and were partly built according to type building plans. However, such projects were more an exception than common practice. The city mayor at the time, Vjekoslav Heinzel, who himself was an architect, ignored the rapidly growing slums, despite the social and health problems they were generating, and the urgent need for the city's modern regulatory plan. Zagreb was thus built according to partial regulation plans, the largest of which was the one for the new district east of Draškovićeva Street, marked by construction of generously subsidized, private rental residential buildings.[4]

Weissmann made a crucial step in his career and in his personal understanding of architecture thanks to his professional training in Paris. Collaborating in Le Corbusier's studio (1927-1930) on the projects of Villa Savoye, Cité de Refuge, and Moscow's Centrosoyuz, he mastered the free plan, the functional, flexible organization of space, and skeletal construction. Together with type buildings, standardization, and new technologies, namely prefabrication, the knowledge he acquired became the tool of social change. As it was stated in the *La Sarraz Declaration* of the International Congress of Modern Architecture [CIAM] Weissmann embraced the role of an engineer who uses modern technologies and planning in order to provide mass housing and a human living environment for all. This was made possible only by the subordi-

Fig. 2 Ernest Weissmann (previous page)

Fig. 3 Ernest Weissmann, A House for Workers' Welfare – graduation thesis at the Zagreb Polytechnic, 1926



1 On Weissmann and his work see: Galic, 1991 and Bjažić Klarin, 2015.

2 When Weissmann took over the UN DESA Section methods such as self-help in housing, were already adopted [Mumford, 2018].

3 Peter Behrens also spoke on housing in a lecture on cities, given at the Zagreb Polytechnic in the spring of 1923, while in 1924 Jan Dubovy published an article on the construction of garden cities in the *Tehnički list* [Dubovy, 1925].

4 The city municipality funded the infrastructure and waived its right to tax the new owners for the next 18 years [*** 1920].

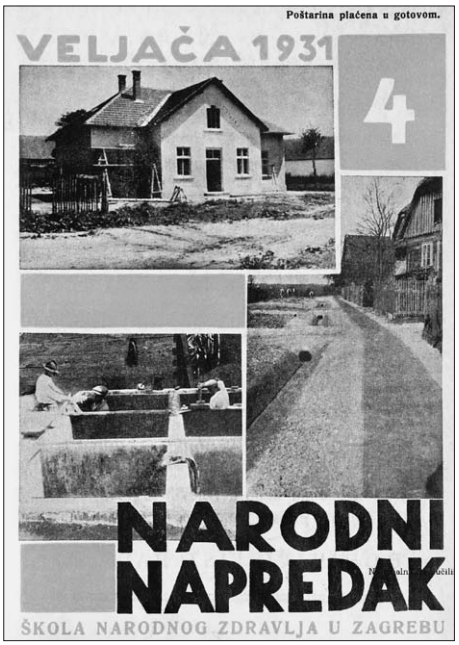


FIG. 4 *NARODNI NAPREDAK* (PEOPLE'S PROGRESS)

nation of private to the public one.[5] Weissmann looked up to Soviet and European constructivists, whose results in "minimum dwelling" production were witnessed by him at the Second CIAM Congress held in Frankfurt in 1929. In a country without a housing policy, where every eighth resident suffered from tuberculosis, Weissmann collaborated with the architect Bogdan Teodorovic and the physician Miroslav Delić, who worked for the School of Public Health, on the development of standardized prefabricated sanatorium or hospital buildings, improved through several projects from 1928 to 1931 (Fig. 1).[6] The final result – a standardized building based on a free plan and skeletal construction – was flexible enough to meet different building programs and locations.

Aware of different conditions of production, Weissmann did not insist on the use of "concrete, glass and steel" (*** 1931.a), but on solving a given design task in the most economical way with the available resources – materials, technique, and labor that defined the very form of the building.[7] While the jury of the international architectural competition for the Foundation and Clinical Hospital in Zagreb recognized his standardized prefabricated system as a valuable contribution to the health care architecture, Weissmann constructed his first building – the People's Center with an outpatient clinic and public bath in Pisarovina for the School of Public Health. The Center was built with traditional materials, and the key role in its construction was played by the local community, which contributed "money, transportation, and physical work" (*** 1931.b).[8]

In the backward Pokuplje region, the People's Center was a bearer of progress, socialization, and of curative and preventive medicine. The School's work was dedicated to modernizing life in rural areas, where 80% of Yugoslavian population lived in poor-quality housing. The rural population was encouraged to help itself through the construction of "model (...) houses to serve as an example and inspire imitation" and through the distribution of free plans for type family houses and farm buildings (Kolarić-Kišur, 1938: 38), construction courses, public lectures, exhibitions and screenings of sanitary-technology films, etc. (Fig. 4). At the same time School's employees were sent abroad for study trips and training in sanitary engineering. Thanks to the collaboration with the School of Public Health, Weissmann delivered public lectures, participated in the Hygiene Exhibition in Zagreb in 1931, and conducted research on the housing conditions of Yugoslav emigrants in the United States for the Ministry of Social Policy and Public Health in 1933.

CIAM AND A UNITY OF SOCIAL, ECONOMIC, AND PHYSICAL PRODUCTION OF SPACE

Weissmann was first introduced to the field of city and urban planning through multiple analyses of Zagreb prepared for the Fourth CIAM Congress in 1932 and he immediately established the relation between urbanization and economy.[9] It was a joint effort of Work Group Zagreb *(Radna grupa Zagreb)*, a CIAM national group for Yugoslavia established by Weissmann, Vladimir Antolić, Viktor Hećimović, Zvonimir Kavurić, Josip Pičman, Josip Seissel, and Bogdan Teodorović. As Weissmann's knowledge of planning ob-

FIG. 5 ZAGREB WORK GROUP, THE THEMATIC UNIT HOUSE AND LIFE AT THE FOURTH EXHIBITION OF THE ZEMLJA GROUP IN ZAGREB, 1932

5 Weissmann published the *Declaration* in the *Problemi savremene arhitekture* edited by Stjepan Planić in 1932.

6 Those projects were the Jewish Hospital and the Foundation and Clinical Hospital in Zagreb, tuberculosis sanatorium near Belgrade etc.

7 He summed this approach in the formula "function ´ technique = form", and explained it on the example of the sanatorium in Kraljevica in a publication of the same name [Weissmann and Delić, 1930].

8 The municipality provided the site, and the Sava County (Banovina) funds for the construction [Bjažić Klarin, 2015: 117].

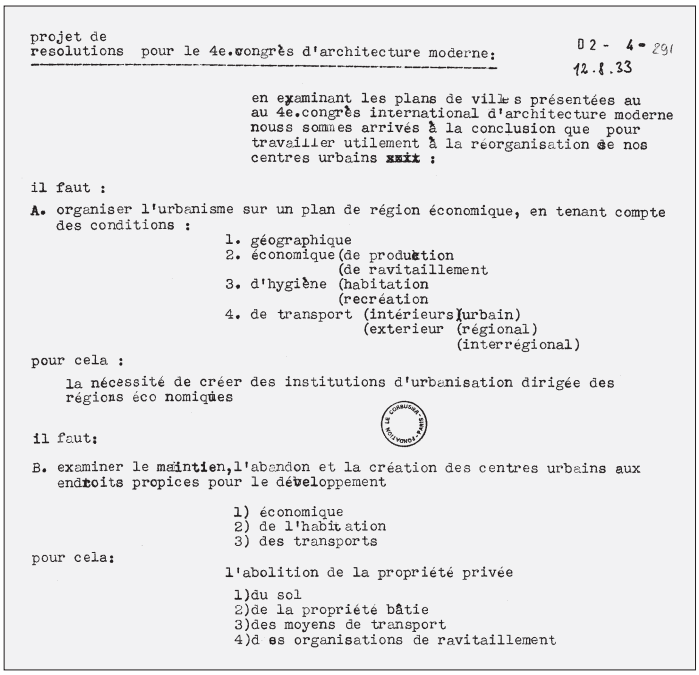
9 Results of the Zagreb Work Group analyses were presented at the Fourth Exhibition of the Association of Artists "Zemlja" in Zagreb in 1932. More in: Bjažić Klarin, 2015.

10 Department was established in 1928.

11 A complex study of Zagreb was provoked by the CIAM's secretary Sigfried Giedion. He conditioned his support to Weissmann in the struggle to exercise his right to produce construction documents for Foundation and Clinical Hospital by participating in CIAM 4. More on CIAM4 in: Sommer, 2007.

12 CIRPAC was CIAM elected executive body [Giedion, S. (1935) *Letter to E. Weissmann*, 9th July; GTA ETH, Zürich; CIAM 5 Working Program. CCA, MARS Papers, 130627].

tained at the Zagreb Polytechnic was lacking, the Urban Planning course was introduced in 1934, while Le Corbusier only become intensively involved in urban planning in the early 1930s, Weissmann's mentor was a city planner and Zagreb Group member Vladimir Antolić. As an employee at the Department for City Planning Antolić worked on the new Zagreb regulation plan based on the entry awarded at the international competition for the plan launched in 1930.[10] Thanks to the competition, Zagreb finally met the conditions for establishing urban planning on a scientific basis. The plan introduced all the principles of a functional city, including zoning and neighborhood units that became the main social and spatial organizational element provided with housing services, educational facilities, and supply chains. Neighborhoods of free-standing residential buildings surrounded by greenery were meant to replace workers' slums placed south of the railway line. Furthermore, besides working in Le Corbusier's studio, Ernest Weissmann used his stay in Paris to take an economics course that would play an important role in his understanding of the city and spatial planning.



projet de
resolutions pour le 4e.congrès d'architecture moderne:

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12.1.33

en examinant les plans de villes présentées au au 4e.congrès international d'architecture moderne nouss sommes arrivés à la conclusion que pour travailler utilement à la réorganisation de nos centres urbains xxxx :

il faut :

A. organiser l'urbanisme sur un plan de région économique, en tenant compte des conditions :

1. géographique
2. économique (de production
(de ravitaillement
3. d'hygiène (habitation
(recréation
4. de transport (intérieurs (urbain)
(exterieur (régional)
(interrégional)

pour cela :

la nécessité de créer des institutions d'urbanisation dirigée des régions économiques

il faut:

B. examiner le maintien, l'abandon et la création des centres urbains aux endroits propices pour le développement

1) économique
2) de l'habitation
3) des transports

pour cela:

l'abolition de la propriété privée

1) du sol
2) de la propriété bâtie
3) des moyens de transport
4) des organisations de ravitaillement

Fig. 6 Ernest Weissmann (Zagreb Work Group), *Alternative Version* of CIAM's Athens Charter, 1933

The Fourth CIAM Congress was aimed to use the analysis of 33 cities to bring a resolution of functional city, a resolution on the technical aspects of modern urban planning with which Weissmann agreed.[11] Analyzing the relations between the city of Zagreb and its region, traffic, housing, and labor, Work Group Zagreb was faced with the slums and the impossibility of implementing regulation plans (Fig. 5). The Group insisted on questioning the implementation, which implied a critique of the capitalist system. Namely, they pointed out that without changing the legislative and legal framework, all plans were more or less useless. At the time of the US New Deal – programs of economic and social recovery that included low-cost housing, and the construction of new industrial cities within the five-year plan in the USSR, the Zagreb Work Group wanted to incorporate the issue of plan implementation into the resolution of CIAM at the Fourth Congress, a document intended to direct the future urbanization in the world. In its *Alternative version* of the Athens Charter, the group presented by Weissmann, Antolić, and Teodorović – demanded the coordination of spatial planning with the "economic plan for the region" – geographical, economic (production and distribution), and hygienic factors and needs (Fig. 6). Like architecture, planning depended on rational spatial organization and the use of modern technology. The model which was proposed as optimal was the Soviet, Milyutin's version of a linear city, a planning model designed to abolish the village-city duopoly – provide the village with public facilities, and the city with direct contact with nature. The backbone of the city was the main traffic corridor with greenery, which was lined with "belts" of housing, public facilities, green areas, and industry. The most radical part of the *Charter* concerned the implementation of a plan in which the Group required "the abolition of private ownership over: 1. land, 2. real estate, 3. means of transport, 4. the organization of supply system", all in the interests of the community (Weissmann, 1933).

Le Corbusier, Giedion, and Walter Gropius, who took over the CIAM after the departure of the left CIAM fraction for the USSR in 1930, were not fond of the Zagreb Group initiative supported by comrades from Spain, the Netherlands, Britain, and France. They pragmatically resolved the architecture – politics or technique dilemma in favor of technique. Although the *Alternative Version of the Charter* had been rejected, Weissmann, José Luis Sert, and Wells Coates were entrusted with the preparation of the Fifth CIAM Congress program, also dedicated to urban planning, which assumed further work on analyses, on drawing up a schematic plan of the region and on devising concrete projects, like clearing the slums (Fig. 7). Slums and their clearance also represented points of interest for the British group MARS and the French CIAM group, with which Weissmann closely collaborated in London and Paris, where he lived from 1934 to 1937. The proposed program, presented at the 1935 CIRPAC meeting in Amsterdam, established a hierarchy of spatial planning – state, region, city, and neighborhood units, viewed from the standpoint of natural features, causality, and sustainable development – available resources, production, markets, and transport.[12] Production,

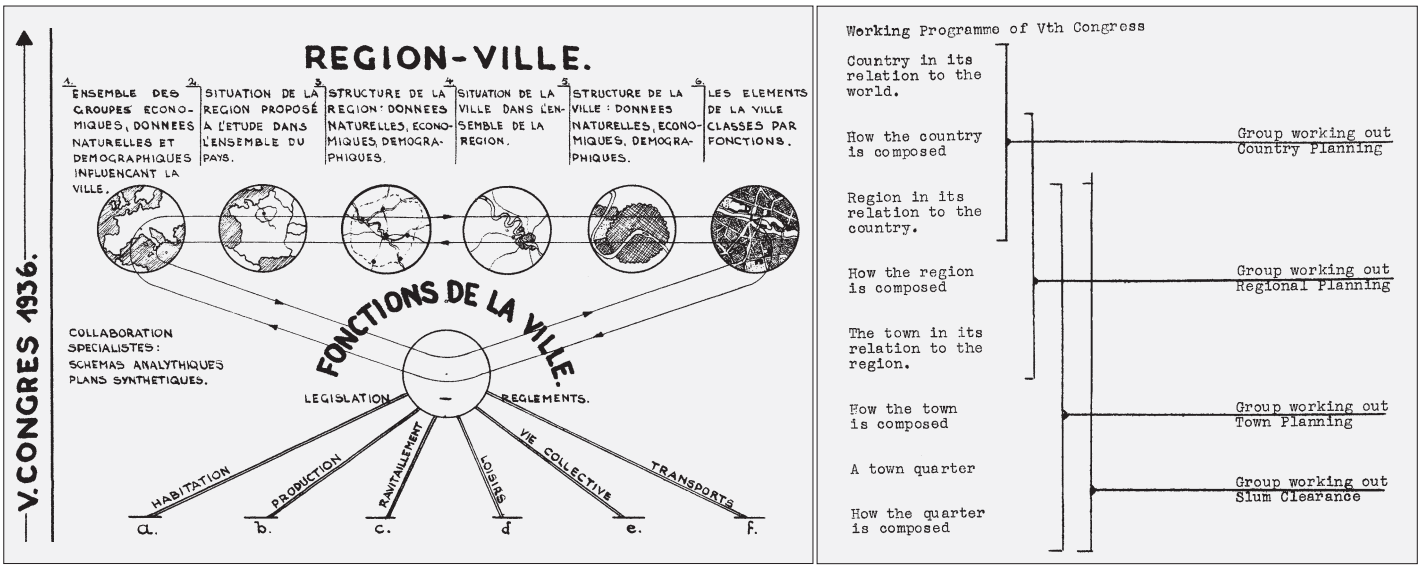

FIG. 7 ERNEST WEISSMANN, WELLS COATES, AND JOSE LUIS SERT, CIAM 5 WORKING PROGRAM

administration, and business operations determine the capacity of the housing stock, the quality of which depends on the density and size of living space per person, and space for recreation.[13]

Weissmann presented the first comprehensive elaboration of his understanding of housing and leisure in the context of cities and villages, as well as their general, technical, administrative, and legislative features, in a letter to Le Corbusier on the eve of CIAM 5[14] (Weissmann, 1937). Inspired by the victory of the Popular Front in France, he repeatedly called for social housing programs funded by the state and municipal authorities. He elaborated on the construction of new and the renewal of old city districts, as well as the reorganization of rural areas – coordination of program and location with the needs of the population and the economic and regional plan, free disposal of land, development of collective housing types adapted to population structure and customs, technologies and natural resources. He incorporated all of these into the proposals and conclusions of the Fifth Congress on the General Principles of Housing, which he co-signed with Antolić, Arthur Korn, and Mart Stam (*** 1937).[15] In the conclusions, special attention was given to the housing community with accompanying facilities for the preschool and elementary education, supply, and leisure, which were to be developed in consultation with the inhabitants. The Fifth Congress was the culmination of Weissmann's pre-war career at CIAM.

Weissmann further elaborated the conclusions of CIAM 5, i.e. the approach he called "human planning" (Weissmann, 1939), in the USA where he arrived to arrange the Yugoslav exhibition space at the World's Fair in early 1939. In a presentation prepared for the Fifteenth International Congress of Architects in Washington on *Humane Planning (Urbanism). Cities and Villages* he introduced the notion of a regional unit – city and village, whose planning was of course based on geographical, topographical, economic, technological, and socio-political factors that were constantly changing – progressing or deteriorating, which was why the plan itself had to be flexible.[16] The points elaborated in the conclusions of CIAM 5, on the construction of new and the renewal of existing city districts, were adjusted to the scale and protocols for the transformation of the region, i.e. its settlements. Weissmann put the crisis of the village and the city in both the historical and contemporary context, addressing the issues of industrialization, urban growth, and rural stagnation, a process that yet awaited Third World countries in which what can be called free labor was still a substitute for technology. Technology could be used for the common good, but could also be abused like Ger-

13 Amsterdam CIRPAC meeting, Report, 1935 [FLC, D2-6-125/141].

14 These were also the topics of CIAM 5.

15 These conclusions were supposed to serve as the basis for the Congress resolution.

16 The Congress was canceled due to the German attack on Poland [*** 1939].

17 Weissmann worked with Frey for Le Corbusier, and met Larson at CIAM 2. SSA architects promoted their ideas in magazines *Shelter* and *Architectural Record,* in which Weissmann published his tuberculosis pavilion of the Foundation and Clinical Hospital in 1934 [Strum, 2019; Weissmann, 1934].

18 Weissmann was Yugoslavia's representative in the Exhibition Sub-Committee of the Inter-*Allied Information Committee* and Center in New York 1942-1943. In 1940 and 1941 he shortly worked with J.L. Sert in New York. They designed the luxury East River Crescent [ERC] apartment building on East River Drive, and a slum-clearance project

many was doing, by putting it in the service of war and mass extermination. Weissmann, however, was not a pessimist. He called for an era of planning that would meet the material and spiritual needs of all mankind, and it was up to architects and planners to use their knowledge to provide the technical, economic, and administrative framework for its implementation.

The USA – Putting the Ideas into Practice

The idea of a radical transformation of society through technological rather than social revolution became even more appealing in the atmosphere of the coming World War II. Instead of being harnessed for profit, technology, especially mass housing production, could be used to create a quality living environment for all (total design). Weissmann shared such ideas with the Structural Study Associates [SSA], a group of left-wing technocrats, American supporters of the *Neue Bauen*, which were gathered around Buckminster Fuller – Albert Frey, Knud Lönberg-Holm, Simon Breines and Carl Theodor Larson. Weissmann was in contact with Lönberg-Holm and Breines thanks to CIAM 4 preparations since his visit to the USA in 1933.[17]

Collaboration with SSA, dedicated to the team work, was of particular importance for Weissmann, a Jew and – since 1940 – an emigrant involved in the promotion of anti-fascist resistance in Yugoslavia.[18] It provided him with an opportunity to participate in the production of a prefabricated building – the Dymaxion Deployment Unit [DDU], development of the syllabus for Building Industry Training, and get employment in the Board of Economic Warfare and UNRRA where he worked on programs of assistance and reconstruction.[19]

Buckminster Fuller's Dymaxion Deployment Unit was designed to tackle the housing crisis in the growing centers of the US defense industry (defense housing) and in the long run to change the very idea of architecture and living.[20] Weissmann contributed to the production of a DDU prototype designed for six people in Butler Manufacturing in Kansas City which took three months.[21] The assembly of the pre-fabricated, corrugated steel unit with standardized furniture required two workers and six working days (Fig. 8). After being presented to the federal authorities in Washington in May 1941, the unit was exhibited at the New York MOMA in the winter of the same year.[22]

Fig. 8 Buckminster Fuller (collaborator Ernest Weissmann), Dymaxion Deployment Unit (photo by Ernest Weissmann)

The wide application of mass-produced housing required the education of a new generation of architects, or rather the reform of the education system. The reform program, *The BI-2 Report on Design Training for the Building Industry*, was developed by Weissmann, Lönberg-Holm, Larson, Paul Nelson, and Sert under the group name Building Industry Design Education Group.[23] The program relied on a radical reform of the construction industry that was expounded in Lönberg-Holm and Larson's *Planning for Productivity*, or rather on the production of a housing unit (shelter) which, like any other product, had a shelf life. This led the group to design a sustainable cycle of production and use. Industrial production and the environment, natural resources, research, design, fabrication, distribution, use, and *disintegration* were viewed as a cycle to which both contributed, the architect and the user (Strum, 2019).

Holding the position of industrial engineer and economic analyst in the Board of Economic Warfare since May 1943, Weissmann worked on the preparation of the first phase of "assistance and reconstruction programs for the occupied European countries, with an

– renovation of two city blocks in East Harlem with free-standing slab blocks and Y-shaped skyscrapers in greenery. [Weissmann, E. (1943) *Letter to the Yugoslav Information Center*, 6th August. AEW, f. 6.1.]

19 The Committee, which had offices in charge of import, export and analytics, prepared the US economy for total war; it determined the production quotas of strategic industries and strategic Axis Powers' targets, controlled the import, export and distribution of raw materials, etc. [Woods, 2021].

20 For Fuller the prefabricated lightweight and portable structures were also a tool for *dismantling* overcrowded cities by dispersing industry into agricultural areas. Decentralization provided absolute freedom of movement that was supported by a global network of roads and air corridors. [Strum, 2019]

21 More on DDU in: Colomina, 1997.

22 *** 1941.b

23 Sert emigrated to the US in the summer of 1939.

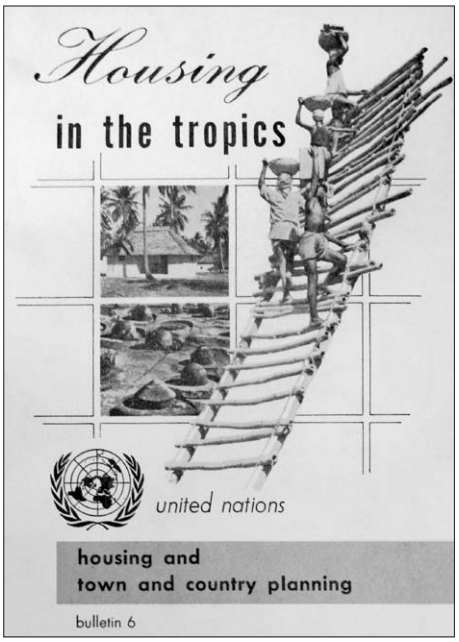

Fig. 9 Housing and Town and Country Planning

emphasis on special reconstruction programs for various fields of industry, mining, raw materials, transportation and communications" (Weissmann, undated). The program was also aimed at reviving the building industry, providing temporary accommodation, and developing a plan for the distribution of aid in the territories that were yet to be liberated.[24]

In June 1944, Weissmann got a similar position in the United Nations Relief and Rehabilitation Administration [UNRRA], its Technical Service of the Industrial Rehabilitation Division of the Procurement Office in Washington (UNRRA 1944).[25] With over 8,200 employees in regional offices and operational missions in recipient countries, UNRRA was in charge of purchasing the goods, providing basic prerequisites for reconstruction, and handling of displaced persons. As a "Shelter Specialist", Weissmann and Ben Reiner devised the first UN shelter program, packages with blankets (Oberlander, 2006), and had opportunity to apply the self-help approach on a big scale. The UNRRA policy was to encourage self-help as much as possible, including the governments of the recipient countries to plan reconstruction and development on their own. In the first year, they provided food, clothing, medical supplies, etc., while in the second year the basic infrastructure and production were established thanks to shipments of machinery, tools, and materials as well as the training of local experts.

Weissmann programmed aid for Czechoslovakia, Italy, Poland, China, and Yugoslavia, which he visited in the summer of 1945 (UNRRA, 1945). The latter was among the worst-ravaged countries; its industry and infrastructure were destroyed, while it had 1.6 million displaced and a large number of starving people and war orphans. In the name of its fight against the Axis Powers, Yugoslavia was granted $415 million in machinery, building materials for the reconstruction of 25,000 houses, etc. (Ajlec, 2020).[26]

Opposing the CIAM Chapter for Relief and Postwar Construction

Weissmann and the SSA group – Paul Nelson, Carl Theodor Larson and Knud Lönberg-Holm shared the same idea of post-war reconstruction.[27] As the experts involved with prefabrication and reconstruction, they tried to contribute to discussions on CIAM's contribution and organization after the war.[28] In May 1944, the severance of ties with CIAM groups in Europe and the approaching end of the war, prompted the establishment of the CIAM Chapter for Relief and Postwar Construction, a temporary body that would operate in New York until the groups reunited.[29] In the election for the Management Board, Weissmann was third in the number of votes – behind Sigfried Giedion and László Moholy-Nagy, and ahead of Walter Gropius and Mies van der Rohe.

The main dispute within the Chapter was: how should the CIAM members stationed in the US during the War get involved in rebuilding Europe? Starting from the UNRRA's policy that architects in war-torn countries wanted to manage reconstruction on their own, Weissmann stood with Paul Nelson and Marcel Breuer against accepting commissions in Europe and meddling too much. Reconstruction should be undertaken by young, local architects, while their US colleagues should be available to them for cooperation and advice. The latter's focus should be on post-war housing in the US and the problems that would arise due to large, forthcoming migrations.[30] Through these projects, they would develop new knowledge and practices that could be applied in Europe.[31]

Weissmann also pointed to the dangers that could "arise from not fully considering all phases of the reconstruction as well as limiting our (CIAM's, A/N) interest only to Europe", or rather to the need for all involved in reconstruction to understand that "there is only one development and that we must account for the development all over the world" (Weissmann, 1944).

Like Lönberg-Holm, Weissmann thinks of the CIAM Chapter solely as an advisory body. Having in mind that the US was one of a few countries that developed new construction technologies and materials during the war,

24 The renovation of damaged residential buildings, hospitals and schools was included. New facilities were built only for displaced persons and workers in basic industries. [Ernest Weissmann's résumé, AEW, f. 4.2.]

25 The Board was abolished in July 1943, and the UNRRA established in November 1943.

26 Thanks to the knowledge of foreign languages along with exceptional communication and organizational skills, Weissmann was appointed the Deputy Director of Industrial Rehabilitation as early as December 1945 [UNRRA, 1945].

27 Nelson was engaged in the reconstruction of France, while Larson worked for the Senate National Housing Agency and the Military Affairs Committee [Strum, 2019: 178].

28 CIAM's activities in the US were intensified after Giedion's arrival in 1938, as well as after a significant number of European architects were hired for the 1939 World's Fair. More in: Mumford, 2000; Kalpakci, 2017.

29 *CIAM-Meeting, 20th May 1944*. GTA ETH, 42-SG-2-214; *The CIAM Chapter Committee Meeting, 20th May 1944*. GTA ETH, 42-SG-2-201

30 *CIAM Special Meeting, 20th May 1944*. GTA ETH, 42-JLS-1-8/76

31 In 1943, Weissmann reviewed conference material on post-war housing [*National Housing Agency, 1944*. AEW, f. 3.2].

32 CIAM Chapter planned to publish manuals on the US building industry [*Technical News Service,* GTA ETH, 42-SG-2-177].

they imagined the Chapter as an international center for the acquisition and exchange of knowledge on reconstruction and construction, first in Europe, and then also in underdeveloped countries.[32] The Center was supposed to address issues such as an integral approach to design, research of construction technologies and different types of buildings, and continuing education of designers. The public also had to be prepared for their implementation and aware of their interdependence within the system.[33]

After giving a presentation on the problems of the first phase of post-war planning, emergency care, and reconstruction, in June 1944 Weissmann, Larson, and Nelson were joined by Lönberg-Holm and put in charge of drafting the work program for the CIAM Chapter – *Shelter Relief. Rehabilitation of Housing. Rural and Urban Redevelopment* (Larson, Lönberg-Holm, Nelson, and Weissmann, 1944). In line with the self-help approach, the report emphasized the need to activate local resources to rebuild the housing stock and start up the economy.[34] Providing housing for the homeless was planned in three phases. The first included the redistribution of the existing housing stock, repair of the less damaged buildings, and setting up of temporary camps. In the second phase, inhabitants would work on the reconstruction with provided tools and materials independently, and establish the building industry. The last phase was the reconstruction of urban and rural communities through the development of their own production. The latter would initiate the transition from wartime to a peacetime economy. Of course, all of these activities varied, depending on geographical, economic, and technical factors, which was why the standards for design, urban and rural renewal and construction, as well as laws, had to be flexible. The requirements were the minimum space standard, basic hygienic conditions, individual freedom, and privacy, but also the customs of the community.

Lönberg-Holm, Larson, Nelson, and Weissmann thought that the first post-war CIAM congress, the Sixth one, should be dedicated to the topic of World Reconstruction – the organization of education, plant production, construction, and planning.[35] Eventually, Lönberg-Holm drafted the *Standards on Community Planning* program and presented it to the CIAM Chapter in late 1945.[36]

However, proposals were also submitted by the UK group *(The Impact of Contemporary Conditions Upon Architectural Expression),* the Swiss *(The Relationship between Architect, Painter, and Sculptor),* and the Polish group (?) *(Neighborhood Unit)*. In May 1947, Weissmann brought together all the proposals under the topic – *New Standard of Values for Community Development* (Weissmann, 1947). He believed that the subject of CIAM 6 should be the problems of emergency reconstruction in Europe and long-term reconstruction in the US (slum clearance and working-class housing), i.e. the impact of industrialization, which was inevitable, on the planning, design, and organization of work. Larson, Lönberg-Holm, Nelson, and Weissmann did not attend CIAM 6 in September 1947 in Bridgewater.[37] Once again, the demands for an interdisciplinary approach and planned development, or rather an integrated approach to the planning of the human environment, were overlooked.[38]

After the dissolution of the UNRRA, in January 1948 Weissmann continued working at the Industry and Material Division of the Economic Commission for Europe [ECE] in Geneva, the organization in charge of rebuilding the European economy.[39] His job description was once again similar – analyses of the current situation and the strategy for the development of European industry, including the building and housing industry, whose main problems were lack of materials and transportation. Weissmann renewed and established a forum on construction and housing in Europe – both Eastern and Western, which was one of the fundamental tasks of ECE. After his transfer to the UN Department of Social Affairs Weissmann's deliberations on the balanced development of European countries, the poor East and the wealthy West, were mapped on a new, larger scale (Weissmann, 1981). The underdeveloped Third World countries became the main field of his activity.[40]

33 The issues were defined / borrowed from the Lönberg-Holm questionnaire prepared for the Architects Committee of the National Council of Soviet-American Friendship [*CIAM Special Meeting, 20th May 1944*. GTA ETH, 42-JLS-1-8/76].

34 Larson, Lönberg-Holm, Nelson and Weissmann were members of the Chapter's Technical Research Committee and the Programming and Planning Committee. The report was presented in July 1944 [*CIAM Chapter Meetings, 25th June and 15th July 1944, H.H. Harris's circular letter, 30th June 1944*. AEW, f.1.5].

35 The goal of CIAM 6 was the adoption of the Chart of the Principles of Reconstruction [*CIAM Chapter Informal Meeting, 20th October 1944, CIAM Chapter proposal for the CIAM 6 theme*. AEW, f. 1.5].

36 Papadaki, S. (1946) *Letter to E. Weissmann*, 25th February. AEW, f. 1.5.

37 *CIAM 6 Documents. Bergamo 1947*. GTA ETH, 42-AR-1-1/21.

38 Weissmann, E. (1943) *Letter to S. Giedion*, 16th March, *Unofficial Meeting of Giedion, Lönberg-Holm, Sert, and Weissmann, 19th February 1943*. AEW, f. 1.5; Strum, 2019: 198.

39 UN ECE, 1957

40 In the early 1950s, Asia alone had more than 100 million people living in slums with 1,000 inhabitants per square meter [Gartner-Medwin, 1952].

CONCLUSION

Ernest Weissmann refused the idea of an architect serving the investor and took over the responsible role of a builder of the new, more egalitarian society that would provide the deprived categories of the population with decent living conditions as early as in the late 1920s. In the 1920s and 1930s he already started to articulate his understanding of the architect's social role through the collaboration with Le Corbusier, the School of Public Health in Zagreb and a left-leaning fraction within CIAM. Weissmann adopted, developed, and implemented design and planning concepts and practices that remained a personal *modus operandi* throughout his career. Taking the demand for maximum economy and productivity into account, Weissmann always strived to develop the universal type of designs and programs that were also adaptable to each particular situation – to different resources, traditions, and workforce. When work methods were in question, he stood up for the self-help approach. Its aim was to straighten the local population, educate it (model buildings, type building plans, construction courses, film screenings, etc.), and make it more self-reliant in modernization and independent in improving their living conditions. In cooperation with the local community, Weissmann carried out his first construction – the People's Center in Pisarovina, with an outpatient clinic and public bath.

Weissmann's idea of *humane planning* defined in the 1930s also stood out from the CIAM discourse. It was not directed toward the technical aspects of urban planning, but rather toward its implementation, with a particular focus on land disposal, and coordination between economic, social, and spatial development. For Weissmann, urban planning was just a segment of a complex system of the development and construction of a sustainable living environment on various scales – from villages, housing communities, and cities to the regions, countries, and entire continents, aimed at preventing unplanned construction with fatal consequences for both the society and individuals. It was based on the neighborhood unit, rural reorganization, and the linear city, or rather a new regional planning unit that combined the village and the city into one whole.

In the early 1940s, Weissmann was granted the opportunity to put some of his ideas into practice. Thanks to the collaboration with Buckminster Fuller and SSA he took part in the production of lightweight prefabricated housing unit, Dymaxion Deployment Unit, and got employed in the Board of Economic Warfare and UNRRA. The postwar reconstruction of Yugoslavia, Poland, Italy, China etc. gave him an opportunity to upgrade his "help the people to help themselves" approach. He participated in the implementation of reconstruction programs aimed at providing basic conditions for self-development, basic production, and educational and health care infrastructure.

However, Weissmann's efforts to introduce his concepts and methods an international scale through CIAM were not successful. In the 1930s CIAM refused his radical demands for the abolition of private property and in the 1940s it gave priority to the issue of synthesis in architecture at the expense of shelter and post-war reconstruction. As Weissmann claimed, as early as in the 1930s CIAM turned into an elite organization that was too professional, "abstract" and exclusively interested in developed countries – Western Europe, US and maybe USSR (Weissmann, 1984-1985: 34). Nevertheless, as a "practical idealist", Weissmann remained committed to his goal and position of an "international civil servant" who did not stop believing "in peoples' equality and right for decent living conditions".[41] Thanks to his engagement as a director of the UN Sector for Housing, Urban Planning, and Regional Planning, his work contributed to the implementation of original concerns of pre-war "new architecture" to post-war reconstruction in the 1940s and development in the Global South in 1950s and 1960s.

[Translated by Lida Lamza]

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3. GTA ETH – Institut für Geschichte und Theorie der Architectur, Eidgenössische Technische Hochschule, 42 CIAM Archives.
4. FLC – Fondation Le Corbusier, Paris.
5. TFA – Teodorović Family Archive, Zagreb.
6. UN-UNRRA – United Nations Archives, United Nations Relief and Rehabilitation Administration

Illustration sources

Fig. 1 Planić, 1932

Fig. 2 Association of Croatian Architects / Udruženje hrvatskih arhitekata, Zagreb

Fig. 3 Faculty of Architecture, University of Zagreb, Department of Architectural Technology and Building Science / Arhitektonski fakultet Sveučilišta u Zagrebu, Katedra za arhitektonske konstrukcije i zgradarstvo, Zagreb

Fig. 4 School of Public Health Journal, 1931

Fig. 5 UBU Gallery, Marc Dessauce Collection, Ernest Weissmann's Archive, f. 9.1, New York

Fig. 6 Fondation Le Corbusier, D2-4-291, Paris

Fig. 7 Het Nieuwe Instituut, Cornelis Van Eesteren Archive, EEST-IV-109, Rotterdam; Canadian Centre for Architecture, Wells Coates Bequest, MARS Papers, 130627, Montreal

Fig. 8 UBU Gallery, Marc Dessauce Collection, Ernest Weissmann's Archive, f. 4.1, New York

Fig. 9 UN DESA Journal, 1952

Author's biography

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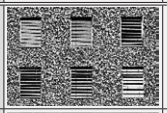
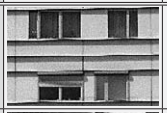
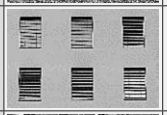
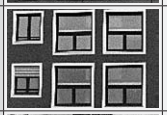
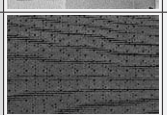
Acknowledgment

This paper is a result of the research project *Models and Practices of Global Cultural Exchange and Non-aligned Movement. Research in the Spatio-Temporal Cultural Dynamics* (IPS-2020-01-3992), of the Croatian Science Foundation and the Slovenian Research Agency.

Table I Façades and respondents' reactions

Façade	Photo	Pair of (non-) greened façades	Negative reactions (x1-x4)	Positive reactions (x5-x10)	Neutral reactions (x11)	Façade	Photo	Pair of (non) greened façades	Negative reactions (x1-x4)	Positive reactions (x5-x10)	Neutral reactions (x11)
F1		F1ng-F10g	89 (90.9%)	7 (7.1%)	2 (2.0%)	F11		NA	72 (73.5%)	21 (21.4%)	5 (5.1%)
F2		F14ng-F2g	14 (14.3%)	79 (80.6%)	5 (5.1%)	F12		F12ng-F6g	70 (71.4%)	24 (24.5%)	4 (4.1%)
F3		NA	87 (88.8%)	9 (9.2%)	2 (2.0%)	F13		F5ng-F13g	25 (25.5%)	66 (67.4%)	7 (7.1%)
F4		NA	47 (48.0%)	47 (48.0%)	4 (4.0%)	F14		F14ng-F2g	71 (72.5%)	22 (22.4%)	5 (5.1%)
F5		F5ng-F13g	68 (69.4%)	18 (18.4%)	12 (12.2%)	F15		NA	64 (65.3%)	28 (28.6%)	6 (6.1%)
F6		F12ng-F6g	30 (30.6%)	57 (58.2%)	11 (11.2%)	F16		F16ng-F7g	61 (62.2%)	32 (32.7%)	5 (5.1%)
F7		F16ng-F7g	26 (26.5%)	66 (67.3%)	6 (6.2%)	F17		NA	33 (33.7%)	60 (61.2%)	5 (5.1%)
F8		NA	87 (88.8%)	7 (7.1%)	4 (4.1%)	F18		NA	68 (69.4%)	30 (30.6%)	0 (0%)
F9		NA	86 (87.8%)	10 (10.2%)	2 (2.0%)	F19		NA	43 (43.9%)	51 (52.0%)	4 (4.1%)
F10		F1ng-F10g	45 (45.9%)	51 (52.1%)	2 (2.0%)	F20		NA	88 (89.8%)	9 (9.2%)	1 (1.0%)

Notes: ng – non-greened; g – greened; NA – not applicable.
Response (X): x1 – dangerous, frightening, scary; x2 – unpleasant, incomprehensible, disturbing; x3 – very disturbing, repellent, depressing; x4 – boring; x5 – soothing, pleasant; x6 – understandable, coherent, legible; x7 – attractive, fascinating, invigorating; x8 – dreamy, romantic; x9 – mysterious; x10 – acceptable, unobtrusive; x11 – does not evoke determined response, neutral.
Mainly positive reactions (x5-x10 › 50%) are marked with a gray background.

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Original Scientific Paper
https://doi.org/10.31522/p.30.1(63).2
UDC 711.64 159.937.522
Technical Sciences / Architecture and Urban Planning
2.01.02. – Urban and Physical Planning
2.01.04. – History and Theory of Architecture and Preservation of the Built Heritage
Article Received / Accepted: 12. 4. 2022. / 14. 6. 2022.

How Does Greenery on a Nearby Façade Change Perception of a Window View?

MULTIDISCIPLINARITY
PERCEPTION OF VIEW
URBAN DENSIFICATION
VISUAL AESTHETIC
WINDOW VIEW

Window view is an important parameter of comfortable living. In densely urbanized areas, window view is often limited to a nearby façade, without all three visual layers visible and possibility of distant view. The purpose of the study is to examine what reactions are triggered by views of nearby façades, which by definition are not quality window views, and how observers' reactions are influenced by additional greenery on the façade. A questionnaire survey was used in the study as a method for obtaining research data. Respondents defined reactions to 20 various window views and the reasons for them. The results showed that reactions to window views of nearby façades varied, and that the negative response depended not only on a limited number of visual layers and the distance between buildings, but also on the visual aesthetic.

Furthermore, added greenery in the window view triggered more positive reactions than did façades without greenery. Measures for greening façades are proposed.

Introduction

The basic function of the window is the introduction of daylight and fresh air into the interior, and the view of the outside space from the interior, which provides psychological comfort and personal satisfaction (Yeom et al., 2020; Veitch and Galasiu, 2012). The importance of the window was demonstrated during the epidemic that required long-term lockdown, as window view provided the only visual contact with the environment and also social connection with other people (Batool et al., 2021a). Looking at the greenery through the windows reduced the level of anxiety, anger, fear, moodiness, boredom, irritability, and sleep disturbance (Spano et al., 2021, Soga et al., 2021).

Window view meets different needs (Szybinska Matusiak and Klöckner, 2016):

– The need for information about the outside environment – The window view provides important information about the time of day, informs about weather conditions, orients on the location and monitors activities that take place outside. Visual information through the window complements the audio information provided by the location (Deng et al., 2020) – birdsong, the rustling of the wind, the murmur of water, the bustle of children... All of that triggers pleasant feelings.

– The need for health and restoration – Numerous studies have shown that window views can improve the psychological well-being of individuals (Kaplan and Kaplan, 1989; Kaplan, 1995; Abraham et al., 2010), reduce stress (Tyrväinen et al., 2014), and prevent mental fatigue (Kaplan, 1995; Li and Sullivan, 2016). People respond to the window view. Most of them e.g. prefer an office with windows (Stone and Irvine, 1994), because the views allow for greater work productivity (Gilchrist et al., 2015). The price of hotel accommodation is shaped by the quality of the window view (Kim and Winneman, 2018). Patients in rooms with a view of nature recover faster and need less medication than those looking at a brick wall (Ulrich, 1984). Views of the green area from classrooms in schools reduce stress levels and restore students' attention (Li and Sullivan, 2016). Restorative environments help people recover from mental fatigue and stress (Tyrväinen et al., 2014), increase positive emotions, and improve mood and self-esteem (Jo et al., 2013). People like to look at natural environments (Ulrich, 1981; Kaplan, 2001) because they are much more restorative than urban ones (Korpela, 1992; Purcell et al., 1994; Sonntag-Öström et al., 2014). Furthermore, some studies attribute greater regeneration capacity to natural views and urban scenes with natural elements (Tenngart Ivarsson et al., 2008; Subiza-Pérez et al., 2021) rather than urban scenes without nature (Giraldo Vasquez et al., 2019).

The need for an aesthetic experience – Humans are sentient beings so they are also susceptible to visual aesthetics, defined by quantitative and qualitative parameters. Quantitative elements are the breadth and depth of the motive that the view encompasses, both the foreground and the horizon (Littlefair, 1996). Distant views take precedence over close ones (Herzog and Shier, 2000; Kent and Sciavon, 2020). A quality window view must have three "visible layers": the top layer (in the distance, contains the sky and the natural or artificial horizon), the middle layer (contains natural or artificial elements such as fields, trees, hills or buildings) and the bottom layer (visible in the foreground), includs greenery and soil (Bell and Burt, 1995; SIST EN 17037). The lower layer is particularly important, as the observer's gaze is often directed toward movement (e.g. vehicle, pedestrian activities, etc.) and also provides visual information about the distance and thus the size of objects in the middle layer. Giraldo Vasquez et al. (2019) investigated the dependence of preferences between views on the number of layers in the view – the smaller the number of layers, the more important is the view of nature; the larger the number of layers, the more desirable / acceptable urban views are. According to studies, visual content is also important. Users prefer urban features to be viewed

from afar, but this does not apply to nature. When views from afar cannot be provided due to location constraints, satisfaction increases with the placement of nature, e.g. a tall tree into the visible field (Kent and Sciavon, 2020).

Qualitative elements for evaluating the quality of the view are beauty (visual aesthetics of elements predominant in the view) and the composition of the view. Especially in urban environments, the aesthetic component is determined by architectural elements that contribute to visual richness. The view is improved by the complexity and legibility of the composition (Herzog and Chernick, 2000; Van den Berg, 2016). Perception of the urban environment is also decisively influenced by the age of buildings and their maintenance (Szybinska Matusiak and Klöckner, 2016; Herzog and Shier, 2000).

View of the nearby façade

The façade is the outer envelope of the building, which with its tectonics, volumes, geometric proportions and decoration gives the space an artistic identity. The farther the building is from the observer, the easier it is to interact with the wider environment, as it comes to life only in the context of the surroundings. The closer it is to the observer, the lesser the readability of the tectonic structure of the building is, and the more important become details such as disorder and poor maintenance, which can trigger negative responses (Joedicke et al., 1975).

A large part of the population today lives in urban environments, where the window view is often limited to the nearby buildings. These are sometimes so close that the view does not satisfy neither the need for information about the external environment, the need for health and restoration, and due to poor architecture, nor the need for aesthetic experience (Szybinska Matusiak and Klöckner, 2016). Some authors, nevertheless, find that people can respond positively to urban views if all three layers are included in the view, buildings are visible in the distance, and there is some greenery between the window and the built environment (Kent and Sciavon, 2020). Observing trees or plants through a window alone can have measurable effects (Grinde and Patil, 2009; Van den Berg et al., 2016). The more vegetation obscures the view of the urban environment, the greater the perceived restorativeness of the view (Ojala et al., 2019). The question is in what form greenery in the window view should be integrated into the urban environment, as research also shows that in addition to greenery, other features in the window view also affect psychological, physical and work well-being (Van Esch et al., 2019). Numerous studies, for example, identify the importance of quality window views and highlight the benefits of landscape views, or focus on comparisons between landscape and urban views, exploring the impact of greenery on well-being and health (Veitch and Galasiu, 2012; Soga et al., 2021), distance, number of layers in the view, differences between responses to views of natural and urban environments (Ulrich, 1981; Kaplan, 2001). Some studies have also indicated restorative potential in urban environments (Ulrich, 1981; Van den Berg, 2016; Tyrväinen et al., 2014; Sonntag-Öström et al., 2014). Batool et al. (2021b) for instance, found that urban views can be interesting if they are mysterious and encourage investigation. We note that there is very little research on the topic of close urban views when only the middle layer is visible through the window, without the sky layer that allows for a distant view, and/or the ground layer at which human activities take place. This creates a substantial research gap in this area. This study is, therefore, focused on finding the reactions to such window views, and establishing whether the greenery on the façade affects the response of observers. We assume that despite the absence of three visible layers and distant view, which are otherwise a strong indicator of window view quality (Bell and Burt, 1995; SIST EN 17037), respondents' reactions to window views of nearby façades, may not be only negative. We also expect that window views with greenery on a nearby façade will trigger more favourable responses than the window views without it and attempt to determine the differences in perceptions of façades with and without greenery (Kaplan, 2001, 1993; Ulrich, 1981; Van den Berg et al., 2016). The study focuses on the question of whether the view of the nearby façade with added greenery changes or improves the respondents' reactions and the reasons for them.

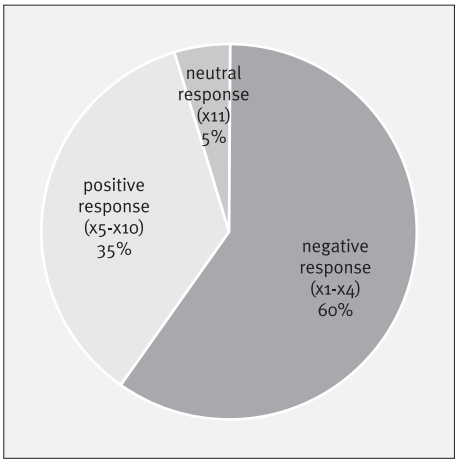
Aim, method and materials

The first step of the research was to record the responses to window views of nearby façades, which primarily do not meet most recommendations for quality view, to check whether greenery on the façade reduces the impact of its poor visual quality, and determine how reasons for reaction to window view relate to specific window views.

In order to ensure comfortable living, the room must, in addition to the appropriate temperature and relative humidity, air composition and acoustic conditions (Zbašnik-Senegačnik, 2018), also provide quality window views. This study, however, focuses specifically on the reactions to window views of the nearby façade, which is due to urban densification

Fig. 1 Issues discussed – view from the 3rd floor, two floors of the neighboring building are visible in the window view (only one layer, no possibility of distant view)

Chart I Structure of the reactions to the façades



often in the immediate vicinity. The view is, therefore, limited to only a part of the façade, which is contrary to the recommendations.

Based on the previously discussed theoretical context, 20 façades in close-up view in residential neighbourhoods in Ljubljana were selected for the analysis of window views, which were considered suitable for the study. Façades with articulated architectural elements that Ching (2015) highlights as important for achieving visual comfort were deliberately avoided and the quality of the architecture was not a criterion for the selection. To ensure sufficient variability, façades from different architectural periods, which contain different architectural and construction elements and are in various maintenance stages, were selected. Some selected façades are deliberately similar to check the consistency of the responses. In the representative sample, the buildings have 5 floors. The view is framed in the way that the 3rd and 4th floors of the adjacent building can be seen through the window in terms of communication distance (Hall, 1966), horizontal field of vision (Gehl et al., 2006), architectural or environmental determinism (Carmona et al., 2003), and human scale elements (Gehl, 2010). At this position, only the middle layer is visible, without trees, shrubs, activities of people on the ground and without roofs and the sky above them – i.e., without most elements recommended by Bell and Burt (1995) to achieve visual comfort (Fig. 1). Greenery on five façades was created with Adobe Photoshop. The framing of views is unified so that all the façades had the same apparent distance from the observer.

A total of 135 students of the 3rd year of architectural study at the University of Ljubljana, Faculty of Architecture (UL FA) were invited to participate in the study, and 98 students responded. The problem of small distances between buildings, which leads to poor quality of window views, was not previously discussed with them. We hypothesize that students of architecture are particularly sensitive to detecting visual features and architectural elements on the façades, which is positive from the research point of view, as it makes it easier for them to define the reasons for specific reactions to window views. In the analytical phase of the research, a questionnaire was designed. The questionnaire contained 52 questions in three parts: (1) In the socio-demographic section the focus was on gender, age and long-term residency; (2) The second part of the questionnaire included questions about the type and size of the building in which the respondents live and their connection with nature; (3) The study presents the results of the third part of the questionnaire, in which the respondents expressed their reaction to 20 window views of nearby façades and the reason for them. The survey was published in the learning platform Moodle of the UL FA, 20 May 2021, access was available for 24 hours. The time to complete the survey was not limited.

The respondents answered two questions on each of the façades. In the first question, they chose between 11 possible reactions to a specific window view. The characteristics of the views were descriptive (variable X): x1 – frightening, scary, dangerous; x2 – unpleasant, incomprehensible; x3 – very disturbing, repellent, depressing; x4 – boring; x5 – soothing, pleasant; x6 – understandable, coherent, legible; x7 – attractive, fascinating, invigorating; x8 – dreamy, romantic; x9 – mysterious; x10 – acceptable, unobtrusive; x11 – does not evoke determined response, neutral. Specific responses were defined based on past experiences of researchers and case studies from the literature (Kim et al. 2018; Brown et al., 2013; Aries et al., 2010; Kent and Schiavon, 2020; Van Esch et al., 2019; Kaplan and Kaplan, 1989; Elsadek et al., 2019; Drobne et al., 2022). The second question on the same façade referred to the reason that triggered the selected reaction X. Respondents choose between 7 reasons (variable Y): y1 – surface characteristic (e.g., colours, texture), y2 – composition quality (good or bad) e.g., position and proportions of the elements), y3 – narrative quality (e.g., involuntary attention, suggestiveness), y4 – complexity (e.g., singularity in form, details), y5 – dynamics (e.g., degree of vegetation, human activities in opposite buildings), y6 – unpleasant/pleasant space (e.g., maintenance, safety, health, compatibility, unity), y7 – other (can't define). The selected reasons are derived from the conceptual elements of visual aesthetics (Ching, 2015).

In the second step statistical analyses were carried out by comparing the frequencies of reactions and reasons, analysing the analytical charts and using statistical testing of the hypotheses. The x^2-test was used to test the research question about the randomness of the reactions, to test the correlation of the nominal variables, but the homogeneity of the answers, as well as the reasons, was tested with the Fischer-Snedercor test.

Results

A summary of the survey results can be found in Table I, where all façades included in the survey are labelled F1 to F20. In the table, pairs of façades are labelled as non-greened (ng) and greened (g) façades. We have highlighted the reactions of the respondents when they see the façade. We distinguish between negative (x1-x4), positive (x5-x10) and

neutral (x11) reactions. The predominantly positive reactions (more than 50% of the positive answers) are highlighted with a gray background.

Looking at the results in Table I, it is immediately noticeable that respondents overwhelmingly reacted positively to the greened façades (F2g, F6g, F7g, F10g, F13g and F17g) and to the one façade without greening (F19ng) – which is quite varied and unusual.

We investigated whether reactions to the views of neighbouring façades differed even when the distance of view in three layers is not present and we would expect negative reactions in all of them. The results of the survey showed very different reactions. 98 respondents gave 1960 reactions for the 20 façades. 1174 (60%) of the reactions expressed a negative experience of the façade, 694 (35%) of the reactions expressed positive feelings when viewing the façade and 92 (5%) of the reactions were neutral (see Chart I). The test x^2 was used to test the hypothesis that the reactions were random. Assuming that the reactions were not random, the risk is very low, almost zero (H = 360,893.02; x^2 = 68.76, α = 10^{-16}).

Next, we tested whether façade greening triggers positive reactions compared to façades without greening. The analysis was carried out in two steps. In the first step we analysed the reactions for all façades (F1 to F20), and in the second step we compared only the pairs of non-greened/greened façade (F1ng-F10g, F14ng-F2g, F5ng-F13g, F12ng-F6g and F16ng-F7g). The contingency tables for façades without and with greening can be found in Table II (for all 20 façades) and Table III (for pairs of façades only). The tables show that in both cases relatively more respondents had a positive reaction to the greened façades.

In both cases, the correlation test of the nominal variables (test x^2) shows a statistically significant correlation between a greened façade and an overwhelming number of positive reactions (in the case of all 20 façades: (H = 314.24; x^2 = 73.68, α = 10^{-16}); in the case of pairs of façades: (H = 110.88; x^2 = 73.68, α = 10^{-16}). From this we conclude that the greening of the façade generally triggers positive reactions.

We thus found that façades with additional greenery (façade pairs F1ng-F10g, F14ng-F2g, F5ng-F13g, F12ng-F6g and F16ng-F7g; see Table IV) elicit predominantly positive reactions. For the façade pairs, the predominant reactions, their changes when the same façade is greened, and the predominant reasons for the reactions were analysed below. Thus, façades without greening were described as boring (x4) and as unpleasant, incomprehensible, disturbing (x2). The reasons for these reactions ranged from compositional quality (y2), to unpleasant/pleasant space (y6), to surface characteristic (y1). After the façades were greened, the responses changed to predominantly acceptable, unobtrusive (x10) and soothing, pleasant (x5). The most frequently cited reason for this change in reactions was dynamism (y5), other reasons were surface characteristic (y1) and other (can't define) (y7). Chart II shows the change in reactions when the façade is greened. Positive reactions increase differently with greening for the different façades, but always by more than 1/3. Positive feelings increase the most with greening for the pair F14ng-F2g by 58.2%, for the pair F1ng-F10g by 45%, for the pair F5ng-F13g by 38.8%, for the pair F16ng-F7g by 34.6% and for the façade pair F12ng-F6g the least with 33.7%.

For the paired façades, we also checked whether greened façades, by eliciting more positive reactions, unite them; we also checked what happens to the reasons for greened façades. The dispersion of reactions and reasons was analysed using a relative measure of dispersion, namely the coefficient of variation. Chart III shows greater uniformity of reactions for greened façades (CV = 0.455) than for non-greened façades (CV = 0.625); the degree of confidence is very high (F = 1.373; a = 0.0005). For greened façades, the uniformity of reasons is also slightly higher, but the difference is not statistically significant in this case (F = 1.041; a = 0.67).

Table II Contingency table between façades and reactions

	non-greened	greened
negative reaction (x1-x4)	1001	173
positive reaction (x5-x10)	315	379
neutral reaction (x11)	56	36

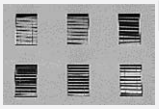
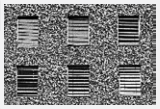
Table III Contingency table between non-greened/greened façades in pairs and reactions

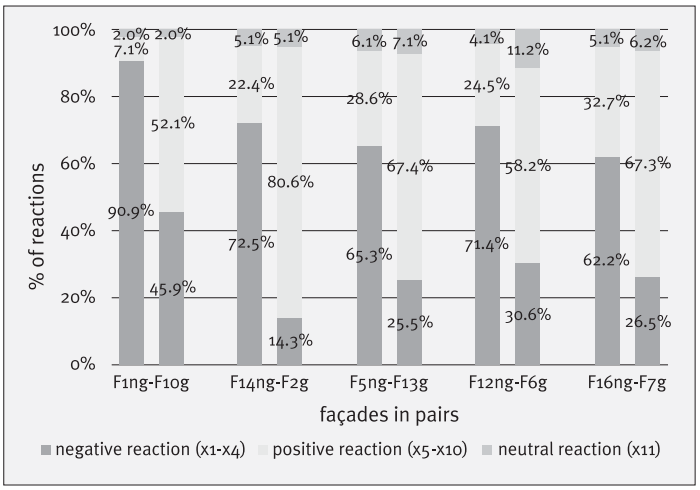
	non-greened	greened
negative reaction (x1-x4)	359	140
positive reaction (x5-x10)	103	319
neutral reaction (x11)	28	31

Discussion

The results show that 60% of all respondents expressed negative reactions when viewing the nearby façades, while the share of positive

Table IV Non-greened/greened façades in pairs, the most frequent respondents' reactions and reasons

F1ng-F10g	F1ng		F10g	
reaction	x4 – boring		x10 – acceptable, unobtrusive	
reason	y2 – composition quality		y1 – surface characteristic	
F5ng-F13g	F5ng		F13g	
reaction	x4 – boring		x10 – acceptable, unobtrusive	
reason	y1 – surface characteristic		y5 – dynamic	
F12ng-F6g	F12ng		F6g	
reaction	x4 – boring		x5 – soothing, pleasant	
reason	y2 – composition quality		y7 – other (can't define)	
F14ng-F2g	F14ng		F2g	
reaction	x2 – unpleasant, incomprehensible, disturbing		x10 – acceptable, unobtrusive	
reason	y6 – unpleasant/pleasant space		y5 – dynamic	
F16ng-F7g	F16ng		F7g	
reaction	x2 – unpleasant, incomprehensible, disturbing		x5 – soothing, pleasant	
reason	y6 – unpleasant/pleasant space		y5 – dynamic	



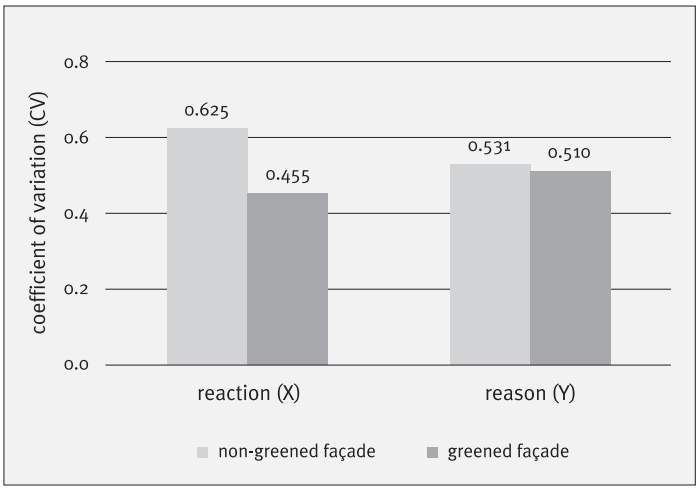


Chart II Change in reaction when the façade is greened

Chart III Variability of respondents' reactions and reasons to the non-greening/greening façades in pairs

reactions was around one third of all responses, and very few were neutral reactions.

Further analyses showed that the reactions were not random. With that we confirmed the hypothesis that respondents' reactions to window views vary despite the fact that the window views do not contain three visible layers and distant view and therefore lack essential components of view quality (Bell and Burt, 1995; SIST EN 17037). Previous studies indicated that urban views can be interesting if they are mysterious and encourage investigation (Batool et al., 2021b). The observer's attachment to a certain type of location can also have an impact on the response – people from rural areas, e.g., value the natural environment, and urban dwellers are fascinated by both natural (Herzog and Shier, 2000) and urban environments (Wilkie and Stavridou, 2013). Some studies also suggest that city dwellers can find restorative views in an architecturally stunning neighbourhood or feel anxious in a lonely forest (Twedt et al., 2019) and those views of museums, monasteries, city images at night can have a similar effect as natural restorative views (Kaplan et al., 1993). In further studies, it would be valuable to identify correlations between the location of residence and personal preferences with targeted research on the criteria for specific responses.

This research has indicated that there are also other parameters that affect the reactions to window views of nearby façades. A very important research question was whether the added greenery on the nearby façade changes the reactions of the respondents. We added different types of greenery to five selected façades and randomly included them in the questionnaire:

– Unsupported climbers who ascent the entire façade surface (grip independently) (F1ng-F10g);

– Linear planting with flower containers on balconies – upright or hanging perennials or seasonal plants that create dynamics on the façade (F5ng-F13g and F12ng-F6g);

– Climbers on balconies that need support such as balcony railings (façades F14ng-F2g and F16ng-F7g).

Selected five pairs of façades were presented in the questionnaire in the variant with and without greenery (Table IV). We deliberately used two examples of façades with covering and linear planting to check the consistency of responses.

The correlation test of nominal variables showed a statistically significant correlation between the greened façade and the predominantly positive reaction. Based on the results, we can see that the change is quite pronounced and that the added greenery in the window views in all cases of the analysed pairs of façades – triggers a significantly more positive reaction (Chart II):

Façade pair F1ng-F10g: For F1ng with an even flat surface, uniformly arranged windows of equal dimensions and monotonous geometry, received 90.9% of negative reactions, most often x4 – boring; as the reason respondents most commonly named y2 – composition quality. F10g has an added climber that completely covers the façade surface, the façade has become x10 – acceptable, unobtrusive, and the most common reason is y1 – surface characteristic.

Façade pairs F5ng-F13g and F12ng-F6g: F5ng and F12ng have slightly fewer negative reactions than F1ng (69 and 70%), are geometrically varied (protruding façade planes) with colour accents, however, respondents mostly defined them as x4 – boring. With the addition of flower containers (F13g and F6g) they become more acceptable, most commonly x10 – acceptable, unobtrusive, then x5 –

soothing, pleasant. In F13g, the size of added greenery is larger and according to the respondents the facade has become y5 – dynamic, while in F6g the greenery is not very pronounced and respondents did not find or could not decide the reasons for their reactions and most commonly chose y7 – can't define.

Façade pairs F14ng-F2g and F16ng-F7g: F14ng and F16ng (71 and 61% of negative reactions) form a distinctive construction ornamentation with additional balcony elements, creating an intricate, hardly legible composition. Among the negative reactions, the most common was x2 – unpleasant, incomprehensible, disturbing. Respondents most commonly chose y6 – unpleasant space as the reason for such a response. Previous research suggests that due to the proximity of the façade, the tectonic design of the building is not visible. In such cases the details (Herzog and Shier, 2000), as well as the lack of maintenance, sometimes become disturbing (Joedicke et al., 1975). In the case of the views considered, the reason can also be neglected, dirty or unmaintained surfaces. The greening of balcony railings with climbers covers displeasing elements on façades (F2g and F7g), unifies the appearance and reduces the complexity of the façade composition. A uniform green surface changes the reaction from y6 – unpleasant space on both façades to y5 – dynamic.

These results confirmed the initial expectation that the greenery on the façade triggers mostly positive reactions. Similar result can be observed in reactions on all façades (Table I) and also in the comparison of the paired façades (Table IV). This is consistent with the findings of previous studies that the satisfaction of residents with window views is significantly improved in the presence of natural elements (Kaplan, 2001; Kaplan, 1993; Gilchrist et al., 2015; Li and Sullivan 2016, Chang et al., 2020, Soga et al., 2021). We see that the greenery on the façade changes the character of the façade and thus triggers a change in the perception of the façade. We found that in the façades with added greenery, respondents' reactions were much more uniform than in the non-green façades. With this we confirmed the initial assumption that green façades, by triggering more pleasant sensations, unify reactions of respondents. We could not prove that they also unify the reasons for these reactions.

Respondents give very different reasons for their reactions. Among the reasons for the reactions to greened window views, respondents often chose the importance of dynamics in the view (variability, seasonal dynamics, movements), which stimulates interest in the window view of the nearby façade. According to previous research, greenery in the view with its dynamism contains the potential of "fascination" or "being away" (Kaplan and Kaplan, 1989), which also suggests the possibility of restorativeness in the view (Li and Sullivan, 2016) and thus potential stress relief (Tyrväinen et al., 2014). Some examples of studied window views where the most common listed cause was surface characteristics (greened façade surface) can be also placed in this category (for example, the interesting properties of the surface, which moves in the wind and changes seasonally). These results are consistent with the findings of previous studies, which suggest that the more vegetation obscures the view of the urban environment, the greater the acceptability of the view of the nearby urban environment (Ojala et al., 2019; Kent and Sciavon, 2020).

The acceptability of the views is also influenced by the age and maintenance of the buildings. People generally prefer newer buildings to older ones; however, this is also related to their maintenance. When older buildings are well maintained, people prefer them to newer ones, as they excel newer ones in complexity, readability, mystery, and coherence (Herzog and Shier, 2000). Greenery simply covers up the consequences of poor maintenance, which can be otherwise disturbing.

Furthermore, the survey results have shown important impact of compositional quality on reactions. In urban motives, the aesthetic component also influences the reaction to the window view (Szybinska Matusiak and Klöckner, 2016). Given that the view of the nearby façade is studied, which excludes the sense of the architectural context of the entire building in an urban environment, architectural elements with a constructional and decorative function are crucial for providing visual comfort. As mentioned above, due to their proximity, the range of these elements excludes readability of tectonics (Joedicke et al., 1975), is limited to the colour and texture of façade surfaces, grids and sizes of glazed surfaces, exposed / protruding balcony structures and deepened niches and terraces, and unique functional elements such as fences, shading devices, curtains, etc. When the listed architectural elements on the façades are not balanced and harmonious, the artistic composition of the façade is hardly comprehensible and legible, and this is reflected in the reactions to window views (Herzog and Shier, 2000; Van den Berg, 2016).

Conclusion

In the case of urban environments, building density often limits the distant window view and allow only the observation of the middle visible layer. In such a context of urban space, the reaction to window view largely depends on visual aesthetics (Szybinska Matusiak and Klöckner, 2016), including high compositional quality, part of which is the introduction of greenery. Greenery on the façades changes the aesthetics of the façade and thus triggers a change in the perception of the façade. The results of the study show that it elicits mainly positive reactions. Among the reasons for responses to greened window views, respondents also highlighted the importance of dynamics in the view.

According to the findings, the following measures are suitable to improve the quality of the window view of the nearby façade:

– Covering the uniform façade with climbers creates more acceptable surface characteristics.

– Greenery in balcony planters makes the view more acceptable and pleasant, but the green area must be large enough.

– Partial greening of surfaces, e.g., climbers on balcony railings, may cover excessive or poorly maintained elements, unify the complex construction ornamentation and create a more harmonious and dynamic façade.

The greenery on the façade therefore has a significant effect on the higher acceptability of the window view of the nearby façades in a densely built environment. It also makes a significant contribution to improving the microclimate, as it reduces overheating of façade surfaces and consequently mitigates urban heat island (UHI), offers sun protection on balconies and terraces, balances air humidity, absorbs dust and reduces noise levels (Bustami et al., 2018).

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Acknowledgments

This research was funded by Slovenian Research Agency, by Research Program "Sustainable planning for the quality living space" (P5-0068), by Research Program "Earth observation and geoinformatics" (P2-0406), by Research Project "Creating social value with age-friendly housing stock management in lifetime neighborhoods" (J5-1784) and by Research Project "Evaluation of the sustainable development of the urban environment through the parameters of social infrastructure and life satisfaction" (J5-3112).

Fig. 1 Some illustrations demonstrating the different open spaces of the neighborhood

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Original Scientific Paper
https://doi.org/10.31522/p.30.1(63).3
UDC 711.58 79 (652.30) "20"
Technical Sciences / Architecture and Urban Planning
2.01.02. – Urban and Physical Planning
Article Received / Accepted: 8. 1. 2022. / 14. 6. 2022.

The Relationship between Spatial Configuration of Residential Quarters and Children's Outdoor Activity

CHILDREN
OUTDOOR ACTIVITY
RESIDENTIAL QUARTER
Space Syntax
SPATIAL CONFIGURATION

Open spaces in neighborhoods are children's main living spaces, closely related to their daily activities. There is an increasing awareness that the physical form of the neighborhood plays a critical role in children's activity, by offering opportunities for exploration and interaction. The aim of this paper is to explore the impact of the spatial configuration of buildings on children's activity on the example of a residential area in the city of Oum El Bouaghi (Algeria) as the research object. The hypothesis of this work indicates that spatial configuration and the location of the buildings, in particular, the way in which the site is embedded are important variables in children's outdoor activity. Based on this hypothesis, both quantitative and qualitative methods are used together through Space Syntax and Snapshot Observations. Findings indicate that the extent and character of children's outdoor activities are greatly influenced by the physical characteristics of the neighborhood environment in residential areas through the degree of space enclosure interpreted by visibility and accessibility. By uncovering the impact of spatial configuration, this research offers an approach to designers for rethinking and considering new insights into managing and designing current and future spaces in light of children's preferences and behavior patterns.

Introduction

The housing sector in Algeria, as a developing country, has been facing a serious crisis (Madani, 2012; Merzag, 2015). The fast growth of the Algerian population in the past years has resulted in rapid urbanization, whereby almost all Algerian cities have been going through an increased mass housing production (Mebirouk, Zeghiche & Boukhemis, 2005; Hima, Tacherift & Abdellaoui, 2018; Zerouati & Bellal, 2020). By putting an emphasis on a quantitative dimension, the state has made dwellings a priority without considering the importance of outdoor open spaces (Madani & Tacherifte, 2010).

However, outdoor open spaces are recognized as highly important to children's development (Jansson, 2010; Carson & Predy, 2019), they are especially associated with children in terms of outdoor play as a fundamental part of their daily life (Bao et al., 2021). According to Bagattini (2019), children are the most vulnerable social group, they are also the most present category in public open spaces within the residential neighborhoods. The Algerian residential neighborhoods are composed of various units of buildings in different shapes and arrangements, generating several voids and different spatial configuration types.

The topic discussing the impact of spatial characteristics of outdoor space in residential quarters on children in the Algerian context is still unexplored. In response to this research gap, the purpose of this work is to investigate the actual use of outdoor spaces, by analyzing the spatial configuration and demonstrating children's recreational preferences and behavior patterns in residential neighborhoods. The research centres on how satial configuration affects the ways in which spaces are occupied by children. In other words, how does spatial configuration shape children's outdoor interactions?

The hypothesis of this work indicates that spatial configuration and the location of buildings, in particular, the way in which the site is embedded, are important variables in children's outdoor activity. Based on this hypothesis, both quantitative and qualitative methods are used together via Space Syntax and Snapshot Observations. Therefore, by uncovering the impact of spatial configuration, the research offers an approach to designers for rethinking and considering new insights into managing and designing current and future spaces in the light of children's preferences and behavior patterns.

Related Studies

In the last few years, the number of studies exploring the impact of environmental factors on children's physical activity has grown rapidly. In a recent study, Bao et al. (2021) investigated the physical activities of children in neighborhood space, more specifically, they were interested in the influence of the urban neighbourhood space on the duration of physical activity. In a similar context, Sallis, Prochaska & Taylor (2000), Popkin, Duffey & Gordon-Larsen (2005), Davison & Lawson (2006), highlighted factors such as accessibility, safety and area deprivation to be important influence factors for play activity. As the most essential space that has also become the most critical factor affecting children's physical activity, other researchers also agree that the outdoor activity of children is influenced by environmental factors (Chawla, 2001; Romeo, 2004; De Vries et al., 2007; Aarts et al., 2010; Henderson et al., 2015).

Spatial configuration as an important environmental factor also has an impact on the quality of life and space use. Whyte (1980) and Gehl (1987) have considered the physical features of public spaces and their impact on residents' behavior and their main findings indicated that the use of places was correlated with space characteristics, mainly visibility created by the buildings arrangement as an important factor in space frequency. By using the space syntax approach, many other recent research studies (Campos, 1997; Ferguson, 2007; Bada, 2012; Can & Heath, 2015;

Bendjedidi, Bada, & Meziani, 2018; Zerouati & Bellal, 2020;) have also confirmed the impact of spatial characteristics on the use patterns of public spaces and neighborhood spaces. However, these studies have not address spatial configuration impact on children in particular.

The use of space syntax in the context of children is relatively unexplored. Only a few research studies have used the space syntax method in investigating children. Özgece et al. (2015) investigated the perceptions and children's experiences with regard to outdoor spaces in order to discover children's landmark recognition and preferences of outdoor spaces. Their main results confirm the impact of city proprieties on the spatial perceptions of children. Meinert et al. (2019) investigated the relationship between children's use of urban spaces and the quality level of living environments (in two different neighborhoods in Bergen, Norway) using segment analysis and the urban microscale tool. The findings indicate the importance of children's use of urban spaces as the main factor in choosing living environments. Loit (2021) too has explored children's access to playgrounds in Stockholm using space syntax, and his findings reveal the existing conflicts between creating a safe play environment and the ambition of designing accessible areas.

Material and Method

• Study area – Oum El Bouaghi is a small-sized city, its total population is around 80 thousand inhabitants. Located in the eastern part of Algeria (Fig. 2), Oum El Bouaghi, as almost all Algerian cities, has its own mass housing neighborhood extension area situated in the south western part of the city. The neighborhood in question includes about 2100 inhabitants belonging to an intermediate occupations category (clerical, sales, service) with a total number of children of 1260. (This study is interested in the age range of school children 6-14 years old). The neighborhood space is composed of 420 housing units and some public and administrative buildings (high school, bank, clinic, group of individual houses, courthouse, office and gym). It also contains a considerable surface of open spaces exposed as leftover plots, with poor physical conditions and a lack of furniture (Fig. 1).

• Materials and design – The analytical approach used in this study case is based on the combination of two methods according to the objectives to be achieved. The first one is space syntax, using Visibility Graph Analysis VGA and Agent-Based Modelling while the second is observation, using static snapshots. As a third step, an overlapping of the two mentioned methods is used in order to verify the hypothesis that refers to the relationship between the children's use of open space in mass housing, and the characteristics produced by spatial configuration.

Fig. 2 Location of the study area

Space syntax was used in the analysis of the physical residential environment. It provides an effective quantitative indicator of spatial configuration in order to understand children's space use and behaviors. Among the space syntax analysis methods, the visibility graph analysis is used for analyzing open

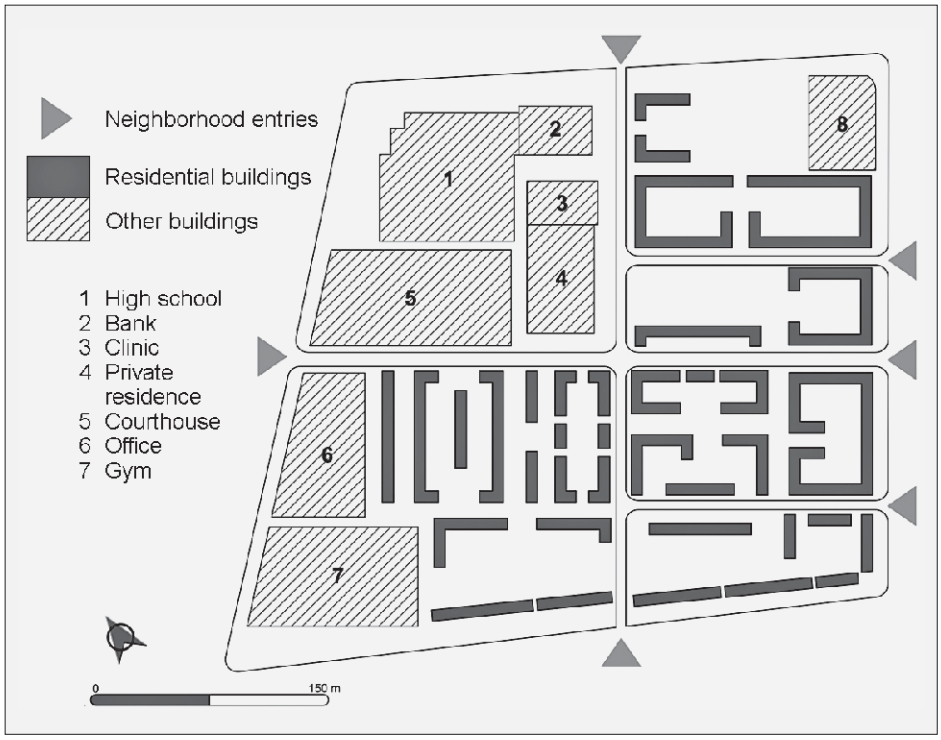


Fig. 3 Spatial composition of the neighborhood

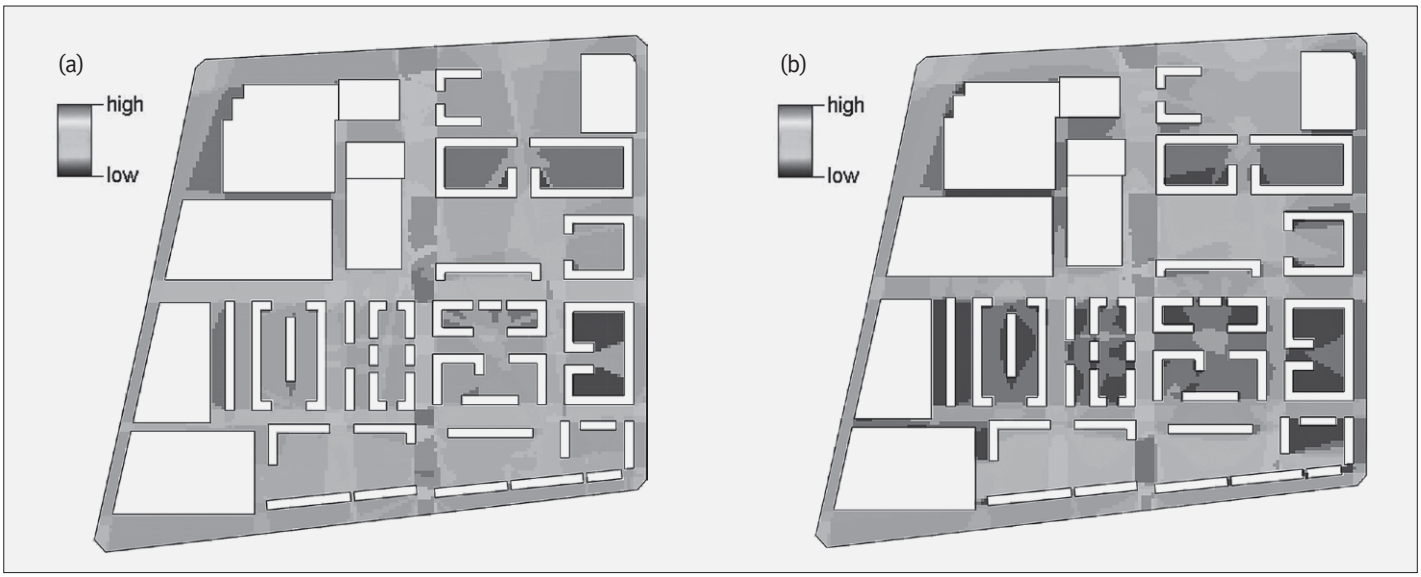
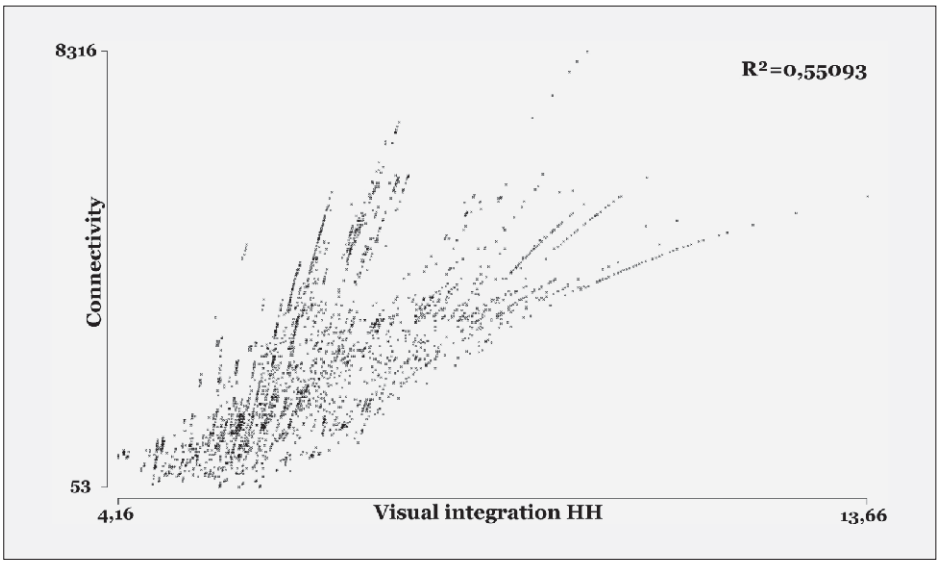


FIG. 4 (A) VISUAL GLOBAL INTEGRATION MAP (VGA); (B) VISUAL CONNECTIVITY MAP (VGA)

spaces. Connectivity, integration, and intelligibility were measured for the data analysis.

The visibility graph analysis (VGA) is a method for analyzing the inter-visibility connections of urban space, it is used to evaluate the design of outdoor areas, parks and gardens (Van Nes & Yamu, 2021). This approach promotes a quantitative analysis of visual properties in the built environment (Ostwald, 2011). In terms of visual analysis, VGA is used to study the visibility in the neighborhood's open spaces in order to understand the relationship between visibility and children's use of space. Two syntactic measures will be obtained; the integration which identifies the most visible and accessible spaces besides the local measure of connectivity which indicates visual connections between different spaces of the neighborhood using the "DepthmapX" software. The visibility analysis radius used is (n) in the global analysis and (3) in the local one.

FIG. 5 INTELLIGIBILITY OF THE NEIGHBORHOOD



Agent-based modeling is a relatively new technique for modeling accessibility and interactions between people and spaces based on visual fields and syntactic steps. Using "DepthmapX" software, the agent-based modeling is applied to the neighborhood for the purpose of understanding the relationship between spatial configuration and children's movement patterns. With a sight field angle of seven degrees (7°) and a number of five (5) syntactic steps, a certain number of agents is equally distributed in the investigated space for a certain time frame, aggregating their movement in order to comprehend the ways children orient themselves and navigate outdoor spaces departing from different locations in the neighborhood.

Static Snapshots represent an effective observation technique for the registration of various people's stationary activities, moving activities, and social interactions in public spaces, by recording the use patterns from specific moments (Van Nes & Yamu, 2021), in order to consider in detail, the open spaces of the neighborhood such as a plaza, playgrounds, green spaces and also the leftover plots. The method is used for recording both stationary and moving activities to make a direct comparison and demonstrate the existing relationships between different types of space. For each part of the neighborhood, 15 to 20 min of observations and activity records were executed. This technique provides an understanding of how children use and interact within a particular space according to its characteristics. The method supplies an

effective tool for understanding the spatial configuration impact of a neighborhood on children and evaluating the results of design decisions.

Findings

• Spatial Configuration Analysis – Visibility Graph Analysis results (Fig. 4) illustrate both global integration (a) and connectivity (b) measures of the neighborhood under investigation. Values range according to different colors, from red for the highest values to dark blue for the lowest ones (or shades of grey). The global integration values ranged from a maximum of 13.6695 to a minimum of 4.16427 and an average of 7.99001, while the connectivity values ranged from a maximum of 8316 to a minimum of 53, and an average of 2950.97.

Results show a high similarity in the distribution of values between integration and connectivity. Compared to different space configuration types the most integrated and connected areas of the neighborhood are located in the spaces representing an open configuration. These spaces are more accessible and well-connected compared to other spaces. On the other hand, moderate integration and connectivity values are located in semi-open spaces while the lowest integration and connectivity values are located in semi-closed spaces.

Intelligibility is the most commonly used correlation in space syntax, it is calculated as the correlation between visible global integration and visible connectivity. This syntactic measure is based on the correlation coefficient (R^2) where the closer the correlation coefficient is to one (1), the more orientable and thus intelligible the built environment under scrutiny is. In our findings, the coefficient (R^2) was moderate ($R^2 = 0.55/\ 0.5 < R^2 < 0.7$; Fig. 5), meaning that the area is vital, relatively easy to orientate in and navigate through and the spatial hierarchy of space is clear. This stands for how easy it is for children in a local position to infer the structure of the whole neighborhood setting from one situated point of observation.

The agent-based modeling of children's behavior in space (Fig. 6) demonstrates the ways agents as children tend to orient themselves in the built environment. Agents are released from all locations in the simulation, however, they gather mainly in the extremes of the neighborhood. Also, the highest levels of agents' clustering are registered in spaces with open configurations while the agents' clustering tends to progressively decrease in the closed ones. The clustering degree of agents follows a stepwise spatial hierarchy correlated to the syntactic characteristics (integration and connectivity) of space, along with its spatial configuration types.

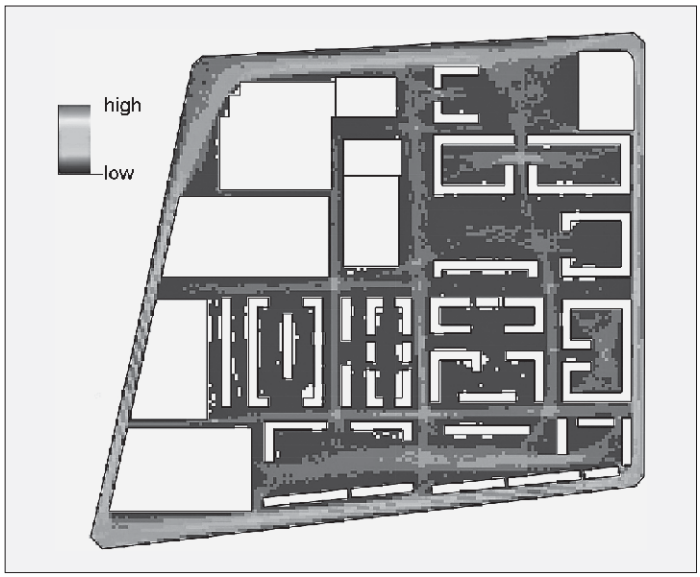


Fig. 6 Agent-based model

• Effect of space configuration on children's use and interaction – The next step was to analyze the correlation between children's use patterns and the frequency of interaction on the one hand and the space configuration of the neighborhood on the other, in order to identify the related factors. The results from the static snapshots technique (Fig. 7) show an unequal distribution and imbalance of the frequency of children within the different open spaces of the neighborhood. Some spaces tend to be more used compared to

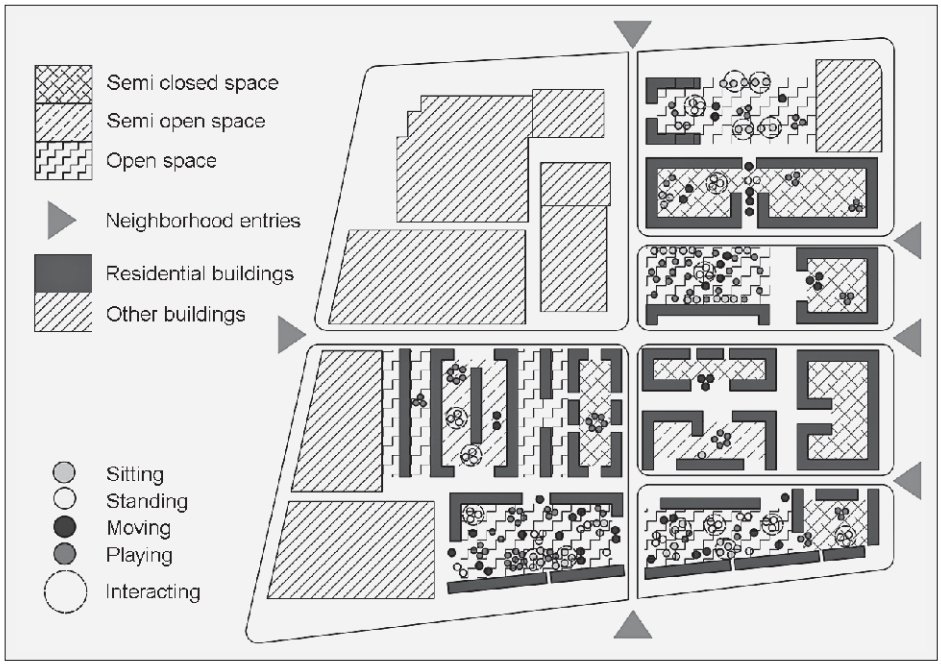


Fig. 7 Static snapshots data for the neighborhood

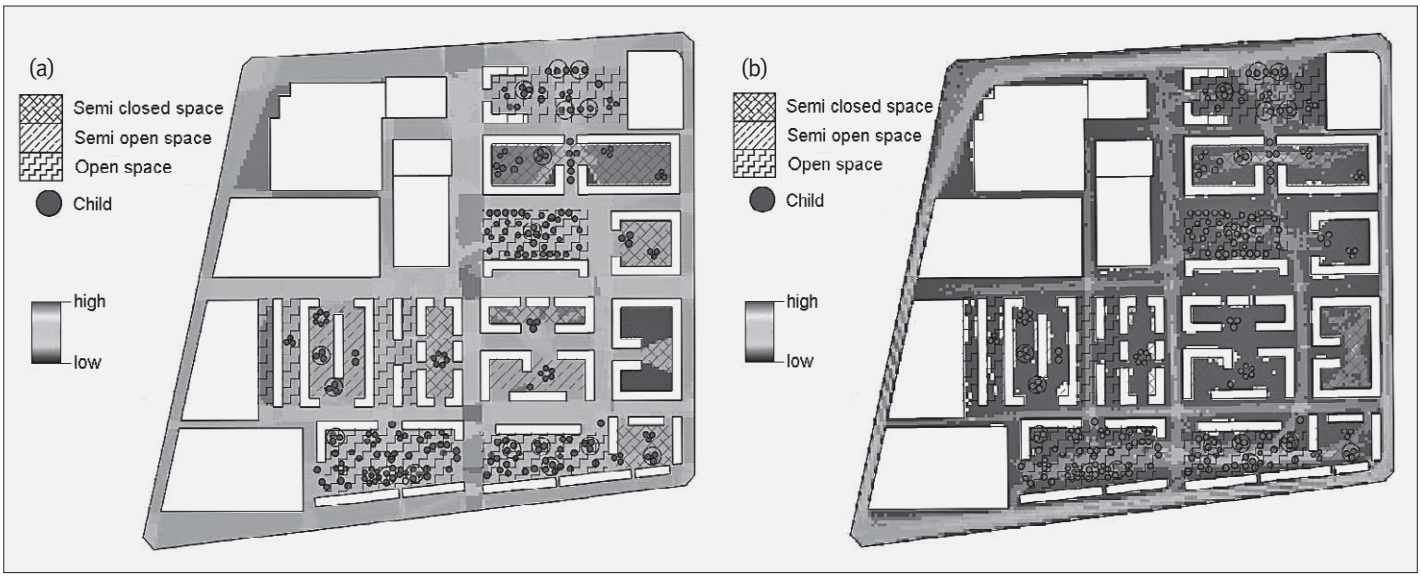


FIG. 8 CORRELATION OF STATIC SNAPSHOTS WITH (A) VISUAL GLOBAL INTEGRATION (VGA) AND (B) AGENT-BASED MODEL

others. The highest presence of children was concentrated in spaces with open configurations while it tends to decrease progressively in the closed ones.

The spatial-configuration data analyzed in the previous section were used to represent the correlation between the spatial configuration of the residential area and children's use and interaction within outdoor spaces. All the registrations from the Static Snapshot technique are overlapped and compared with results from the Visibility Graph Analysis and the Agent-Based Modelling (Fig. 8). Accordingly, the highest concentration of children exists in the most integrated and connected areas. On the other hand, in the highly segregated and unconnected areas of the whole, mainly spaces with semi-closed configurations, children's concentration tends to be low and the spaces are mostly abandoned. Similar to the agents, children gather mainly in the spaces with open configurations and avoid closed ones. Thus, the children's clustering tends to decrease progressively from open configurational spaces to the closed ones.

DISCUSSION

The purpose of this paper was to investigate the relationship between the spatial configuration of residential quarters and children's outdoor activity in order to assess planning decisions. The correlation between the spatial configuration of residential neighborhoods and the frequency of use of outdoor spaces by children was analyzed. As was shown, space syntax seeks to objectively understand the ways in which the urban form influences the collective use of spaces. Therefore, the main finding of this study indicates that children living in the residential quarters and mass housing neighborhoods are directly affected by the spatial configuration that emerged from buildings arrangements.

On the one hand, the application of visibility analysis and agent-based model in our previous findings shows that syntactical measures vary considerably within the same neighborhood depending on the type of building arrangement. Spaces with open configuration are well-connected and integrated, they have adequate accessibility and openness, oppositely to spaces with closed configurations which possess low-connectivity and low integration, they have poor accessibility and openness. In association with the intelligibility analysis, areas with high integration present high intelligibility values and thus a better interaction with space. This was also confirmed by Kim (1999) in his research discussing space intelligibility and space usage.

On the other hand, the application of snapshots demonstrates that children are aware of their surrounding environment and can identify the places where they prefer to spend their time. They occupy the most integrated and inter-connected space with open configuration, seeking more opportunities for free play, or due to some preferences for particular play or games, group activities and social interactions that open spaces can provide. This is contrary to the least integrated and inter-connected spaces with semi-open and semi-closed configurations, which remain almost abandoned. According to children's perception, these kinds of spaces provide physical restrictions and make them leave their close environment avoiding vari-

ous obstacles. This is confirmed by the research discussed by Özgece (2015).

The results indicate a strong correlation between "space visibility", "space accessibility" and "space use". Outdoor spaces with a well-connected and integrated value are those which are highly used by children for their daily play activity. Young children felt freer to move, play and interact in spaces demonstrating accessibility and openness. Thus, this type of open spatial configuration supposedly encourages children to use the space more fully, and allows them to explore the physical environment freely. A similar result was obtained in the works of Ferguson (2007) and Bada (2012), where a common feature of those studies is that places with high accessibility in their spatial configuration are potential spaces, in which interaction between people occurs frequently. However, their research is mainly concerned with adult users.

Conclusion

The urban neighborhood space has an important impact on residents' activity and interaction, including children. This study was carried out with the main objective of revealing the existing relationship between spatial configuration and the use of outdoor spaces by children. Space syntax analysis through different syntactical measures has uncovered some hidden aspects of open spaces within housing neighborhoods. Therefore, the extent and character of children's outdoor activities are greatly influenced by physical characteristics of the neighborhood environment in residential areas. As a result, the building arrangements and site organization in mass housing affect outdoor activities of children through the degree of space enclosure interpreted by visibility and accessibility.

From a spatial point of view, the built environment is defined as an area for interaction. It can provide opportunities or form obstacles for physical and social use. Findings stand to confirm our hypothesis that the space use patterns and children's frequency are strongly correlated with the spatial configuration of residential buildings. Overall, the spatial configuration itself is the primary piece that influences the physical and social well-being in housing neighborhoods. Ultimately, this work provides an aid for urban planners and designers in exploring the spatial configuration of buildings in line with children's use preferences, offering an approach for rethinking outdoor space design adapted to children.

[Translated by: Ouafa Chibane]

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Illustration sources

Fig. 1, 3-8 Authors, 2021

Fig. 2 Google Earth and authors' adjustment, 2021

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Conceptualization, O.C. and A.H.; methodology, O.C.; software, O.C.; validation, O.C. and A.H.; formal analysis, O.C.; investigation, O.C.; resources, O.C.; data curation, O.C.; writing – original draft preparation, O.C.; writing – review and editing, O.C.; visualization, O.C.; supervision, A.H.; project administration, A.H.; funding acquisition, O.C.

Both authors have read and agreed to the published version of the manuscript.

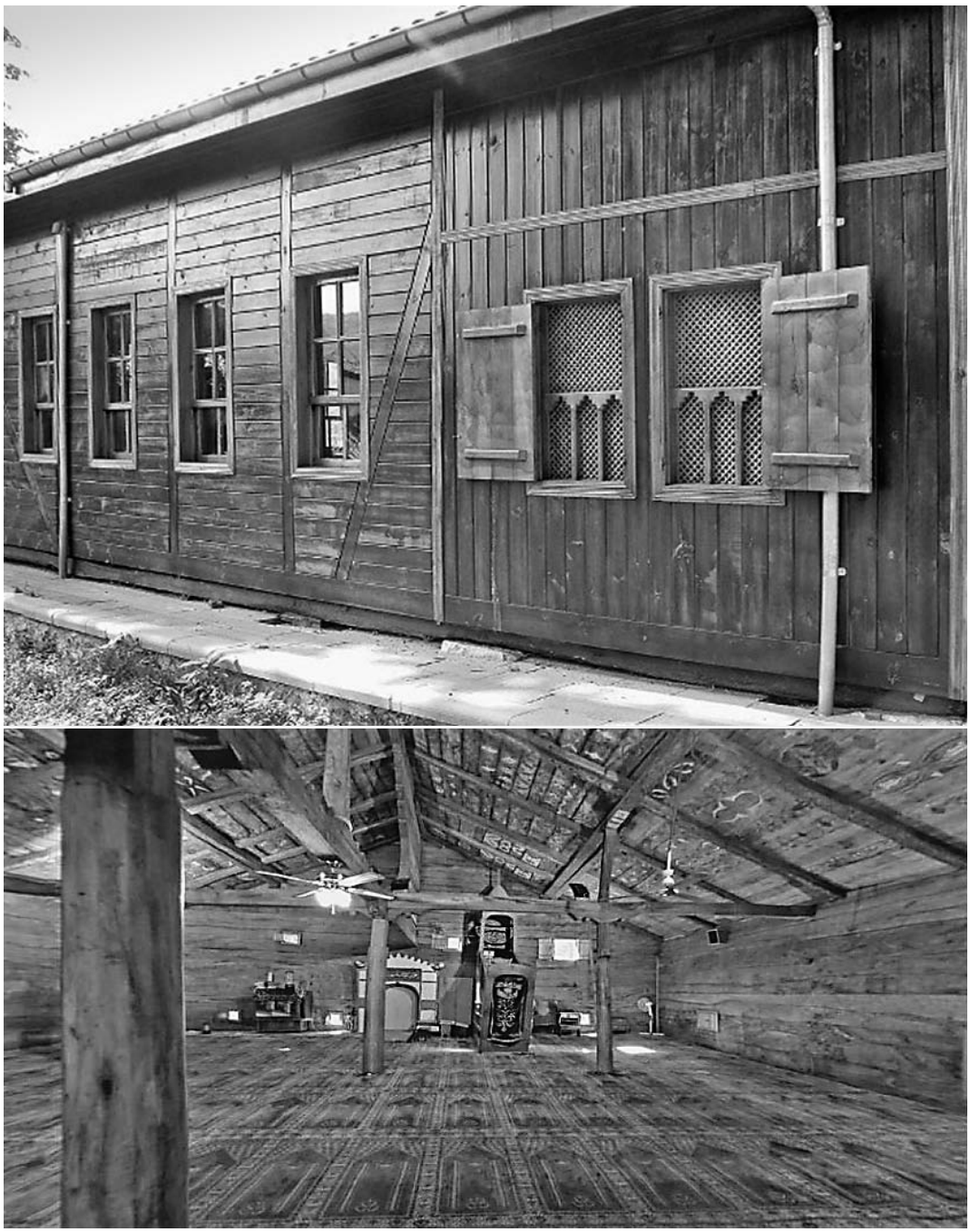

Fig. 1 Orhan Gazi Mosque (up), Göğceli Mosque (down)

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Preliminary Communication
https://doi.org/10.31522/p.30.1(63).4
UDC 624.04 726:28-523.42 (560.414) "13/14"
Technical Sciences / Architecture and Urban Planning
2.01.03. – Architectural Structures, Building Physics, Materials and Building Technology
Article Received / Accepted: 21. 1. 2022. / 14. 6. 2022.

Structural Behaviour of 13th and 14th Century Seljuk Mosques and Acculturation of Construction Knowledge

Ahi Elvan Mosque, Ankara, Turkey
finite element model
Hanönü Mosque, Kastamonu, Turkey
hypostyle wooden mosques
peripheral walls

This study aims to demonstrate the acculturation of Seljuk architecture and construction techniques by tracing the development of peripheral walls in Seljuk wooden hypostyle mosques built in 13th and 14th centuries. To track the exchange of construction knowledge two Seljuk mosques (the Hanönü Mosque in Kastamonu and the Ahi Elvan Mosque in Ankara) are selected for comparison in this study. The main difference between the two mosques is their structural systems: one has a wooden peripheral wall and wooden skeleton system, while the other has a masonry peripheral wall and wooden pillars. In this study, a comparison of the structural systems and performances of these examples of wooden mosques exhibiting different wall systems was made together with structural analyses under basic loads. A series of structural analyses provides significant data about the structural behaviour of these types of structures, indicating acculturation of elements from Asia and Byzantium within Seljuk architecture and construction techniques.

Introduction: Acculturation of Construction Knowledge between Asia and the Byzantine Empire

The first official contacts of Turks with the Islamic World happened in 11th century with Seljuks, who soon became the first Turkish dynasty to rule the Muslim world. In terms of construction culture, Turks were advanced in adobe and brick masonry but they also knew wooden construction techniques. As a culture with its origins in Asia, Turks introduced new construction techniques and in return they transferred new types of buildings from Islam.

Meanwhile, they also encountered Byzantine culture at the border of Anatolia where stone masonry construction techniques were advanced. When Seljuks began to rule in Anatolia, they established a cosmopolitan mosaic of diverse cultures in which Romans, Greeks, Armenians, Turks, Persians and others could cooperate. Under these circumstances, architecture and construction techniques were cultivated rapidly. During this period, Seljuk architecture, which had been based on brick or timber, created a new fusion of stone masonry and wooden carcass by uniting the newly transferred knowledge of Byzantine techniques (Altun, 1988).

This engendered a construction vocabulary that was acculturated between East and West. Uçar and Örmecioğlu (2021: 220) state: "As a nation that encountered various civilizations, Turks learned many techniques and concepts from them and adopted these as practices, customs, and also their semantic network. Architecture is a part of this semantic network in which the transfer of knowledge and technology is embedded in building forms, construction techniques, and/or space culture."

This acculturation of construction knowledge in Seljuk architecture is best observed in hypostyle mosques with timber pillars and masonry peripheral walls. Wooden hypostyle mosques generally have rectangular plans and the roof is supported by timber pillars, placed in between the naves in the main prayer hall (Harim). There is also padding on the pillars, carrying the timber girders placed perpendicular to the mihrab wall. The girders support the timber beams, placed parallel to the mihrab wall. Cross-bracings are placed in between beams for lateral stability (Ministry of Culture, 2005; Katipoğlu, 2013: 75; Katipoğlu Özmen, 2018: 118).

Bayhan (2009: 55) says that the very first examples of timber-pillared mosques were in the Arabian Peninsula, Iran and Central Asia. The type transferred to Anatolia thanks to migrating Turkish groups in the last quarter of the 12th century. As a matter of fact, hypostyle was a structural system which was used for long span halls in Asia and the Middle East.

One of the very first examples of hypostyle halls in Iran are seen in Hasanlu IVb (1050-800 BC; Dyson and Muscarella, 1989: 2; Muscarella, 1966: 121). Additionally, the Ak-Beshim Buddhist temple in Kyrgyzstan is another example based on pre-Islamic constructional traditions. Also, some halls in the Pencikent and Aktepe settlements, which were constructed in the pre-Islamic period, are instances of this construction technique (Er Akan et al., 2021: 2; Ya Staviskij, 1974; Nusov, 1971).

The aim of this study is to express the acculturation of Seljuk architecture and construction techniques between Asia and Byzantium by outlining the development of peripheral walls in Seljuk wooden hypostyle mosques built in 13th and 14th centuries. With this aim two Seljuk mosques (Hanönü Yukarı Küreçayı Mosque and Ahi Elvan Mosque) have been selected for a comparison of their structural behaviour. Hanönü Yukarı Küreçayı Mosque has a wooden peripheral wall and wooden skeleton system while Ahi Elvan Mosque has masonry peripheral wall and wooden pillars.

Therefore, the paper's scope covers the adoption of timber and masonry hybrid construction techniques in Seljukid mosque architecture. In other words, the paper is about the specific effect of the masonry peripheral walls on the structural behaviour of timber pillared mosques.

Transformation of Peripheral Walls in Seljuk Wooden Hypostyle Mosques

O'Kane (1994: 122) states that "The natural resources available for building vary considerably across the region. [In Iran] wooden construction is found in limited areas, principally on the Caspian littoral, and in some mountain villages." In Turkey too wooden construction is found mostly on the Black Sea littoral, an area surrounded by forests. Wood is a sustainable material that is environmentally friendly and renewable, and also has good strength compared to its density. Moreover, it is compatible with other building materials and can be very long-lasting when used properly (Bozkurt, 2011: 115). With these features, it was used as a basic building material in traditional Turkish architecture. In the eastern Black Sea region, especially around Samsun, Ordu and Kastamonu, many wooden mosques are found (Karpuz, 1992a: 20; Karpuz, 1992b; Şahin, 2010: 31; Sümerkan and Okman, 1999). All these wooden mosques in the Black Sea region of Anatolia are from 12th and 13th centuries (Fig. 1).

As we move from the Black Sea region to Central Anatolia, stone begins to take place alongside the wooden architecture. The transformation of peripheral walls in Seljuk wooden mosques starts as a result of the interaction with Byzantine architecture. The wooden skeleton system of Seljuk architecture combined with stone masonry construction system of Byzantine architecture in the 13th and 14th century mosques that are called "hypostyle wooden mosques". The first examples of these hypostyle wooden mosques with stone masonry peripheral walls and timber pillars are from 13th century: Afyon Ulu Mosque (Bayhan, 2009: 55), Eğridir Hızırbey Mosque, Candaroğlu Mahmutbey Mosque (Fig. 2), and Ankara Ahi Elvan Mosque (Öney, 1971).

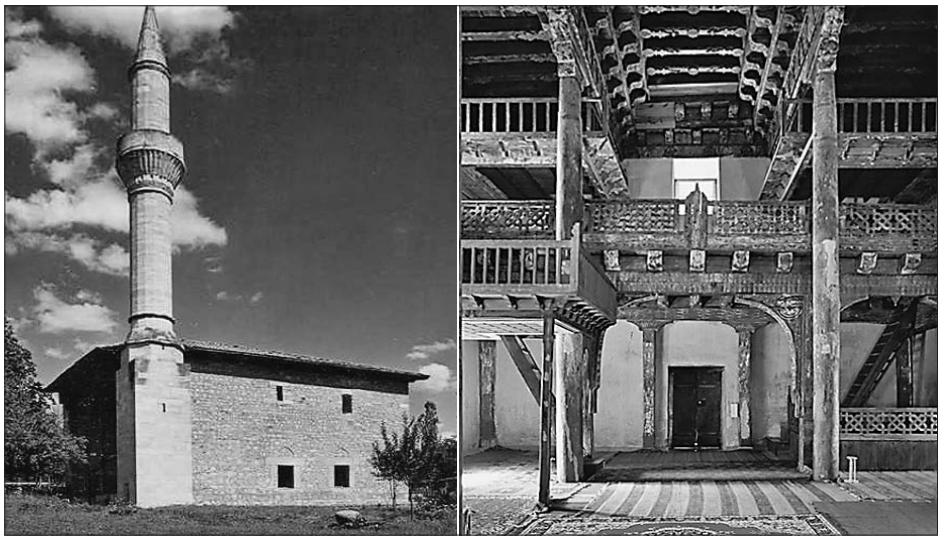


Fig. 2 Mahmutbey Mosque

Most of these remarkable mosques, which date back to 13th and 14th centuries, have survived various natural disasters such as floods, landslides, fires etc. without significant damage. However, Anatolia is on one of the most active seismic belts on earth.

As a result, many similar monuments have been destroyed due to earthquakes or resulting fires. Preservation and strengthening of such valuable historical monuments are high on the agenda of the architectural and engineering community. In parallel with the development of structural analysis software, it became possible to easily and accurately conduct the finite element analysis of historical monuments with very complex geometries in short periods of time (Er Akan, 2004: 60; Er Akan, 2008: 92; Er Akan, 2021: 2; Özmen et al., 2011: 452; Ünay and Özmen, 2006: 255; Özmen, 2021).

Fig. 3 Outer, inner views and plan of Hanönü Mosque, 1285

Fig. 4 Outer, inner views and plan of Ahi Elvan Mosque, 1382

Architectural and Structural Characteristics of Hanönü Mosque and Ahi Elvan Mosque

The first case is Hanönü Mosque (Fig. 3) which is a totally wooden Seljuk mosque located in Kastamonu, and built in 1285. The mosque was restored by the Regional Directorate of Foundations and reopened for worship in 2012 (Tunçay, 2018). The peripheral walls, which form the main prayer hall of the building, were formed by placing wooden planks, 7 cm thick, on top of each other along the height of the main prayer hall, using the dovetail joint technique. The wooden planks are notched at the corner points of the sanctuary, and they are physically interlocked with the wooden planks coming from the other direction. However, it has been observed that nails and clamps are not used frequently enough to provide physical clamping between each plank forming the peripheral wall.

The connection between the peripheral walls of the mosque and the ground is provided by the rubble stone walls. There are three wooden beams that carry the ceiling of the sanctuary on each façade, in the corners and in the middle. In this way, the roof load is transmitted to the wooden external walls, wooden beams and wooden columns and the rubble stones on the ground. There are four wooden pillars on the qibla (kıble) façade and wooden beams connecting them to each other and to the peripheral walls. The wooden structural system of the floor of the loge for women (kadınlar mahfili)[1] was extended to the end level of the main prayer hall forming the roof of the loge. The building was made with the wooden peripheral wall and wooden frame system consisting of wooden columns and beams on all façades (Çelik et al., 2021: 18).

There is a minaret on the south-west façade of the mosque, and a staircase providing access to the women's quarter on the north-west façade. The minaret, located on the south-west façade of the last communion section, was formed by combining a circular wooden log with a diameter of 170 mm and wooden planks with a diameter of 120 cm and a wall 4 cm thick with 2 cm thick wooden steps. The structural system, which goes up to the balcony level by drawing a spiral around the main wooden column, expands in this section and reaches 160 cm in diameter, and thus rises and continues up to the lower level of the minaret cone.

The second case is Ahi Elvan Mosque (Fig. 4), which is a typical timber pillared Seljuk mosque located in the citadel of Ankara, and built by Ahi Elvan Mehmet Bey (1331-1389) in 1382 (Öney, 1971: 23). The mosque has a hypostyle structural system, which consists of masonry external walls and timber pillars. It has an almost rectangular plan, covering 396 square metres. The 1 m thick masonry walls are the main load-bearing element surrounding four sides and supported by 12 timber pillars. Although the roof was first covered with traditional flat-roof made with mud, it was replaced with pitched timber roofing in later periods. As in many other timber mosques, it has a timber balcony, used by women (kadınlar mahfili), and added later. The pillars supporting the balcony have special sections both on their upper and lower ends. The only opening in the north façade is the door of the women's balcony. The supporting walls made up of brick and adobe have stone foundations (Er Akan, 2010: 42).

The minaret is on the northwest corner of the building. The twelve pillars are set in three rows perpendicular to the mihrab. The pillars sit on the base and their heads are connected to each other with massive wooden lintels (Öney, 1971: 24). The mosque has undergone three major restorations in 1413, 1967 and 1985.

1 "Turkish mosques generally allocate some areas, termed loges (kadınlar mahfili), for women congregants; these spaces, however, are often appropriated on Fridays by the large numbers of men who attend services." (Alyanak, 2019: 125).

Structural Behaviour of Timber Walled and Masonry Stone Walled Mosques

In recent years, developments in computer hardware and software technologies have dramatically augmented the capacity, speed and graphical quality of structural analysis programs, which in turn increased the demand for the structural analysis of historical buildings with complex geometrical forms. However, structural analyses conducted without paying attention to appropriate analytical modelling procedures may result in serious mistakes in the assessment of the actual structural conditions of these buildings. This is why the analytical modelling phase is very critical in the finite element analysis of historical structures.

In order to investigate the structural behavior of the timber walled vs. masonry stone walled wooden mosques, structural analyses of Ahi Elvan Mosque and Hanönü Mosque were made. However, the structural analyses carried out are not detailed structural analyses of these mosques, but only calculations carried out to raise awareness about the importance of understanding structural behavior in terms of architecture. For this reason, it is different from the detailed engineering calculations which are made to examine the current state, structural capacity and earthquake behavior of similar structures. In order to observe and understand the different structural behavior of mosques, the basic structural behaviors of the mosques were observed under the applied vertical and horizontal loads. Since the overall geometric dimensions of the mosques are not the same, it is not correct to make a comparison with the calculated forces, stresses and displacements. However, the results obtained from both examples give quite comprehensive and explanatory information about the structural behavior of each separately.

There are some examples of structural analysis for stone walled timber mosques in literature. One of these examples is the finite element analysis of Ahi Elvan Mosque, which belongs to the previous studies of the author (Er Akan, 2010). The structural behavior of masonry stone walled timber mosques can be explained by individual structural behavior of the masonry stonewall and the timber frame inside.

As shown in Fig. 5, the finite element model of Ahi Elvan Mosque is assembled according to following conditions.

– 1 m thick peripheral stone walls are modelled with general SHELL element.

– Timber pillars, main beams and other component of the roof structure is modelled with FRAME elements.

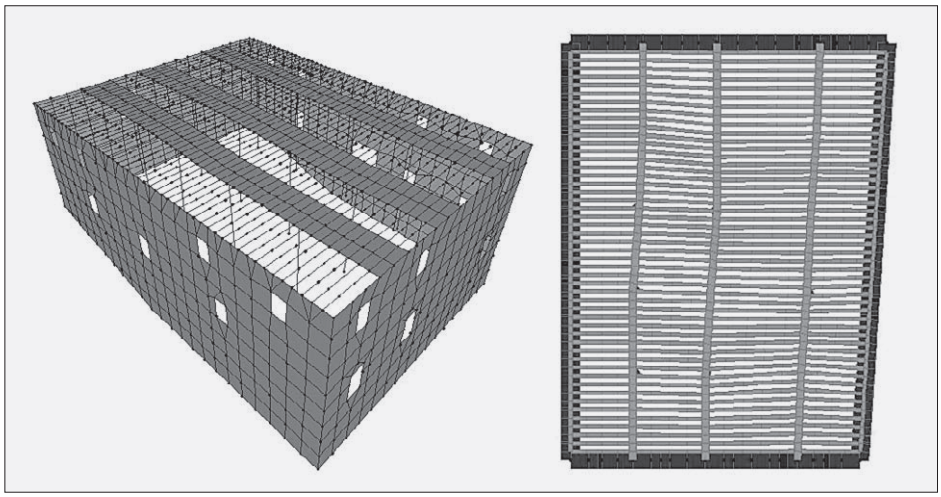


Fig. 5 Finite element model of Ahi Elvan Mosque

– The analytical model is built with 1627 nodes, 1030 shell elements and 1091 frames elements.

– Moment releases and partial fixities are introduced at the connections of frame elements to define the timber connection details of pillar capitals and beams connections.

– The linear elastic material characteristics of the masonry is defined by assuming that stone and mortar have a homogenous material behavior.

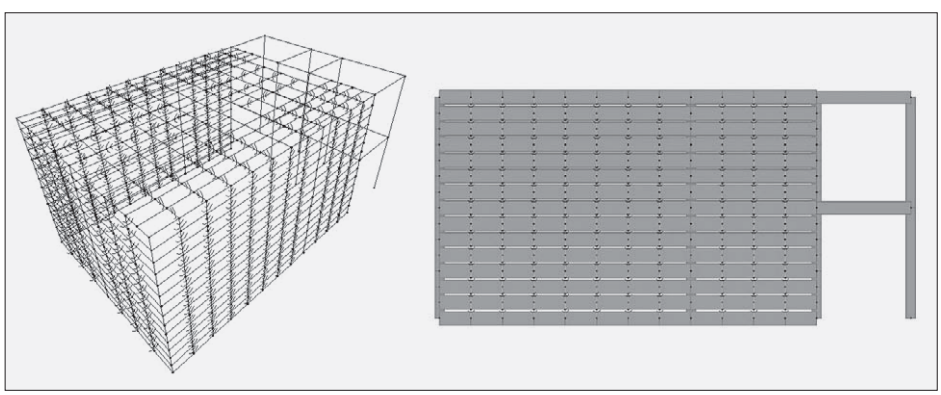
Another finite element model is prepared for Hanönü Mosque, which has a very different characteristic in terms of its structural behavior.

As shown in Fig. 6, the finite element model has the following data.

– The finite element model is formed by assembling timber pillars, timber beams and the 7 cm thick wooden planks constituting the walls and the roof plate.

– The walls are modelled with frame elements, based on the principle that wooden planks of 7 cm thickness are connected to each other by T/C (tension-compression) friction isolator elements.

Fig. 6 Finite element model of Hanönü Mosque



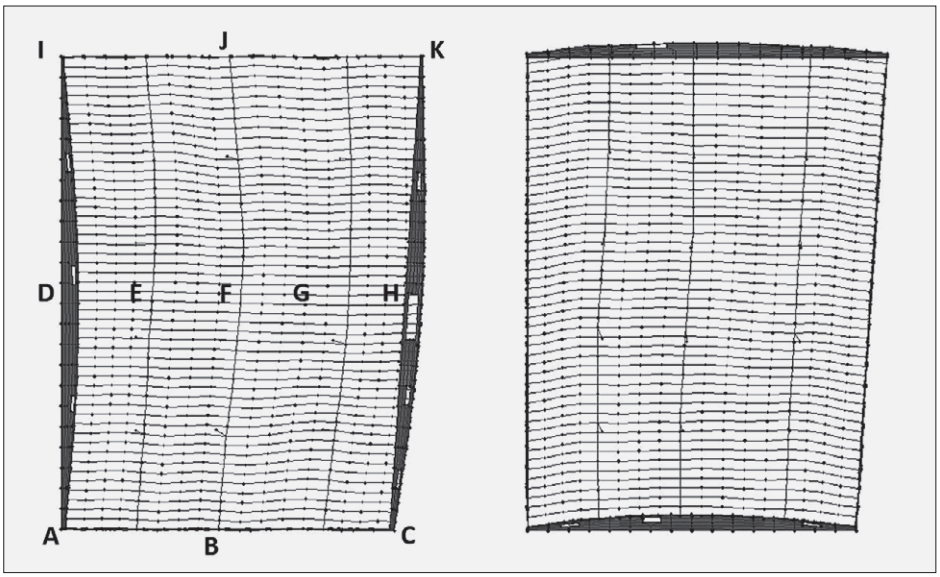


Fig. 7 Deformed shape of Ahi Elvan Mosque for the horizontal loads

– Square-sectioned 30×30 cm timber pillars and rectangular sectioned 25×40 cm timber beams are modelled by FRAME elements.

– Since the beams, pillars and planks are connected to each other with the dovetail joint technique, rigid connections and element end releases are introduced at particular nodes according to their assembly details.

– The wooden planks forming the outer walls of the mosque with the dovetail joint technique are modelled by introducing T/C friction isolator elements. T/C friction isolator elements provide shear resistance due to friction at contact surface of the planks in case of tension and compression forces and stresses between them.

Planks are connected to each other at every 1 m by T/C friction isolator elements according to the following principles. Link elements have certain stiffness in compression, while zero stiffness in tension. Therefore, a gap arises between the planks due to tensile forces and full contact and stress transmission occurs between the planks due to compressive forces. In case of horizontal loads, by defining friction coefficients to LINK elements according to tensile and compressive forces, a shear resistance develops between the planks when compressive forces are transmitting through the LINK elements, while no shear occurs due to tensile forces. This provides the most accurate way to observe the transmission of forces through structural elements and presents reasonable displacements under vertical and horizontal loads.

Following loads cases are applied to observe the structural behavior of Ahi Elvan Mosque and Hanönü Mosque. As vertical loads, the self-weight of all structural members, weight of the roof and other auxiliary elements are considered. Since the total mass of the structure is not too large, instead of the response spectrum analysis, horizontal gravity loads equal to 40% of the total weight of the structure are applied in both horizontal axes perpendicular to each other. Material properties for the finite element analysis of Hanönü Mosques and Ahi Elvan Mosque are summarized in Table I.

A precise description of the structural behavior of a building is not possible with structural analysis results alone. A structural analysis usually depends on how joint restraints, member dimensions and loads are defined and applied. Within this definition, the structural analyses for Ahi Elvan Mosque and Hanönü Mosque aim to evaluate the structural behavior of inner timber frames and planked timber walls in particular.

In the previous publication of the authors for Ahi Elvan Mosque, which essentially aims to investigate seismic behavior of the building, seismic forces induced by recommended earthquake spectrum for that region is considered along two perpendicular horizontal axes.

In this study, the structural analysis based on the 40% of the total weight of the building as horizontal loads with the simplified analytical model intending to inspect the structural behavior of the building achieved almost identical displacements along the x-axis and y-axis.

Base reactions are calculated as 18066 kN in the global z-axis (vertical direction, the total weight of the structure) and as 6800 kN along the x- and y- global axes (horizontal direction due to 40% of the total weight applied as horizontal loads) in the structural analysis of Ahi Elvan Mosque. Whereas, base reactions are calculated as 186 kN in the vertical direction as the total weight of it and 93 kN along the x- and y-axes as the horizontal base shear

Table I Material properties for the finite element analysis of Hanönü Mosque and Ahi Elvan Mosque

Mosques	Structural element type	Modulus of elasticity (E) kN/m²	Unit weight kN/m³	Mass t/m³
Hanönü Mosque	Wooden planks	9000000 (9000 MPa)	5	0,50
	Timber pillars	9000000 (9000 MPa)	5	0,50
	Timber beams	9000000 (9000 MPa)	5	0,50
Ahi Elvan Mosque	Stone masonry walls (mortar included)	450000 (450 MPa)	24	2,45
	Timber pillars	9000000 (9000 MPa)	5	0,50
	Timber beams	9000000 (9000 MPa)	5	0,50

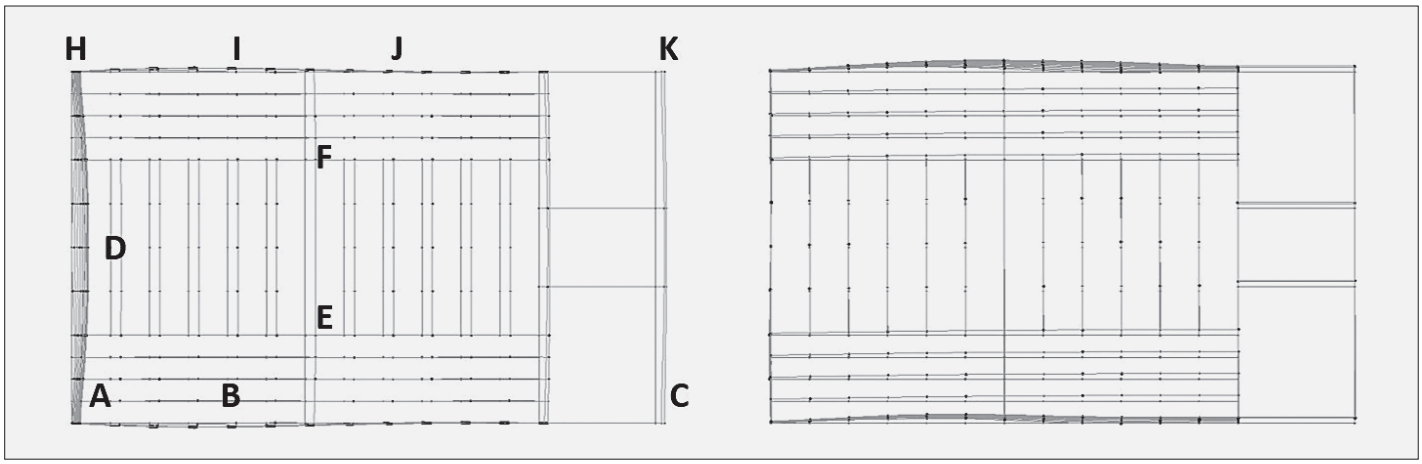


Fig. 8 Deformed shape of Hanönü Mosque for the horizontal loads

in the structural analysis of Hanönü Mosque. The comparison of these two buildings in terms of forces and stress gives irrelevant conclusions because of unequal size, dissimilar materials and construction systems. Therefore, an evaluation of calculated displacements provides reliable interpretation about their structural behavior.

As shown in Fig. 7, at the top of the masonry walls, maximum displacements are determined along the x-axis and y-axis as Δ_x = 27 mm and Δ_y = 18 mm respectively. A realistic explanation of structural behavior of the building considering these displacements only is not possible without the consistency of the applied loads, actual material properties of the masonry walls and the construction technique of the wooden frame elements. However, displacements and forces smaller than expected indicate that the outer walls provide a significant fortification to the inner timber frames, especially against lateral loads.

As shown in Fig. 8, similar results were obtained in the structural analysis of the Hanönü Mosque. At the top of the timber planked walls, the maximum displacements are determined along the x-axis and y-axis as Δ_x = 74 mm and Δ_y = 28 mm respectively. The deformed shape of the building under lateral loads shows that the structural behavior of the Hanönü Mosque, which is constructed by dovetail joints, demonstrates similar structural behavior of the wooden hypostyle mosques with peripheral masonry walls. It is not possible to compare these two unequal size buildings with the calculated displacements only. The ratio of the maximum displacement to the total height of the building indicates that the planked wooden walls provide at least as much lateral resistance as the peripheral masonry walls in a dovetail-jointed wooden structure. This ratio is 0.0034 and 0.0028 along the x-axis and the y-axis respectively in Ahi Elvan Mosque. Whereas, it is 0.011 and 0.004 along the x-axis and the y-axis respectively in Hanönü Mosque. The displacements determined in the structural analyses are summarized in Table II with respect to deformed shapes of Ahi Elvan Mosque and Hanönü Mosque shown in Figs. 7 and 8.

It should be kept in mind that the material properties used in the finite element model were not actual values obtained from the testing of the material samples from the actual structure but values taken from scientific literature. As a result, it is possible for certain partial damage to happen due to the non-homogenous behaviour of the actual structural elements or material deterioration.

Lastly, interpretation of analysis results in terms of the interaction between the timber frame and masonry walls is important. The finite element model of Ahi Elvan Mosque is designed to realistically simulate the behaviour of the connection nodes in-between the timber frame and masonry elements with different levels of rigidity. The thick peripheral masonry walls with a high level of rigidity provide adequate lateral resistance for the slender timber frame structure. With the support of the peripheral walls, timber beams in both directions behave as continuous beams rather than single span beams. Due to this behaviour the timber pillars of the mosque are subjected to smaller bending moments.

Despite this additional support from the masonry portion of the structure, displacements from the vertical axis have been observed in the timber pillars of Ahi Elvan Mosque and similar timber pillared structures. The analyses have demonstrated these displacements are not due to vertical or horizontal load effects but the result of material deteriorations and partial settlements in the timber pillars-beams joints and connection details in-between timber beams and masonry walls.

Table II The displacements determined in structural analysis of Ahi Elvan Mosque and Hanönü Mosque

Ahi Elvan Mosque			Hanönü Mosque		
Joint label	Δ_x (mm)	Δ_y (mm)	Joint label	Δ_x (mm)	Δ_y (mm)
A	6.26	0.90	A	4.21	0
B	7.64	-0.43	B	4.56	-0.90
C	7.74	-2.39	C	4.55	0
D	27.89	0.11	D	8.15	0
E	27.79	-0.66	E	5.29	0
F	27.93	-0.65	F	5.29	0
G	28.02	-1.71	G	4.54	-0.01
H	28.11	-1.98	H	4.38	0
I	3.01	-0.52	I	4.55	0.90
J	4.28	-0.16	J	4.54	0.39
K	4.27	1.06	K	4.56	0

Conclusions

The analysis of historical structures is different from the analysis of modern buildings. The lack of precise measurements for element sizes; the complexity of defining correct connection and support conditions; and the difficulty of determining the mechanical properties of structural materials make the previous experiences obtained from similar buildings critical in the interpretation of structural behaviour. The comparison of the results of analyses of two different peripheral walls (planked wooden walls and stone masonry) of the cases indicate that in the case of timber pillared mosque with highly rigid stone masonry, the peripheral walls have protected the inner timber frame structure from lateral load effects, such as wind and earthquakes, and provided the survivability of these mosques for centuries. The main parameter defining the lateral resistance of the heavy masonry peripheral walls is their height. These walls, which act as vertical cantilevers, are often built more thickly and therefore more rigidly than the wooden masonry peripheral walls precisely so that they can resist vertical loads. This is most likely because of the experiences obtained from past earthquakes. The continuous frame behaviour of the timber beams supported by the masonry peripheral walls render the timber pillars into structural elements which carry primarily axial loads. Unless there is a buckling problem due to the height of the pillars, these elements do not carry significant bending moments. It should be kept in mind that the buckling problem and related damage may also occur due to heavy snow loads and unexpected loading conditions resulting from careless repair and restoration. No significant lateral structural weakness is observed in the timber pillared mosques due to the above-mentioned interaction between rigid masonry peripheral walls and a light timber frame structure. The simple geometry of the timber frame system is a positive factor in both vertical and lateral resistance of the structure. However, great care should be given to the preservation of the timber material and the details of the connections in-between structural elements in order to ensure the continuity of this lateral resistant structural behaviour. As a result, transformation of peripheral walls in Seljuk wooden mosques stemming from the interaction with Byzantine architecture provided additional resistance to lateral forces. The experience gained from these construction techniques created the acculturation of construction knowledge between Byzantium and Asia. Seljuk mosque architecture, which had been based on timber hypostyle, flourished through the fusion of stone masonry and wooden carcass with the newly transferred knowledge of Byzantine techniques.

[Translated by: Aslı Er Akan, proofread by: Steve Bryant]

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Illustration sources

Fig. 1 up: Düzce Provincial Culture and Tourism Directorate Archive, 2022; down: Municipality of Çarşamba Archive, 2022
Fig. 2 Culture Portal of Turkey, 2022
Fig. 3 Zamur Koçak, 2020: 42-49
Fig. 4 Er Akan, 2010: 43-44
Fig. 5-8 author

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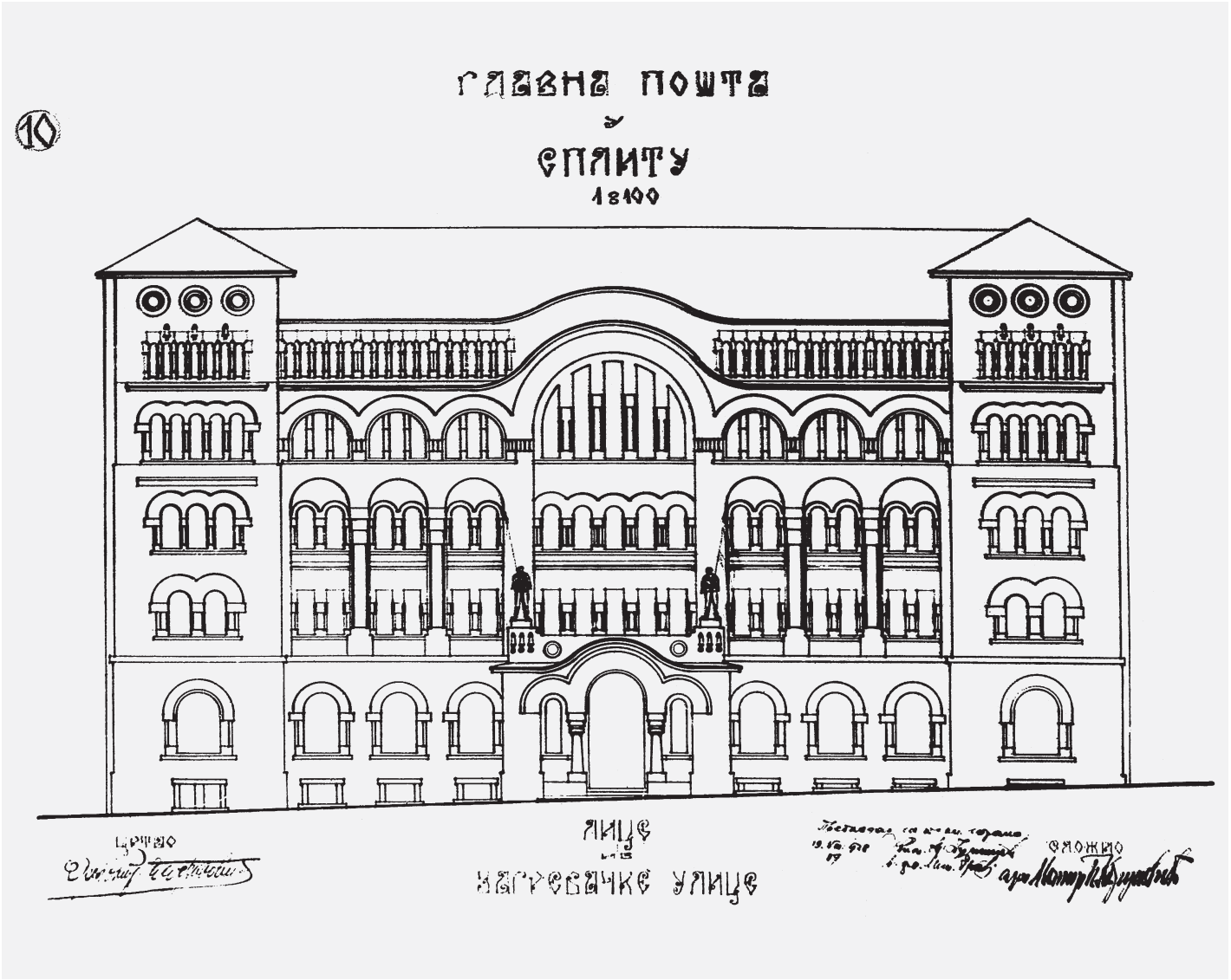

Fig. 1 M. Korunovic: Post Office in Split, 1928, unrealized project, main facade in Zagrebaćka street

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Preliminary Communication
https://doi.org/10.31522/p.30.1(63).5
UDC 72.012 M.Korunović (497.58) (497.572) "1928/1939"
Technical Sciences / Architecture and Urban Planning
2.01.04. – History and Theory of Architecture and Preservation of the Built Heritage
Article Received / Accepted: 21. 3. 2022. / 14. 6. 2022.

Architectural Opus of Momir Korunović in Dalmatia and Kvarner (1928-1939)

Adriatic coast
Croatia
interwar period
Korunović, Momir
1928-1939

As a state architect in the Kingdom of Serbs, Croats and Slovenes (since 1929 the Kingdom of Yugoslavia), who built about ninety buildings of various purposes on the territory, Momir Korunović (1883-1969) has left a tangible creative mark in Croatia. Besides one built and one unstructured Orthodox Church in continental Croatia, he designed four public buildings on the Adriatic coast, in the areas that belonged to the Savska and Primorska Banovina, out of which two were realized. Modestly adjusted to the architectural tradition and climate, his works in the Adriatic area did not differ significantly from the work he completed in other parts of the multinational state. Anti-modern and conservative, they contain elements of the Yugoslav unitary style (projects of the Main Post Office in Split and Student Dormitory in Šibenik), and the national style of the Orthodox churches on Vis and Sušak. For a more significant architectural result on the Croatian Adriatic coast, Korunović obviously needed to go one step further and more fully adapt to local conditions and cultural tradition. However, he was not ready for that, because in his creative consciousness he fixed a conservative matrix of neo-medieval style in the early twenties and enriched it with deposits of post-secession and expressionism, which from 1928-1929 affected the promotion of integral Yugoslav ideology.

INTRODUCTION

As a state architect in the Kingdom of Serbs, Croats and Slovenes (since 1929 the Kingdom of Yugoslavia), who built about ninety buildings of various purposes on the territory, Momir Korunović (1883-1969) has left a tangible creative mark in Croatia (Fig. 2). Besides one built and one unstructured Orthodox Church in continental Croatia[1], he designed four public buildings on the Adriatic coast, in the areas that belonged to the Savska and Primorska Banovina (Marković, 2019), out which two were realized. Modestly adjusted to the architectural tradition and climate, his works in the Adriatic area did not differ significantly from the works he completed in other parts of the multinational state. Anti-modern and conservative, they contain elements of the Yugoslav unitary style (projects of the Main Post Office in Split and Student Dormitory in Šibenik), and the national style of the Orthodox churches on Vis and Sušak.[2]

FROM A VILLAGE IN CENTRAL SERBIA TO THE LEADING ARCHITECT OF THE YUGOSLAV ESTABLISHMENT

The rise of the young Korunović from a humble newcomer to the Belgrade environment, at the end of the 19th century, to the leading state architect of the Kingdom of Yugoslavia (along with Nikolai Petrovich Krasnov) was very thorny, because without patronage, he constantly needed to prove himself creatively and assert himself institutionally (Kadijević, 1996, 2014). He was born in a priest's family in the Moravian village Glogovac on the 1st January 1887, where he was raised with five brothers and a sister in the strict patriarchal spirit. After finishing primary school, he began his high school education in nearby Jagodina in 1894, and the following year moved to the First Male High School in Belgrade, where he joined the youth of the Pan-Slavic society "Falcon". From 1902 to 1906 he studied at the Architectural Department of the Technical College (since 1905 University) in Belgrade, specializing in state buildings and Orthodox Church design. Immediately after graduating, he got a job in the Construction Department of the City of Belgrade, and then in the Architectural Department of the Ministry of Construction of the Kingdom of Serbia (1907), and from 1918 he continued working as a government official in the Kingdom of Serbs, Croats and Slovenians. Between 1910-1911 he temporarily left the regular design tasks at the ministry due to training in Rome, Paris and Prague. In Prague, he came into contact with the Czech Art Nouveau, applying those ideas to unfinished drafts. He designed public buildings in Belgrade, among which the realized Seismological Pavilion in Tašmajdan Park (1907), the competition draft for the Administration of State Monopolies (1908) and the Post Office 1 project (1912) stand out. (Kadijević, 1996: 27-37; Sretenović, 2017) He also participated in the Fourth Yugoslav Art Exhibition in Belgrade (1912) and became a member of the elite Working Committee for the Organization of Art Affairs of Serbia and Yugoslavia (1913), together with Ljubo Babić, Vladimir Becić, Richard Jakopić and Secretary Kosta Strajnić, whose honorary committee was led by Ivan Meštrović and Jože Plečnik. As an officer in the Serbian army, Korunović took part in two Balkan wars (1912-1913) and the First World War (1914-1918), and he got a medal "Miloš Obilić" for bravery (Kadijević, 2013; Ilijevski, 2021: 120-121).

The period between the two world wars (1918-1941) represents the most fertile phase of Korunović's work. As a productive state architect, he regularly received orders from different parts of the country so he did not have the need or the legal right to participate in public competitions. He erected a lot of administrative buildings, falcon homes, public monuments and Orthodox churches throughout Yugoslavia. Among them the following stand out: the Control Department of the Ministry of Post and Telegraph (1926-1930), Post 2 (1927-1929) and the Falcon Home "Matica" (1935) in Belgrade, the Church of the Ascension of Christ (1928-1932) in Krupanj, Saint Sava (1929) in Celje and Saint George (1938-1939) church in Sušak, war mausoleums on Mačkov kamen (1926) and Zebrnjak (1937). He also

built several private houses, among which his family house at 10 Lamartinova Street in Belgrade (1923) stands out.

Inspired by medieval Serbian and Byzantine sacral architecture, the architecture of a traditional Moravian house with arches, post-Art Nouveau, Expressionism and Czech Rondo-Cubism, he formed a specific romantic synthesis, noticed by the French architectural magazine *L'Architecture d'Aujourd'hui* (Ilitch, 1933: 50). Until the end of his career in 1947, he did not accept the principles of progressive modernism, remaining faithful to tradition Christian way of life. The period of socialism was spent in creative isolation, because the cultural environment, in which he accomplished his major works and gained recognition, disappeared irretrievably. His architectural *oeuvre*, despite considerable devastation in the Second World War, has been present in the entire post-Yugoslav area (Manević, 1981; Manević, 1990: 9-12; Kadijević, 1996; Grčev, 1998: 213-227; Grčev, 2003: 246-250; Damljanović, 2004: 80-88; Jovanović, 2007: 204-207; Kadijević, 2012; Kadijević, 2013; Tomasella, 2021: 234-249).

Architectural Opus in the Croatian Adriatic Area

In the years after the First World War, the territory of Croatia was under the jurisdiction of eight regional construction directorates, which sent budget proposals for works and projects in their area to the Ministry of Construction in Belgrade (founded in 1918), which in turn announced public tenders and submitted technical documentation. There were 14 sections of the Construction Directorate for Croatia and Slavonia in Zagreb, and in Dalmatia there were 8 (Toševa, 2018: 47). Thanks to competent architects from the regional services, only a small part of the projects for state buildings was prepared in the Belgrade headquarters of the Ministry of Construction. The reorganization of the external technical service of the Ministry of Construction began with the division of the state into nine regions – Banovina in 1929. A Technical Department was established in each and did not unconditionally accept all projects sent from the capital.

Observed from today's critical distance, Korunović's work in Croatia was in the function of implementing the unitary cultural policy of the central authorities from Belgrade, in which the architecture of state buildings played an important ideological role. The supranational concept of Yugoslav architecture, considered acceptable for all peoples in a multinational community, was based on the merging of elements of different cultural traditions into a recognizable stylistic framework. It was primarily expressed in state public buildings (Banovina palaces, post offices, branches of state banks, falcon homes, public monuments and pavilions at world exhibitions) and residences of the ruling Karađorđević dynasty (Ignjatović, 2007; Putnik, 2015; Kadijević, 2018; Kadijević & Ilijevski, 2021).

Korunović also fruitfully cooperated with the Serbian Orthodox Church, which, after uniting into a Patriarchy (1920), endeavoured to strengthen its influence outside Serbia. However, due to strong competition from Croatian architects, who resisted the imposition of "ready-made" solutions from the state capital, his ideas in Croatia were not approved outside the Dalmatian diocese of the Serbian Orthodox Church.[3]

Main Post Office in Split (1928)

The initiative for the construction of a new Post Office in the centre of Split was launched in November 1923, when the Post and Telegraph Directorate announced that land between 2,500 and 3,000 square meters big was needed for its construction (Piplović, 2008: 92; Piplović, 2015: 47; Tušek, 2020: 131). The building in which the post office was located in today's Tončićeva Street was in poor condition, with insufficient space, making business activities difficult for the state-owned company. Reports in the daily newspaper *New Age,* quoted in architectural historiography, are a testament to the thorny ten-year process of designing and building the new Post Office (Piplović, 2008: 412).

In 1924, the Ministry of Posts and Telegraphs from Belgrade, with the help of the City of Split, bought land in an accessible location in the city centre, behind the building of the Cooperative Union, for 505,386 dinars. It envis-

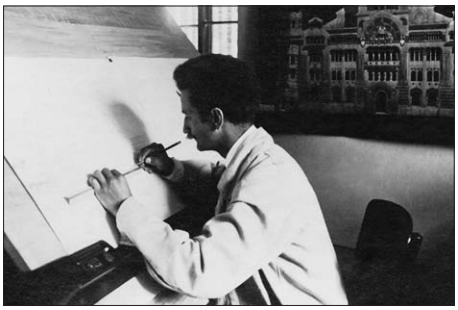


Fig. 2 Momir Korunović in his home studio (from early 1920s)

1 These are the churches of the Nativity of the Most Holy Mother of God in Trnjani near Slavonski Brod, the Diocese of Slavonia (1938-1939, demolished in 1941) and in Sisak (1935, unrealized). For more details, see: Kadijević, 2012: 323, 325.

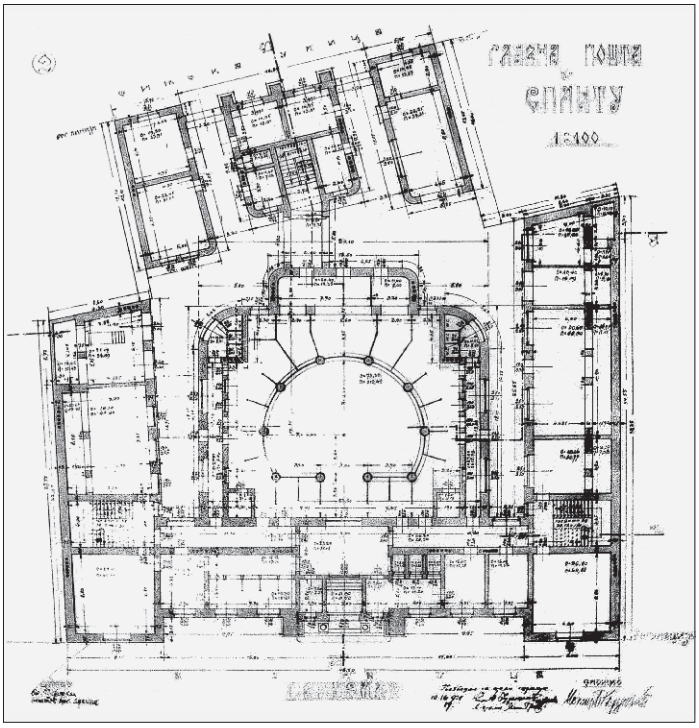
2 Korunović's work on the eastern Adriatic coast has been partially presented in Croatian, Serbian and Italian historiography, but a comprehensive review of his genesis and cultural implications has been lacking. By studying the technical and photo documentation that are a testament to them, newspaper and historiographic sources, as well as visiting the only preserved object in the field, conditions were created to see them more fully.

3 The Croatian cultural public was much more in favor of the progressive reformist ideas of Nikola Dobrović (1897-1967), whose work in Dalmatia it wholeheartedly supported. Inspired by the Mediterranean as much as by international modernism, during the Dubrovnik period of his activity, Dobrović grew into a respectable professional judge, which Korunović, who rarely came to Croatia, could not and did not want to become. Belgrade architect Milan Zloković (1898-1965), originally from the Bay of Kotor, also received a better reception in Dalmatia. However, what thoroughly connects all three authors is the notion of Croatian territory as an indivisible segment of the Yugoslav cultural scene (Ivanišin, 2000; Blagojević, 2015; Kadijević, 2020).

FIG. 3 ANTE BARAĆ: POST OFFICE, SPLIT, MAIN FACADE IN ZAGREBAČKA STREET, 1929-1939

aged the construction of the entire block of buildings, in which the Main Post Office Split 1, intended for work with users, is located in the southern part in Zagrebačka Street (today King Tomislav's Street), and the Directorate on the northern side in Sinjska Street. The estimated value of the works was more than 11 million dinars. At the invitation of the Ministry of Post and Telegraph, with which he was intensively cooperating at the time, the architect Momir Korunović prepared project documentation for the new Post Office in the spring of 1928. It seemed that its construction would begin soon, as confirmed by engineer Katušić, head of the Technical Directorate of the Post Office from Zagreb.[4]

FIG. 4 M. KORUNOVIĆ: POST OFFICE, SPLIT, UNREALIZED PROJECT, 1928, PLAN OF GROUND FLOOR IN ZAGREBAČKA STREET



At the beginning of July, Korunović arrived in Split with great expectations, with a delegate from the Ministry of Post, Fran Bonači. His representative palace, whose draft was presented to the public in the window of the newspaper *New Age* on the People's Square, left an impression on the citizens with its monumentality, large portals and balconies, rustic stone panelling and "Romanesque-Byzantine" style (*** 1928b; Fig. 1). The main entrance was planned in Zagrebačka Street, with two staircases and a round atrium in the middle, around which there would be galleries on pillars on all floors. According to the conditions of construction in Dalmatia at the time, the new buildings inserted into the historical cores had to be lined with stone, in this case predominantly taken from Split, and to a lesser extent from the island Brač (for details). The Post Office was supposed to have a basement, a ground floor and four floors. It was concluded that "the new monumental building would mean a lot for the modern development of our city" (*** 1928b).

In September 1928, a public tender was announced for the construction of the Main Post Office Split 1, and six companies applied. However, the Ministry of Construction abruptly annulled the tender at the suggestion of technical experts from Split, who assessed Korunovic's draft as "harmful" and "done in a hurry", because "it does not correspond to the intended function and the coastal environment" (Piplovic, 2008: 93). Momir Korunović did not respond to the objections, waiting for the attitude of the Ministry of Construction. In the heated political atmosphere, when the civil revolt against the central authorities was growing in Croatia after Croatia's political representatives in the National Assembly were killed on June 20, 1928, the Belgrade ministries were forced to accept the change of plan. Soon, the Split Construction Section was allowed to prepare a new project that would meet commercial and functional needs better.

The Construction Section entrusted the change of the project to its employee, the architect Ante Barać (1900-1985), whose career had just picked up (Borčić, 2016: 588-589; Tušek, 2020: 27). The project was later partially reworked in collaboration with builder Felix Šperc and architect Boris Katunarić. After that, in January 1929, a new auction was announced for the lease of works. By the end of the year, a radical revision of Korunović's project was completed, with the goal of expanding the air and underground telephone network. However, the plan to introduce an automatic control panel in the new building postponed the start of works and imposed new changes (Piplović, 2008: 94). Following that, new tenders were launched so that the

construction of two post office buildings was completed only in July 1938, exactly ten years after the emergence of Korunović's project. That is when the decoration of the interior began, including the installation of state-of-the-art telephone installations. The stone blocks for the exterior cladding were brought from the Pušić quarry on Brač.

With a modest ceremony on the 28th August 1939, the new Post Office in Split was finally opened. Architect Barač composed both street facades differently. He divided the facade in Zagrebačka Street into two zones, with a three-part entrance divided into two columns, and a three-storey middle zone with square windows (Fig. 3). He designed the facade in Sinjska Street differently, with arched entrances and a rhythmic row of rectangular windows. As at the previous Hygienic Institute at 46 Vukovarska Street (1932-1933), where he had the ability to emphasize the effect of graded masses on a free-standing building, Barač strove for a calm architectural expression without accentuated contrasts (Tušek, 2011: 152; Tušek, 2020: 119).

In relation to Barač's block with buildings, Korunović's project, prepared in the scale of 1:100, is much more appropriate for the concepts of Yugoslav state architecture from the end of the third decade, representing the stylistic and typological whole with its Belgrade palaces of the Ministry of Post and Telegraph (1926) and Post Belgrade 2 (1928) (Kadijević, 1996: 54-56, 63-65, 145, 148). Although original and praised in the daily press, it was discontinued under the pressure of competitors from Split. The facade in Zagrebačka is 46 meters wide, and in Sinjska Street 28 meters. The height of both facades is 28 meters, which would highlight the post block in the city centre. It is interesting that Korunović did not sign on the projects as a designer, but as an author who "composed" the projects, since during his entire career he tried not to use foreign words in everyday communication.

New observations can be added to the affirmative description of Korunović's project presented in the newspaper *New Age*. The foundation of the two buildings connected by a corridor and with garages in the yard is conventionally designed, like other Korunović's block-separated units (Fig. 4). As the main motif of the interior in the section in Zagrebačka Street, a spacious counter hall stands out, designed in the form of an atrium with galleries on all floors and a glazed roof. It does not stand out in the external composition, which confirms the consistency of the romantic compositional approach, in which the outer mantle of the building conceals more than it reveals the structure of the inner spatial organization. The monumental four-storey Post Office building, conceived in the Romanesque-Byzantine style, is adorned with rhythmic arched forms that emphasize the horizontal compositional rhythm. The main motif of the façade in Zagrebačka Street is the central projection, visually harmonized with the connecting fields and side towers in a folkloristic manner. On the ground floor, Korunović's three-part portal, finished with a wavy tympanum and bordered by male figures carrying state flags, also appears. According to the solution of the middle zone, the facade in Zagrebačka Street is similar to the Ministry of Posts and Telegraphs in Belgrade (1926-1930; Fig. 5) where the corner towers of the strong outcrop also stand out. On the other hand, the connection with Art Nouveau is reflected in the increase in the number of openings and their dimensional fragmentation from the bottom to the top of the facade.

Symmetry is also characterized by the rustic facade of the Directorate in Sinjska Street (Fig. 6) on which the side towers are also emphasized. For practical reasons, in order for the postal traffic not to interfere with the population, the entrance to the yard is planned on that side of the block, as seen in Korunović's design, where the car entrances are wider and arched, unlike the two central entrances for officials.

Fig. 5 M. Korunović: The Ministry of Posts and Telegraphs, Palmotićeva 2, Belgrade, 1926-1930

Fig. 6 M. Korunović: Post Office, unrealized project, Split 1928, facade in Sinjska street

4 The report showed that „everything is ready for the construction of the post office and that a public competition for contractors works will be announced soon" (*** 1928a).

FIG. 7 M. KORUNOVIĆ: CHURCH OF SAINTS CYRIL AND METHODIUS ON VIS, 1932, HARBOUR VIEW

CHURCH OF SAINTS CYRIL AND METHODIUS ON VIS (1932)

After the liberation of the island of Vis from the Italian occupation (1921), Croats gradually converted to Orthodox religion out of economic interest. At the Assembly in Vis, held in 1925, a decision was made on the conversion of believers, and the Serbian Orthodox Parish was officially founded on the 1st July 1926. The initiator of the conversion was Ivan Ruljančić (1872-1953), a member of the Radical Party and the leader of the agricultural movement during the Austro-Hungarian rule (Mladineo, 2008).

The initiative for the construction of a church on the cadastral plot Ravnica, located at the centre of the island and donated by Ivan Ruljančić, was launched in 1931. It was one of the two Orthodox temples of worship completed that year in the Dalmatian diocese, next to the Church of the Assumption of the Blessed Virgin Mary in Vođenica (Lečić, 1971: 90). With its position and size, it dominated the panorama of the city of Vis (Fig. 7), leaving the impression that it was a much larger religious community than it really was (out of 3,189 inhabitants of Vis in 1931, there were almost 217 Orthodox; Mladineo, 2008: 239). In addition to the contributions of the local population and the Holy Synod of Bishops of the Serbian Orthodox Church, the "Princess Ljubica Society" from Belgrade also supported the construction process. The church was consecrated on November 12, 1933, by the Dalmatian bishop Irinej Đorđević, with the assistance of the Bishop of Zahumlje-Herzegovina Stanković, and is dedicated to the Slavic saints Cyril and Methodius.[5]

Orthodoxy on Vis fell into a difficult period after 1936, when Ruljančic's party was defeated by the Croatian Peasant Party. Interfaith tensions culminated in the first serious incident in the summer of 1937, when the Catholic population of Vis, organized by their clergy, prevented a group of Orthodox Czechs from visiting the island and the newly built church (Mladineo, 2008: 241).

After the Italian occupation in 1941 and the transfer of the parish priest Bukorović to Zadar, the Orthodox parish of Vis was gone. The last service in the church was held at the end of that year. Italy capitulated in August 1943, and control of the island was taken over by partisans, aided by the British and American Army. Vis became a significant stronghold of the allies. The German bombing at the beginning of 1944 damaged the Orthodox Church of St. Cyril and Methodius.

At the end of the war, very few Orthodox remained on Vis, led by Ivan Ruljančić. Many were active in the partisan movement. The damaged and neglected Orthodox Church, without a door, continued to decline. The idea of removing the church and erecting a partisan monument appeared in 1947, and in August 1959 the People's Committee of the Vis municipality sent a letter to the Commission for Religious Affairs, requesting the demolition of the church. It was demolished in the fall of 1963 as part of the celebration of

FIG. 8 M. KORUNOVIC: CHURCH OF SAINTS CYRIL AND METHODIUS ON VIS, 1932, A BASE OF GROUND FLOOR

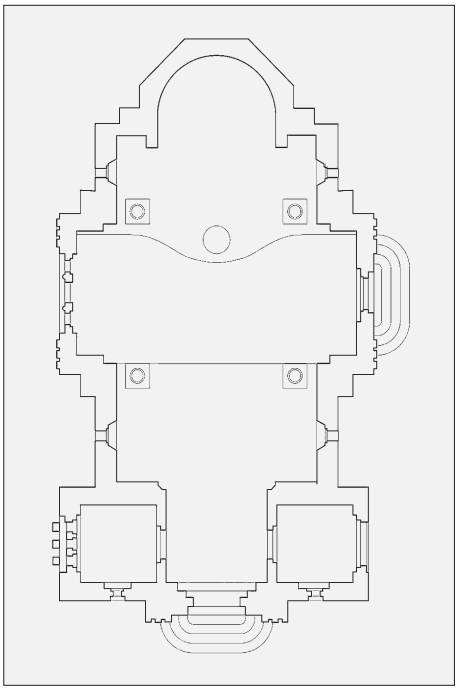
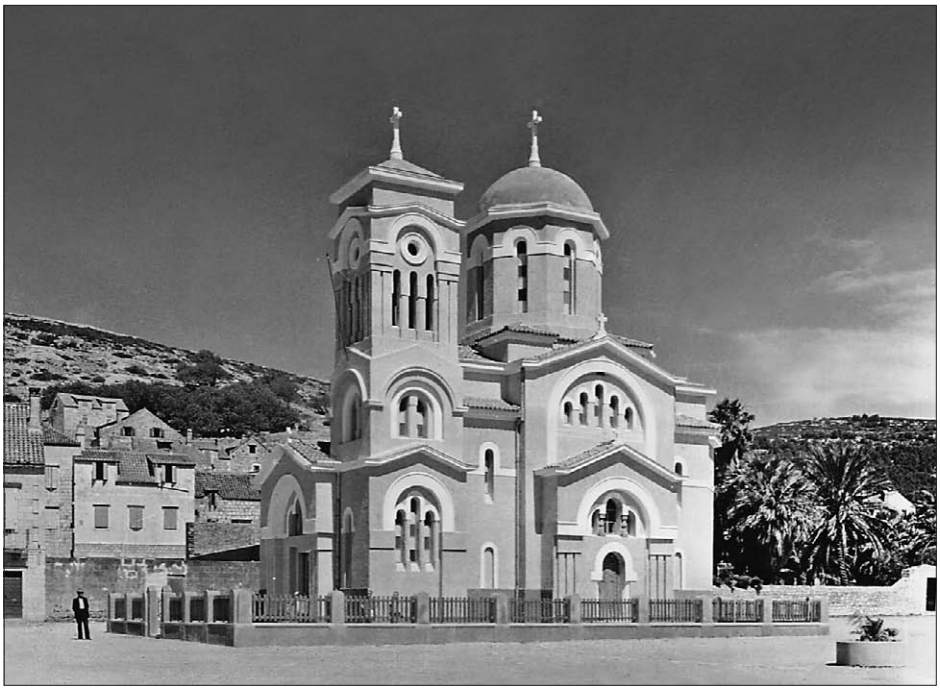


FIG. 9 M. KORUNOVIĆ: CHURCH OF SAINTS CYRIL AND METHODIUS ON VIS, 1932, FRONT VIEW, CHRISTMAS POSTCARD



the 20th anniversary of the arrival of Josip Broz Tito on Vis, which followed in September 1964.[6]

The realized project of the church of St. Cyril and Methodius from 1932 is a part of Korunović's family legacy (Kadijević, 2012). The design of the church began in 1930, when the Ministry of Construction was contacted. The ground plan of the church in the scale of 1:50, longitudinal section and drawings of all facades have been preserved.

A copy of the charter, inserted into the foundations of the temple, was also designed by architect Korunović, and mentions all important protagonists from the state and church hierarchy. It is a single-domed building with the base of a developed inscribed cross with accentuated arched openings and a slender bell tower on the southwest side (Figs. 8-9).

It was conceived as a combination of Serbian-Byzantine, Romanesque-Gothic and Renaissance architectural traditions, which imprinted a desirable Yugoslav ideological dimension, with the first matrix quantitatively prevailing. However, such a tense synthesis did not bring an authentic artistic result, but rather a scenography-like, eclectic solution. Although it was qualified in the daily press as "the most beautiful Orthodox church in Dalmatia" (*** 1937) due to its rigid contour and inorganic merging of different traditions, objectively, it was not that.

Unlike most of Korunović's churches in Yugoslavia, the church on Vis was not captivated by its silhouette compactness, due to the asymmetrically placed bell tower (17 meters high), which reduced the visual significance of the dome above the nave (20 meters high). The porch with pilasters, arranged in front of all three entrances, is shallower and narrower than in other Korunović's churches. In historiography, it is commented on as a significant achievement of Korunović, but also as a "military" church from the far west of the country, which was supposed to strengthen the influence of the Serbian Orthodox Church and central state authorities (Kadijević, 1996: 79; Ignjatović, 2007b: 190; Mladineo, 2008: 238-239; Čolović, 2011: 83).

5 The iconostasis was supposed to be made by the famous painter Uroš Predić (1857-1953), who later gave up.

6 The demolition required the consent of the Serbian Orthodox Church, but Bishop Stefan of Dalmatia opposed it, stating that the construction was well preserved and that the church could be repaired. The bishop eventually agreed to the demolition, with monetary compensation and permission to rebuild the church in Knin. The demolition agreement was signed on December 12, 1963. Palm trees were planted on the site of the demolished church of Cyril and Methodius in the town of Vis, and a partisan monument was erected, later also removed.

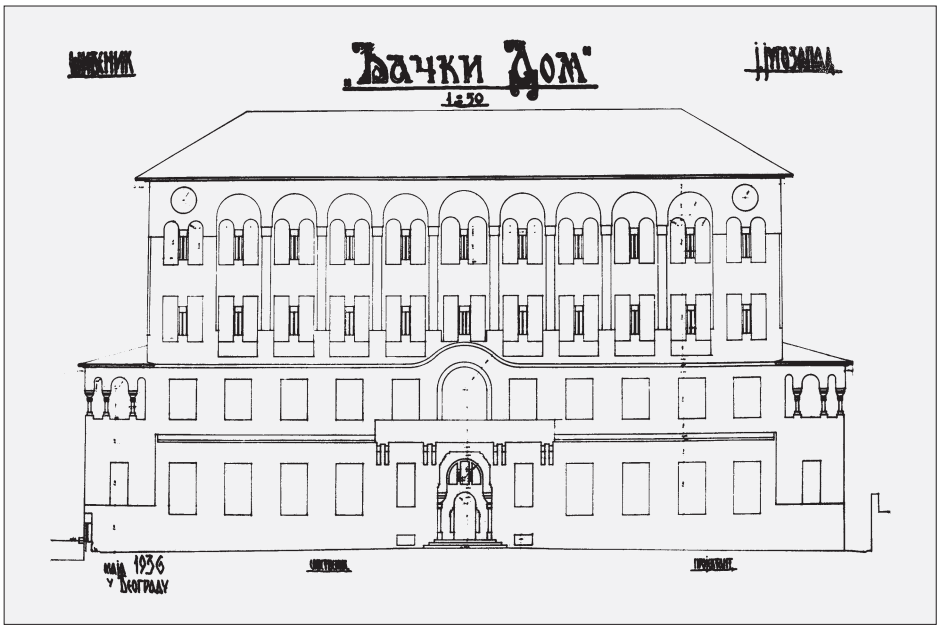


Fig. 10. M. Korunović: Student's dormitory, Šibenik, unrealized project, 1936, main facade

Student Dormitory in Šibenik (1936)

Korunović's unrealized architectural projects in Dalmatia include the project of the Student Dormitory in Šibenik, made in 1936. It is a building of a residential-educational character, ordered from the Dalmatian Diocese of the Serbian Orthodox Church. Since the majority of the rural population from the poor parts of northern Dalmatia did not have the funds to educate their children in cities, on

Fig. 11 M. Korunović: Student's dormitory, Šibenik, unrealized project, 1936, a base of ground floor

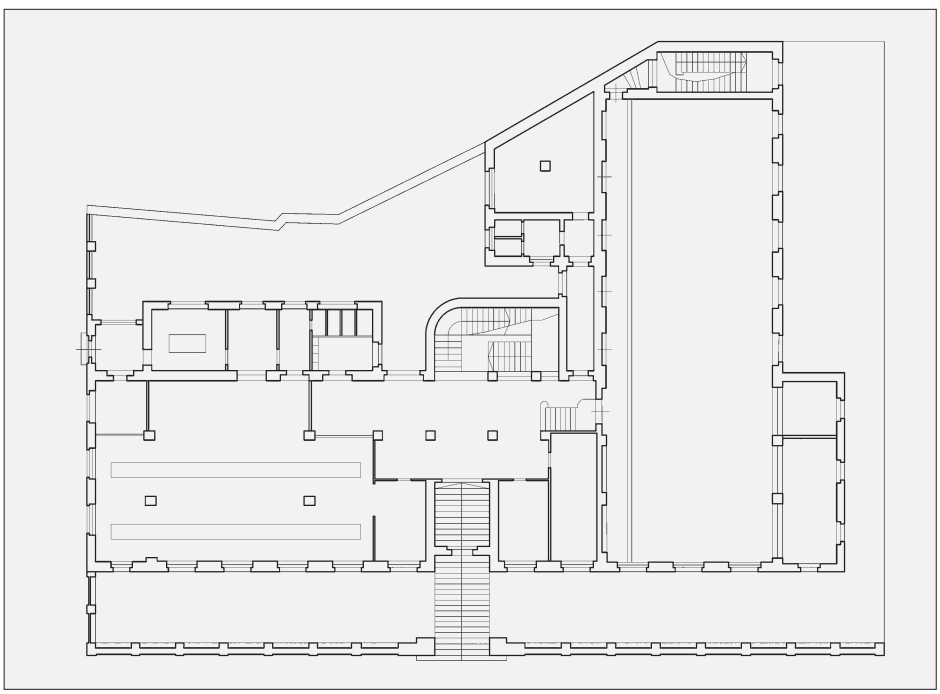


FIG. 12 M. KORUNOVIĆ: CHURCH OF ST. GEORGE IN SUŠAK, 1938-1939, FRONT SIDE VIEW

May 16, 1931, at a conference held in Knin, it was decided to build a dormitory in Šibenik. They began collecting the funds in 1927 (*** 1931). It is planned for children of high-school age. The task was entrusted to the versatile state architect Momir Korunović, not only because of his reputation as a builder of public buildings, but also because of his strong ties with the Serbian Orthodox Church, which financed the purchase of land and the plan for the dorm building.

The key role in the organization of the construction endeavour was played by the Dalmatian bishop Irinej Đorđević (1894-1952), with whom Korunović collaborated in the construction of the temple on Vis. The student dormitory, along with the bishop's courtyard and the Cathedral of the Assumption of the Most Holy Mother of God, would be a gathering centre for Šibenik's Orthodox believers mostly living in the suburbs of Varoš, but it would not fit organically into the architectural image of the city (Marković, 2009). In addition, the economic situation in Dalmatia did not support the realization of this humanitarian endeavour. However, in April 1938, Bishop Irinej invited believers through the press to send donations to his address in Šibenik so that the collection of funds would continue (*** 1938).

The Student Dormitory from May 1936 (preserved in the scale of 1:50), contains well-known elements of Korunović's Yugoslav unitary style, interpreted in an inspired way (Fig. 10). The main façade, facing south-west, is divided into a wide single-storey base topped by a two-storey narrow block, divided by arcaded arches that include two window shafts composed of bipartial openings. Although deprived of the usual contrasts of horizontals and verticals, the romantic treatment of the imagined building prevails in the solution of the side loggias of the first floor, the structure of the main entrance and the shape of the balcony on the front facade. It obviously intersects the layers of Romanesque-Byzantine and Balkan folklore heritage (arches of windows connected in arcades, a hipped roof, a wavy projection between the first and second facade zones, porches, pillars flanking the central portal and dissecting the openings of the side loggias), presented without emphasised expressiveness. Instead, a symmetrical composition of restrained rhythm is offered, conventional and strict, as befits the function of the educational function of the building. However, the hardness of its wide facade is softened by decorative motifs and rounded side finishes. The Mediterranean character of the whole is less emphasized than the general Yugoslav one, which was believed to unite the "folk" elements of all cultural traditions.

The floor plan of the building is composed of two connected rectangular blocks that merge into a shape similar to the Latin letter "L" and divide into three zones on the ground floor (Fig. 11). The central zone is dominated by a lobby bordered by rooms for the gatekeeper and educator, from which one enters the staircase leading to the first floor. Behind is a laundry room. In the left wing there is a large dining room (divided into a section for taking

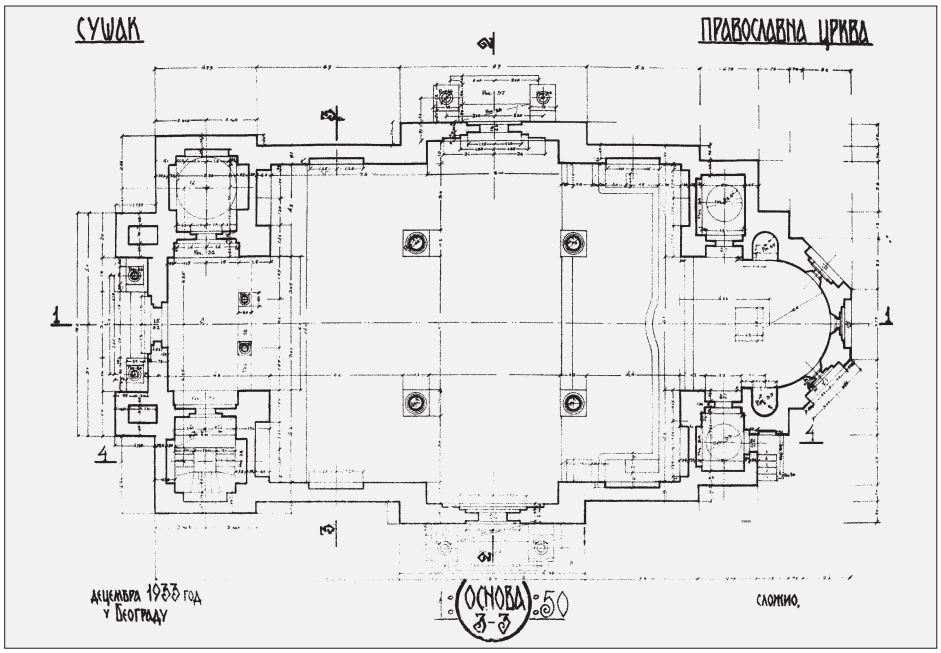


Fig. 13 M. Korunovic: Church of St. George in Sušak, 1938-1939, a base of ground plan, project

Fig. 14 M. Korunovic: Church of St. George in Sušak, 1938-1939, project of western facade

food and dining), kitchen, pantry, toilets and sinks. In the right wing, the dominant motif is a spacious rectangular ceremonial collection, with a gallery on the left. Side entrances for staff are provided, as well as auxiliary ones from the side streets. Upstairs are staff cabinets, multi-bed rooms, toilets and bathrooms for students, as well as rooms for rest, study, socializing and a library. Communications within the building are narrow and reduced, which makes their collective use more difficult, while the main attention is focused on increasing accommodation capacity. Due to the internal political crisis in Yugoslavia before the founding of the Banovina of Croatia in August 1939 (Marković, 2019: 257-260), and later the outbreak of the Second World War, the construction of the Student Home did not take place.

Church of St. George in Sušak (1938-1939)

The Archives of Yugoslavia and Korunović's legacy preserve his project of the Church of St. George in Sušak, commissioned by the Dalmatian Diocese[7] (Lečić, 1972: 11-112). The initiative for construction was launched in 1931, due to the religious needs of parishioners from occupied Rijeka (150 families). Therefore, in December 1932, the Serbian Orthodox Municipality was founded in Sušak.

On the plot on the Upper Boulevard in the Trsat district, which the municipality donated to the Serbian Orthodox parish, the Church of St. George was built (Fig. 12). The foundations of the temple were consecrated in 1938 by Metropolitan Dositej of Zagreb. It was completed and consecrated on September 30, 1939. Material funds for its construction were collected by the municipality and combined with the voluntary contributions of the citizens. The works were carried out by the company of Boren Emili, while the iconostasis was painted by an emigrant from imperial Russia, Boris Shakhovalov (Vicelja Matijašić, 1988; Kadijević, 1996: 99-100; Bradanović, 1996: 132; Tomasella, 2021: 238-249). The consecration of the completed temple was performed by Patriarch Gavrilo Dožić on September 30, 1939, when the Second World War had already begun in Europe (Paunović, 1939).

The drawing plan from 1933 (later precisely realized) shows the developing type of inscribed cross in the nave, upgraded with three domes – wide over the central part of the spacious nave and two smaller ones on the sides of the narthex (Figs. 13-14). Like Korunović's monumental churches in Ljubljana and Maribor (Kadijević 1996: 72, 79), the nave is separated from the narthex by two pillars. However, thanks to the sharp and clearly demarcated geometric shapes, the temple on Trsat has a more expressive silhouette than most of Korunović's churches. Slender pillars of porches also appear at the church of St. John the Baptist in Grdelica (1936; Kadijević, 1996: 97, 161).

A gallery for the choir was built on the first floor of the narthex. The altar space is three-part, with a three-sided apse on the outside

7 AY, MK

and a semi-circular apse on the inside. The main dome is octagonal, while the raised arms of the inscribed cross are conspicuous on the facades. All portals are made in the form of a shallow Serbian-Byzantine portico with low columns and a wavy tympanum. According to Korunović's aesthetics of sacral architecture, the windows here are elongated and narrow. Based on the width of the interior, a thousand people could fit in the church, although the number of Orthodox believers in Sušak rarely exceeded 150. Except as a forgotten achievement of Momir Korunović, in historiography it is commented as an example of building Orthodox churches in the far west[8] (Ignjatović, 2007b: 182-183).

CONCLUSION

For a more significant architectural result on the Croatian Adriatic coast, Korunović obviously needed to go one step further and more fully adapt to local conditions and cultural tradition. However, he was not ready for that, because in his creative consciousness, in the early twenties, he fixed a conservative matrix of neo-medieval style, enriched with deposits of post-secession and expressionism architecture, which from 1928-1929 affected the promotion of integral Yugoslav ideology. Unlike Nikola Dobrović and Milan Zloković, who engaged in interpretations of architectural Mediterranean and opened up to modern ideas, Korunović insisted on traditional assemblies more suitable for the continental part of the country. Therefore, he was satisfied with the cooperation with the Dalmatian Diocese of the Serbian Orthodox Church, which did not review his projects, trying to strengthen religious and social influence.

As he did not give up the established conservative line of his work, Korunović became increasingly lonely in the late 1930s, especially since most of his contemporaries accepted architectural modernization. Still, stubborn as he was, in the last pre-war years, he never crossed the line and emphasized the forms characteristic of totalitarian regimes of the time, attractive to many Serbian investors and architects (Manević, 1984; Kadijević, 2005; Stefanović, 2014), which also contributed to the fading of his influence.

[Translated by: Dragana Kadijević]

8 Today, the temple is used liturgically only occasionally due to the small congregation. Recently, the facade and roof were renovated (covered with new copper roofing), video surveillance was installed and the lightning rod was reconstructed.

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Figs. 1-2, 4-14	MK
Fig. 3	www.google street view, Split, 2022
Figs. 8 and 11	were digitalized by arch. Nebojša Antešević, Ph.D.

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The author prepared the whole work.

Acknowledgments

The realization of this research was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia within the funding of scientific research work at the University of Belgrade – Faculty of Philosophy (contract number 451-03-68 / 2022-14 / 2001 639). In addition to the Korunović family, several colleagues helped us to collect material for this article, and we thank most sincerely: Zlatko Karač, Nebojša Antešević, Kristina Perkov, Josip Pavić, Stanislav Živkov, Paolo Tomasella, Milenko Lošić, Jerko Denegri, Aleksandra Ilijevski and Tadija Stefanović.

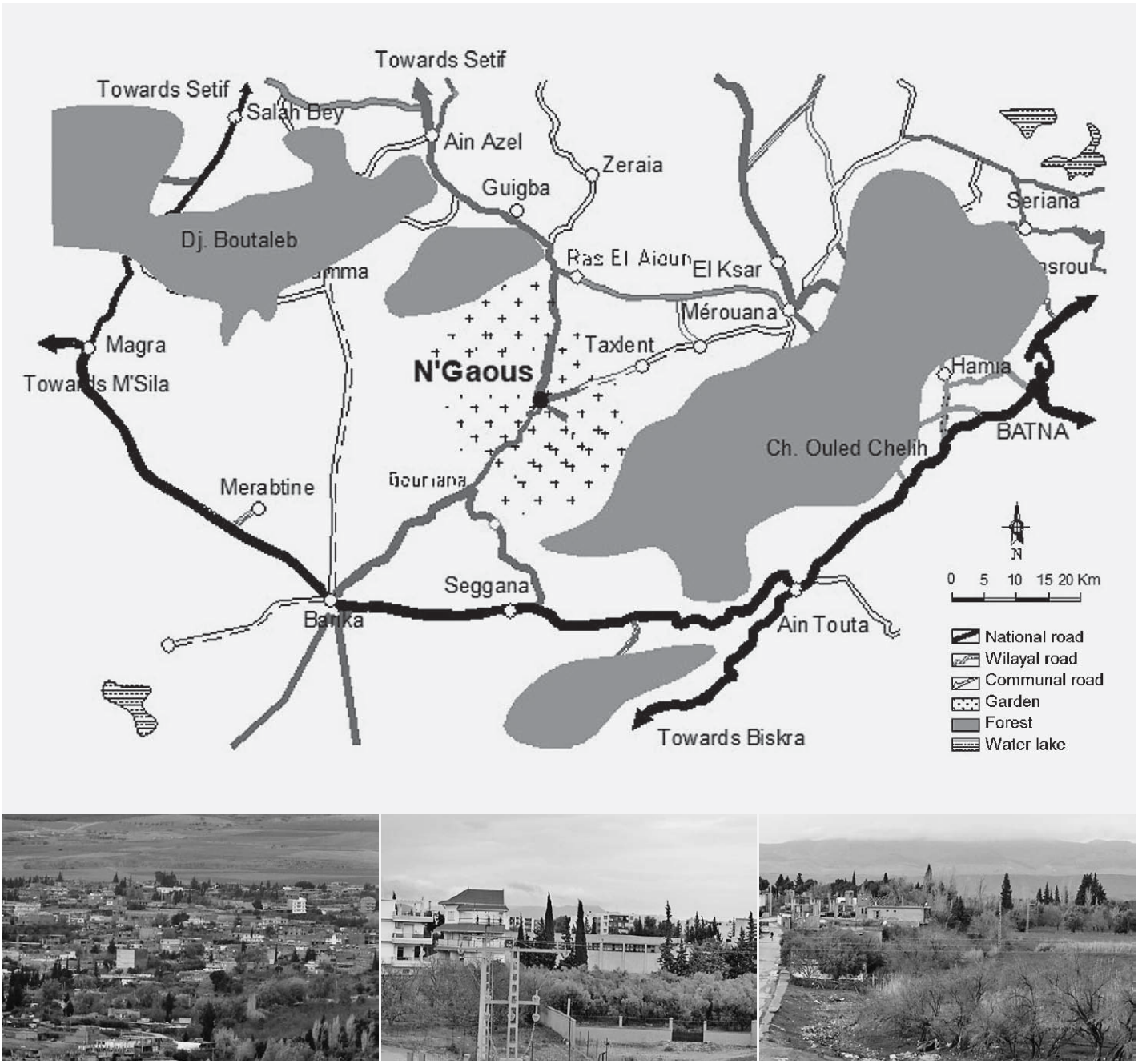

Fig. 1 The location of N'Gaous in the middle of a semi-steppe plain between two mountains

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Preliminary Communication
https://doi.org/10.31522/p.30.1(63).6
UDC 719 711.14(652 N´Gaous)"20"
Technical Sciences / Architecture and Urban Planning
2.01.02. – Urban and Physical Planning
Article Received / Accepted: 17. 1. 2022. / 14. 6. 2022.

Green City or Urban Countryside?

An Analytic Review of the Urban Sprawl Phenomenon in the City N'Gaous, Algeria

agrarisation
city
countryside
N'Gaous, Algeria
urban sprawl

Urban sprawl is a global phenomenon in which a city suffocates its surrounding countryside. These indivisible entities coexist in a field that juxtaposes and composes urban and rural traits. N'Gaous city in Algeria has experienced an astounding spatial expansion over the last 60 years, establishing a strong presence in its territory. Its land area expanded by more than ten times (from 33.7 to 379.7 hectares), while the population increased by more than six times (from 4,887 to 33,515 persons). The purpose is to ascertain the effects of urban expansion on peri-urban agricultural land, the primary economic activity in the area, and to chart its evolution. Accordingly, the article employs an analytical approach to assess the agronomic potential of soils in order to quantify and monitor the agricultural potential consumed by the construction. This method is supported by the use of Geographic Information Systems as a decision support tool for spatializing the city's growth. The focus of the article is to achieve the optimal agri-urban balance feasible. Hence, it will serve as a demonstration that the urban future is fashioned with the inherent potential to guide growth via the use of land assets.

Introduction

Urbanization has been an important worldwide phenomenon throughout history. Urban sprawl characterizes cities' increasing surface area and artificializing land faster than the population component alone (FNE-VEOLIA, 2017). Several studies explain that the dynamics of urban sprawl seen in an area are based on notions like density, fluxes, and temporal dynamics (Abrantes, 2010). Similarly, Robert (2016) stated that detailed knowledge of land usage is necessary for detecting agricultural land consumption due to artificialization. Recently, Vandermotten (2010) has stated that the countryside is being urbanized. Comby (2017) further notes that urban sprawl is an expansion of the periphery that, rather than pushing forward the urban-rural divide, crosses it. The method is translated by placing forms meant to transform urban positional values in rural areas.

Economic and social developments in Algeria have shifted the population's geographic distribution (Kateb, 2003). Batna is one of the country's fastest-growing metropolises. The extension of the urban perimeter has spawned peri-urbanization and the unplanned and uncontrolled spread of urban development into formerly undeveloped areas. Therefore, the impact of Batna city on the surrounding countryside has been studied extensively, from inadequate development to urban expansion phenomena (Dridi et al., 2015).

In the same region, N'Gaous city is an ancient town located in Batna. N'Gaous and its countryside present an opportunity for empirical research for urbanization analysis and urban sprawl control. The link between the city and its countryside is obvious since the city does not produce the means for it to feed itself. That is why city dwellers have been showing a stronger desire for nature than before. However, urban growth is imposing its own planning logic and threatening the natural spaces contained within the city's boundaries (Werquin, 2008).

The purpose of this article is to explore contemporary trends that herald the emergence of new socio-spatial, economic, and symbolic links. The growth of N'Gaous is resulting in a ruralization of the countryside. The situation of N'Gaous is questioned in particular because of the bangs caused by peri-urbanization and the installation of amenities, which result in the fragmentation and fragility of the agricultural domain. With the intertwined relationship between urban and rural, the possibility of new cities is proposed as a viable and practical alternative for balancing the urban frameworks of metropolises and small Algerian cities. The established technique employs an analytical evaluation in conjunction with Geographic information systems (GIS) as a decision support tool to spatialize the expansion of the city.

Materials and Methods

- **Description of the search field** – N'Gaous is a small Algerian settlement situated 750 meters northwest of Batna, on the axis linking Barika and Setif through Ainzel. It is surrounded by two geographical sets: the green spot plain on one side and the two Jebel Boutaleb and Jebel Ouled Chelih on the other. The Barika valley runs north-south across this region, bringing together all the rivers that water the fields downstream (Fig. 1).

With almost 600,000 apricot trees in the town and its environs, N'Gaous, the apricot's icon, has a unit dedicated to the production of jams and juices, a germ of an expanding business sector. The orchard is already failing due to diminishing arable land and water availability. Orchards will die unless immediate protection is established. A spatial mismatch between the urban environment and the orchard defines N'Gaous land. The fabric is irregular and lacks structure (Dounia & Boudjemaa, 2022). Smaller buildings on the urban outskirts fracture and disintegrate. Orchards surrounding the old core add to the city's chaotic fragmentation. The present city grew and developed around orchards.

The city's vibrant contemporary core has a Mediterranean/subtropical desert climate. It

is surrounded by major retailers and public services (town hall, daira on the main highway), giving it an irregular shape. Also, roads and pathways run through the orchards. The neighborhood's narrow, winding paths and lack of access roads testify to the lack of building lots and the history of travel on foot.

The new urban residential zone Ras El Ain lies three kilometers east of the old city. The distribution of amenities is inequitable. Most communal housing complexes are located here, displacing other urban fabric. This approach has altered spatial hierarchy and equilibrium. Individual residences are "villas" set in their own orchards with apricot trees. This substantial structure includes contemporary comforts. When this habitat encroaches on agricultural land, it is illegal.

In such situations, local governments adopt compromising positions, combining monitoring and limitation with acceptance, due to the lack of alternatives. National law forbids the development of undeveloped land into community land reserves. That is why the state repealed the Construction and Subdivision Permit Law 82-02 and established urban planning tools. This aim was achieved by creating Fenarou, 1.5 km north of the metropolitan area's economic core. Fenarou is currently part of N'Gaous due to its location and geomorphology. The area is home to the police station and hospital. Two main axes link the town to the city (the national highway and the successful North construction bypass).

N'Gaous' apricot bounty led to the creation of Emac and Enajuc (National Company for Juices and Preserves). N'gaous-Conserves were created due to the fruit's exceptional organoleptic value and natural character, as well as the preservation process learned. So N'Gaous' urban form is unique. Located in an orchard, it has a single communication line connecting it to the center.

Methods

The purpose of this work is to highlight the analytical method combined with a decision support tool through Geographic information systems (GIS) in order to understand the problem of urban sprawl on agricultural land and to measure the dynamics of the spaces in the territory of N'Gaous. The data gathering process began with the examination of documentation sources that serve as a critical foundation for understanding the state of the art. Additionally, this study is based on a firsthand survey of residents and interviews with municipal officials in N'Gaous. Concerning the case study's knowledge, it is built on field observations, and images gathered in the pursuit of local information about the issue at hand, as we have made fieldwork a methodological basis of major importance.

• **The analytical method** is structured around two distinct phases: The first phase is based on direct observation of the soil. This method entails three aspects:

– The land use mapping (aerial photos and digital pictures).
– The built urban spot (Cadastral data and cartographic products).
– Quantitative field surveys to explore local residents' true impressions of the destruction of agricultural land by urban development.

The second phase reconstitutes land use and its evolution from data initially dedicated to another activity. It is characterized by measuring flows (economic and social) and by quantification (statistical data).

• **Quantification of the expansion growth rate** – The developed methodology uses GIS as a decision support tool to spatialize the expansion of the city. The coupling of information with the decision support tool allows the territorialization of the effects of the growth of the city at the expense of agricultural land. The introduction of the database on a geo-referenced cartography through GIS leads to a quantifiable reading of the factors inherent to the phenomenon of the nibbling of agricultural land. To this end, the interrogation of this spatialization enables thematic maps to explain the impact of spatial evolution.

From the combined method used, three main indicators are defined and serve as evaluation and decision support tools to measure space consumption at a given time:

– The basic indicator for quantifying space consumption entails the characterization of the different types of land use at a given date, evolution of artificialized spaces and mutations of agricultural spaces. The second aims to qualify the consumption of space and describe its spatial dynamics:
– The second indicator tackles spatial growth and development of the built environment within and outside the urban spot, which describe the impacts on the rural space (physical surrounding and human environment) under the effect of action-related phenomena.
– The third indicator aims to put space consumption into perspective: Urban sprawl is defined by the relationship between population growth and land consumption via structural developments (social and economic) measured at a point in time T and compared to previous situations. The attractiveness of the city of N'Gaous (health, education and transportation) favors a sustained demographic growth that is manifested by a strong dynamic of its peri-urbanization.

FIG. 2 THE SHIFT FROM URBANIZATION TO THE PERIPHERY

The first method adopted allowed to characterize the dynamics of peri-urbanization and to identify their causal relationships across the N'Gaous territory through the artificialization of agricultural land. Its implementation consists of analyzing and monitoring the consumption of agricultural land.

• **Statement of the problem** – Based on the data, four main issues were identified:

– To raise awareness of the preservation of the agronomic heritage of the soil (the cultivation of apricot trees);

– To slow down the dynamics of soil artificialization (sprawl, fragmentation);

– To maintain and promote the dynamism of agricultural activity;

– Maintain and promote the territory's coherent development capacities.

For each of the four issues, measurement criteria relevant to the stakeholders' point of view and reflecting different levels of concern were identified. These criteria have been formulated in a deliberately synthetic manner to facilitate exchanges and understanding of the approach followed.

The organization of the measurement criteria constitutes a reference base that guides the selection of the three indicators mentioned above. The exercise of this analysis refers to the spatio-temporal relevance of the indicators to be retained and, therefore, to the spatial information to be mobilized. The importance of the phenomenon of agricultural land consumption led to the need to spatially focus the various indicators on the outlying lands of N'Gaous. The spatial data exploited has allowed for a building of a database with reference to the year 2018, a period of profound spatial mutations (land occupation and use) in which the action of actors in terms of territorial management fits.

Discussions on the purpose of the results of the fieldwork revealed the need for spatial data that would make it possible, on the one hand, to qualify the agronomic potential of soil and, on the other hand, to measure and monitor the consumption of this potential by artificial spaces.

RESULTS AND INTERPRETATIONS

The 1977 census indicated a population of 9,284 compared to 4,887 in 1966. Although higher than the average for small towns (4.6%), N'Gaous' growth rate declined substantially to 6%. This is due to the relative stagnation of migration resulting from the displacement of populations to other more attractive areas (Batna, Setif, and Algiers). Blind consumption of agricultural land by the urban growth will come to a halt through ordinance N° 71-73, carrying the nationalization of agricultural lands and through ordinance N° 74-26 carrying the nationalization of the urban land. During this period, it is observed that N'Gaous experienced major economic difficulties related to the context prevailing after decolonization. Houses of traditional rural character, scattered at the gates of the village on agricultural land, were built. This primary extension outside the core expresses an apparent disparity in the built environment between the initial core and these first extensions.

During the period 1977-1987, the population of N'Gaous increased by 5,848 inhabitants, from 9,284 in 1977 to 15,132 in 1987, at a rate of 5.0% per year compared to 6.0% for small towns. This demographic evolution can be

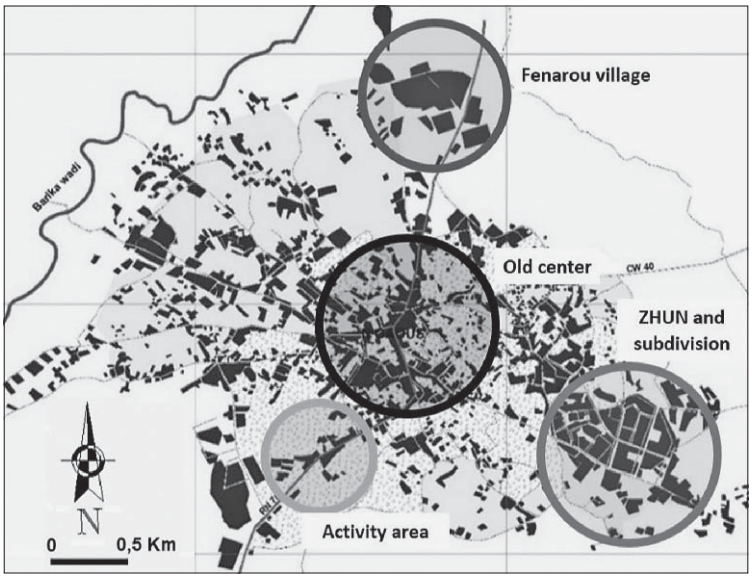


Fig. 3 N'Gaous, a radioconcentric city with a fan-shaped breakdown

explained first by more births than deaths, a logical consequence of the improvement in health conditions, where the mortality rate, including infant mortality, decreased significantly, consequently leading to an acceleration, sometimes spectacular, of natural population growth (3332 people), and, second, by a migratory balance that remains relatively constant (2516 people; Fig. 2).

Originally a rural town, N'Gaous has adapted its rurality to the needs of urban recreation as it has grown from a village into a city. A large part of its orchards has disappeared in favor of communal and private housing developments. However, local authorities are aware of the seriousness of the situation, and for this reason, strict measures have been taken to preserve agricultural land. A building permit is only issued on an agricultural parcel if the applicant is the owner and the use of the house is strictly personal.

Despite these measures, orchards are declining. That is why the city of N'Gaous presents a mosaic of vegetation and mineral; sometimes, an urban island in the middle of trees, sometimes an island of fruit trees in the middle of urban constructions. This image offers a landscape, both urban and rural (Fig. 2).

At the 1998 census, the city of N'Gaous had a population of 25,766 inhabitants, compared to 15,132 in 1987, corresponding to an annual growth rate of 4.6%, higher than the national average for small cities (3.8%). As a result, immigration is its main factor of demographic growth, coming in particular from the communes near the city.

The city of N'Gaous has urbanized rapidly following its promotion to the rank of the chief town of Daira in (1984), which has resulted in the excessive consumption of the peri-urban lands. This new administrative function led to the establishment of public services in socio-educational, administrative, and health realm, turning it into in a new urban centre. A Master Urban Plan from 1986 consequently forced developers and elected officials to consider the status of urban agricultural space.

Simultaneously, the commune has embarked on a massive program of housing estate development to suit the population's demands. Their designs are straightforward: They feature dwellings constructed on plots of 150 to 200 m^2 and consisting mostly of a first floor and an upper story. The latter is not necessarily completed as its building is contingent upon the financial resources of the owner. They are half rural, half urban dwellings designed for affluent rural immigrants determined to erect a roof by whatever means necessary and for renters desiring a pleasant "home".

Figure 2 shows that agriculture occupies gaps that are neglected almost to the point of obscurity because they are incompatible with the classical harmony of the city. It will require all local government's attention to understand that these vacant areas are an inherent part of the urban fabric and form a necessary structural element that must be addressed.

The critical fact about this period is that the bulk of these outlying communities, or pieces of land, were privately owned, allowing for the development of massive spatial extension activities to accommodate newcomers. This fast urbanization is a result of a major demographic overflow and a desire to be closer to the city's amenities (school, work, housing, electricity).

TABLE I EVOLUTION OF EMPLOYMENT BY BRANCH OF ECONOMIC ACTIVITY BETWEEN 1977 AND 2018 (IN %)

Year	Agriculture		Construction		Industry		Services		Total workers
1977	244	22.30%	232	21.21%	123	11.24%	495	45.25%	1094
1987	156	6.07%	283	11.01%	247	9.61%	1885	73.32%	2571
1998	233	5.52%	379	8.97%	763	18.06%	2849	67.45%	4224
2008	336	4.72%	495	6.96%	2127	29.93%	4148	58.37%	7106
2018	1421	10.12%	645	4.59%	5929	42.25%	6036	43.01%	14031

The city of N'Gaous has a population of 33,515 residents as of the 2018 census. The latter disperses its communities across an ever-expanding territory. Between 1998 and 2018, the built-up area more than quadrupled in size. It is highlighted that urbanization and agricultural decline coexist, giving rise to increasingly varied activity dominated by the tertiary sector. The process of residential mobility that began during the decade continues with an accentuated scope. Rather than being delayed, the urban front, voracious for space, has burst towards the whole of the gardens in a fan-shaped manner (Fig. 3), using the periurban grounds as a support point. It continues to grow at an accelerated speed, despite public pressure on lot beneficiaries, resulting in expansions in oil fields devoid of basic facilities and, as an added benefit, in the excessive consumption of land, obliterating any attempt of space optimization.

In summary, the city of N'Gaous is a pretty unique instance; it is a mosaic of plants and minerals, at times an urban island surrounded by trees, at others a fruit tree island surrounded by urban structures. This picture depicts an urban and rural setting; in reality, it depicts a metropolis in the countryside. The city's districts are spread out across an ever-expanding territory, and its fabric, which lacks a regular and organized grid, coexists with these gardens, transforming it into a green metropolis in a diluted system along the roadways supplying the peripheries. The farmer who builds his home in the center of his orchard is responsible for this swarming. Thus, N'Gaous is one of the few cities that has retained its agricultural areas despite its development at their cost.

ANALYSIS

The analysis of Table I reveals that the agricultural sector has declined in importance over the last few decades, from 22.3% of the workforce in 1977 to 6.1% in 1987 and 5.5% in 1998, despite the fact that agriculture is the region's vocation, indicating that the workforce is shifting toward more lucrative and less strenuous work. The construction and industrial sectors have remained stagnant, accounting for only 27% of the active population, despite the presence of production units (Emac and Enajuc factories for shoes and apricot processing) that employ workers from outside the municipality; whereas the tertiary sector has exploded, rising from 45.3% of occupied workforce in 1977 to 73.3% in 1987 and 67.5% in 1998, establishing itself as the driving activity in the municipality (high school, hospital, vocational training center).

Economic activity continues to be a significant driver of urban expansion in N'Gaous. Nevertheless, a 2018 survey found that the percentage of influxes continues to grow as a result of urban development on all azimuths.

In 1977, employment in N'Gaous was equally divided across all sectors, with agriculture accounting for one worker in four; the rest is employed to the tune of 45% in the tertiary, 22% in construction, and 11% in the processing industry of fruit productions. The city's promotion as a daïra in 1984 increased employment in the tertiary sector, particularly in public services, as a result of the management of newly acquired facilities. Additionally, the apparent decline in agricultural employment does not reflect a decline in agricultural activity but rather a conversion of a portion of its workforce to services and administration, as arboricultural activity is seasonal.

In 1998, the secondary sector was supplemented by the creation of a shoe factory, which offset the tertiary sector's weight and rebalanced its internal structure in favor of commercial activity.

Since the 2000s, municipal governments have reinforced their efforts by providing assistance to farmers who practice urban agriculture, actively encouraging the return of agricultural activities for the promotion of agro-industry, and ensuring the sustainability of community garden plots in the face of real estate pressure.

According to Fig. 4, the engine of the economy in N'Gaous is arboriculture, followed by related industries; paradoxically, employment is dominated by the tertiary sector due to the city's new position and the development of related activities. N'Gaous is a relay center; its physical location is the barycenter of a triangle whose apexes are the rival urban centers of Merouana, Barika, and Ain Azel in an arboriculture area.

The attractiveness of the city of N'Gaous was quanitified by examining public utilities (health and education) in conjunction with the transportation sector. This appeal has a direct effect on the city's urban sprawl. N'Gaous has a polyclinic, a health center, and a 240-bed hospital in the health sector. Apart from outpatient treatment, the hospital registered 12,361 hospitalizations in 2018, all of which originated in the communes of its daïra and its environs. This infrastructure is in high

demand because of the high level of care given and the skill of its medical and paramedical employees (Direction of Planning and Development of the Territory of Batna 2018).

Thus, 2667 patients come from N'Gaous (21.6% of the total), 779 from Boumagueur (6.3%), and 1013 from Sefiane (8.2%), for a total of 4462; 3437 patients (36.1%) under the communes that comprise its daira; 1910 patients are from Ras El Ayoun, 1613 Gosbat, 988 Guigba, a total of 4511; 3474 patients (36.5%) from the communes of the daira of Ras El Ayoun, 990 patients from Ouled Si Slimane, 482 Lemsene, 815 Taxlent, or 2448; 1885 patients (19.8%) coming from the communes of the daira of Ouled Si Slimane and finally 939 patients of Rahbat (7.6%), commune of the daïra of Ouled Sellam. As observed in Fig. 5, the strong influence of health facilities, both by the number of hospitalized and by the number of localities covered, the sector devotes 2/3 of its capacity to the service of the daïra of its region (in the circle of about 50 km).

In terms of secondary education, the city of N'Gaous is served by three high schools, two of 1000/300 and 760 posts each, and a 1000/300-seat technicum. The combined secondary cycle of the city's three-four structures accommodates 3736 students, of whom 2600 are from N'Gaous (69.6%), 265 from Boumagueur (7.1%), and 41 from Sefiane (1.1%), municipalities that are part of the city's daira; the remainder comes from the neighboring daira of Ras El Ayoun, with 11 students from Gosbat (0.3%), 30 students from Ras El Ayoun (0.8%).

Two factors account for this influence: the city's core location in this rural setting is somewhat remote from other cities of comparable size within a 50-kilometer radius, and the city has benefitted from a program to construct educational infrastructure that fits the region's youth requirements. However, its area of appeal extends farther to the northeast, including the communes of Taxlent and Ouled Si Slimane that were once part of its daira but have since been absorbed into Ouled Si Slimane; while, to the south, it is restricted to the official limits of its present daira (Fig. 5).

The attractiveness of the city through the means of transport mentioned in Fig. 5 confirms the links that unite it to its environment. The center dominates relations with the communes in its territory and those of Ras El Ayoun to the northeast in all areas, while its relations with Batna are those of a subordinate urban center, and exchanges with Barika are balanced and are of an economic nature. The current means of connection, which is the minibus for the small distances which separate the small city from the chief towns

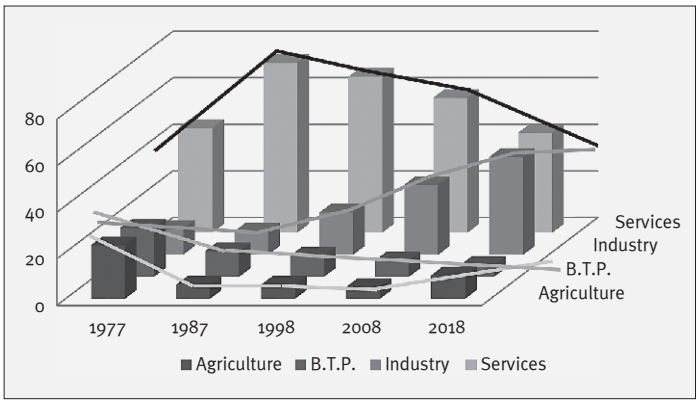


Fig. 4 Evolution of economic activity per branch from 1977 to 2018

(approximately 20 km), ensures more than 305 rotations per day. Its important economic potential, its level of appreciable equipment and its dense road network make of the city a dynamic center which serves the localities of its territory and those of its environment, pushing back even the limits of the neighboring influences (Mérouana and Aïn-Azel), whereas that of Ras El Ayoun is largely absorbed.

In sum, the city, unquestionably, exerts a multiform attraction with its rural environment directly or indirectly. Motivations for this attraction are diverse and numerous, daily or permanent. Permanent, they are related to the unprofitability of agriculture, the arduousness of agricultural work, rural un-

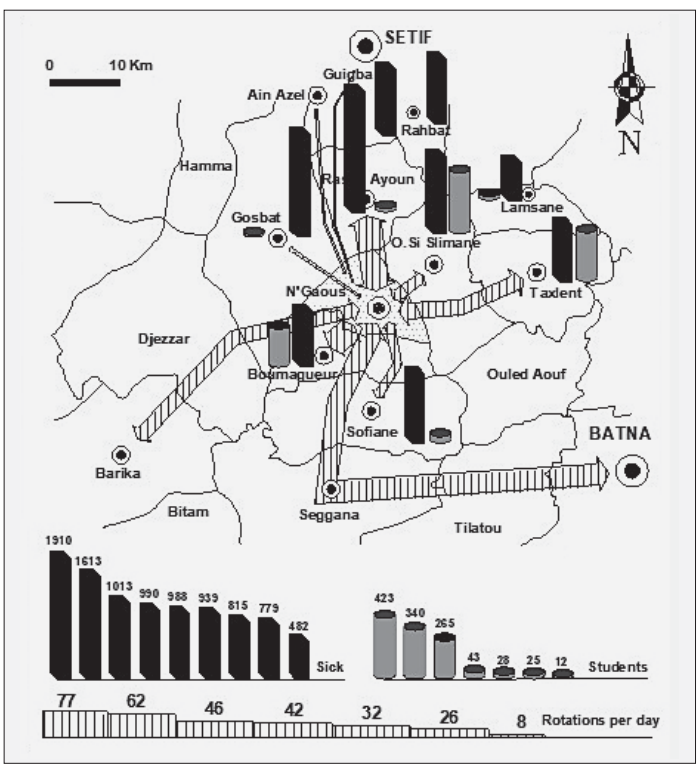


Fig. 5 The city of N'Gaous exerts a multiform attraction on its environment

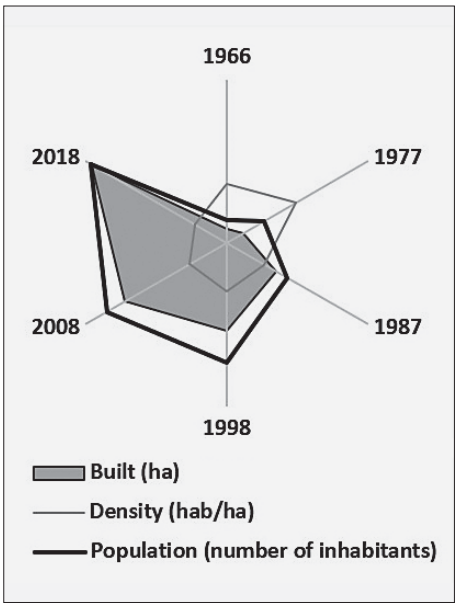


FIG. 6 CONSUMPTION OF RURAL SPACE AND EVOLUTION OF URBAN SPACE

employment, the comfort of urban services and the dynamics of the tertiary sector, etc., because city dwellers in this center, both rural and urban, are looking for the advantages of the city and the countryside combined, without their disadvantages, for the proximity of jobs, services and culture, linked to their centralities. This has led to a maximum artificialization of the gardens surrounding the city. Micro and macro socio-economic factors interact: means of transport, the land market, individual preferences for residential location, demographic changes, the attractiveness of the city.

DISCUSSION

From a technical standpoint, the cartographic and GIS approaches were deployed in estimating the changes that happened between 1966 and 2018, demonstrating a large spatial expansion equal to 69% of the entire urbanized area (Fig. 7). By conducting quantitative field surveys, local residents' true impressions of the destruction of agricultural land by urban development would be explored. The findings indicate that the town of N'Gaous's urban expansion has resulted in a spatial recomposition characterized by the steady retreat of agricultural regions in favor of built-up areas (Fig. 6). As the urban frontier spreads, the city's image deteriorates as developments on orchard land plots violate all urban planning standards. Certain types of expansion create enormous difficulties and exclude any sort of control over the management and growth of space. This circumstance is a result of a desire to possess a single-family house.

Similarly, the survey shows that the urban center is organized in a radioconcentric logic; a belt of apricot trees (600,000 apricot trees on 420 hectares) surrounds the city. The peripheral space is a food belt under the city's influence, allowing it to be supplied directly. The image of nourishing and essential agriculture remains present in the minds of city dwellers who praise "miniature" agriculture (Vidal & Fleury, 2009).

Beyond the orchards, there is an area of intensive, high-yield crops, mainly market gardening, covering 570 hectares. Despite industrialization, the city and agriculture are still closely linked. The city still needed local agriculture on the outskirts of the city, especially because the means of transportation were limited and rather slow. This agriculture allows a certain transition from the city to the countryside, despite the fact that it is often threatened by its consumption because it is considered a land reserve in answer to private actors and neglects the function of food production.

Fig. 8 illustrates the development of the urban area in relation to population increase. It represents the territory's uniqueness and history. Behind the "dynamics" of space consumption, one must detect techniques for population reception that, depending on the region, follow distinct logics but are all highly influenced by the individual's economics. These changes are indicative of a loss in agricultural land that is highly productive (Table II).

There is a remarkable emergence of a metropolis whose production and consumption are shifting back to agriculture. While the city of N'Gaous is far from avoiding the spread of peri-urbanization, it is making strides in maintaining the core green zone (Fig. 9). From now on, in the context of N'Gaous, returning to the land and caring for apricot gardens at the city's gates has developed into a privileged relationship of goodwill, and appears to have completed its transformation from agriculture considered and organized to feed humans to an "agrarianization" of places and men sharing the same space. As a result, it is suggested to properly inquire about the degree to which agriculture is evolving into a new instrument for urban development. In summary, the appeal of N'Gaous is shown by the urban area's expansion, which is surpassing population growth.

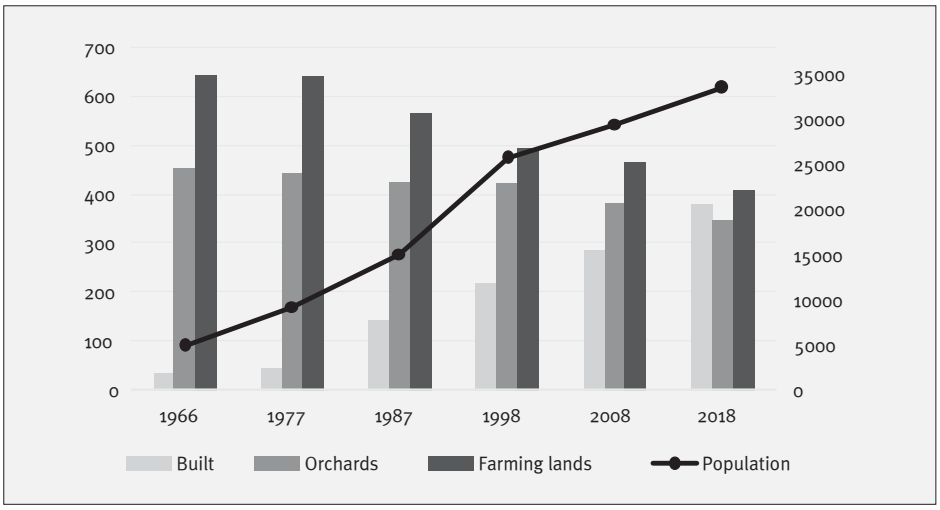
This attraction to this portion of the territory has resulted in phenomena such as:

– "De-densification" of the old and dilapidated city center increases the consumption of space in order to have an airy, and therefore not very densely populated, individual habitat and a decent housing.

– New lifestyles (shrinking of households) can explain in part this situation.

– The increased need for equipment, infrastructures, services and utilities in the attractive areas that appear to be "better provided for" than in the city center.

FIG. 7 N'GAOUS, EVOLUTION OF THE URBAN AREA FROM 1966 TO 2018



Faced with this position, local decision-makers must aim to maintain as much control over property as possible in order to influence city growth decisions and promote urban redevelopment. However, they must also strive for compactness in order to maximize the surface area and prevent land consumption, or enhance the multi-functionality of peri-urban places shared by city actors, and thereby foster a more acceptable mix (shared parking, common commercial, and service spaces). The territorial players must adopt and share the same reality of the stakes associated with space usage.

Conclusion

The current study aimed to highlight the phenomenon of the urban sprawl in the Algerian city N'Gaous. To define the implications of the phenomenon, it was necessary to adhere to urban planning standards and to implement the terms of the management plan, which are included in the city's master plan. That is why the results call upon rational land use and planning and the balance between the urban-rural realities. Apart from N'GAous, and, more widely, Algerian cities, it is indisputable that the city has lost its unfavorable reputation as a "tutelary parasite" in order to exert progressively unilateral dominance over the surrounding countryside. The city-countryside binary looks to be shifting progressively in favor of the metropolis, for which rural regions have provided suffocating contingents of peasants. The interest of this paper has been to provide practical results that contribute to improving the challenges of peri-urban agriculture in the Algerian context, which is strongly marked by rapid demographic and urban growth.

The case of N'Gaous has offered an opportunity to put the concept of an agri-urban system to the test. This has allowed for the understanding of the breadth of the city's exploring links with agriculture. Additionally, it facilitated the collection of data on the actions, uses, and arrangements of urban agricultural actors.

To this end, the findings emphasize the critical role of adaptive governance in the ongoing construction of sustainable agricultural production, in addressing environmental challenges, in reconciling rural and urban lifestyles, and in renegotiating the relationship between the city and agriculture for sustainable development: all of which are enabled by these unprecedented glimpses into rural life, using planner-like tools.

This paper proposes an analytical technique for assessing the urban sprawl in a city that decision-makers may utilize to ensure sustainable urban growth. Moreover, the research reveals that the analytical method, combined with Geographic information systems (GIS), is beneficial for urban planning and monitoring and a future regulation of new urban projects.

As for recommendations, decision-makers are accountable for enforcing and adhering to the rules, as residents construct dwellings to suit their housing requirements, which the state was unable to supply due to the silence of competent authorities. In other words, the future of Algeria's urban form is determined by the country's selected territorial planning strategy.

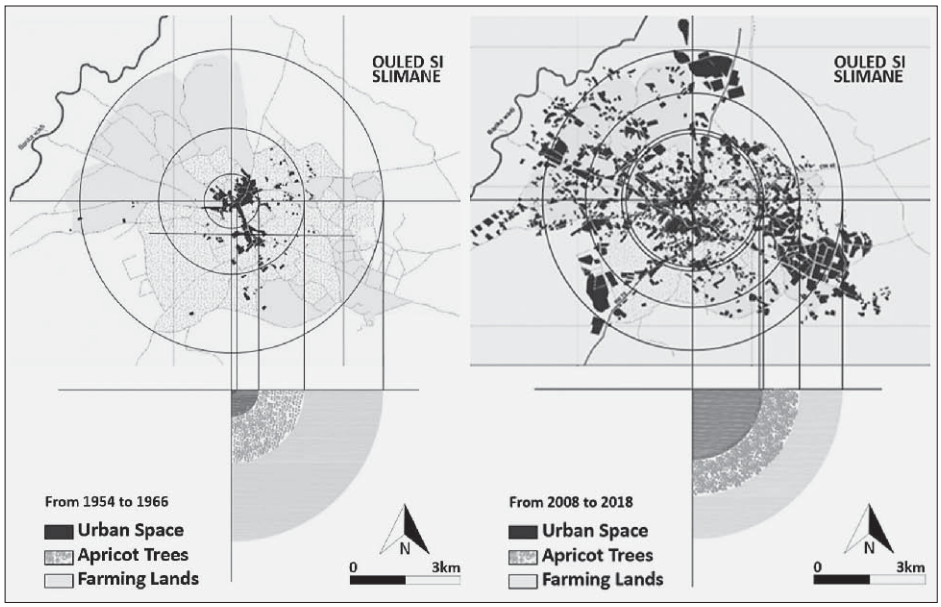
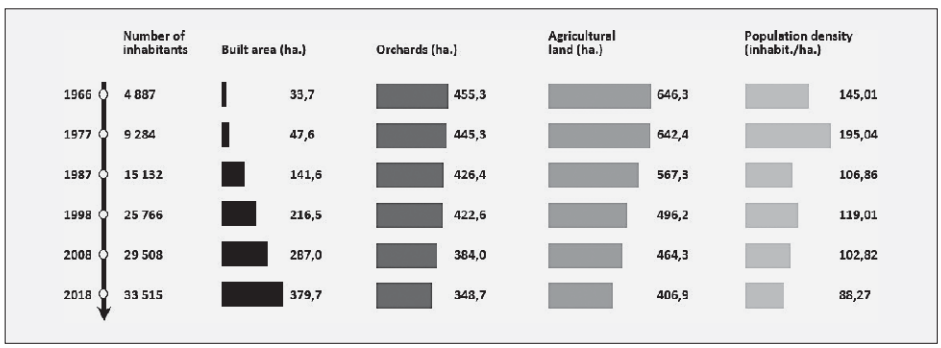


Fig. 8 The shift of N'Gaous from a rural center to a fragmented city (above)

Table II Distribution of the surface area of the territory and the population of the city of N'Gaous between 1966 and 1998

	1966	1977	1987	1998	2008	2018
Built area	33,7	47,6	141,6	216,5	287	379,7
Orchards	455,3	445,3	426,4	422,6	384	348,7
Farminglands	646,3	642,4	567,3	496,2	464,3	406,9
Trees	646 427	632 229	605 395	600 000	545 196	495 503
Population	4 887	9 284	15 132	25 766	29508	33515
Density	145	195	107	119	103	88

Fig. 9 Consumption of rural space and evolution of urban space



AUTHORS' BIOGRAPHIES AND CONTRIBUTIONS

Dr. **IMEN BENDJEMILA** is a doctor, a teacher, and a researcher. She attained the rank of Master of Conferences. Dr. Bendjemil is currently conducting research related to the development and urban sprawl of cities and her work is focused on the identities of Maghrebi coastal cities.

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Conceptualization: I.B. & S.C.; methodology: I.B. & S.C.; software: I.B.; validation: I.B.; formal analysis: I.B.; investigation: I.B.; resources: S.C.; data curation: I.B. & S.C.; writing-original draft preparation: I.B.; writing-review and editing: I.B. & S.C.; supervision: S.C.; project administration: I.B. & S.C.; funding acquisition: I.B. & S.C. Both authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENTS

The authors are grateful to Urbanism and Environment Laboratory for their contribution to the current research. The author is also grateful to Selma Zouaoui for her significant contribution to proofreading the article.

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Illustration sources

Fig. 1	*** 2020b, treated by authors, 2020; photos: authors, 2022
Fig. 2	*** 2020d, authors' interpretation, 2018
Fig. 3	*** 2020d, authors' interpretation, 2018; photos: authors, 2022
Fig. 4	*** 2020c, authors› interpretation, 2018
Fig. 5	Personal survey of the Batna health department, 2018
Figs. 6-9	*** 2020a, treated by authors, 2020
Tables I-II	*** 2020c

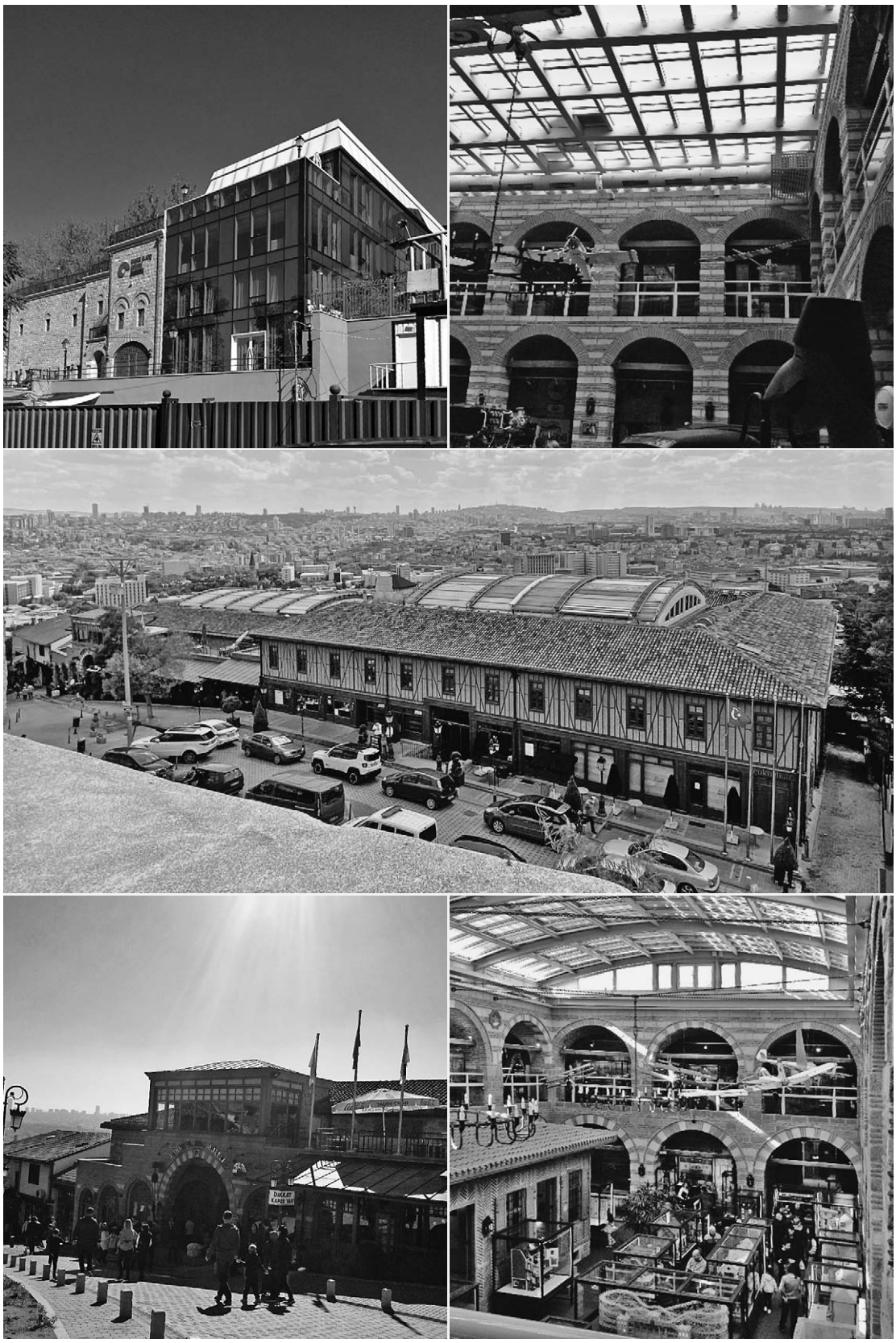

Fig. 1 Examples of waqf buildings renovated by the Koç Foundation:
– Safran Han (top left and right): refunctioned as a museum in 2016
– Çukur Han (in the middle): redone to be used as a hotel in 2010
– Çengel Han (bottom left and right): refunctioned as a museum in 2005

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Scientific Subject Review
https://doi.org/10.31522/p.30.1(63).7
UDC 623.68 (560) (73) "19/20"
Technical Sciences / Architecture and Urban Planning
2.01.04. – History and Theory of Architecture and Preservation of the Built Heritage
Article Received / Accepted: 12. 12. 2021. / 14. 6. 2022.

Historic Preservation in Turkey and the United States: a Cross-Cultural Comparison

cross-cultural comparison
historic preservation
non-governmental organizations
the United States
Turkey

The research examines and compares the various roles of governmental and non-governmental organizations (NGOs) in Turkey and the United States, aiming to assess how they shaped the preservation field and their potential knowledge transfer values. The study was conducted in governmental archives, official websites of related organizations and through oral communication and literature surveys related to preservation foundations, NGOs, and waqfs in both countries – with different national, historic, religious, and cultural characteristics. The parameters used as cross-cultural comparison included primary actors and main legislations in preservation both in history and at present. The research has revealed that the waqf system in Turkey has a deep-rooted historic, religious, and socio-cultural context, and differs from the preservation foundations in the USA in many respects. Yet, the foundations established in and after the 20th century in Turkey and the preservation activities of foundations in both countries also share similar motives, stimuli, and objectives to preserve both natural/cultural heritage and cross-cultural comparisons suggest that they may learn from each other by knowledge transfer.

Introduction

Cultural heritage is an important part of society's social, cultural, and economic well-being. Governmental institutions and the countries' private sector work together in the architectural preservation of the built heritage and in doing so, both national and international legislation, standards, and guidelines are applied. Existing approaches to architectural conservation mostly tend to seek an answer to "how" and "why" preserve (Ahunbay, 2004: 8; Kuban, 2000: 54, 58; Madran and Özgönül, 2005: 57; Tümer, 1997: 19-21; Zakar and Eyüpgiller, 2015; Page, 2016: 19-67; Wagner and Patterson-Tiller, 2018; Tomlan, 2015; Meeks and Murphy, 2016). However, to better understand the answers to these questions, it is also important to question the main actors in historic preservation and to ask the question of "who". Hence, in this study "how" and "why" to preserve is discussed shortly and due to the lack of literature on the efforts of preservation actors, it is aimed at examining the role of state institutions and private foundations, waqf[1], and civil society organizations in historic preservation in the context of two different countries. Thus, the question of "who" is equally important and is in the focus of the paper.

Turkey and the United States, which have rather different legislations, organizations, and even terminologies in the preservation field, have been chosen as the case study countries. There is a limited number of studies on the cross-cultural comparison of heritage preservation in the United States, Britain, Europe, and Asia (Barthel, 1989: 87-105; Fung et al., 2017: 927-942; Keune, 2003: 353-382; Ornelas et al., 2016: 725-732; Quintard-Morenas, 2004: 137-190; Stubbs and Makás, 2011; Xu, 2017; Yang, 2014; Wang, 2007; Yeomans, 1994: 159-178). There are also quite a few studies on the preservation of built heritage by foundations and the waqf system in both Turkey (Akar, 2009; Dedehayır, 2010; Keskin, 2015; Madran, 1996, 1997, 2004; Öztürk, 2007; Şahin and Güner, 2006) and the USA (Howe, 2003; Merrill, 1980; Mulloy, 1976; Murtagh, 1997; Wood, 2010). The studies focus on the preservation activities in each country, and thus lack a comparative context. However, cross-national and cross-local comparisons can be useful for transferring knowledge for contemporary studies (Alterman, 2010). In the same way, such a comparison is essential to understand the role of NGOs, state and community involvement, conservation mechanisms, and to reveal advantages and disadvantages in architectural preservation in both countries. That way both heritage regulation makers and heritage users of each country may learn from each other by transferring their strengths and/or re-arranging the weaknesses. The main arguments in favour of such a comparison of these two cases are presented below:

– Despite the very differences in each country, there are also links and relationships in the preservation field/policies, and the preservation legislation in each country plays a similar role and functions to resolve problems/dilemmas in historic preservation practices. Therefore, by revealing links and comparing preservation practices and policies, practitioners in the preservation field might have the opportunity to exchange knowledge about alternative approaches to preservation and could benefit from a comparative experience in order to enhance the sustainability of built heritage.

– Cross-cultural comparisons of two different countries with two long-established systems (waqf versus NGOs), should also enable legislators and practitioners (in both the public and private sector) to gain knowledge about an alternative legal framework, actors' participations/engagements, and their main stimulus/motivations in the heritage preservation, making it possible to come up with better solutions, face challenges, and avoid past failures.

– Last but not least, such a comparison reflects various public, national, social, and cultural conditions of each country, making systematic mutual learning/development and sustainable management of heritage preservation a possibility in case they are well-analysed.

Methodology of the Research

The research method included literature survey, historic and archival research and cross-cultural comparisons in Turkey and the USA. Archives of the Directorate General of Foundations (DGF) Department of Culture and Registration in Turkey was applied for the waqf deeds of the monuments and for their translations in order to gain knowledge about the terms and conditions of waqf documents. Waqf documents on Sultan Suleyman Khan Waqf, Nurbanu Valide Sultan Waqf, Sultan Keykavus Waqf, and Bursa Yıldırım Bayezid Waqf were examined in detail. In addition, the Foundation Services Department was applied and the experts in the department were interviewed for the data on new and old foundations to specify the ones related to the preservation field. The author also experienced the Cultural Heritage Conservation Board meetings in Ankara and Karabük in 2005-2008 as the institution representative member of the Ankara Regional Foundation Directorate Office. In the USA, similarly, the author attended the Minnesota State Review Board meeting in late 2012 as a guest participant. That way it became possible to interview Conservation Board members and gain experience about Conservation Board meetings in both countries, as well as about various conversations, decisions, and perspectives on historic preservation in both Turkey and the USA. Data on registered historic properties in both countries has been provided from the official websites of the Ministry of Culture and Tourism in Turkey (MoCT, 2022a) and the National Register Database and Research in the USA (NRDR, 2022). Similarly, primary legislation, by-laws, resolutions, organizations, standards, guidelines, and higher education programs on historic preservation were provided from the official websites of related institutions (National Park Service-NPS, Ministry of Culture and Tourism-MoCT, T.R. Presidency Legislation Database System-PLDS, Council of Higher Education-CHE, Preservation Directory) in both countries (Council of Higher Education-CHE, 2022; NPS, 2018a; NPS, 2018b; NPS, 2021a; NPS, 2021b; Preservation Directory, 2022; MoCT, 2022b; PLDS, 2022).

The research covers the development of historic preservation, various preservation legislation, and organizations in both countries, a clarification of the roots and history of different NGOs, foundation/waqf systems, and their role in preservation activities and the questions of "how" and "why" to preserve in each country. What follows is a cross-cultural comparison in the preservation field held by foundations, revealing their similarities and differences, as well as potential advantages and disadvantages, in order to develop a transfer of values.

Turkey and the USA have been chosen as the case study regions for cross-cultural studies first, because they have different historic backgrounds and legal frameworks on the field and, second, have different cultural, social, national, religious, economic, geographical, landscape, and climate characteristics, which all shape preservation activities. Their total area and population density also differ. Regarding the governmental, institutional authorities, and civil society working within the preservation field, the two countries have highly different organizational frameworks and historic roots (waqf versus NGOs). Regarding the similarities, both have abundant and diverse heritage properties similar in number, of international significance, national, or local importance, which are under legal protection.[2]

This increases tourism potential related to built cultural heritage and presents a pool of similar challenges and opportunities in terms of preservation and urban development. In addition, both countries have their own preservation legislations, as well as adopted international preservation charters and conventions, dedicated to the enhancement of heritage preservation. Similarly, they both have a dynamic history hosting various identities, which influence the management, function, and owners of heritage buildings/areas, and both of them were also influenced by their neighbours or multi-ethnic societies throughout history. Despite their different sizes, culture, and economy, public participation can be observed in preservation practices, affecting the cultural heritage management and development in both countries. There is also community involvement and public-private partnership in both Turkey and the USA, which has been beneficial for the preservation of different types and scales of cultural heritage. Lastly, in both countries, a master's program in historic preservation started in the same years, proving the increased level of consciousness and emphasis on the scientific importance of the preservation field.

Differences and similarities attract the attention of a deeper study which should reveal the very reasons and transfer potentials for the betterment of preservation studies in both countries.

1 Waqf means "to prohibit the selling or buying of an immovable and donate it for the use and welfare of the public" (Madran, 2004: 143).

2 Since 1966, more than 95.000 historic properties (in total 96.643 buildings, structures, districts, and sites) have been registered and listed in the National Register of the USA (NRDR, 2022), and the number of registered historic properties in Turkey has reached to 119.263 by the end of 2021 (MoCT, 2022a).

Preservation in Turkey

In Turkey, until the mid-19th century, Islamic provisions and the waqf system, first started in the Seljuk period and continued up till the end of the Ottoman period, provided the most effective regulatory system in the field of conservation. Regarding the questions of "why" and "how" to preserve; waqf institutions were based on charitable giving, serving God forever, and concepts of alms and offerings of the Koran, establishing many buildings or complexes such as mosques, madrasahs, baths, imarets, and hospitals[3] (Akar, 2021: 87-104). The philanthropic people, who established the waqf institution, also donated an income-generating property to this institution and ensured that the services, including repairs and maintenance works, were provided uninterruptedly in the institution. Waqfs include a written endowment deed to formalize all the donated goods and incomes and include information on their status, how the income was collected, and where and how it would be spent. It was in 1839 with the Tanzimat period that the institutionalization of the waqf system and legal regulations in repairs started (Madran, 2002: 14-15; Madran, 1996: 60; Dişli and Günel, 2020). Ebniye Regulations (1848), Municipal Provisions of Şehremenati (1855), and Turuk and Ebniye Charter (1864) all included indirect regulations on the repairs of cultural heritage, but it was in 1869 that the first legal regulation on the protection of cultural heritage (Asar-ı Atika) was adopted. In 1874, 1884, and 1906 the second, third, and fourth Ancient Monument Regulations were adopted, respectively. The Conservation of Monuments Act was adopted in 1912 for the protection of monuments from demolition that requires authorization, and in 1923 the Turkish Republic was established, so all the remains belonging to earlier cultures were accepted as the common heritage (Jokilehto, 2011: 245). In 1917, a conservation council, mostly responsible for the registry of monuments throughout Istanbul, was established and later, with a new regulation in 1924, renamed the Committee for the Protection of Old Monuments, making it compulsory for both the state and individual actors to take permissions from this new commission for any restoration interventions (Açıkgöz, 2014). In 1933, a new Commission, responsible for the conservation of monuments in the whole country, was established and giving impetus to national listing and documentation. In the Early Republican period (1923-1950), the restoration of monuments in Istanbul went through coordination problems and inter-institutional conflicts. There was also an intense restoration program, in most cases extending the building itself and causing the destruction of adjacent structures for the sake of increased visibility and modernization via urban transformation projects (Açıkgöz, 2014; Dinler, 2021). Açıkgöz (2014) interprets this situation as a kind of appropriation, either in the form of refunctioning of old monuments or 'stylistic, periodic, and dynastic classification' of heritage buildings all discursively aimed at emphasizing the national label, Turkish patrimony. He further argues that in the Early Republican period, historic preservation was an effective way to exhibit the nascent power of the nation-state and to increase its authority on society, while their diplomatic significance, national prestige, construction period, and patrons of the monuments were the primary factors affecting preservation decisions (Açıkgöz, 2014).

With the establishment of the first expert agency, the High Council (HC) for the Historic Real Estate and Monuments in 1951, new discussions on conservation began, such as conservation of historic areas as well as individual buildings, and HC operated as the scientific body of the centralized authority (Şahin-Güçhan and Kurul, 2009: 22, 26, 28; Dinler, 2021). Later, Antiquities Law No 1710 was accepted in 1973, which introduced the term 'conservation site' for the first time as part of "integrated conservation" (Dinler, 2021). The HC continued its duties until the adoption of the Law of 2863 on Conservation of Cultural and Natural Property in 1983. With the amendment of this Law, in 2004, some major changes were observable both in institutional and regulatory areas in preservation works. Thus, new responsibilities were given to the local governments, resulting in the increasing localization of the conservation activities (Table I). In addition, according to Aykaç (2021) with the establishment of the Turkish Cooperation and Coordination Agency (TİKA) in 1992, the Neo-Ottomanizm policy, first emerged in Turkey in the 1980s, accentuated the political, cultural, and economic influence of Turkey, including heritage conservation activities, in the regions where Ottoman Empire was dominated once over, and in early 2000, this policy was more strongly acknowledged. She further argues

3 As an example, most important building complexes in Anatolia such as the Suleymaniye Mosque Complex, Atik Valide Mosque Complex in Istanbul, Sivas İzzettin Keykavus Hospital, and Bursa Yıldırım Bayezid Mosque Complex were all constructed through the charitable giving of waqfs established by the sultans or important people. For more details, see their waqf deeds: Archives of Directorate General of Foundations (case no: 135, new classification no: 52, general 1390) undated foundation deed belonging to the "Sultan Suleyman Khan Waqf"; Archives of Directorate General of Foundations, in Notebook No. 1426 and 2113, Sultan II. Selim Khan's wife Nurbanu Valide Sultan (Atik Valide Sultan) Waqf in Arabic, dated 990 H. (1582 M.); Arabic waqf deed belonging to the Sultan Keykavus Waqf dated 618 H. registered in the Archives of Directorate

Table I Primary regulations and organizations related to historic preservation in Turkey

1.	Establishment of Old Armoury and Artefacts Collection Museum	1846
2.	Ebniye Regulations	1848
3.	Establishment of Şehremenati (Municipality)	1855
4.	Turuk and Ebniye Charter	1864
5.	First Ancient Monument Regulations	1869
6.	Second Ancient Monument Regulations	1874
7.	Regulations for the Construction and Repair of State-Owned Buildings	1877
8.	Ebniye Law	1882
9.	Third Ancient Monument Regulations	1884
10.	Fourth Ancient Monument Regulations	1906
11.	Conservation of Monuments Act	1912
12.	Ancient City Walls and Castles to be left to the municipalities and the governor's officers Act of 578	1915
13.	Establishment of the Permanent Organization of the Conservation Council of Ancient Monuments (Muhafaza-i Asar-ı Atika Encümeni Daimisi)	1917
14.	Establishment of Turkish Monuments (Asar-ı Atika) Directorate affiliated to the Ministry of Education	1920
15.	Acceptance of Turkish Civil Code numbered 743	1926
16.	Law of Municipalities	1930
17.	Municipal Buildings and Roads Law	1933
18.	Establishment of Commission for Conservation of Monuments (Asar-ı Atika Komisyonu)	1933
19.	The Law of Reorganization of DGF	1938
20.	Establishment of regional departments of General Directorate of Historic Artefacts and Museums (GDHAM)	1944
21.	Establishment of The High Council for Historic Real Estate and Monuments	1951
22.	Antiquities Law No 1710	1973
23.	Law on Conservation of Cultural and Natural Property, Act of 2863	1983
24.	Establishment of Ministry of Culture	1989
25.	Law of 5226, Amendment of Law of 2863	2004

that TİKA was involved in the conservation of Ottoman heritage in Central Asia, the Balkans Peninsula, the Middle East, and North Africa by using multiple neo-Ottomanism policies as a convenient tool for constructing Turkey's transnational heritage-making (Aykaç, 2021).

– **The role of foundations in historic preservation in Turkey: history and development** – In Turkey, non-governmental organizations (NGOs) have been active in the conservation field since the Ottoman period. The waqf system[4] of that period already demonstrated civil society solidarity, working for the sake of the public, including maintenance activities without any incentive, such that in the 19th century, nearly 7% of the waqf income was allocated for the repair needs and expenses of the buildings. Under the conditions specified in the waqf deeds, the trustees conducted repairs for the most part before the Tanzimat period (before the mid-19th century). Only when the income of the foundation was insufficient for repair, did the state treasury intervene. In addition, among the employees of the large foundations were there permanent workers, called *'meremmetci'* responsible for regular maintenance and repair works (Madran, 2002: 9). Similarly, in the 19th century, the first non-governmental organizations on conservation and museology were first established. The Izmir Library and Museum Society (founded before 1878) is known as the first NGO in the conservation field in the late Ottoman period, requesting excavation and research permits from the governorship (Madran, 2002: 79). The Art Friends Society, founded by Osman Hamdi Bey, and the Turkish Association (1909) contributed indirectly to conservation studies through financial support or educational activities. The Assembly of Ottoman Engineers and Architects (1908), Assembly of Istanbul Advocate (1911), Izmir Assembly of Advocates of Ancient Monuments (1927), Turkish Touring and Automobile Association (TURING, 1923), Edirne Regional Association of Advocates of Ancient Monuments (1935), Association for the Conservation and Repair of Monuments in Turkey (ACRM; 1946), and Bursa Assembly of Advocates of Ancient Monuments (1946) were among other conservation organizations in Turkey in the early 20th century (Keskin, 2015: 27-33, 45; Madran, 2002: 80; Madran, 1997: 83-84; Şahin-Güçhan and Kurul, 2009: 38). Before the Republican Period (1923), the number of NGOs was rather small, but after the 1990s they increased rapidly, including the Society of Conservation and Restoration Specialists (KORDER, 1998), Foundation of Ankaraites (1999), and Foundation of Beypazarı Culture and Solidarity Society (after 1999; Şahin-Güçhan and Kurul, 2009: 38). The Union of Chambers of Architects and Engineers of Turkey (1954), Association for Conservation of Historic Houses (1976), TAÇ Foundation (1976), and ÇEKÜL Foundation (1990) were among the important NGOs originally established or with conservation activities before the 1990s. The Koç Foundation[5] (1969) and Sabancı Foundation (1974) also work in the field of restoration, though they were originally established for educational

General of Foundations, on page 288 and 138 of the book numbered 584; Bursa Imaret foundation of Yıldırım Bayezid Waqf dated 802 Ramadan / May 1400, Archives of Directorate General of Foundations, Müceddet Anadolu notebooks of 79 and 205, registered on page 45.

4 Waqfs were originally intended for socioeconomic welfare of poor and disadvantaged. But this system was rather different from the patriotically motivated first examples of historic preservation in the US.

5 As an example, Çengel Han, Çukur Han, and Safran Han were among the most important waqf buildings constructed in the 16th century in the historic city center of Ankara, and were all renovated with the financial support of the Koç Foundation in 2003-2016 under the inspection of Directorate General of Foundations.

purposes (Öztürk, 2007: 74-83; Fig. 1). Historical Cities Association (HCA; 2000), on the other hand, was the pioneer of a new understanding of civilization, localization, and mass movement in conservation activities by connecting the public with municipalities. That is why HCA is a good example of public-private partnership in preservation practices in Turkey, by promoting community integration, creating job opportunities, and enhancing heritage tourism and education activities. The Middle East Technical University (METU) was the first university in Turkey with its restoration graduate program established in 1964. At present, the Chamber of Architects of Turkey, private property owners, associations, societies, and universities are the main private actors in historic preservation.

– **General tendencies and institutional development in historic preservation in Turkey** – In the pre-1839 period, it was important to protect the 'economic and functional values' of mostly religious buildings through the waqf system (Akar, 2009; Dişli, 2013: 31-32; Madran, 2004: 140-144, Şahin-Güçhan and Kurul, 2009: 21-22). Especially in the Classical Ottoman period, religion was a very important factor for the conservation of waqf buildings, and the waqf institution provided continuous maintenance, and repair works of cultural properties, enabling a mitigation of the effects of natural disasters, threats, and risks in order to ensure their survival without the need for comprehensive repairs. Yet, this value-based protection approach, unawareness, religious conservatism, and financial obstacles, also caused a decay of heritage buildings (Madran, 2004: 37, 140-141). In the late Ottoman period, the first regulations mostly focused on archaeological works, excavations, and movable heritage/artifacts. In the Act of 1884, conservation was limited to properties belonging to the pre-Ottoman period, and only in 1906, did the term 'historic artifact' start to include the ones belonging to Turkish-Islamic and non-Islamic periods (Dişli and Günel, 2020: 4; Karaduman, 2004: 73-92). Considering the new developments, circumstances, and legislative designs in historic preservation, the 1960s and 1970s witnessed a "better institutionalization and conceptualization of architectural and urban heritage" (Dinler, 2021). At present, the governmental institutions including the Ministry of Culture and Tourism, Directorate General of Foundations, and local municipalities are still primary actors in architectural preservation in Turkey, while the number of NGOs and their budget in the preservation field is rather limited. The Ministry of Environment, Urbanization and Climate Change, Directorate of National Palaces, General Directorate of Highways[6], Turkish History Association, and governorships are other governmental institutions directly or indirectly related to heritage preservation.

Preservation in the USA

There were two distinct paths in preservation activities in the USA between the 18th and 20th centuries; private sector activities[7] and government involvement.[8]

Federal involvement in historic preservation, on the other hand, began after the American Civil War of the 1860s (Stubbs and Makas, 2011: 435). It was in 1872 that Yellowstone National Park was declared a national park of for the first time ever by the federal government, meaning that natural, together with cultural heritage, was accepted as properties that should be preserved (Lea, 2003: 3; Stubbs and Makas, 2011: 436; Tyler et al, 2009: 30, 61). The first federal funding for preservation activities was allocated for the Casa Grande ruin in Arizona, the nation's first National Monument, in 1889, and similarly, Cliff Palace Dwellings of Mesa Verde gained a National Park Status. The Antiquities Act of 1906 was the first preservation legislation. The National Park Service (NPS), established in 1916, was the first governmental administrative agency, responsible for the protection of national parks and environments, and systematic management and administration of properties (Jokilehto, 2011: 263).

At present, NPS is also responsible for the development of historic preservation standards/guidelines (NPS, 2021a), funding and administration of federal historic preservation programs (NPS, 2021b), and works in collaboration with state and local governments, NGOs, individuals, and tribal communities (Tyler et al., 2009: 31-33). The National Historic Preservation Act (NHPA) of 1966 is the main preservation legislation at present. The American Battlefield Protection Act of 1996, Historic Sites Act of 1935, National Environmental Policy Act of 1970, Abandoned Shipwreck Act of 1988, Archaeological and Historic Preservation Act of 1974, and Archaeological Resources Protection Act of 1979 present other complementary legislation in the preservation field (NPS, 2021b; NPS, 2018a). Among them, thanks to the Historic Sites Act, an Advisory Board was created for National Parks, Historic Sites, Buildings, and Monuments (Jokilehto, 2011: 263). Historic American Building Survey Program (HABS; 1933), Historic American Engineering Record (HAER; 1969), Cultural Resources Geographic Information Systems (CRGIS; 1989), and Historic American Landscape Survey (HALS; 2000) were among the important contributions of NPS in documentation and recordation of heritage buildings, structures,

Table II Primary laws and code of regulations related to historic preservation in the USA

1.	Antiquities Act	1906
2.	National Park Service Organic Act, SELECTIONS: NPS MISSION AND REPORTS ON THREATENED LANDMARKS	1916
3.	Historic Sites Act	1935
4.	Federal Property and Administrative Services Act	1949
5.	National Trust for Historic Preservation	1949
6.	Archaeological and Historic Preservation Act	1960
7.	National Historic Preservation Act	1966
8.	Department of Transportation Act, SECTION 4F, HISTORIC SITES	1966
9.	National Environmental Policy Act, SELECTIONS: PURPOSE, POLICY, AND INTERAGENCY COOPERATION	1970
10.	Coastal Zone Management Act, SELECTIONS: POLICY AND GRANTS	1972
11.	Department of Transportation Act, SECTION 4(l) – AMTRAK IMPROVEMENT ACT	1974
12.	Mining in the National Parks Act, SECTION 9	1976
13.	Public Buildings Cooperative Use Act	1976
14.	American Indian Religious Freedom Act	1978
15.	Archaeological Resources Protection Act	1979
16.	Commemoration of Former Presidents	1980
17.	Commission for the Preservation of America's Heritage Abroad	1985
18.	Abandoned Shipwreck Act	1988
19.	Internal Revenue Code, SELECTIONS: QUALIFIED CONSERVATION CONTRIBUTIONS AND REHABILITATION TAX CREDIT	1980
20.	Native American Graves Protection and Repatriation Act	1990
21.	National Underground Railroad Network to Freedom	1990
22.	Intermodal Surface Transportation Efficiency Act, SELECTIONS: SCENIC BYWAYS PROGRAM	1991
23.	American Battlefield Protection Act	1996
24.	National Marine Sanctuaries Act, SELECTIONS: DESIGNATION, RESEARCH, AND LIMITATIONS	1972
25.	National Maritime Heritage Act	1994
26.	Save America's Treasures	1998
27.	Preserve America	2003
28.	Sunken Military Craft Act	2005
29.	National Women's Rights History Project	2009
30.	23 CFR Part 771 Environmental Impact and Related Procedures for the Department of Transportation	2018
31.	26 CFR Part 1.48-12 Income Tax: Investment Tax Credit for Qualified Rehabilitation Expenditures	2001
32.	26 CFR Part 1.170A-14 Income tax: Qualified Conservation Contributions	2017
33.	36 CFR Part 60 National Register of Historic Places	1981
34.	36 CFR Part 61 Procedures for State, Tribal, and Local Government Historic Preservation Program	1998
35.	36 CFR Part 63 Determinations of Eligibility for Inclusion in the National Register of Historic Places	2011
36.	36 CFR Part 65 National Historic Landmarks Program	2003
37.	36 CFR Part 67 Historic Preservation Tax Incentive Certifications	2012
38.	36 CFR Part 68 The Secretary of the Interior's Standards for the Treatment of Historic Properties	2012
39.	36 CFR Part 73 World Heritage Convention	1982
40.	36 CFR Part 78 Waiver of Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act	1999
41.	36 CFR Part 79 Curation of Federally Owned and Administered Archaeological Collections	2012
42.	36 CFR Part 800 Protection of Historic Properties – Advisory Council on Historic Preservation	2012
43.	40 CFR Parts 1500-1517 Council on Environmental Quality	2011
44.	41 CFR Part 101-17 Assignment and Utilization of Space – General Services Administration	1998
45.	41 CFR Part 101-20 Management of Buildings and Grounds – General Services Administration	1999
46.	43 CFR Part 3 Preservation of American Antiquities	2008
47.	43 CFR Part 7 Protection of Archaeological Resources	2012
48.	43 CFR Part 10 Native American Graves Protection and Repatriation Act	2012

sites, and landscapes. The two divergent paths in historic preservation, namely the private sector and public activities, became a united whole with the establishment of the National Trust for Historic Preservation (NTHP) in 1949, a new quasi-public organization, aimed at linking the NPS and other federal preservation activities with the private sector. It was supported by federal funding until 1998, and then became independently and privately funded (Table II; Tyler et al. 2009: 61-62).

– **The Role of NGOs in historic preservation in the USA: history and development** – According to Tyler et al. (2019: 12, 29) historic preservation in the USA is based on a 'grassroots' movement stimulated at the local level and then expanded onto larger contexts. Numerous associations were founded in the early to mid-1800s, aimed at preserving the heritage. The protection of a log cabin in Philadelphia in 1749 was the first recorded preservation activity held by community efforts in the country and Independence Hall in Philadelphia was among the nation's first preservation efforts to save the building from demolition in the early 1800s (Murtagh, 1997: 1-2; Stubbs and Makaŝ, 2011: 429-430; Tyler et al., 2009: 27). Fort Wayne in Indiana and Fort Meigs in Ohio were the two major sites, where individual preservation efforts were observable as early as the 1840s (Tyler et al. 2009: 29). Mount Vernon Ladies Association founded in 1853 to save Mount Vernon, George, and Martha Washington's homestead is considered the first nationwide preservation organization (Jokilehto, 2011: 263; Lea, 2003: 2; Stubbs and Makas, 2011: 431). The Minnesota Historical Society (MNHS), established in 1849, was among the first historical organizations rapidly created by the Territory's legislature and acted actively in historic preservation. Guidance for the creation of the Itasca State Park in 1890 and long-term stewardship for the rehabilitation

6 It is responsible for preservation of historic bridges.

7 They mainly involved fundraising to save individual historic buildings and landmarks.

8 Government involvement mainly focused on the protection of natural parks, landscapes, and features (Tyler et al., 2009: 27, 42).

Fig. 2 Views from Washburn A Mill Complex – Mill City Museum rehabilitated with the stewardship of MNHS

of Washburn-Crosby 'A' Mill Complex to be used as Mill City Museum were among the most prestigious works of the Society (MNHS, 2022; Fig. 2). In 1895, a decision was made to preserve the Adirondack Forest in New York as 'forever wild' via a public-private partnership (Tyler et al. 2009: 61). The restoration of the original colonial town of Williamsburg in 1926 was the first effort to preserve an entire city with the generous support of John D. Rockefeller. Similarly, Henry Ford sponsored the Greenfield Village preservation project in 1929. Charleston became a pioneering example to save the whole district, where the local citizens and planners established an ordinance to protect the district in 1931 (Jokilehto, 2011: 267). Philadelphia Centennial Exposition (1876), Columbian Exposition (1893), and Bicentennial Celebrations (1976) were the other noteworthy achievements of preservation activists (Dişli, 2013: 36). Especially between the years 1966-1976 many private preservation associations were established including the Victorian Society, Friends of Cast-Iron Architecture, Association for Preservation Technology (APT) International, and the Society for Commercial Archaeology (Shehada, 2020: 116; Tyler et al. 2009: 35-39, 54), and in the mid-1960s, the first Historic Preservation Graduate Program was initiated at Columbia University by James Marston Fitch (Jokilehto, 2011: 269).

– **General tendencies and institutional development in historic preservation in the USA** – As understood from the above mentioned literature, early attempts for preservation activities were mainly conducted by private citizens and local or nationwide associations/organizations, which all contributed to the public awareness and knowledge in the preservation field in the early 19th century, even though most attempts failed to reach success (Jokilehto, 2011: 263). Private sector activities in the early years were mostly developed upon significant figures, events, or structures, whereas the government focused on the preservation of natural landmarks and parks and took virtually no active role in the preservation of historic buildings. Regarding "why" to preserve, patriotic reasons were more prominent than the architectural history, in preservation activities. Similarly, the older the better was the dominant thought (Tyler et al., 2009: 27-30).

In addition, according to Murtagh (1997), the assertion of legitimacy, history for reassurance, and use of preservation as defense against cultural and political hegemony were among other reasons and stimuli, and women were highly dominant figures in preservation practices. Compared to today's organized and systematic activities, the preservation movement has changed dramatically since its early years. At present, local, state, and federal government institutions work together with nonprofit organizations to support the preservation activities. With the acceptance of NHPA in 1966, significant structural changes, changes in the way of the perception of preservation, and its main actors were observable. Entire areas were designated as historic districts, recent buildings were also included in the National Register depending on their significance, and heritage tourism activities increased largely. Similarly, with the Tax Reform Act in 1976, private sector involvement in preservation activities multiplied largely thanks to the tax incentives/tax cut, which turned historic structures into financial opportunities and a part of the business, rather than obstacles for development.

Preservation of old buildings, especially adaptive reuse became an important stimulus for urban revitalization and renewal, and the Main Street Program of the 1980s promoted this effort. All these perspectives also encouraged and increased the number of preservation activists and advocates (Tyler et al., 2009: 53-55, 60).

Cross-Cultural Comparison and Possible Knowledge Transfer Values / Intercultural Exchange of Experiences

In this section, based on the above-mentioned descriptive part in which differences between the Turkish system and the system in the United States have been argued, together with an illustration of the links and relationship between the two countries. What follows is a suggestion of the possible intercultural exchange of experiences and knowledge between the two countries, by cross-replicating some aspects of the system. As for the differences, thanks to the Ottoman waqf system and its role in preservation in Turkey, a financial source for the repair expenses of waqf buildings is already present through their income-generating properties (called '*akar*'). Even though waqf was a private enterprise when it was first established by philanthropic people, at present it is transferred onto the state institution of Directorate General of Foundations (DGF). In the USA, similarly, there are federal trusts, but different from the waqf system and DGF in Turkey. They do not have a permanent financial source and have to create their source of income when the preservation need arises, and there is not a central institution like DGF for the management and administration of federal trusts. A comparison between Turkey and the USA also reveals that the establishment of NGOs in the preservation field was much delayed in Turkey. It was in the 1990s that the private sector inclusion and the number of preservation organizations increased substantially in Turkey (Şahin-Güçhan and Kurul, 2009: 38). Yet, none of the early organizations active in historic preservation in the late 19th-early 20th centuries is existent today or if they are, they changed their fields of activity (Keskin, 2015: 185). Contrary to the rapidly increasing private sector involvement in the USA, civil society organizations in the preservation field in Turkey do not show such fast development. Also, NGOs have an enormous stimulus both in the development of historic preservation studies and in increasing community awareness in the USA. In the same way, Watt (1991: 247) argues that "America is a 'strong' nation with a 'weak' state (contribution)" compared to other European countries. American civil society organizations such as APT, Presidio Trust, NTHP turned into huge institutions carrying out preservation studies and giving training throughout the country. In Turkey, on the other hand, governmental involvement and revenue as a percentage of preservation activities in comparison with the private sector, are much higher than in the USA, and there is a more centralized system both in terms of regulations/jurisdictions and administration of heritage foundations. However, in the USA, individual/private support is the main financial source for preservation works, and jurisdictions of preservation organizations are rather minimal (Dişli, 2013: 116-117).

Regarding the links and relationship between the two systems and countries, neither the architectural nor the historic value of the heritage buildings were the main stimulus for preservation activities at the beginning. Rather, it was mostly either the economic, functional values of the heritage or religious conservatism and later national prestige in Turkey or patriotic reasons in the USA. Yet, in both countries, the activities of preservation organizations and individual contributions have been supported by the state. As an instance, the TURING Association, ACRM, and Bursa Assembly of Advocates of Ancient Monuments (1946) were all declared public-benefit associations and supported by the state. However, changing and developing conditions forced these associations to leave their activities to state institutions in Turkey. Increasing public awareness on repairs, fundraising activities from philanthropic citizens, congress organizations, and detailed archive research were among the main activities of the NGOs (Keskin, 2015: 186). At present, preservation organizations still conduct similar activities in Turkey, but only in some rare cases do private organizations such as Koç and Sabancı Foundations or individual philanthropic citizens undertake all financial burdens of restoration works. Similarly, both countries have quasi-public organizations active in preservation activities, such as National Trust for Historic Preservation (NTHP; 1949) in the USA and Historical Cities Association (HCA; 2000) in Turkey. They either provide the link between the federal state or municipalities with the private preservation bodies. In addition, as Luke (2018) pointed out, in multi-ethnic communities such as Novi Pazar in Serbia, both Turkey and the USA play a strategic role in heritage programs, by either using their neo-Ottomanism or Americanism ideologies, causing the heritage, identities, and developments in those regions to compete with each other. Americanization movements were acknowledged in Turkey, especially in the early 1950s with the Marshall Plan and Turkey's NATO membership, reinforcing the USA-Turkey alliance. The establishment of the High Council (1951) also coincided with this alliance, and up till the end of the 1960s, the USA support was observable in historic preservation activities in Turkey (Dinler, 2021). As another similarity and link between the two countries, preservation education at the university graduate level started in the same years, at the beginning of the 1960s. What is even more, the historic pres-

ervation program at METU in Turkey was founded with the aid of the USA, with the aim of addressing the needs of the Middle East (Dinler, 2021). However, in the USA, the preservation program is more interdisciplinary and gathers students from different departments, except in the case of architecture. At present, in addition to graduate-level historic preservation programs, universities in both countries also have four-year or two-year bachelor/minor degrees and certificate programs in heritage preservation.[9] In addition, in both countries, there are either tax deductions or inceptions in preservation activities done by private bodies, but it is not the primary stimulus for the ones in Turkey, though highly important in the USA. Similarly, both countries have their own regulations and organizations related to historic preservation that emerged in similar periods. In Turkey, it was around the mid-19th century that the first regulations were adopted and the institutionalization of the waqf system was acknowledged. In the same way, federal involvement in the preservation field was observable in the 1860s in the USA and it was in the early 20th century that the Antiquities Act came into force.

As for knowledge transfer values and intercultural exchange of experiences between the two long-established systems, the situation is as follows:

– It is suggested to give structure to the highly developed voluntarism, citizen initiative, and private contribution in historic preservation activities in Turkey like in the United States. Preservation funds and funding institutions in the USA, as well as tax incentives programs, contain the potential knowledge transfer values for Turkey. In the same way, the waqf-based buildings in Turkey, which already have a financial source for their preservation and are tax-exempt in their repairs, together with the centralized and autonomous administration and management system for the waqf income and private preservation foundations in Turkey, make it possible to organize predetermined preservation decisions. This might have transfer values for the USA.

– In addition to the waqf-based buildings, which were initially repaired with philanthropic activities, the preservation of the remaining Turkish cultural heritage resources have progressively transferred to the centralized government level, making a more systematic decision support system possible. Each year, the related bodies of the Central State System of Turkey decide on the needs for preservation and allocate financial resources either from their waqfs (if existent) or from the State Treasury. Although this system seems to be a burden for the State, it also provides a kind of a guarantee for sustainable preservation and management of historic properties; this might be a knowledge transfer stimulus for a de-centralized federal state structure in the USA.

– Similarly, the highly strong collaboration between the state and non-profit organizations, namely the public-private partnership to support preservation activities, deserves to be transferred from the USA to Turkey, where the state-NGO collaboration in preservation works is also existent, but is still rather weak.

– Both early and present examples of public participation in heritage preservation activities in the USA have promoted sustainable community engagement in heritage actualization (restoration/adaptive reuse practices), education, publicity programs, cultural heritage tours, and most private organizations continue their preservation activities. In Turkey, on the other hand, early examples of preservation organizations do not exist, and new ones are not active enough compared to the ones in the USA. That is why the motives or the stimulus for community involvement in heritage preservation activities in the USA might have transfer value for Turkey.

– Public participation is possible Conservation Boards' sessions on the decisions on heritage properties, such as listings in the National Register, in the USA. In Turkey, on the other hand, only authority bodies (institution representatives), are permitted to participate in the Conservation Board meetings and have the right to comment on their decisions. A more open and transparent structure of the USA Conservation Board meetings could, therefore, be transferrable to Turkey, in order to achieve a more participatory decision.

– In the USA, NPS is responsible for the preparation of all kinds of standards related to historic preservation, and in Turkey, the Ministry of Culture and Tourism is the main legislative body. When compared to the preservation laws, standards, regulations, and guidelines, they are far more advanced in the USA com-

9 As an instance, in Turkey Hacı Bayram University, Department of Conservation and Restoration of Cultural Heritage, Ankara University Department of Conservation and Restoration of Cultural Properties give four-year restoration bachelor education, and there are many higher vocational institutions with a two-year restoration education (see: CHE, 2022). Similarly in the USA, Eastern Michigan University, Ball State University, Shepherd University and many others have historic preservation minor and certificate programs (see: Preservation Directory, 2022).

10 For instance, in Turkey there is not a specific regulation/standard/principle decision on refunctioning/adaptive reuse of, or new exterior/interior additions to historic properties (see: MoCT, 2022b; TR-PLDS, 2022), even though they are highly important issues that should be clearly explained. Whereas, in the USA, there are specific guidelines on these and many other preservation related issues (see: NPS, 2021a).

pared to Turkey, meaning that there are clear regulations in nearly all preservation-related issues in the USA. Yet, in Turkey, standards, laws, and by-laws fall short in some preservation aspects[10], and variable decisions of responsible Conservation Boards are applied for the basic preservation decisions that are not included in primary regulations. In other words, highly developed standardization activities of the USA have knowledge transfer values for Turkey.

– Although in the USA universities accept students for the historic preservation graduate programs from all disciplines in addition to architecture programs, in Turkey, most universities accept only architecture students at the graduate level. That is why the interdisciplinary nature of the USA universities has transfer value for Turkey universities. Considering that students who graduated from these programs are potential advocates of private organizations, NGOs, and community engagement in preservation practices, it is important to increase the interdisciplinary nature, quality, number, and alternatives for historic preservation degree/certificate programs.

Conclusion

The paper compared differences and similarities in state and community-based historic preservation mechanisms and policies in Turkey and the USA, with the aim of revealing possible knowledge transfer values for each other. The history and development of community engagement, namely through the waqf and NGO system, their role, and main legislation and tendencies in historic preservation in both countries were examined for a better understanding of the background and its implications in preservation practices. The role of private actors in the preservation of historic properties is particularly sensitive, both in Turkey and in the USA. Although not always in terms of financial support, they generate reactions and engender fundamental questions for the repair of historic buildings, districts and even cities. The research found that the development of preservation legislation in the USA and Turkey progressed differently. While in the USA, parks, and landscapes were the main interest of the government, movables, and museum objects were given greatest importance in the 18th-19th century legislations in Turkey. The private sector involvement and contribution supporting preservation activities also show differences, such that in the USA, NGOs played an important role in local, national, and federal levels since the early periods and either patriotic reasons or tax incentives increased the private sector contribution. Yet, in Turkey except for the classical waqf system, neither the financial power nor the number of NGOs was high and effective in preservation activities. Rather, it is the government that holds the majority of repairs. The main reasons for giving and volunteering were benefactions rather than financial incentives at the beginning. The 1960s-70s could be considered the time for the development of comprehensive preservation legislation in both Turkey and the USA and the concept of site/district conservation. Overall, they both proved to be effective in heritage preservation, no matter whether state-funded or privately-funded practices are dominated. In addition, both the deep-rooted waqf system of Turkey and the long-established NGO system of the USA contribute significantly to the preservation of heritage and have possible knowledge transfer values for each other. All the state institutions and NGOs/ private bodies / community involvement are equally essential actors, and beyond their individual improvements, more collaboration among them should guarantee more increased improvements in preservation works. Similarly, Bahçeci and Yenel (2019) point out the importance of a strong and mutual collaboration between the state, local municipalities, civil society organizations, and the private sector and suggest creating a common platform and a network that will enable them to easily interact with each other. That way it would be possible to provide better management and preservation of the heritage. This study similarly, suggests that the relationship between the built environments and their users/community contribution should be ensured for their management and sustainability. In the same way, the lessons learned from the comparison of Turkey and the USA, their different approaches, private sector contribution, and legislations in preservation, might have the possibility of adaptation and application in different national contexts.

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Sources of illustrations and tables

Fig. 1 Photo archives of the author, 2018-2020, Ankara, Turkey

Fig. 2 Photo archives of the author, 2012, Minneapolis, USA

Table I Şahin-Güçhan and Kurul, 2009; TR-PLDS, 2022

Table II NPS, 2018a; NPS, 2018b; NPS, 2021b

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Gülşen Dişli, PhD., is an Associate Professor and Head of the Historic Preservation and Restoration Program. Her main areas of expertise are architectural conservation, historic preservation, functional systems in historic buildings, and cultural heritage management. Her scientific achievements include numerous journal papers, book chapters, and conference presentations on existing built heritage, their conservation, and management.
A single author is responsible for all the contributions and writing processes of this research article.

Acknowledgments

This research is based on a thesis study completed at the University of Minnesota, Historic Preservation Graduate Program. The author would like to thank Assoc. Prof. Greg Donofrio, Prof. Katherine Solomonson, and Prof. Giancarlo Casale for their vigorous review and share of expertise during the research and writing process of the study thesis. The author also would like to thank the Directorate General of Foundations for the provision of the waqf documents and their translations. The anonymous referees also deserve special thanks for their support in the development of the paper.

Fig. 1 Residential buildings in Pristina, capital city of Kosovo (photo credits: Arben Llapashtica)

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Scientific Subject Review
https://doi.org/10.31522/p.30.1(63).8
UDC 711.58 (497.115) "19/20"
Technical Sciences / Architecture and Urban Planning
2.01.02. – Urban and Physical Planning
Article Received / Accepted: 15. 4. 2022. / 14. 6. 2022.

Review of Housing Policies in Kosovo from 1947 to 2021

COLLECTIVE HOUSING
HOUSING POLICIES IN KOSOVO
RESIDENTIAL NEIGHBOURHOODS IN KOSOVO

In a period of transition, sudden and numerous economic, social and political changes led to an uncontrolled growth of cities in Kosovo. The rapid population growth and geographical expansion of cities challenged planned development, which resulted in an uncontrolled urban expansion. This paper includes a historical review of housing policies in Kosovo from 1947 until 2021. The research starts with the period after World War II, which marked the beginning of a trend of rapid construction all over Europe, both due to urban growth and as a result of the destruction of many residential buildings. It analyses the implementation of policies, laws, housing regulations in residential neighbourhoods and, in particular, multi-unit housing in Kosovo. The research also includes housing policies in some of the most developed countries in Europe, to give the reader a clearer understanding and comparison of European and Kosovar housing issues.

Introduction

Housing is one of the basic necessities of life. Housing and housing policies are among the core problems for the social, economic and political development of a country, so it is important to create mechanisms that ensure the selection of appropriate housing conditions for all citizens, especially for the most vulnerable categories (Institute for Spatial Planning, 2010: 30). Housing is an important economic and social component of development, organization and regulation of space and it impacts the quality of life of citizens.

All countries that are going through a period of transition face many challenges in different areas. Kosovo, as a new state, went through a challenging planning period. During the last conflict of 1999, about 30% of apartment buildings were destroyed or damaged. As a result of the destruction, there was a period after the war when rapid transition and reconstruction that affected major cities of Kosovo, especially Pristina, took place. In the absence of housing policies, construction laws, or regulations, the post-war period and rapid construction in Pristina were rather challenging.

In the absence of consolidated research on planning, urban development and dwelling which meets needs, the paper includes a brief historical background of housing policies affecting the quality of multi-family housing construction. It analyses the history of housing and housing policies since the beginnings of collective housing construction in Kosovo. Furthermore, a special emphasis is placed on post-war housing policies and current housing sector policies. As a territorial part of Europe, Kosovo has been consistently indirectly linked to housing policies that have been developed in Europe, albeit under political influences of different governments. There are still efforts to adapt to good examples of European countries, providing citizens with affordable and suitable housing conditions. Therefore, housing policies in Europe have been reviewed.

As housing policies affect many aspects related to appropriate housing, the paper aims to give an overview of the history of housing policies in Kosovo. Furthermore, through a comparative method between Kosovo and Europe, housing policies are analysed from different perspectives, such as: investment cost, housing standards, legislation and urban planning.

The historical overview of housing policies in Kosovo presented in this paper deals with the period from 1947 to 2021. The research was conducted using archival and bibliographic units: books, papers, documents, reports, etc. Using analytical, qualitative and comparative methods, the research focused on the impact of housing policy on collective housing, so a comparison was made with some European countries as examples of good practice.

Providing ample living space will be one of the main challenges for our society. There is no doubt that the demand for housing is high, and it surfaces in varying degrees depending on the region. Currently, only the private sector is involved in increasing the housing stock in Kosovo, which is often characterized by irregularities and a lack of criteria, while the social housing sector is less developed. The solution to this problem in Kosovo has been made more difficult by the lack of data on the number of dwellings needed (Institute for Spatial Planning, 2010: 30).

Historical background of housing policy in Europe and Kosovo

With the expansion of cities after World War II in 1945, European socialist states developed housing policies to provide proper planning of housing. All European countries have been developing housing policies at local levels, and these processes are observed in the Balkans as well. When the construction of collective housing in 1947 started in Kosovo, which was then a part of the Yugoslav federation, special policies were developed. Public housing was financed by state-owned enterprises (Fig. 2). The "social apartment" was one of the symbols of the socialist system, reflect-

ing the concept of "common ownership" in which the right to dwell in an apartment owned by society fell in line with the current paradigm of social justice in general (Franić, Korlaet, Vranić, 2005: 199).

In the Balkans region, as well as in Kosovo, the partition of former Yugoslavia brought about political and economic changes that affected the stagnation of investment in housing. On the other hand, European western countries continuously developed policies for providing shelter for their citizens. A significant reduction in state subsidies in Kosovo was observed especially after the conflict in 1999. During the last two decades, statewide instability has affected an unsatisfactory development of housing policies, which had an impact both on the legislative aspect and the economic one. All trends focused on the improvement of legislation and not much attention was given to the subsidized housing programs. At the same time, Europe invested in the further development of housing policies, in addition to improving planning and legislation issues, which provided suitable housing programs for middle-income citizens.

Housing policies in Europe

Housing policies vary significantly from country to country, and this topic is undoubtedly contested even in the most developed countries of Europe. Nevertheless, all countries of the European Union (EU) have found it necessary to subsidize housing by one set of means or another, and this has been done in a wide variety of ways (Maccrone and Stephens, 2017: 1). In EU countries, urban development is an issue addressed by local governments with the participation of citizens, as part of decision-making (Tsenkova, 2005). Historically, various housing policies have been applied in European member states. Whereas

Fig. 2 First multi-family housing in Pristina, 1947

the housing cost overburden is relatively low in many Northern European and Central/Eastern European (CEE) countries, it is high in Germany, Denmark and Bulgaria, and the problem is particularly acute in Greece and some Balkan countries (Caturinas et al., 2020).

After the devastation of World War II, after 1945, development of housing policies and investment in housing began to be widely practised in Europe. Large-scale (often largely subsidized) housing construction began to eliminate serious shortages by the 1960s. The development of the social-rental sector, in many countries, was considered to be an essential tool for alleviating the need for housing and wider ownership of home for a long time, the long-term goal was increasingly aided by tax breaks and exemptions (Balchin, 1996: 15).

According to the report of the European Parliament (1996), housing policies in EU member states were divided into the following groups: owner occupied sector, private rented sector and social rented sector.[1] A significant difference between states can also be seen in the GDP percentage of governments spending in the cost of housing policies. The contributions made by governments, and thus by taxpayers, are enormous in European countries. The cost of support varies between 1% and just over 4% of GDP. Housing policy is a key spending element for all governments in Western Europe (Maccrone and Stephens, 2017: 3).

During the last decade of the 20th century, the countries of Southeast Europe experienced economic growth and great progress in advancing their structural reform agenda. The growth trajectory across the region has been uneven, yet countries have been able to maintain macroeconomic stability and support political reforms towards democratic

1 However, these common strands disguise diversity in the levels and forms of intervention. Member States' housing policies of the may be categorized into four groups:
1) The Netherlands, Sweden and the UK are characterized by much state intervention. These countries have the largest social rented sectors in the EU and their governments spend more than 3% of GDP on housing policy.
2) In Austria, Denmark, France and Germany there has been less market displacement and large private rented sectors have been retained. Public expenditure on housing policy typically lies in the range 1-2% of GDP.
3) Ireland, Italy, Belgium, Finland and Luxembourg form a disparate group, but all have large owner occupied sectors and relatively small social rented sectors. Government expenditure on housing is usually limited to around one per cent of GDP.
4) Portugal, Spain and Greece have particularly large owner occupied sectors, minimal social rented sectors and (until recently) declining low quality private rented sectors. Government expenditure on housing policy is less than one per cent of GDP.

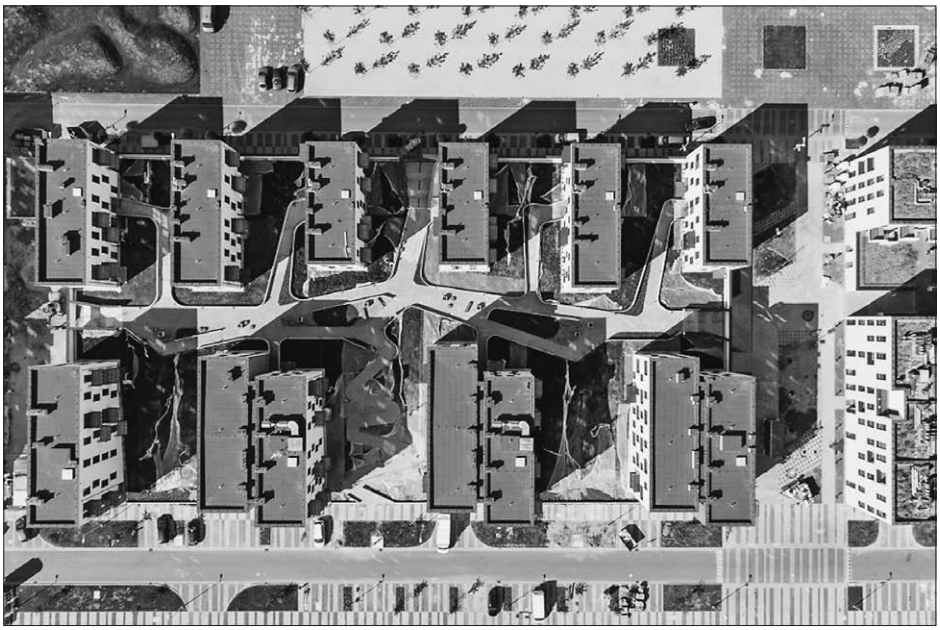


Fig. 3 Small complex of affordable multi-family buildings built in 2016 in Wrocław, Poland

governance (Tsenkova, 2008: 19). The constant tendency of countries of Southeast Europe was to pursue policies similar to those of Western countries. Reforms require extensive privatization of companies, as well as of land and housing. The process of privatizing homes involves changing ownership and managing housing stock, and a new housing financing system (Pichler-Milanovich, 1994). Within this period, countries in Southeast Europe were surrounded by military, economic and political crises and conflicts including Albania, Kosovo and Macedonia and the serious debt burden of Serbia and Montenegro. Furthermore, in Bosnia and Herzegovina, Serbia and Montenegro and Croatia, over one million people were left without a permanent home after being displaced within or across countries during the conflict years (Tsenkova, 2008: 7).

The phenomenon of improving the housing stock and meeting the housing needs can be observed continuously. Another practice that can be seen in some European countries is affordable housing (Fig. 3). The affordability of housing generally refers to the cost of housing services and shelter – both for renters and owner-occupiers often relative to a given individual's or household's disposable income (Bieri, DS., 2014, cited in: Caturianas et al., 2020).

However, research shows that in the medium-term, the economic recession and the loss of jobs and incomes could further increase the cost of housing and the number of homeless people in Europe (Housing Europe, 2021).

Since European countries use policies that they develop at central level, there are mechanisms for improving housing policies. The majority of countries have a national housing strategy in place.[2] Funds are another important parameter that affect the quality of housing. Of course, investment is not the only way that governments can influence housing outcomes, with regulation being just as important. In this respect, a plethora of reforms have been adopted across Europe in recent years, related to many different areas from the reform of housing benefit schemes (for instance in France), the target group for social housing (the Netherlands), planning regulation (United Kingdom) and many more (Housing Europe, 2021: 6). According to The Organisation for Economic Co-operation and Development (OECD)[3], governments need to invest in social and affordable housing in order to provide housing for all, as well as to maintain and renovate existing stock. New constructions must have a suitable location. Therefore, plans, regulations, land use and zoning must be continuously reformed (Fig. 4). Investing in urban renewal strategies improves the quality of neighbourhoods, increases overall access to jobs and services, and reduces spatial segregation (OECD, 2021). Governments should include housing as part of inclusive development, improving the quality of housing and neighbourhoods.

Fig. 4 Masterplan of Langerak, Leidsche Rijn, Netherlands

2 Twenty-seven out of 40 countries report having a national housing strategy in place in the 2021 QuASH. Countries with a national housing strategy include: Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, the Czech Republic, Denmark, France, Germany, Iceland, Ireland, Israel, Japan, Mexico, the Netherlands, Norway, Poland, Portugal, the Russian Federation, the Slovak Republic, Slovenia, South Africa, Spain, Switzerland, the United Kingdom (England), and the United States. Malta is in the process of developing a national housing strategy.

Eleven countries report that a national housing strategy is currently not in place: Australia, Austria, Belgium, Estonia, Finland, Latvia, Lithuania, Luxembourg, New Zealand, Romania, Slovenia, Sweden and Turkey; however, several of these countries report that housing policy objectives are set out in regional housing strategies (Austria, Belgium) or other political documents (Australia, Luxembourg and New Zealand) [OECD, 2021].

Since the EU has no direct responsibility for housing policy, there are numerous EU regulations which may exert influence on housing policy and/or the housing system in the member states.[4] Currently, the EU has the mandate to implement and respect social rights, including the right of access to social housing, it has also made the Green Deal its guiding principle and the fair energy transition and decarbonisation of the building stock should, therefore, have a central place in the years ahead (Egner et al., 2020: 144; Housing Europe, 2021: 6). Countries that apply such policies have the largest social housing capacity (Netherlands, Austria, Scotland, etc.; Table I).

Housing policy in Kosovo

Located in the south-eastern part of Europe, Kosovo is a young state that has gone through challenging political, economic and social periods. Today, it has about 2 million inhabitants, with a continuous uninterrupted population increase, causing an overcrowding of urban areas. In the absence of plans, these urban areas have been taking shape without any control of construction and spatial development. From the data provided by the Kosovo Agency of Statistics from a Census of 2011, it was estimated that there were about 750,000 residential buildings of all types (Table II) in Kosovo. Family migration to medium and large cities has been the main factor of increased demand for housing after the war. The average number of members per family is 6.5. This average varies from rural to urban areas.

The Ministry of Environment and Spatial Planning, as the main entity responsible for Special Housing Programs, administrates the proposing, drafting, approving and ensuring the implementation of policies – strategies and legislation, monitoring and reporting on these programs. Municipalities are responsible for identifying housing needs within the area of their responsibility, developing housing programs, securing construction sites, creating and administering a database, administering, maintaining, monitoring and reporting (Institution for spatial planning, 2010).

• **Review of housing policies in Kosovo until 1999** – As a territorial part of Europe, Kosovo was also influenced by the political developments of the Second World War. At that time, it was a part of the former Yugoslav federation, and mainly had settlements with low-rise buildings. After the war, rapid population growth and geographical expansion of cities prompted broad strategies of raising housing capacities in cities across the country (Marčetić, 2020: 23). Around the 1960s, with the beginning of collective housing construction, Kosovo's central policies were developed by Belgrade, which was the centre of the socialist state of Yugoslavia (Fig. 5). In Yugoslavia, the ownership of plots in urban areas was administered by the state from 1945 to 1990 and for this reason large-scale planning projects were made possible, which is not the case today (Franić, Korlaet and Vranić, 2005: 205). Former Yugoslavia had a different kind of socialist system compared to other Central and Eastern European countries because it followed a "special path of socialism" based on self-management and open relations with the West (Hegedüs and Tosics, 2003: 21-33).

Yugoslavia implemented a housing policy in which public housing construction was financed by state-owned enterprises, organizations and institutions, and housing was allocated to employees according to their priority on waiting lists. Since these funds were not sufficient, the state introduced a mandatory tax on house construction. Persons who had access to public housing were entitled to a lifelong lease, which could be bequeathed to family members who would continue to pay the rent, which was very low because it was not determined by economic mecha-

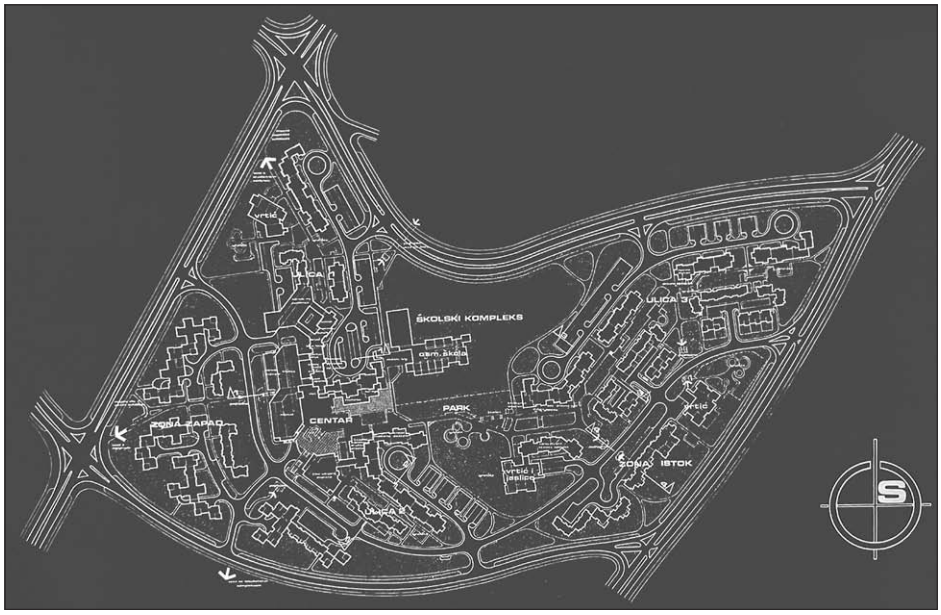
Table I Percentage of social housing in EU countries

Country	Social housing (percentage derived from the total number of housing stock)
Netherlands	29.1%
Austria	24%
Scotland	24%
Northern Ireland	24%
England	21%
Denmark	21%
France	17%
Wales	16%
Ireland	9%
Belgium	5.4%
Italy	3.8%
Germany	3%

Table II Number of dwells in Kosovo

Number of houses	340.945
Number of apartment buildings	412,884
Average used space for resident	13 m²

Fig. 5 Masterplan of neighbourhood "Bregu I Diellit", Pristina, Kosovo, 1980s



3 The Organization for Economic Co-operation and Development (OECD) is an international organization that works to build better policies for better lives, members of this organization are most European countries. OECD: Better policies for better lives. Available at: https://www.oecd.org/about/ [Accessed: 29 March 2022].

4 The most important regulations include the Energy Performance of Buildings Directive (2010/31 / EU, last amended by 2018/844 / EU), anti-discrimination regulations like Directive 2000/43 / EC as well as the general prohibition of state aid (Art 107 TFEU). The right to housing assistance is also mentioned in the EU's Charter of Fundamental Rights (2000 / C 364/01) and the European Pillar of Social Rights [Egner et al., 2020].

Fig. 6 Social housing in Pristina, Kosovo

Fig. 7 Collective housing in Pristina, Kosovo, built in 2017

nisms.[5] The funds collected from rents were used for building maintenance, as well as for the construction of new housing, but they were not even sufficient to cover the basic costs of repairs (Jelinic, 1994). The construction of public housing faced a crisis in the 1980s, due to the lack of financial resources resulting from a generally weakening economic situation in Yugoslavia. However, it is also known that the socialist system created new urban inequalities through inappropriate housing policies and unfair distribution of public housing, which resulted in social division (Szelenyi, 1983, cited in: Spevec and Bogadi, 2009: 457). With the partition of the former Yugoslavia, when Kosovo became part of Serbia, riots broke out; the policies of that time also affected the housing market because the government tended to differentiate societies. This period of privatization continued until 1999, when the 1998-1999 conflict broke out. Because of the war in 1998 and poor housing policies before and after the war, the housing problem in Kosovo has been rather severe (Sylejmani, 2018: 30).

- **Housing policies after 1999** – The post-war period affected the field of construction in all categories, including housing. As the new state did not inherit any legislation from the past, plans, building laws and other official documentation in the early 2000s were no longer applicable. In a nutshell, the previous policies were no longer carried out.

The period of 2000-2002 was a period supervised by UNMIK. According to the rating given by the UNMIK Department of Reconstruction, during the 1999 war, about 120,000 houses and ancillary housing facilities were completely or partially damaged, making up 30% of the total stock. The political conflict had devastating effects on Kosovo's economy. Mass migration to the cities in search of housing and jobs began to occur due to difficult economic conditions[6] and damage done to infrastructure and housing. This increased the demand for housing in all urban areas in Kosovo. The phenomenon of illegal construction and development of settlements in an uncontrolled manner was expressed throughout Kosovo (Institution for Spatial Planning, 2010).

A new law on spatial planning was drafted with the assistance of UN-Habitat and approved by the Kosovo Assembly in July 2003. With the assistance of UN-Habitat, a new Institute of Spatial Planning was established, putting academic theories in practice by drafting spatial plans throughout Kosovo. Considering that at that time almost none of the institutions were fully functioning, the Kosovo Spatial Plan 2010-2020+ was finally approved by the Assembly of Kosovo in June 2011, and this strategic plan for spatial planning has been in force ever since.

In 2004, for the first time after the conflict, the Law on Construction was adopted and enforced, and it aimed at regulating construction in Kosovo, at harmonization with the European Construction Standards, the protection of safety and the environment, as well as at improving the quality of life of the citizens. This law was later supplemented and improved.

Due to all the issues that developed because of the conflict, there was poor investment in the development of housing policies in Kosovo. One of the important issues was the law on Financing of Special Housing Programs (Fig. 6). The purpose of this law has been to create conditions for sustainable housing for families or individuals who are not financially able to afford the offerings of the free housing market and to determine the manner of provision and use of the financial means for the development of separate housing programs (Parliament of the Republic of Kosovo, 2010).

Most of the investment in housing was already from the private sector (Fig. 7). In the absence of plans, laws and technical regulations, there was a decrease in the quality of housing driven purely by profit. After all the efforts to drafting laws, plans and other documents that improve the quality of housing in the state of Kosovo, there have also been constant attempts to create, supplement and improve existing ones. However, as a result of a lack in proper planning, almost all new neighbourhoods of multi-family housing, in all cities of Kosovo, have overwhelmingly turned out to be chaotic urban areas.

In addition to the above parameters, a phenomenon that has affected the planning is illegal buildings, both in individual and collective housing. In the Balkan region, as well as in Kosovo, many illegal buildings have been built, gravely affecting the urbanization of settlements. In Kosovo, a significant number of illegal constructions was identified in 2013: 353,000 (Table III). This occurrence has been continuously more present in rural areas and in the construction of individual houses, yet, after the recent conflict, illegal constructions of collective buildings have begun in the cities of Kosovo as well.

Illegal constructions affected urbanism (Fig. 8), compromised the property market, and affected the precarious possession of property because illegal buildings could not be registered in the cadastre or legally transferred, used, or used as collateral (USAID, 2016). To help the legalization of these buildings in 2014, the Law on the Treatment of Illegal Constructions was adopted, which was completed in 2018 (Parliament of Republic Kosovo, 2018). Despite the continuous work of institutions, the legalization process is slow.

Comparative review of housing policies in Europe and Kosovo

Aiming to improve housing issues, housing policies include government actions such as legislation and program delivery affecting housing strategies, housing standards, and urban planning.

Referring to the review of the researched material, we can encounter a significant difference in the treatment of housing policies between Kosovo and developed European countries. A significant element is the cost of investing in housing policies. According to the data in Europe, the cost of financing by GDP varies from country to country, but it is the lowest in Kosovo. This reduces the development of housing policies, as research shows that investment is a key element for improving housing standards and proper planning.

Another influential factor in improving housing are legislative issues, which affect housing standards and urban planning. Due to a number of political events, Kosovo has had many shortcomings pertaining to legislation and many of the principal issues have not been legally defined. Developed countries, on the other hand, do not have such legal gaps. Attempts to improve the quality of housing through legislation have prompted continuous efforts to align with laws in Kosovo, but there are still shortcomings in this area. They look to developed countries in Europe or worldwide and their alignments of legislation to achieve decent housing: for example, the Netherlands, which offers their citizens quality and sustainable housing by applying a practice in which each city with more than 10,000 inhabitants is required to update and approve plans for future expansion. General and detailed plans are required, and the master plan must be updated every ten years (Franić, Korlaet, Vranić, 2005: 199). Furthermore, housing standards in European countries are strictly defined, while in Kosovo these standards are constantly being changed and updated (Table IV). The large

Fig. 8 Orthophoto of neighbourhood "Dodona", most of the residential buildings are illegal constructions, Pristina, Kosovo, 2021

Table III Number of illegal constructions in Balkan countries

	Number of illegal constructions
Kosovo	353,000
Albania	500,000
Greece	2,500,000
Federal Republic of Macedonia	350,000
Montenegro	130,000

Table IV Minimum apartment floor areas, a comparison between Europe and Kosovo[7]

Apartment type	Europe	Kosovo
Studio apartment (1 person)	39 m²	36 m²
1-bedroom apartment (2 person)	46.3 m²	45 m²
2-bedroom apartment (4 person)	73.3 m²	72 m²
3-bedroom apartment (5 person)	91.3 m²	87 m²

5 "In 1987 the rent was only 2% of personal consumption, and does not depend on the location and quality of the apartment or on the family income."

6 Regarding to Council of European Bank, GDP per capita was the lowest in the region. Growth was directed mainly by foreign aid (close to 50% of GDP in 2002), remittances (30%) and public spending.

7 The area of apartment for Europe is made from the average derived from European countries: Ireland, England and Croatia. The table shows the difference between the standards of apartments in Kosovo and Europe, where similar design standards are observed.

Fig. 9 New social housing in Sluseholmen and prefabricated units in Copenhagen's central areas, Denmark

number of buildings, market competition, the applicability of laws and many other factors have contributed to improving the quality of housing in co-ownership. In recent years we can find good examples of multi-family housing construction in Kosovo, which meet not only the functional aspect of housing, but can be categorized as buildings that meet the current requirements of quality housing based on European standards. However, the urban issues such as: traffic, infrastructure, parking spaces, green spaces, pedestrian and cycling paths, recreational spaces are important elements that influence the quality of housing in Kosovo.

In Europe, collective housing currently deals with special housing programs (Fig. 9). Some countries have started to apply affordable rent and access to inexpensive housing. In Kosovo there are social housing programs, but they are treated separately in each municipality. Deficiencies in the application of such housing programs can be particularly observed in larger cities. However, systemic affordable housing programs are still not being implemented in any city of Kosovo.

Conclusion

A comparative analysis of housing policies in EU countries and in Kosovo has shown that there is a significant difference between them. Kosovo lacks investment in the development of housing policy strategies, there is a difference in the updating of plans and, at the same time, there is a lack of subsidies in special housing programs.

The practices of European countries that offer good housing conditions showed that it is very important for the state to invest in housing policies. Kosovo would also benefit from such a practice. There are some issues related to housing policy which increase the quality of housing, such as the national strategy of housing, updated plans, increased supply of affordable and social housing and a sustainable and healthy environment ensured for all citizens. Kosovo as a new state has a lot to learn from well-established practices of developed European countries (such as: the Netherlands, Austria, Denmark) in the realm of the improvement of the housing stock.

European practices show that the state must plan the expansion of urban areas in advance and the plans have to be constantly updated. Given the economic and social problems, securing a home is quite difficult for many middle-income families. Therefore, subsidizing and supporting the financing of housing by the government would affect the improvement of housing. European practices show that an appropriate mechanism for resolving the housing stock for all categories of residents is affordable and social housing. However, the aim of the government should not only be to provide a roof over the head for its citizens, but it should also be to provide good housing conditions. It means offering multi-family housing with suitable standards for living and residential neighbourhoods that meet the criteria of quality housing and a sustainable neighbourhood. Given the current situation, with a particular emphasis on Kosovo's urban areas, the means and opportunities for improvement are small. However, an innovative housing and urban policy, as well as referring to good practices of Western Europe, can improve current issues.

The presented research has tackled housing policies in Kosovo that will be researched and further elaborated more thoroughly in the future. It also opened the theme of exploring other Balkan countries which have gone through a period of transition, some addressing housing problems at a more advanced level than Kosovo.

[Translated by: Safete Veliu Rexhepi,
Proofread by: Maja Gložinić]

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Sources of illustrations and tables

Figs. 1-2, 6-7	Authors
Fig. 3	Lulko, 2017
Fig. 4	Cousins, 2008
Fig. 5	APZ "Plan" (1980s) *Idejni urbanistički projekt: Sunčani breg* [A3] Personal archive of architect Sali Spahiu, Pristina.
Fig. 8	Orthophoto [online]. Available at: http://geoportal.rks-gov.net/search?municipalityId=19 [Accessed: 28 March 2022]
Fig. 9	Tsenkova, 2022
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Fig. 1 Entering the Graz Museum Schlossberg

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Scientific Subject Review
https://doi.org/10.31522/p.30.1(63).9
UDC 72.012 727:069
Technical Sciences / Architecture and Urban Planning
2.01.01. – Architectural Design
2.01.04. – History and Theory of Architecture and Preservation of the Built Heritage
Article Received / Accepted: 8. 4. 2022. / 14. 6. 2022.

Universal Design Principles Applied in Museums' Historic Buildings

ACCESSIBILITY
ADAPTATION
EXHIBITION
Graz Museum Schlossberg
INCLUSION
UNIVERSAL DESIGN PRINCIPLES

Museums represent an architecturally multifaceted typology. Regardless of their variant focus, their current task is to provide an opportunity for cultural, educational, and exploratory experience for all. The accessibility of the physical environment is important, but so is the accessibility of the perception of the exhibition. This paper deals primarily with spatial and design qualities, which determine the degree of inclusion in museums. The principles of Universal Design (UD) are considered in this regard; therefore, the article reviews means of applying these principles in museums theoretically, and also practically, through on-site evaluation using checklists. Specifically, solutions beneficial for inclusion are examined in an outstanding example, the Graz Museum Schlossberg, which demonstrates many inclusive principles. The aim of the article is to support suitable ways to implement UD in museum architecture with a historical background, one which would meet the needs of the largest possible range of visitors and preserve the historical value of architecture. Beneficial ideas from theory and practice should also be applicable in the future and are commented on in the article.

Introduction

The origins of the museum are linked to one of the basic human activities – collecting. The collection of objects appeared in all ancient cultures, the origins of the precursors of the museum date back to the period of ancient Greece, where they appeared in two forms. The first is the "thesauroi" type of building used for storing rarities, with its main function being to collect and store objects safely, as in a bank (Hoffmann, 2016: 12). However, collector's items were not displayed here, so the building fulfilled only a fraction of the purpose of today's museum. The second type of the museum predecessor was the "museion", which was used to name the part of Alexandria around the famous library (Hoffmann, 2016: 12). This Greek term[1], which originally referred to ancient schools of poetry and philosophy, by the 18th century covered mainly academies and schools and only secondarily places for collections. The Capitoline Museums, opened in 1734 in Rome, can be described as the first museums of modern Europe open to the general public (Lehmbruck, 1974: 126). However, it was not until the 19th century that a name was provided for the museum as it is understood today – "a building that preserves and presents collections and conducts related research" (Naredi-Rainer, 2004: 13) – which spread over a larger area in several countries. Traditional museums were based on rich and high-quality collections and were situated in lofty, landmark buildings resembling (or originally) palaces. Rare collections were assembled by different monarchs and were not open to ordinary visitors for a long time or they did so later with only limited access.

In the 20th century, the museum opened up to an increasingly wider public, taking on other roles besides collecting and exhibiting – for example, offering various educational programmes, becoming more interactive. Along with these changes, the issue of accessibility for all also came to the fore. Today's museums have the opportunity to play an important role in reducing inequalities and increasing the inclusion of people with different needs. In order to create a quality environment for all museum visitors, it is necessary to take into account the requirements of diverse users, i.e. people of different ages and people with different abilities or disadvantages. This article explains the principles of universal design in the context of museum architecture. These principles help to achieve the goal of forming an inclusive museum environment for all people.

Museums are quite exceptional among types of buildings, because in order to create inclusive museums welcoming as many diverse visitors as possible[2], many aspects need to be considered in the process of two activities: 1. planning of the architecture and design of the buildings, 2. creating exhibitions. A museum building must be designed according to principles of UD, so that it provides access to culture for all, and also exhibitions and exhibits must be designed in this way. This paper deals primarily with accessible museum architecture; however, the topics of

1 μουσείον: place of the muses; the place and dance floor of the muses and their mother Mnemosyne, the Greek goddess of memory; Gökçiğdem (2016: viii) claims that "Muses stood for the values of reflection and inspiration", and that museums should strive to "illuminate positive human qualities", among others empathy, and surely also inclusion.

2 The question of social inclusion is connected to inclusion of people with various needs; it is also a crucial topic, which should be mentioned. Inclusive museums for various social and economic groups are highlighted, for example, by Sandell (2003) in the publication "Museums, Society, Inequality". A feeling of belonging and being welcomed can contribute largely, and museum architecture can help create a friendly, welcoming atmosphere and support inclusion in that way. The resulting success is largely influenced by attitudes of people who inhabit this architecture, thus, it is a larger, multidisciplinary issue, and a topic for possible further research.

3 Today, they are applied on buildings of various types. However, UD is often a solution above standards, and many buildings respond only to barrier-free principles, which are suitable for visitors with physical disabilities.

4 For example, also research by Boháčová and Schleicher (2022: 25) deals with UD in cultural buildings (namely theatres), and they emphasize it: "Together with to these days also ignored, or misunderstood sustainability, universal accessibility has the potential to create a better-quality architecture, public space, or everything in between."

exhibition and exhibits are linked to museums so tightly that they are mentioned multiple times as well. The multisensory forms enhance the experience of the exhibition for all visitors.

Background

Universal Design (UD) was coined in 1985 by architect Ronald L. Mace, coordinator of a research centre at the North Carolina State University. His research group consisted of architects, designers, engineers and researchers in the field of environmental design. The principles of UD, first formulated by Mace et al. (1997) have been studied as a starting point and considered for the purposes of museum architecture, so in the theoretical part of this research, 7 principles of UD are applied to museums' environment. Key factors that help to evaluate selected museums considering UD are found in 'The Universal Design File: Designing for People of All Ages and Abilities' by Story, Mueller & Mace (1998), where the authors of The Universal Design File explained the seven principles of Universal Design.[3] These principles are known and promoted worldwide, including the region of Central Europe, as can already be seen partially in practice and publications.[4] This research considers the UD principles as an important part of participation and inclusion of various museum visitors and, therefore, explores and promotes these principles. In addition to the UD principles, various factors that have an impact on the quality and sustainability of the building were taken into account.

Designing with UD principles considers the diversity of users so that people with disabilities can enjoy all spaces and services on an equal basis with others and thus be included in society. "Universal design" means the design of products, environments, programmes and services to be usable for all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed." (Article 2 United Nations, 2006: p. 4). The Convention has been ratified by a number of countries, as well as the EU as a whole, so UD principles should be put into practice. Accessibility and non-discrimination are mandatory in EU-funded investment projects, and non-compliance is an exclusionary criterion in the evaluation.

For the selected research task, it is important to apply the principles of UD to the context of museums, so the basic requirements of UD were taken into account when analysing and researching the museum architecture.[5] Additional relevant literature on inclusive museums and exhibitions and long-time research contribute to this section.

1. Equitable Use – Design responds to the needs of all people. No user is excluded or segregated because of architectural barriers. The same means of design are applied to all when possible, or equivalent when not, so there is preferably one common entry and main vertical communication. Exhibition routes are suitable for all, for example, using a ramp.[6] "Design for All", or precisely "Culture for All", aims to provide access to culture for all different visitors.[7]

2. Flexibility in Use – The design can adapt to numerous choices or methods, visitors can choose among several route options, order, and timing of spaces. Visitors may or may not respect the recommended route; they can for instance see only one part during one visit.[8] Vertical communication is provided by several means, sometimes even in an innovative way of vertical circulation such as a model of a train or cable car, mainly in children's museums. Flexibility is also important with respect to exhibits and exhibition spaces. Schleicher (2017: 91) says: "Primary and fundamental is the adaptability of the spaces to absorb the different nature of the changing exhibitions. But equally important is the philosophical adaptability of direction in the ever-changing environment of art, new media, etc."[9] Flexibility encourages everyone's choices, interests and techniques in learning or discovery of exhibitions.[10]

3. Simple and Intuitive Use – Intuitive moving and wayfinding is very important for every

5 UD principles are intersecting, and some properties can be occasionally interpreted under multiple principles (e.g., an element is flexible and perceptible at the same time).

6 In some cases, alternative solutions, which are equally important and interesting, can be proposed, e.g. two equally important and informative exhibition paths.

7 Čerešňová (2009: 10) mentions two aspects of the philosophy of Design for All: the first one is "to make the physical environment accessible – to enable access and movement without physical barriers [...]", the second one is "to accept different perception and communication possibilities of people – to enable conceptual understanding and accessible information and services [...]".

8 This can be beneficial, especially for visitors with small children or older people, and in the case of a museum with a great volume of exhibits. People can revisit parts of an exhibition, which is important according to Black (2005), but also skip parts that do not currently interest them, etc.

9 Multifunctional solutions are also preferable to Caulton (1998: 28): "exhibits [...] employ a range of interpretative techniques, appealing to visitors with a wide range of interests and learning styles."

10 The topic of learning in museums is a very important one and tied to UD, as well. Information related to it provide Falk and Dierking (2018), Hein (1998), Jůva (2004), Andre, Durksen, and Volman (2017), Song et al. (2017) and others. The authors of this paper examine this topic in their research, too, e.g. in Filová & Rollová (2019) and Filová & Čerešňová (2020).

Table I Evaluation criteria of museums according to UD principles

The UD principle	Main characteristics	Implementation in museum architecture
1. Equitable Use	– the needs of all various people with no exclusions	– museum's public premises are accessible to all visitors equally
	– the same or equivalent means of design applied	– accessible entrance and routes (horizontal and vertical), not creation of separate accessible solutions (e.g. side entrance, staircase lift)
2. Flexibility in Use	– the building can adapt to user's preferences	– connect or divide exhibition space with movable partitions – different route options and timing – flexible routes also support creativity of the exhibition
	– several means of vertical communication	– use of elevator, ramp, stairs, escalator, etc., possibility of innovative ways of vertical circulation, as well
3. Simple and Intuitive Use	– a clear position of lifts, toilets, etc. is highlighted	– open plan, orthogonal, circular routing – signage of the rooms above door openings
	– means of helping in navigation are applied	– using contrast in colour or material – interior and exterior vistas
	– self-explanatory solutions	– the exhibition is clearly structured, exhibits facilitate understanding and learning, museum employees explain
4. Perceptible Information	– multisensory information	– haptic models and relief floor plans, acoustic information, sign language and the relief Latin and Braille – a building model presented in the entrance space
	– various forms	– in multiple languages, easy-to-read, logos and pictograms
	– clear visibility – glass walls marked with contrasting graphics	– exhibits can be observed from multiple visual perceptions from different distances and angles – contrasting background behind exhibits
5. Tolerance for Error	– no dangerous barriers – spaces with low ceilings, under the arms of a staircase, ramp or beam marked in multiple ways	– the low ceiling spaces can be interspersed with aesthetic interior elements or visual exhibits – exhibits hanging from the ceiling or cantilevered elements are marked on the floor below them by colour contrast and also haptically
	– safe evacuation	– the safest evacuation from the 2nd floor in large museums is down the ramp – in smaller museums, an evacuation lift is recommended
	– no sensory overload (sharp lights, reflections on glossy surfaces, unsuitable contrasts, colours, noises)	– diffuse effect and matte surfaces create a less visually tiring environment – noise-absorbing materials help the space become less hectic and more restful
6. Low Physical Effort	– comfortable movement – ergonomic solutions	– ramps with suitable slope, anti-slip surface and handrails and elevators reduce physical effort
	– minimal physical effort in manipulating the interior elements	– automatic doors – easy-to-manipulate exhibits
	– opportunity for rest	– seating
7. Size and Space for Approach and Use	– many spatial dimensions based on the wheelchair parameters – also for people with baby strollers	– the entrance and circulation areas allow for the free movement. – suitable widths of the doors, corridors, lifts, as well as the furniture arrangements (e.g. aisle widths between exhibits) – exhibits placed at an appropriate height

user. The layout should be clear, important points of interest highlighted. Wayfinding and routes are usually intuitive in an open floor plan. In case of layout with multiple rooms for exhibition, orthogonal or also circular routing should be clear. Signage of the theme of the rooms facilitates navigation.[11] The use of spaces and elements should not require special abilities or skills. The space legibility enables people to see or predict activities in the space. As Black (2005: 140) suggests: "Visitors will require an understanding of the 'whole' as well as parts, and parts must be understood in the context of the whole". Visual and other sensory contact with the environment (the view of daylight, the colour solution[12], or feeling fresh air from the exterior) can satisfy human senses and contribute to well-being.[13] Views help visitors navigate, thus people more accurately determine their position and direction of movement with respect to their surroundings.[14]

4. Perceptible Information – The communication is effective when different modes are incorporated. Various information is provided in a multisensory way, e.g., the main entrance uses contrast, it could be marked aurally by acoustic beacon[15], and haptically by tactile paving which is a more universal solution. Exhibition should be interactive, supporting hands-on, and multisensory approach.[16] Visual, acoustic and haptic types of information are very important in museum architecture and exhibition. Models, sometimes even originals, can be accessible by touch under certain conditions. Modern technologies are applied, as well.[17] Occasionally, even olfactory information and taste are incorporated in specialised exhibitions. The distinctive vertical or horizontal elements can be seen from several levels, positions and angles.

5. Tolerance for Error – The environment is risk-free, hazards and errors are minimised. People using the white stick technique need to recognize the presence of protruding elements. Stairs should preferably not have nosing because of the risk of tripping. In the environment, suitable colour contrasts and acoustic methods are used to prevent the risks of injury. Crucial for planning in accordance with this principle are (1) experiencing the museum environment through different senses, e.g., soundwalking and sound mapping technique in museums[18], and (2) participatory planning. Users with different needs or impairments can then name the risks they

11 And also offers choice to visitors about which exhibition theme they want to visit.

12 Interesting lighting solutions in architecture can be seen in Lumitecture by Yudina (2016), and the power of colour effects is researched by Urlandová (2016).

13 Comfort in physical environment is another crucial issue and is examined for example by Kotradyová (2015). Elements contributing to a feeling from space is also interestingly reviewed in Atmospheres by Zumthor (2006).

14 This aspect is associated with proprioception, which is related to the perception of natural or artificial space, influences activities, interactions, and movement in it. 'Ecological proprioception' examined by Pacher (2015) is a factor of being aware of the relationship between one's position and the surrounding space.

15 Although they can sometimes have high demands on technical devices, and there are many people with visual impairment who do not have these devices

16 Exhibits, sometimes even parts of the building, stimulate multiple senses in various ways described in the publication *The Multisensory Museum* (Levent and Pascual-Leone, 2014). The meaning of multisensoriality is also enhancement of experience, memorability, and accommodating multiple learning styles.

17 Čerešňová and Rollová (2015: 95-96) mention "transformation of visual formats into audio or tactile form".

experience in the built environment and can review the ideas of architects and also suggest suitable solutions for them.[19] Measures for evacuation from the premises are also included. Design should avoid unpleasant light, colour and contrast effects. Similarly for acoustic background, materials and spaces should not create echo and unwanted noises.[20] Redundant information and music should not be imposed on visitors.

6. Low Physical Effort – The design causes minimum fatigue and repetitive actions. The layout should not require redundant walking and vertical transfers which can cause fatigue and discomfort. Communication spaces offer a refreshing experience, when combined with rest zones. Exhibition spaces benefit from rest zones, benches, and informal seating.[21] They could be placed in divided nooks and in the exhibition area next to exhibits. Locating a café near the information desk and a playroom for children is a refreshing idea, reduces fatigue and helps visitors stay focused for a longer time. Exhibits and activities require minimum strength, so that children, older people, and people with disabilities are able to manipulate and interact with them. Automatic doors increase comfort and enable independence for people with disabilities: (1) to the photocell, (2) on the button, and (3) fire doors that are open in normal operation but close automatically when smoke is detected.

7. Size and Space for Approach and Use – The elements are visible, approachable and reachable by a standing or seated person, and by users of various body sizes, including children. The spatial solution of buildings must accommodate a wide range of users, including persons in a wheelchair, taking into account the size of the manoeuvring space with a wheelchair. Exhibits are placed at an appropriate height, lower than it was usual in the past, or ideally installed on an adjustable panel, allowing movement of the exhibit.[22] Exhibition desks should be lower and have free knee-space, so seated people can easily tuck in and manipulate with objects on the desks. Texts can also be repeated in several heights, so that various visitors can read it in a comfortable position. Table I systematises main criteria which have been considered in the evaluation of museums according to UD principles.

Table II Selection of 12 positive analysed examples of historic buildings adapted into museums in the region of Central Europe

Name of the museum	City	Year of adaptation	Author of reconstruction
Graz Museum Schlossberg	Graz	2020	Studio WG3
Joanneum Museum: Neue Galerie, Natural History Museum, and CoSA	Graz	2009-2011	Nieto Sobejano Arquitectos; eep Architekten
Kunsthalle Wien	Vienna	2001	Ortner & Ortner Baukunst
Vienna Museum of Science and Technology	Vienna	2010	Querkraft Architekten
Silesian Museum	Katowice	2010-2014	Florian Riegler, Roger Riewe
Techmania Science Center	Plzeň	2012-2014	Atelier Soukup and designer Štěpán Soutner
Olomouc Archdiocesan Museum	Olomouc	2000-2006	HŠH Architekti
National Museum	Praha	2011-2019	Zdeněk Žilka, Pavel Jerie
Kulturpark Košice	Košice	2012-2013	ZEROZERO
Slovak Museum of Nature Protection and Speleology	Liptovský Mikulás	2011-2014	B4ARCH & ARCHITEKTI
Esterházy Palace: Slovak National Gallery	Bratislava	2004-2005	Rosica Borščová
Old Town Hall: Museum of the City History	Bratislava	2008-2011	Peter Bouda

Methodology

The purpose of broader research is to assess selected museums from several perspectives related to Universal Design and to promote inclusive solutions. Areas of interest in museum buildings have been listed in checklists, elaborated in CEDA (Centre of Design for All) at the Faculty of Architecture and Design at Slovak University of Technology in Bratislava, in which the authors of this paper have participated.[23] Consequently, this checklist tool is introduced in the article. Secondly, the assessments of 52 museums regarding principles of Universal Design, and also suitability for children visitors, have been conducted by the authors of this paper during the last four years.[24]

The museums selected for the comparative analysis are located in Central Europe, and were chosen according to following criteria: (1) it was needed to cover various regions forming the whole territory of Slovakia to gain comprehensive knowledge of the situation in this area; (2) the chosen museums are of national significance to study relevant facilities; (3) 12 Slovak museums required the

18 Examined for example by Kannenberg (2020).

19 Research by Vaz, Freitas & Coelho (2020) shows participatory approach with participants with visual impairments in a museum environment.

20 Preferably, there are headphones or sound boxes in the exhibition area that allow visitors to choose to listen according to their preferences.

21 They provide visitors with the possibility to relax and consolidate gained knowledge from exhibitions. It is also an opportunity for people to look after children from a seated position. It is a design opportunity to create benches that are aesthetically harmonized with surrounding exibits, and are at the same ergonomic.

22 Sometimes, exhibits are made available using small stages which can help smaller children to reach, but these are not suitable for people using wheelchairs, so it is not a UD solution.

23 The authors' related research can also be seen in papers and seminar works with students elaborated within the course Universal Design. Examples of related research: Čerešňová (2018), Filová & Rollová (2019), Filová & Čerešňová (2020) and Filová, Rollová & Čerešňová (2022), as well as other publications.

24 Additional 10 museums have been evaluated by architecture students with the help of the authors of this paper within the course Universal Design.

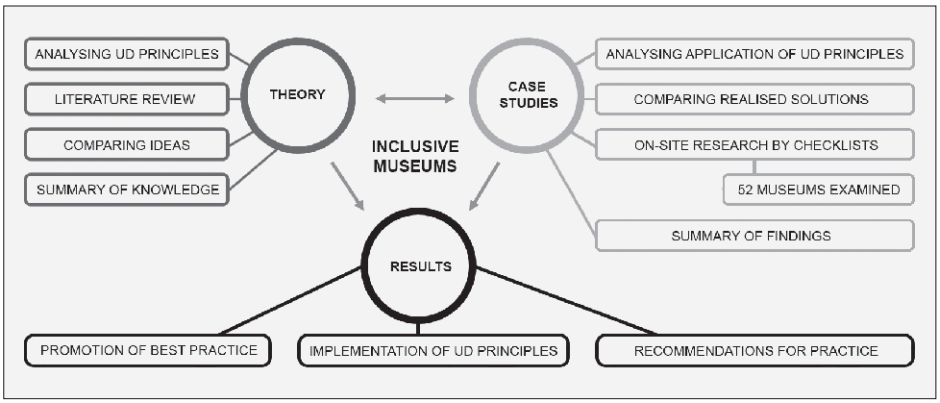

Fig. 2 Diagram illustrating methodology of the research

analysis and advice by themselves because they have taken steps to become more inclusive; (4) the museums from countries outside Slovakia were selected based on desk research as good examples for future practise; (5) the selected museums were established in various periods to see the progress in the UD application in time.

These museums from Central Europe were submitted for a comparative analysis. Most of the museums in the region are located in historical buildings. 36 buildings are historic and 14 are new buildings. That led the research to focus more on discussing ways to make historic cultural buildings more inclusive for all people with various needs. From these museums, Table II presents selection of 12 analysed examples of historic buildings adapted into museums, which reflect UD principles in many positive aspects.

Accessibility modification of historic architecture is a specific problem and the principles of monument restoration must be respected in its solution. The accessibility of the historic environment must therefore be carried out by means of sensitive interventions that do not undermine the historic value. The selected case study represents a good example of how to approach the accessibility of historic architecture in accordance with monument restoration and protection, in order to preserve the heritage value of the buildings.

Evaluation Methods – Principles to achieve inclusiveness are examined; the main goal is the visitability and understandability of all parts of the museum by people with various needs. The accessibility of the museum's architecture, exhibitions and exhibits are the target examined features. Among methods of this part are on-site observations, interviews with museum employees, and as a source of information, serve museum and architectural websites, as well. Photo documentation of the buildings underline the studied phenomena. The methodology and main goals are visually presented on the diagram in Fig. 2.

Fig. 3 Scheme of examined museum areas

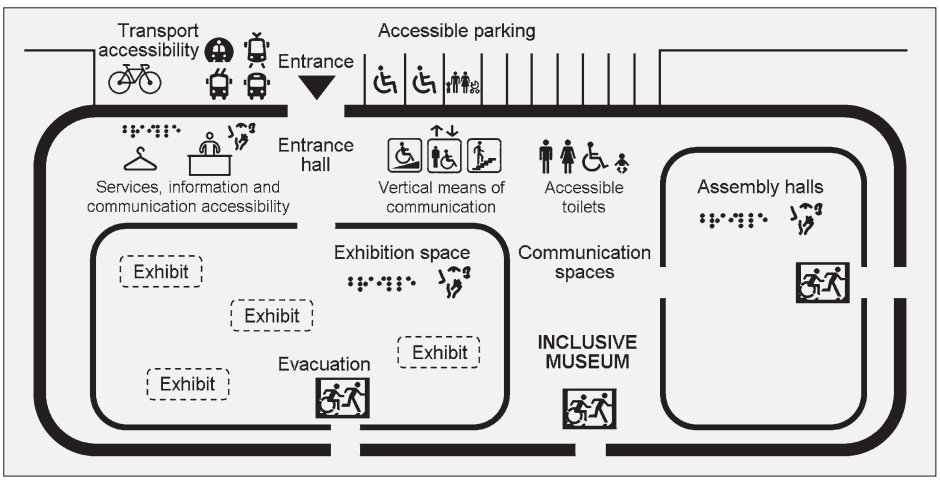

Table III Example of a segment of Access Audit Checklist by CEDA[25]

F. Exhibition spaces				
F.1	Are there accessible routes in the exhibition space?	□ yes □ no □ y/n □ o	□ the floor is at the same level □ using a suitable ramp □ using an inclined stair platform (on a handrail / on the wall) □ using a vertical lifting platform	comments:
F.2	Is there sufficient viewing area in front of the exhibits for manoeuvring a person in a wheelchair?	□ yes □ no □ y/n □ o	□ more than 1,5 m □ more than 3 m □ hall open spaces	comments:
F.3	Is there a tactile wayfinding system in the exhibition space?	□ yes □ no □ y/n □ o	□ relief orientation plans □ tactile paving guidelines on the floor (tour route) □ room descriptions in relief/Braille	comments:

yes – meets the requirements; no – does not meet the requirements; y/n – partially meets the requirements; o – space / element does not exist

Evaluation Checklists

Several evaluation factors have been considered. Evaluation checklists serve as an instrument for examining environments in terms of accessibility. This Access audit system is based on the results of several years of research in collaboration with various groups of users (Samová et al., 2010). "CEDA FAD STU has compiled the structure of the evaluation checklists into tables according to the particular types of spaces [...]" (Čerešňová et al., 2018: 91). They evaluate buildings from the point of view of UD, but are sequenced according to the buildings' premises (not each principle of UD separately), because it appears easier to evaluate separate segments of spaces from various points of view than to assess the whole building according to 7 principles of UD. These checklists are a basis for creating evaluation reports which contain recommendations to make the evaluated premises more accessible and inclusive. They form together access audits of built environments. Many building owners of public buildings, especially the state or cities, ask professionals to evaluate their buildings to help create a more inclusive environment for all.

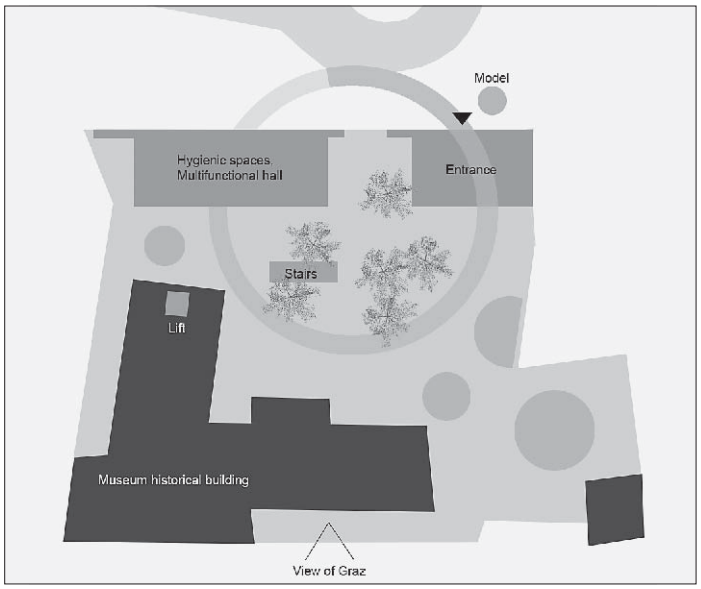

Fig. 4 Scheme of the Museum Schlossberg area ground floor

Fig. 5 Collage from photographs: sidewalk to the Museum Schlossberg; front of the museum; haptic model

There are several types of checklists according to building types. Among them is also the checklist for cultural facilities (i.e. museums), which is the most relevant for this research.

These areas are evaluated in the checklist: (A) Transport accessibility and parking, (B) Entrance to the building, (C) Entrance hall and communication spaces, (D) Vertical means of communication (lift, stairs), (E) Accessible toilets, (F) Exhibition spaces, (G) Assembly halls, (H) Services and information and communication accessibility, (I) Evacuation. See visualisation of the assessed areas in Fig. 3 and an example of evaluating questions in Table III.

Graz Museum Schlossberg Case Study

For the purpose of this paper and after continuous analyses of the museums, a highly elaborated museum in terms of UD, the Graz Museum Schlossberg, has been selected as an exemplary case study.[26] The museum is presented in historical buildings, and its supporting functions are placed in new subtle structures. In the museum and its area, the UD principles are incorporated very well, possibly also because it was recently adapted and opened, thus the architects who design adaptations have used contemporary knowledge about inclusive design. Interestingly, it deals with its demanding historical context, originally with many barriers, of course, considering and protecting its important historical value at the same time.

The Graz Museum Schlossberg is a recently opened museum (September, 2020) that strives to support inclusion of everyone. It is designed by the architecture studio WG3, which won the architectural competition with this solution. They formulate their concept as an open, inviting museum with no barriers (wg3.at). The emphasis on inclusiveness is even more remarkable and inspiring in this project due to its historic foundations and elevated position in the city, on a hill. It communicates largely in alternative forms, especially in haptics, and in hands-on/interactive approach in the exterior part of the exhibition. These additional methods and functions are an added value and create an innovative form of museums. Schleicher (2019: 186) mentions: "in the context of museum buildings, especially those that go beyond the classical understanding of the museum are particularly interesting."

The museum area consists of new and historic buildings. The new buildings have rather supportive functions (entrance with shop/café, toilets, lockers, multifunctional hall), whereas the historic structure serves the main museum purposes (Fig. 4). It has a ground floor and an underground historic floor accessible via a lift as the main route, as well as stairs as an alternative route and a fire exit.

The sidewalk leading to the museum contains natural guiding lines in the form of paving stones in contact with the lawn connected to the relief marking in front of the entrance, an artificial guiding line, tactile tiles for people with visual impairment. It also connects to the paving in the shape of a circle, which is a design trait of the urban-architectural solution. The guiding tactile tiles lead to the en-

25 The entire checklist is 10 pages long.

26 The study does not attempt to be an access audit; rather a promotion of beneficial UD solutions in historical cultural context.

Fig. 6 Collage from photographs: entrance area with the counter desk illustrated with persons of various heights

trance and also to a tactile model of the museum and its surrounding area. The model represents the spatial form and proportions of the architectural elements; the model is interesting and informative for all visitors, including children and people with visual impairment. All these elements are a reflection of the 4th principle – Perceptible Information in practice. The area in front of the entrance is illustrated in Fig. 5.

There is one common entry for all as a reflection of the 1st principle – Equitable Use. After entering a suitable automatic sliding glass door with a pictogram which is in line with the principles 6 – Low Physical Effort, and 4 – Perceptible Information, visitors find the information and ticket area. The tactile paving continues from the exterior through the interior and guides people to the ticket and shop counter, which has a lowered height with an empty space at the ground. This space can be used to insert footrests of a person sitting in a wheelchair. The height of the counter is suitable for people using wheelchairs, but children and persons with lower height also benefit from this solution (Fig. 6).[27] This reflects the 7th principle – Size and Space for Approach and Use.

Fig. 7 Collage from photographs: exterior area with greenery and movable chairs; interactive exterior exhibits

The exterior spaces of the museum, the "Garden of Wonders" (wg3.at), are full of interactive and creative exhibits with no strict order accompanied by resting elements. Sometimes, a café also functions there. Children can explore and discover various stories according to their wishes and educate themselves in a playful way (Fig. 7). This is application of the 2nd principle – Flexibility in Use and 6th principle – Low Physical Effort. Used materials in these exterior pieces are soft, good contrast is used also, so the principle 5 – Tolerance for Error is presented.

To overcome exterior differences in terrain height, ramps are used, but there are also stairs, so people can choose, thus it is the 2nd principle – Flexibility in Use. Several points in the area offer extraordinary views of the city projected also onto a relief model of the view with signs in Braille. Information about one's position in the area and individual museum buildings and exhibits is provided by information and orientation boards. The principles 3 – Simple and Intuitive Use, and 4 – Perceptible Information are applied here. Boards with a uniform recognizable circular shape and good contrast, and are, therefore, clearly presented. To become even more accessible, there could also be some parts in easy-to-read format and Braille on these boards. The mentioned exterior features can be seen in Fig. 8.

The interior ground floor contains showcases lower in height and elevated, allowing space for footrests for people on wheelchairs. The exhibition space also contains multisensory and acoustic exhibits. They are presented in different formats, multifaceted and diverse methods of communication, so they are accessible for many people with sensory disabilities. These are principles 7 – Size and Space for Approach and Use, and 4 – Perceptible Information. One semi-circular exhibit is installed hanging from the ceiling. It should be ideally marked at floor level (e.g., with a stop or interior furnishings) so that it would not pose a risk of collision for people with visual impairment. In the future, the museum plans to add even more interactive, playfully mechanical elements and audio-visual media installations (wg3.at).

The underground area, the casemate, is also accessible to all thanks to the installation of a lift. The Graz Museum (wg3.at) claims that its aim was a "comprehensive inclusion and the greatest possible removal of barriers".[28] Thus, the lift makes the underground space

27 Moreover, it is also comfortable for the employees, who can sit and still have a view, so it does not require unnecessary physical effort.

28 Policies in the city of Graz are aimed to build its new facilities that are fully accessible for people with disabilities.

Fig. 8 Collage from photographs: ramp to view point; view with relief model; information and orientation boards

Fig. 9 Collage from photographs: ground floor (interior exhibition with showcases); underground floor - the casemate (ramp route, audio-visual Schlossberg model, lift)

Fig. 10 Collage from photographs: hygienic spaces and lockers; accessible toilet

Table IV Results of evaluation taking into account previously studied principles of UD and their application in the 52 museums

Principle of UD	Unsuitable solutions	Compliant implementation in practice – recommendation
1. Equitable Use	– Missing accessible entrance. – Separate accessible side or rear entrance (not visible from the main entrance). – Staircase lift – not suitable solution for all visitors. – Steep ramp or missing handrails. – Accessible toilets only for people in wheelchairs.	– One common entrance – suitable for all visitors. – If necessary to use the side entrance – clearly visible and easy to find. – All accessible adaptations usable for all visitors (not only for specific groups). – Exterior spaces and ramps are comfortable for all visitors. – Accessible toilets for all visitors, including people with small children.
2. Flexibility in Use	– Only one solution for the vertical movement. – Only one exhibition route – strictly defined and difficult to pass. – No interactions with the exhibition. – Few activities for various groups of visitors (including children). – Meeting room/hall only with fixed seats.	– Vertical communication to all floors by lift and stairs, ideally also by ramp for evacuation and easy routing. – Free exhibition route of museum buildings and exhibition pieces. – Many ways of perceiving and interacting with the exhibition. – Possibilities for interior and exterior activities. – Flexible multifunctional hall for various activities and different users.
3. Simple and Intuitive Use	– Complicated solutions of the floor layouts. – Lack of visual and tactile identification of the main exhibition and circulation routes. – Lack of colour or tactile contrast of the walls, doors, stairs, etc. – Dark spaces – no visual overview/ preview inside and outside spaces.	– Clear orientation (tactile paving as guidelines, interior ramp as a programmed route in otherwise possibly less clear floor layouts). – Easy routes for wayfinding, providing many views. – Colour and tactile contrast or colour coding of specific zones in the building. – Visual and other sensory contact with the environment.
4. Perceptible Information	– Lack of various (multisensory) forms of perception of information and exhibition. – No clear and legible signs and information. – Dark exhibition spaces – not legible information.	– Multisensory (haptic – by relief, acoustic – using headphones, visual – good lighting and contrasts) and hands-on exhibits. – Aesthetic and understandable signs and pictograms. – Multimedia information in alternative formats (with good lighting).
5. Tolerance for Error	– Protruding objects/exhibits at the circulation routes. – Glass walls and doors without contrasting marking. – Improper shape and dimensions of stairs and ramps (and no handrails). – Slippery and glossy flooring.	– Glass doors marked with colour-contrasting signs. – Exhibits and used materials are durable, resistant, easy to operate. – The environment is risk-free (stairs are straight shaped with no nosings, ramp is generally preferred). – Slip-resistant floor materials without glare.
6. Low Physical Effort	– Steep or long ramp as a part of the exhibition route. – No places to rest or only uncomfortable benches.	– Comfortable movement (including slight ramp slope and landings). – Many resting points. Comfortable solutions for furnishing. – Movable chairs with back support for resting.
7. Size and Space for Approach and Use	– Insufficient space for manoeuvring of a person in a wheelchair and inconvenient access to interior elements. – Narrow corridors, insufficient door widths, small dimensions of lifts, etc. – Missing accessible toilets with baby-changing facilities.	– The elements are visible, approachable and reachable for all. – Counter and showcases with lower height. – Appropriate dimensions for manoeuvring of the person in a wheelchair or people with baby strollers. – Appropriate width of the corridors, doors, ramps, lifts and stairs.

accessible to all, including wheelchair users, the elderly, people with prams, and people with reduced mobility. Furthermore, the underground exhibition route is formed with a suitable subtle ramp, which does not visually compete with important spatial traits and structure of the historical setting. It comfortably guides all visitors through the underground space and forms a clear route common for all. This way prevents accidents that could occur due to bumpy floor surfaces and protects the historical structure from damage. This is regarded as application of the principles 1 – Equitable Use, and 5 – Tolerance for Error. Visitors find there an audio-visual "Schlossberg Story" around a spectacular new transparent Schlossberg model, which illustrates the history of the hill. Visitors perceive the information about the Schlossberg Story visually and auditory, so possibly the museum could consider also adding a haptic model, a relief board, or an interactive tactile exhibit somewhere in the museum premises in the future, so it would saturate the 4th principle – Perceptible Information even more. The interior exhibition areas are presented in Fig. 9.

Finally, one can also mention universally designed hygienic spaces and lockers at various heights (Fig. 10). Both toilets serve all people, both are accessible, and one of them even contains a changing table for babies (Fig. 10). Principles 1 – Equitable Use, and 2 – Flexibility in Use are applied. The design is very appealing; possibly, a colour contrast between doors and walls could be used to facilitate navigation to people with partial visual impairment and would therefore be more according to the 4th principle – Perceptible Information.

Results

The selected exemplary museum in this article was chosen because it reflects the UD principles very well and shows possible ways to welcome all diverse visitors in the environment of a museum with a historic core. The inclusive approach is also shown in its exhibitions, interactive for different age groups and people with various needs. Even in a great solution, it is possible to find some elements that could be even better, so we briefly proposed a few suggestions in the article, most of them with regard to people with reduced vision or visual impairment relating to the 4th principle – Perceptible Information. However, this case study was not selected for a detailed access audit, it was chosen as an exemplary realisation that presents an overall positive implementation of UD.

The result of broader research is the evaluations of several museums; some of the museums' founders are even inclined to implement recommendations into practice, so this has the impact on strengthening a more inclusive practice of creating a museum environment. Based on the findings and evaluations of 52 visited museums, the implementation of UD principles in Table IV is summarised.

Conclusion

The paper explained the methods used in the research, the original background from 7 principles of Universal Design, and characterised also the tool of Access Audit Checklist which has the structure different from original UD principles because it considers functional areas from all points of view from UD

(not each principle separately in the whole building at once) to facilitate the examination process. Multiple museums with regard to Universal Design were evaluated. In many cases, museums are situated in historic buildings, so the topic of UD is an important issue in the process of their restoration and renovation.

The issue of applying UD principles to historic buildings is very important for architects and people in general. This research indicates that a significant number of museums are situated in historic buildings and often tied to historical times, people and events. Applying UD principles in the process of renovation and adaptation of these objects provides access to education, experiences and participation in social life to all people with different needs. The presented example illustrates that combining methods of UD with sensitive monument restoration is possible and even complementary (e.g. the ramp providing accessible route and protecting the historic constructions at the same time).

In current and future practice, there is a strengthening trend and a great desire to make public buildings, including museums, more accessible and welcoming. This article demonstrates theoretically, and practically, through the case study, that it is possible to apply UD principles even in a difficult terrain and historic environment, and combine it with the effort to preserve the historical value of the place in a very aesthetic way. Multiple ways are shown to give various visitors a quality experience of the museum tour and global impression from the visit. The summarisation of findings proposes suitable ways of implementing UD principles in museums' historic buildings.

[Translated by: Natália Filová
(originally written in English).
Proofread by: Zuzana Čerešňová]

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Sources of illustrations and tables

Fig. 1-3, 5-10	Authors, 2022
Fig. 4	Authors, 2022; drawn according to personal visit, information provided in information tables in the area and also from WG3 studio (wg3.at)
Tables I-IV	Authors, 2022

Authors' biographies and contributions

Natália Filová is a Ph.D. Candidate. Her thesis topic is "Museum for children?", and she focuses on inclusive museum architecture.
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The article emerged from the cooperation of Natália Filová (N.F.), Lea Rollová (L.R.) and Zuzana Čerešňová (Z.Č.). The main concept of the article was developed together. Used methodology resembles methods applied in previous research of L.R. and Z.Č. On site research was realised by N.F. All coauthors shared their resources. L.R. and Z.Č. supervised and reviewed the draft of the paper written by N.F.

Conceptualization: N.F., L.R., Z.Č.; Methodology: L.R., Z.Č.; Software: N.F.; Validation: L.R., Z.Č.; Formal analysis: N.F.; Investigation: N.F.; Resources: N.F., L.R., Z.Č.; Data curation: N.F.; Writing – original draft preparation: N.F.; Writing – review and editing: L.R., Z.Č.; Visualization: N.F.; Supervision: L.R., Z.Č.; Project administration: N.F., L.R.; Funding acquisition: L.R.

All authors have read and agreed to the published version of the manuscript.

Acknowledgments

The paper is published in the framework of the national project Support for Universal Design No. NFP312040APA3, which is implemented thanks to the support from the European Social Fund under the Operational Programme Human Resources.

Fig. 1 Distribution of the literature based on authors' affiliation addresses

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Scientific Subject Review
https://doi.org/10.31522/p.30.1(63).10
UDC 72-047.44 BREEAM (048)
Technical Sciences / Architecture and Urban Planning
2.01.03. – Architectural Structures, Building Physics, Materials and Building Technology
Article Received / Accepted: 15. 5. 2022. / 14. 6. 2022.

The Comparative Analysis of the Scoring System Used in BREEAM International New Construction 2016 and the Recent Trends in Housing Sustainability-Related Literature

BREEAM certificate
building benchmarking
sustainability assessment tools
sustainable housing

Paying attention to the sustainability of houses and any effort in this direction can be extremely important in achieving more sustainable societies. In this regard, sustainability assessment tools and more specifically the certificates that are used to evaluate the sustainability of urban houses can play major roles and, therefore, present points that need to be as efficient as possible. The study is an attempt at analyzing the efficiency of BREEAM (The British Building Research Establishment Environmental Assessment Method), as one of the most advanced and highest used certificates (in the world) in the housing sector, based on the results from a systematic literature review. To achieve this goal, the scoring system used in the BREEAM International New Construction 2016 is evaluated in order to see if the credits and weightings that are assigned to the assessment issues are aligned with the trends existing in the recent literature related to urban housing sustainability. The results of a previously published systematic review of 118 recent papers are used to extract the most important factors (and their importance degrees) affecting the sustainability of urban houses on a global scale. The analysis outcome shows significant differences in the prioritization of factors and the importance degree given to each factor between the BREEAM evaluation process and the literature review factors.

INTRODUCTION

Residential construction is an important industry in achieving sustainable development. The initiatives in this sector have been primarily concerned with technical and financial practicality (Tupenaite et al., 2017). Nevertheless, in recent years, since housing has been identified as a critical component in achieving sustainable development, the focus on housing has expanded far beyond financial and technical feasibility. To present some instances of the importance of housing in sustainable development, it can be stated that, from a social perspective, housing not only delivers shelter but also generates a sense of security and supports local communities (Arman et al., 2009). In terms of economics, housing is one of the major investments that individuals can make in their lifetimes (Maliene and Malys, 2009). Furthermore, from an environmental point of view, energy consumption in the usage phase of housing causes the largest environmental impact in Europe (European Environment Agency, 2019). These examples demonstrate how sustainable housing (in all areas of sustainability) may significantly contribute to society's sustainable development.

Developing and applying building sustainability assessment and benchmarking methodologies, according to Mateus and Bragança (2011) and Zhang et al. (2014), is one of the measures that might promote a more sustainable built environment and housing. Presently, several techniques for evaluating the sustainability of buildings are being employed in the housing industry, some of which are being used internationally. The British Building Research Establishment Environmental Assessment Method (BREEAM), which is now one of the most extensively used tools worldwide, and especially throughout Europe, was first developed in the United Kingdom in 1990. The most current international version, BREEAM International for New Construction 2016, has been launched to certify projects across the world (BRE Global, 2016).

Academics disagree on the extent of efficiency of the BREEAM certificate and, in general, the international building sustainability assessment tools. Some authors have criticized the scoring system of sustainability assessment tools through the usage of life-cycle assessment (Humbert et al., 2006; Trigaux et al., 2016). Besides, there are multiple previous studies evaluating the diverse aspects of the BREEAM certificate (different versions). For instance, there are studies criticizing its holistics regarding various sustainability aspects -e.g., (Hassan, Cheen and Rahmawaty, 2011; Sharifi and Murayama, 2013)- its local applicability -e.g., (Ameen and Mourshed, 2019; Awadh, 2017; Sallam and Abdelaal, 2016)- different variables and indicators and weighting measures -e.g., (Sallam and Abdelaal, 2016; Suzer, 2015)- and the extent of alignment between its performance and design procedures/building simulation techniques -e.g., (Schweber and Haroglu, 2014; Schwartz and Raslan, 2013).

Previous evaluations of BREEAM have mostly been done in comparison with other building sustainability assessment tools or the locally-specific priorities and variables. However, there has not been an investigation done to assess the BREEAM's weighting system efficiency according to the sustainability priorities that exist in the recent literature related to urban housing sustainability. Using the data of a systematic review of the recent literature, this paper attempts at filling out this gap by comparing the prioritization of assessment issues used in the scoring system of the BREEAM International New Construction 2016, with the prioritization of housing sustainability factors gathered from the recent related literature.

MATERIALS AND METHODOLOGY

This paper uses the results of a systematic literature review of 118 recent papers (journal articles, conference papers, review papers and book chapters published in the period from 2015 to 2020) by Sanei, Khodadad, and Calonge Reillo (2022). As can be seen in Figure

1, the results of this study are not based on the priorities of a limited region in the world, but are constructed in a universal context.

Figure 2 illustrates the search structure used for the literature review in Scopus. Keywords related to housing sustainability factors are searched within multiple areas of research, including "social sciences", "engineering", "energy", "environmental science", "decision sciences", "economics, econometrics and finance", "business, management and accounting", "arts and humanities", and "multidisciplinary", to ensure the holistics of the results regarding multiple aspects of sustainability.

Literature review provides a comprehensive prioritized list of factors (F; mostly categories of indicators) that affect the sustainability of urban houses. The full list with the references can be found in the Appendix. The prioritization of factors is done by their investigation frequencies (IF; the number of times each factor is found in the total reviewed literature; e.g., if a factor is found in 10 reviewed papers out of the total 118, IF for this factor equals to 10). Scrutinizing the frequency of each factor is chosen as a possible method to show how much a factor is investigated in the selected literature, and therefore, to be a base to calculate the degree of importance that literature has given to each factor. The specific and detailed methodology used for literature review can be found in *Identifying the Most Investigated Factors Affecting Urban Housing Sustainability and Their Scale/Sector of Influence - A Systematic Review of the Recent Literature* (Sanei, Khodadad and Calonge Reillo, 2022). Investigation frequencies of factors (results of the previous study, Table I), as the assigned measures showing their degree of significance, are used in this paper to evaluate the prioritization (overall weightings) of the assessment issues used by BREEAM International New Construction 2016 in its scoring system. This is the most recent version of the BREEAM certificate which can be used in any country around the world, with the exception of territories where locally-adapted versions exist (BRE Group, 2022). Therefore, it can be assumed that the scale of implementation for this certificate matches the universal context of the literature review outcomes. Investigation frequencies of factors (results of the previous study, Table I), as the assigned measures showing their degree of significance, are used in this paper to evaluate the prioritization (overall weightings) of the assessment issues used by BREEAM International New Construction 2016 in its scoring system.

For each BREEAM assessment issue, all the related Fs are found and then the average amounts of their IFs are calculated (Av. IF), as the overall score which is based on the literature review results. These numbers shape the foundation of the comparison with the values gathered from the BREEAM assessment system (maximum weightings). It should be mentioned that in order to find the related Fs, the description related to each assessment issue in the BREEAM International New Construction 2016 official report is read and only the factors directly related to the descriptions that are used by the BREEAM certificate are selected from all the factors extracted from literature. Therefore, there may be some other factors from the list that seem to be related to each credit but as this relationship is not mentioned directly in the description of the credits, these factors are not included in the credits analysis, because they do not have roles in the scoring process of BREEAM.

To use Av. IFs for analyzing the weightings of BREEAM assessment issues, the range used for these values (see Table II, Av. IF_{min} = 13, Av. IF_{max} = 63.67) is converted to the range of the overall weightings (W) that are given to the issues in the BREEAM scoring system (W_{min} = 0.65, W_{max} = 10.56). This way, the

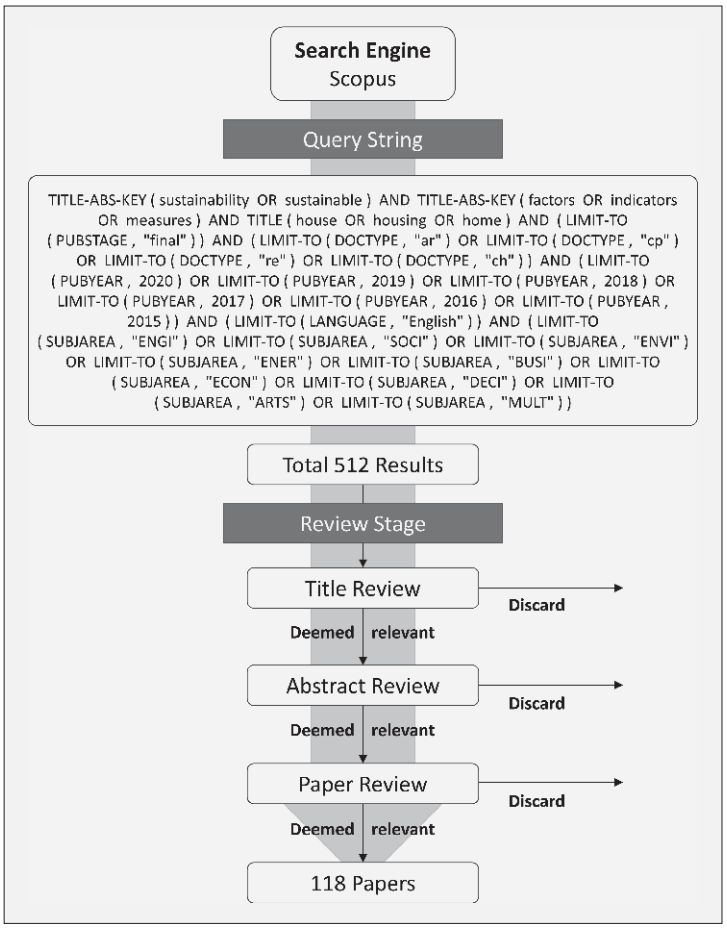


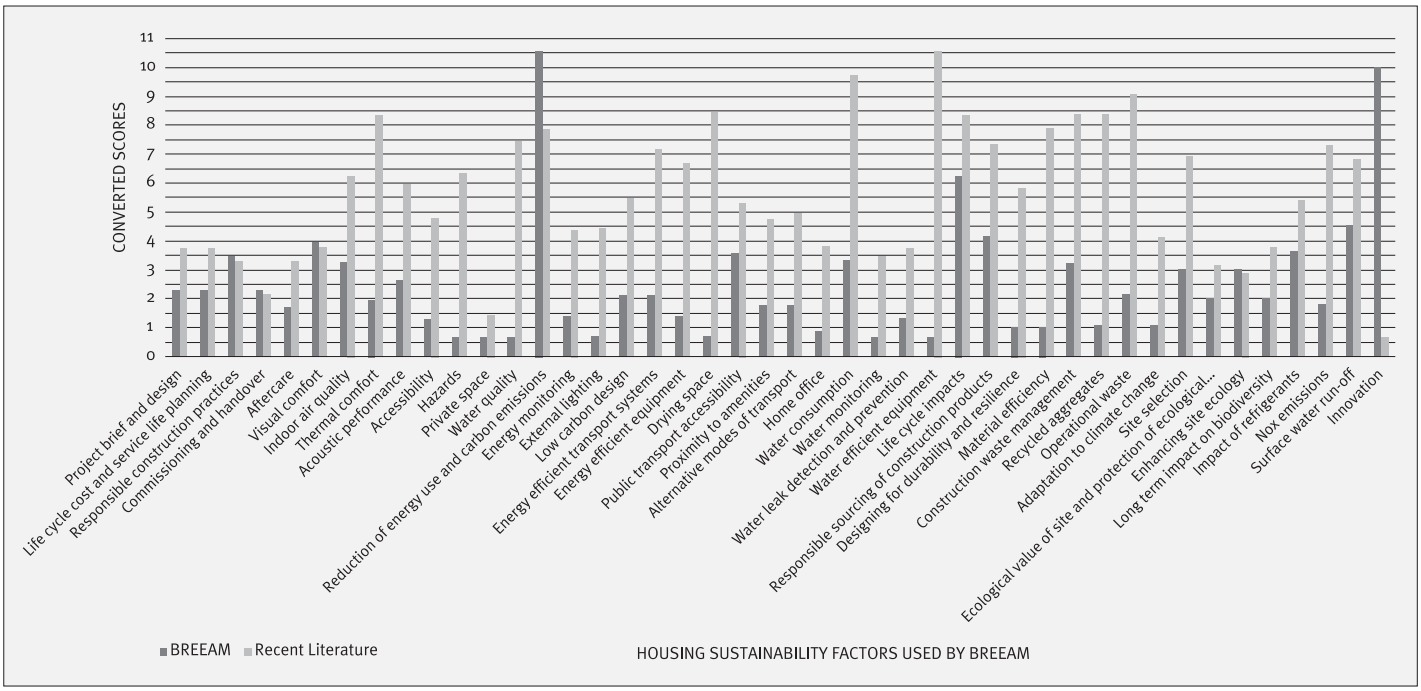
Fig. 2 The search structure used to select the related literature

Table I Factors Affecting Urban Housing Sustainability and their Investigation Frequencies (Source: Sanei, Khodadad and Calonge Reillo, 2022)

No.	Factors Affecting Urban Housing Sustainability	IF
F1	Natural resource or energy consumption/efficiency of the building/equipment (during the construction, operation, etc.)	87
F2	Materials performance (durability, cost, thermal capacity, permeability, ability to re-use, recycled, eco-friendly materials)	78
F3	Access to public services/infrastructure: availability/quality of services and/or distance/time of travel time to the services (public transport, education/health/shopping/leisure facilities, parks, etc.)	72
F4	Building spatial layout (size and dimensions, building form, internal space distribution, etc.)	72
F5	Location – Site – Development land	67
F6	Healthy conditions (hygiene, clean environment, air/water quality, mental health, etc.)	66
F7	Housing affordable purchase/rental/mortgage costs (market value, relation to household income)	66
F8	Waste management/facilities (waste recycle/reduction, appropriate disposal of waste, etc.)	62
F9	Safety and security	59
F10	Building equipment/technologies (heating/cooling systems, ventilation systems, kitchen appliances, furniture, etc.)	56
F11	Rehabilitation/refurbishment of the building/community (repairing the deteriorations, functional improvements, etc.)	53
F12	Building envelope (thermal performance of the building, insulation, air tightness/exchange, etc.)	52
F13	Indoor environment (air quality, humidity, mold, thermal comfort, air circulation, etc.)	49
F14	Carbon footprint – GHG emissions	48
F15	Water management (consumption rate, irrigation systems, recycling, etc.)	48
F16	Use of renewable/clean resources (solar, wind, geothermal, renewable material, etc.)	47
F17	Opportunity for social cohesion/integrity/interaction/connectivity (common use areas, facility sharing, etc.)	46
F18	Re-use/recycle (materials, water, waste, etc.)	43
F19	Housing-related policies/strategies/guidelines/plans/decision-making procedures	41
F20	Building's basic services (safe drinking water availability, access to electricity, sewer, sanitation, etc.)	40
F21	Noise level – Acoustic design – Aural comfort	40
F22	Building codes/energy standards/technical specifications/regulations	40
F23	Investment/finance measures (subsidies, financial risk/support options, investment cost, return of investment, payback period, profitability, cost-benefit data, budget adaptability)	39
F24	Pollution (air, water, land)	37
F25	Climatic/microclimatic conditions (air temperature, humidity, wind speed, solar radiation, heat island effect, etc.)	37
F26	Land use (mixed-use building/community, zoning plans, re-using a developed area instead of new developments, land use change, amount of land supplied, etc.)	36
F27	Natural light – Solar radiation (availability, intensity, etc.)	35
F28	Built-up density	35
F29	Building typology (single-family, attached, apartment, etc.)	35
F30	Flexibility/adaptability (design, construction, function)	35
F31	Neighborhood spatial layout (street layout and network, space between blocks, pedestrian paths, open space layout, human scale features, public furniture, disables accessibility, etc.)	34
F32	Construction method/techniques/technologies (prefabrication, light/heavy structure, energy efficient techniques, traditional method, etc.)	34
F33	Passive/green/low-energy/near-zero-energy/plus energy design/principles	34
F34	Lighting systems (indoor lights, street lights, open space lights, etc.)	33
F35	Housing occupancy rate – Community population	31
F36	Overall/lifecycle costs of the building	31
F37	Operation cost (energy/water/telephone bills, technology investment price, etc.)	31
F38	Aesthetical quality	29
F39	Traffic – Car dependency – Parking area	28
F40	Space functionality	27
F41	Participatory actions (design, management, bottom up governance, educational programs, etc.)	27
F42	Housing/community administration and management (cost/time/risk/maintenance management, etc.), and the types (self-managed, co-managing, etc.)	26
F43	Accessible house (easy physical accessibility for pedestrians/cars/elders/disables/etc.)	26
F44	Structural quality and durability	26
F45	Natural hazards and the related resilience/repair (earthquake, flooding, etc.)	25
F46	Building orientation	25
F47	Natural ventilation	25
F48	Walkability/bikeability (auto-free zones, sidewalks, bike routes, etc.)	24
F49	Access to workplaces (distance/time of travel)	23
F50	Local materials	23
F51	Construction cost (material, transport, labor, equipment and installation, etc.)	22
F52	Household/project team overall satisfaction rate	21
F53	Employment/business activity rate/opportunities in the area	21
F54	Compatibility with household/community cultural values or heritage	20
F55	Shading options – Rain protection	19
F56	Building's/neighborhood's identity/reputation/popularity	19
F57	Private/semi-public outdoor space (courtyard, garden, greenhouse, green roof, etc.)	18
F58	Privacy	16
F59	Presence/preservation of cultural heritage/natural resource (ponds, preserved greenery, topographical contours, etc.)	15
F60	Pleasant view/scenery	15
F61	Maintenance cost	14
F62	Renovation/repair/reconstruction cost (material, transportation, etc.)	14
F63	Greening the building (plants, green wall/roof, garden, etc.) and types of greenery (types of plants, etc.)	14
F64	Light pollution/quality – Visual comfort	13
F65	Innovation (design, management, technologies, etc.)	13
F66	Socio-cultural mixing of the community	13
F67	Fire prevention/emergency measures	13
F68	Building age – Year of construction	12
F69	Cost/value of land – Land use rights	12
F70	Household transport costs	11
F71	Type of tenure (private ownership, shared/private rent, etc.)	11
F72	Property value retention – Balanced housing market – Market trends	11
F73	Life expectancy of housing – Long lasting house	10
F74	Biodiversity/wildlife in the area	9
F75	Cater for senior citizens/disables	9
F76	Ease of movement inside the building (elevators, stairs, furniture and decoration placement, etc.)	9
F77	Construction time/speed	9
F78	Smart home/community (smart technologies/equipment: energy management systems, smart communication, intelligent controlling of home performance, smart toilets, etc.)	8
F79	Sense of belonging	8
F80	Odors – Olfactory comfort	7
F81	Access to the city center/urban space (distance/time of travel)	7
F82	Skilled/local labor and/or manager	7
F83	Security of tenure	7
F84	Standards of living	6
F85	Administration/government/management/design cost	6
F86	Ease of maintenance/cleaning (space, equipment)	6
F87	Level of physical deterioration	5
F88	Green/electric car usage – Carpooling	4
F89	Community acceptance/opposition with the project	4
F90	Economic mixing of the community	4
F91	Demographic/ethnic mixing of the community	4
F92	Diversity of building typology and/or spatial/aesthetic forms in the area	3
F93	Openness/closeness of the community (open/semi-open/gated neighborhoods)	3
F94	Community agriculture/gardening	3
F95	Mixed tenure community	3
F96	Access to internet (speed, capacity)	3
F97	Access to telecommunication service	3
F98	Access to television/cable system	3

Table II BREEAM International New Construction 2016 Assessment Issues and Their Related Factors

Categories and Issues	Credits	Weightings (W) %	Associated factors from literature	Av. IF	CIF
Management	*21*	*12.00*			
Project brief and design	4	2.29	F19, F41, F42, F52	28.75	3.73
Life cycle cost and service life planning	4	2.29	F7, F23, F36, F37, F41, F42, F51, F69, F85	28.89	3.76
Responsible construction practices	6	3.43	F41, F42	26.5	3.29
Commissioning and handover	4	2.29	F41, F42, F77	20.67	2.15
Aftercare	3	1.71	F41, F42	26.5	3.29
Health and wellbeing	*23*	*15.00*			
Visual comfort	6	3.91	F13, F27, F34, F60, F64	29	3.78
Indoor air quality	5	3.26	F6, F10, F13, F24, F25, F47	41.67	6.26
Thermal comfort	3	1.96	F10, F12, F13	52.33	8.34
Acoustic performance	4	2.61	F21	40	5.93
Accessibility	2	1.30	F4, F9, F17, F31, F39, F43, F48, F75, F76	34.11	4.78
Hazards	1	0.65	F9, F45	42	6.32
Private space	1	0.65	F57, F58	17	1.43
Water quality	1	0.65	F6, F15, F20, F24	47.75	7.45
Energy	*27*	*19.00*			
Reduction of energy use and carbon emissions	15	10.56	F1, F10, F14, F22, F32, F33	49.83	7.85
Energy monitoring	2	1.41	F10, F78	32	4.37
External lighting	1	0.70	F10, F34, F78	32.33	4.43
Low carbon design	3	2.11	F14, F16, F32, F33, F47	37.6	5.46
Energy efficient transport systems	3	2.11	F1, F10, F33, F78	46.25	7.15
Energy efficient equipment	2	1.41	F1, F10, F32, F33, F78	43.8	6.67
Drying space	1	0.70	F4, F10, F13, F33, F47	47.2	7.34
Transport	*9*	*8.00*			
Public transport accessibility	4	3.56	F3, F24, F31, F39, F43, F48	36.83	5.31
Proximity to amenities	2	1.78	F3, F31, F49, F81	34	4.76
Alternative modes of transport	2	1.78	F3, F14, F31, F39, F48, F88	35	4.95
Home office	1	0.89	F4, F10, F13, F27, F64, F96, F97, F98	29.25	3.83
Water	*9*	*6.00*			
Water consumption	5	3.33	F1, F15, F18	59.33	9.71
Water monitoring	1	0.67	F15, F42, F78	27.33	3.45
Water leak detection and prevention	2	1.33	F10, F15, F42, F78, F86	28.8	3.74
Water efficient equipment	1	0.67	F1, F10, F15	63.67	10.56
Materials	*12*	*12.50*			
Life cycle impacts	6	6.25	F2, F12, F14, F18, F22	52.2	8.32
Responsible sourcing of construction products	4	4.17	F2, F12, F18, F22, F50	47.2	7.34
Designing for durability and resilience	1	1.04	F2, F11, F32, F44, F86	39.4	5.81
Material efficiency	1	1.04	F2, F8, F32, F44	50	7.89
Waste	7	7.50			
Construction waste management	3	3.21	F8, F18	52.5	8.38
Recycled aggregates	1	1.07	F8, F18	52.5	8.38
Operational waste	2	2.14	F4, F8, F31	56	9.06
Adaptation to climate change	1	1.07	F25, F30, F42, F45	30.75	4.12
Land use and ecology	*10*	*10.00*			
Site selection	3	3.00	F5, F22, F24, F26	45	6.91
Ecological value of site and protection of ecological features	2	2.00	F5, F59, F69, F74	25.75	3.14
Enhancing site ecology	3	3.00	F5, F59, F74, F82	24.5	2.90
Long term impact on biodiversity	2	2.00	F5, F22, F26, F59, F74, F82	29	3.78
Pollution	*11*	*10.00*			
Impact of refrigerants	4	3.64	F10, F14, F24, F78	37.25	5.39
NOx emissions	2	1.82	F10, F14, F24	47	7.30
Surface water run-off	5	4.55	F5, F10, F15, F24, F31, F45	44.5	6.81
Innovation	*10*	*10.00*			
Innovation	10	10.00	F65	13	0.65



GRAPH I THE COMPARISON BETWEEN BREEAM SCORES AND CONVERTED INVESTIGATION FACTORS FOR ISSUES

comparisons between Av. IFs and Ws are done on the basis of a similar range of values (0.65-10.56). For this conversion the following equation (linear conversion) is used for each Av. IF, which concludes in Converted IFs (CIFs, see Table II):

$$CIF = ((\text{BREEAM issue's Av. IF} - \text{Av. IF}_{min}) / / (\text{Av. IF}_{max} - \text{Av. IF}_{min})) \times (W_{max} - W_{min}) + W_{min}$$

As mentioned, the outcomes (CIFs) are the amounts that are compared with the W values (overall weightings) of the BREEAMS's issues. It should be noted that, in this evaluation, the prerequisites of the BREEAM certificate are not included, as although meeting these prerequisites are mandatory for buildings to be involved in the certificate evaluation procedure, there is no score (credit and weighting) assigned to these criteria in the BREEAM assessment. Also, only the issues that influence the "residential dwellings" (based on the categorization used in BREEAM, including single and multiple dwellings) are included in the analysis. Other typographical characteristics of residential dwellings (e.g., high-rise or low-rise) are not specified in the BREEAM report and the certificate can be used for all these classes of houses.

RESULTS AND DISCUSSION

Table I shows the factors that are gathered from the literature review conducted by Sanei, Khodadad and Calonge Reillo (2021). As can be seen, a total of 98 factors are prioritized based on their IFs (the total number of each factor's repetition in the studied literature). The factors with IFs less than 3 are not listed. These factors are used to analyze the BREEAM assessment issues and CIFs are utilized to be compared with the Ws that are assigned to each issue.

To have a clear view of the BREEAM scoring process, it should be noticed that each assessment issue (in multiple general categories of issues) has an assigned credit. The percentage of credits achieved in each category is calculated by adding the quantities. The calculated percentage of credits achieved in each section is then multiplied by the corresponding section weighting. This gives the overall section score. The section scores are then added together to give the overall BREEAM score. The overall score is then compared to the BREEAM rating benchmark levels and, provided all minimum standards have been met, the relevant BREEAM rating is achieved (BRE Global, 2016).

Table II shows The BREEAM categories and assessment issues, together with the maximum credits assigned to them for the residential classification of buildings and their weightings. The factors that are related to each issue and the average IF and CIF (converted IF) for them are also included in this table. The organization of issues is based on their appearance in the BREEAM official report.

As seen in Table II, the top three issues with the highest W scores (according to the BREEAM scoring system) are 'reduction of energy use and carbon emissions', 'innovation',

and 'life cycle impacts' with W scores of 10.56, 10, and 6.25, relatively. While, based on CIFs, the top three issues are 'water efficient equipment', 'water consumption', and 'operational waste' with CIF values of 10.56, 9.71, and 9.06, respectively. Also, the issues with the least Ws are 'private space', 'hazards', and 'water quality', all of which have a W value of 0.65. However, the least values for CIFs are related to 'innovation', 'private space', and 'commissioning and handover' issues with CIFs equal to 0.65, 1.43, and 2.15, respectively.

Graph I shows the comparison of BREEAM issues' scores and CIFs related to each of them. Although there are some similarities between the assigned scores for some issues (for example, 'private space', 'commissioning and handover', 'visual comfort' and 'enhancing site ecology'), there are 23 out of the total 44 issues with differences greater than 3 units in their scores. This demonstrates that there is a huge variance between BREEAM scores and CIFs, and accordingly the prioritization of issues in the BREEAM assessment system and the recent literature related to urban housing sustainability. 'Water efficient equipment' and 'innovation' are the issues that are prioritized quite inversely according to each source of prioritization. While 'water efficient equipment' is significantly important according to the literature (CIF=10.56), it is one of the least considered issues in BREEAM assessment (W=0.67). The situation is quite the opposite for the 'innovation' issue. It has the second-highest degree of importance, of all the issues, by the BREEAM weighting system (W=10), whereas it is not explicitly mentioned many times as a significant factor in the sustainability of urban houses in the related recent literature, so it is not given high priority (CIF=0.65).

The lack of alignment between BREEAM and recent literature priorities can highlight the need to revise the BREEAM's assessment system. This is in line with the results of the previous studies, where the focus was on different aspects of sustainability assessment tools, such as local adaptation and the holistics of sustainability aspects. The necessary revision according to our analysis is to make the prioritization of factors in BREEAM more aligned with the priorities mentioned in recent literature. Also, it is understood from the literature review that multiple factors are considered important from the scholars' perspective but are absent in the BREEAM evaluation procedures (e.g., 'building typology (single-family, attached, apartment, etc.)' and 'built-up density'). It is, therefore, of high importance to implement similar methods to include the recent trends of academic research into the housing sustainability evaluation procedures and tools. Nevertheless, it should be noticed that to achieve optimal results regarding the priorities of sustainability assessment tools, including BREEAM, it is better to combine the proposed approach of this research with other sustainability assessment techniques of buildings, such as the life-cycle assessment. The efficiency of BREEAM and other sustainability assessment tools used in the housing sector is crucial not only because these tools are used to evaluate the sustainability of houses but also because they are used worldwide, as very important references, to guide architects, engineers and decision-makers working on housing sustainability. These certificates might be used to guide and establish environmental strategies over the life cycle of a building (Ali and Al Nsairat, 2009).

Conclusion

The housing sector contributes significantly to sustainability development procedures in our societies. This is due to the important impacts that houses have on all aspects of people's lives and their surrounding environment. Therefore, the sustainability assessment of the housing sector can be crucial for overall sustainability of communities. That is why the tools used for this assessment should be highly efficient, which is why their continuous evaluation and upgrade is required.

The paper evaluates the scoring system used in the BREEAM International New Construction 2016 certificate to see if the prioritization and scoring of the assessment issues are aligned with the trend in the recent housing sustainability-related literature. For this reason, the data from a previous study done by Sanei, Khodadad and Calonge Reillo (2022) is used. The results show huge gaps between the ranking and the scores of the assessment based on these two evaluation sources (BREEAM weighting system and the recent literature). Although for some credits values are closer to each other, the general trend shows significant differences in the way these methods prioritize and give importance to the studied credits. This calls for a possible shift and revision in the way that BREEAM scores the credits. As a limitation of the proposed methodology, the restraint of the available writing space in the studied articles should be taken into consideration, as it can affect the number of factors that authors have included in their manuscripts. Also, some topics can often be discussed in literature while their relevance in terms of impact reduction might be relatively limited. Therefore, it is better to use the proposed approach in combination with other quantitative assessments (e.g., life-cycle assessment) to evaluate the priorities used in sustainability assessment tools.

Appendix

Housing sustainability factors gathered from the literature review and the references (Source: Sanei, Khodadad and Calonge Reillo, 2022).

	Factors	References
F1	Natural resource or energy consumption/ efficiency of the building/equipment (during the construction, operation, etc.)	(Henderson, Ganah, and John, 2016) (Mulliner and Maliene, 2015) (Rid, Lammers, and Zimmermann, 2017) (Alrashed and Asif, 2015) (Rehkopf, Rowlands, and Tobert, 2016) (Woo, Kim, and Lee, 2018) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Popova, Glebova, and Karakozova, 2018) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Peruzzini et al., 2016) (Zhang, Chen, and Jin, 2015) (Tomšić and Šijanec Zavrl, 2018) (Boeckermann, Kaczynski, and King, 2019) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Colistra, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Matthews, Friedland, and Orooji, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Chan and Adabre, 2019) (Saldaña-Márquez et al., 2019) (Dong et al., 2018) (Wittmann, Kopacik, and Leitmannova, 2019)
F2	Materials performance (durability, cost, thermal capacity, permeability, ability to re-use, recycled, eco-friendly materials)	(Henderson, Ganah, and John, 2016) (Rid, Lammers, and Zimmermann, 2017) (Alrashed and Asif, 2015) (Nasrabadi and Hataminejad, 2019) (Rehkopf, Rowlands, and Tobert, 2016) (Woo, Kim, and Lee, 2018) (Sanhueza-Durán et al., 2019) (Popova, Glebova, and Karakozova, 2018) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Roosli et al., 2015) (Bintoro et al., 2019) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Boeckermann, Kaczynski, and King, 2019) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Matthews, Friedland, and Orooji, 2016) (Daly, 2017) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019)
F3	Access to public services/infrastructure: availability/quality of services and/or distance/time of travel time to the services (public transport, education/health/ shopping/leisure facilities, parks, etc.)	(Mulliner and Maliene, 2015) (Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Le, Ta, and Dang, 2016) (Woo, Kim, and Lee, 2018) (Roosli et al., 2015) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Boeckermann, Kaczynski, and King, 2019) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Yu et al., 2017) (D. Li et al., 2016) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Colistra, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (Osman et al., 2016) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (Verovsek and Juvancic, 2018) (Kobylarczyk, 2018) (Huang, Mori, and Nomura, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Yuliastuti, Haryanto, and Haryanti, 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cui et al., 2018) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019)
F4	Building spatial layout (size and dimensions, building form, internal space distribution, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Alrashed and Asif, 2015) (Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Popova, Glebova, and Karakozova, 2018) (Roosli et al., 2015) (Bintoro et al., 2019) (Adabre and Chan, 2019a) (Tomšić and Šijanec Zavrl, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Boeckermann, Kaczynski, and King, 2019) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Matthews, Friedland, and Orooji, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Said et al., 2016) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Sari, Nuryanti, and Ikaputra, 2019) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Kobylarczyk, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cui et al., 2018) (Cheng, Bae, and Horton, 2019) (Päätalo, 2016) (Abass and Tucker, 2020) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F5	Location – Site – Development land	(Mulliner and Maliene, 2015) (Alrashed and Asif, 2015) (Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Woo, Kim, and Lee, 2018) (Aghimien, Aigbavboa, and Ngwari, 2018) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Adabre and Chan, 2019a) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Al-Jebouri et al., 2017) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Seo and Kwon, 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Matthews, Friedland, and Orooji, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Sari, Nuryanti, and Ikaputra, 2019) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Huang, Mori, and Nomura, 2018) (Mou, He, and Zhou, 2017) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Yuliastuti, Haryanto, and Haryanti, 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cui et al., 2018) (Cheng, Bae, and Horton, 2019) (Abass and Tucker, 2020) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Karji et al., 2019)

	Factors	References
F6	Healthy conditions (hygiene, clean environment, air/water quality, mental health, etc.)	(Henderson, Ganah, and John, 2016) (Nasrabadi and Hataminejad, 2019) (Karji et al., 2019) (Aghimien, Aigbavboa, and Ngwari, 2018) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Peruzzini et al., 2016) (McHunu and Nkambule, 2019) (Haarhoff, Beattie, and Dupuis, 2016) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Yu et al., 2017) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Al-Jebouri et al., 2017) (Hostland et al., 2015) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Bintoro et al., 2019) (Seo and Kwon, 2017) (Colistra, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Marín et al., 2015) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Tomšić and Šijanec Zavrl, 2018) (Perrucci, Vazquez, and Aktas, 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Feng et al., 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Abass and Tucker, 2020) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F7	Housing affordable purchase/rental/ mortgage costs (market value, relation to household income)	(Mulliner and Maliene, 2015) (Chan and Adabre, 2019) (Woo, Kim, and Lee, 2018) (Aghimien, Aigbavboa, and Ngwari, 2018) (Nuuter, Lill, and Tupenaite, 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (A. Olanrewaju and Tan, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Boeckermann, Kaczynski, and King, 2019) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Yildiz, 2015) (Yu et al., 2017) (D. Li et al., 2016) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Ruiz-Pérez et al., 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Colistra, 2019) (Wu et al., 2017) (Marín et al., 2015) (Wahi et al., 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Said et al., 2016) (Perrucci, Vazquez, and Aktas, 2016) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Huang, Mori, and Nomura, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cui et al., 2018) (Cheng, Bae, and Horton, 2019) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019) (J. Yang and Yang, 2015) (Djebbar, Salem, and Mokhtari, 2018) (Kaoula and Bouchair, 2020) (Henderson, Ganah, and John, 2016) (Rehkopf, Rowlands, and Tobert, 2016)
F8	Waste management/ facilities (waste recycle/ reduction, appropriate disposal of waste, etc.)	(Henderson, Ganah, and John, 2016) (Mulliner and Maliene, 2015) (Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Bintoro et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017) (Peruzzini et al., 2016) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (A. Olanrewaju and Tan, 2018) (Tomšić and Šijanec Zavrl, 2018) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Willems, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Asad Poor, Thorpe, and Goh, 2018) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Matthews, Friedland, and Orooji, 2016) (Daly, 2017) (Osman et al., 2016) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Feng et al., 2018) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Sánchez-Garrido and Yepes, 2020) (Adabre and Chan, 2019a)
F9	Safety and security	(Mulliner and Maliene, 2015) (Karji et al., 2019) (Chan and Adabre, 2019) (Le, Ta, and Dang, 2016) (Woo, Kim, and Lee, 2018) (Nuuter, Lill, and Tupenaite, 2015) (Bintoro et al., 2019) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Peruzzini et al., 2016) (McHunu and Nkambule, 2019) (A. Olanrewaju and Tan, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Yildiz, 2015) (Yu et al., 2017) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Wu et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Sari, Nuryanti, and Ikaputra, 2019) (Dokic, Gligorijevic, and Damjanovic, 2015) (K. Yang and Cho, 2016) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Arifin, Rasyid, and Osman, 2020) (Han and Yang, 2018) (Feng et al., 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Huang, Mori, and Nomura, 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Yuliastuti, Haryanto, and Haryanti, 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019)
F10	Building equipment/ technologies (heating/ cooling systems, ventilation systems, kitchen appliances, furniture, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Alrashed and Asif, 2015) (Rehkopf, Rowlands, and Tobert, 2016) (Karji et al., 2019) (Le, Ta, and Dang, 2016) (Sanhueza-Durán et al., 2019) (Roosli et al., 2015) (Bintoro et al., 2019) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Hostland et al., 2015) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Castellano, Ribera, and Ciurana, 2016) (Kovacic, Reisinger, and Honic, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Karatas and El-Rayes, 2015) (Daly, 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Sari, Nuryanti, and Ikaputra, 2019) (K. Yang and Cho, 2016) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Han and Yang, 2018) (Feng et al., 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Yuliastuti, Haryanto, and Haryanti, 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cui et al., 2018) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Rydborg, Lauring, and Brunsgaard, 2019) (Adabre and Chan, 2019a)
F11	Rehabilitation/ refurbishment of the building/community (repairing the deteriorations, functional improvements, etc.)	(Tomovska and Radivojevic, 2017) (Nasrabadi and Hataminejad, 2019) (Rehkopf, Rowlands, and Tobert, 2016) (Karji et al., 2019) (Woo, Kim, and Lee, 2018) (Sanhueza-Durán et al., 2019) (Popova, Glebova, and Karakozova, 2018) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Adabre et al., 2020) (A. Olanrewaju and Tan, 2018) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Hostland et al., 2015) (Ruiz-Pérez et al., 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Colistra, 2019) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Matthews, Friedland, and Orooji, 2016) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (Verovsek and Juvancic, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cheng, Bae, and Horton, 2019) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rydborg, Lauring, and Brunsgaard, 2019) (Wittmann, Kopacik, and Leitmannova, 2019)

	Factors	References
F12	Building envelope (thermal performance of the building, insulation, air tightness/exchange, etc.)	(Alrashed and Asif, 2015) (Nasrabadi and Hataminejad, 2019) (Rehkopf, Rowlands, and Tobert, 2016) (Sanhueza-Durán et al., 2019) (Popova, Glebova, and Karakozova, 2018) (J. Yang and Yang, 2015) (Zhang, Chen, and Jin, 2015) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Aldossary, Rezgui, and Kwan, 2015) (Al-Jebouri et al., 2017) (Hostland et al., 2015) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Karatas and El-Rayes, 2015) (Daly, 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Han and Yang, 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Adabre and Chan, 2019a)
F13	Indoor environment (air quality, humidity, mold, thermal comfort, air circulation, etc.)	(Karji et al., 2019) (Woo, Kim, and Lee, 2018) (Roosli et al., 2015) (Bintoro et al., 2019) (Peruzzini et al., 2016) (McHunu and Nkambule, 2019) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Al-Jebouri et al., 2017) (Hostland et al., 2015) (Ruiz-Pérez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Marín et al., 2015) (Wahi et al., 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (K. Yang and Cho, 2016) (Tomovska and Radivojevic, 2017) (Han and Yang, 2018) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Adabre et al., 2020)
F14	Carbon footprint – GHG emissions	(Henderson, Ganah, and John, 2016) (Rehkopf, Rowlands, and Tobert, 2016) (Sanhueza-Durán et al., 2019) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Boeckermann, Kaczynski, and King, 2019) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Aldossary, Rezgui, and Kwan, 2015) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Matthews, Friedland, and Orooji, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Verovsek and Juvancic, 2018) (Han and Yang, 2018) (Dong et al., 2018) (Vega-Azamar et al., 2017) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Abass and Tucker, 2020) (Croitoru et al., 2016) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019)
F15	Water management (consumption rate, irrigation systems, recycling, etc.)	(Henderson, Ganah, and John, 2016) (Rid, Lammers, and Zimmermann, 2017) (Rehkopf, Rowlands, and Tobert, 2016) (Woo, Kim, and Lee, 2018) (Sanhueza-Durán et al., 2019) (Popova, Glebova, and Karakozova, 2018) (Ganiyu, Fapohunda, and Haldenwang, 2016) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Peruzzini et al., 2016) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Boeckermann, Kaczynski, and King, 2019) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Ruiz-Pérez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Wahi et al., 2018) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Han and Yang, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Vega-Azamar et al., 2017) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Ahmed and Alipour, 2019) (Karji et al., 2019) (Adabre and Chan, 2019a) (Adabre et al., 2020)
F16	Use of renewable/clean resources (solar, wind, geothermal, renewable material, etc.)	(Nasrabadi and Hataminejad, 2019) (Sanhueza-Durán et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017) (Tomšić and Šijanec Zavrl, 2018) (Boeckermann, Kaczynski, and King, 2019) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Aldossary, Rezgui, and Kwan, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Marín et al., 2015) (Wahi et al., 2018) (Djebbar, Salem, and Mokhtari, 2018) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Vega-Azamar et al., 2017) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019) (Adabre and Chan, 2019a) (Henderson, Ganah, and John, 2016) (Alrashed and Asif, 2015) (Rehkopf, Rowlands, and Tobert, 2016) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Adabre et al., 2020) (J. Yang and Yang, 2015)
F17	Opportunity for social cohesion/integrity/ interaction/connectivity (common use areas, facility sharing, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Le, Ta, and Dang, 2016) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (A. Olanrewaju and Tan, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Yu et al., 2017) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Seo and Kwon, 2017) (Colistra, 2019) (Wu et al., 2017) (Tsuang and Peng, 2018) (Daly, 2017) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Verovsek and Juvancic, 2018) (Feng et al., 2018) (Huang, Mori, and Nomura, 2018) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Yuliastuti, Haryanto, and Haryanti, 2020) (Zasada et al., 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Ahmed and Alipour, 2019)
F18	Re-use/recycle (materials, water, waste, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Rehkopf, Rowlands, and Tobert, 2016) (Tomšić and Šijanec Zavrl, 2018) (Boeckermann, Kaczynski, and King, 2019) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Nasrabadi and Hataminejad, 2019) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Shama and Motlak, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Tsuang and Peng, 2018) (Daly, 2017) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Han and Yang, 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Ali and Alzu'bi, 2017) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (Kaoula and Bouchair, 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Sánchez-Garrido and Yepes, 2020) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Adabre et al., 2020)
F19	Housing-related policies/strategies/ guidelines/plans/ decision-making procedures	(Henderson, Ganah, and John, 2016) (Alrashed and Asif, 2015) (Rehkopf, Rowlands, and Tobert, 2016) (Karji et al., 2019) (Bintoro et al., 2019) (J. Yang and Yang, 2015) (Chohan, Irfan, and Awad, 2015) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Sang and Yao, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Daly, 2017) (Tupenaite et al., 2017) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Verovsek and Juvancic, 2018) (Hagbert and Femenías, 2016) (Han and Yang, 2018) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Lorek and Spangenberg, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Päätalo, 2016) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Croitoru et al., 2016) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Sharafeddin, Arocho, and Anderson, 2019) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Adabre and Chan, 2019a)

	Factors	References
F20	Building's basic services (safe drinking water availability, access to electricity, sewer, sanitation, etc.)	(Aghimien, Aigbavboa, and Ngwari, 2018) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Zhang, Chen, and Jin, 2015) (A. Olanrewaju and Tan, 2018) (Yildiz, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Wu et al., 2017) (Karatas and El-Rayes, 2015) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Huang, Mori, and Nomura, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Nguyen, Bokel, and Dobbelsteen, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Rydborg, Lauring, and Brunsgaard, 2019)
F21	Noise level – Acoustic design – Aural comfort	(Mulliner and Maliene, 2015) (Rehkopf, Rowlands, and Tobert, 2016) (Sanhueza-Durán et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Adabre et al., 2020) (A. Olanrewaju and Tan, 2018) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Chan and Adabre, 2019) (Schneider-Skalska, 2019) (Djebbar, Salem, and Mokhtari, 2018) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F22	Building codes/energy standards/technical specifications/ regulations	(Nasrabadi and Hataminejad, 2019) (Karji et al., 2019) (Popova, Glebova, and Karakozova, 2018) (Bintoro et al., 2019) (McHunu and Nkambule, 2019) (Haarhoff, Beattie, and Dupuis, 2016) (Chohan, Irfan, and Awad, 2015) (D. Li et al., 2016) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Willems, 2015) (Ruiz-Pérez et al., 2019) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Roshanfekr, Tawil, and Goh, 2016) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Said et al., 2016) (Al-Jebouri et al., 2017) (Wahi et al., 2018) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (K. Yang and Cho, 2016) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (Verovsek and Juvancic, 2018) (Han and Yang, 2018) (Dong et al., 2018) (Ali and Alzu'bi, 2017) (Yuliastuti, Haryanto, and Haryanti, 2020) (Sánchez-Garrido and Yepes, 2020) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019)
F23	Investment/finance measures (subsidies, financial risk/support options, Investment cost, return of investment, payback period, profitability, cost-benefit data, budget adaptability)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Le, Ta, and Dang, 2016) (Nuuter, Lill, and Tupenaite, 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (A. Olanrewaju and Tan, 2018) (Tomsić and Šijanec Zavrl, 2018) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (A. L. Olanrewaju et al., 2017) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Marín et al., 2015) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Saldaña-Márquez et al., 2018) (Tomovska and Radivojevic, 2017) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Feng et al., 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Zasada et al., 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Cui et al., 2018) (Verovsek, Juvancic, and Zupancic, 2015) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018)
F24	Pollution (air, water, land)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Aghimien, Aigbavboa, and Ngwari, 2018) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Zhang, Chen, and Jin, 2015) (D. Li et al., 2016) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Al-Jebouri et al., 2017) (Gan et al., 2017) (Shama and Motlak, 2019) (Castellano, Ribera, and Ciurana, 2016) (Marín et al., 2015) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Mou, He, and Zhou, 2017) (Lorek and Spangenberg, 2019) (Ali and Alzu'bi, 2017) (Nguyen, Bokel, and Dobbelsteen, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Henderson, Ganah, and John, 2016) (Chan and Adabre, 2019) (Le, Ta, and Dang, 2016) (Popova, Glebova, and Karakozova, 2018) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Henderson, Ganah, and John, 2016) (Nasrabadi and Hataminejad, 2019) (Rehkopf, Rowlands, and Tobert, 2016)
F25	Climatic/microclimatic conditions (air temperature, humidity, wind speed, solar radiation, heat island effect, etc.)	(Alrashed and Asif, 2015) (Sanhueza-Durán et al., 2019) (Roosli et al., 2015) (Zhang, Chen, and Jin, 2015) (Tomsić and Šijanec Zavrl, 2018) (Yildiz, 2015) (Aldossary, Rezgui, and Kwan, 2015) (Saldaña-Márquez et al., 2019) (Djebbar, Salem, and Mokhtari, 2018) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Sari, Nuryanti, and Ikaputra, 2019) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Kobylarczyk, 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Vega-Azamar et al., 2017) (Pérez-Fargallo et al., 2018) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019) (Adabre and Chan, 2019a)
F26	Land use (Mixed-use building/community, zoning plans, re-using a developed area instead of new developments, land use change, amount of land supplied, etc.)	(Henderson, Ganah, and John, 2016) (Karji et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Oyebanji, Liyanage, and Akintoye, 2017) (Tomsić and Šijanec Zavrl, 2018) (Sang and Yao, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Wu et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Tsuang and Peng, 2018) (Mihnovits and Nisos, 2016) (Osman et al., 2016) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Feng et al., 2018) (Kobylarczyk, 2018) (Mou, He, and Zhou, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ahmed and Alipour, 2019)
F27	Natural light – Solar radiation (availability, intensity, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Woo, Kim, and Lee, 2018) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Tomsić and Šijanec Zavrl, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Yildiz, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Soyinka and Siu, 2018) (Mou, He, and Zhou, 2017) (Vega-Azamar et al., 2017) (Lorek and Spangenberg, 2019) (Zasada et al., 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019)
F28	Built-up density	(Rid, Lammers, and Zimmermann, 2017) (Le, Ta, and Dang, 2016) (Sanhueza-Durán et al., 2019) (Roosli et al., 2015) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Al-Jebouri et al., 2017) (Prochorskaite et al., 2016) (Seo and Kwon, 2017) (Castellano, Ribera, and Ciurana, 2016) (Marín et al., 2015) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Saldaña-Márquez et al., 2018) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Ali and Alzu'bi, 2017) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)

	Factors	References
F29	Building typology (single-family, attached, apartment, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Woo, Kim, and Lee, 2018) (Adabre et al., 2020) (Adabre and Chan, 2019a) (Haarhoff, Beattie, and Dupuis, 2016) (Yildiz, 2015) (A. L. Olanrewaju et al., 2017) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Asad Poor, Thorpe, and Goh, 2018) (Mihnovits and Nisos, 2016) (Daly, 2017) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Soyinka and Siu, 2018) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Han and Yang, 2018) (Kobylarczyk, 2018) (Vega-Azamar et al., 2017) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Abass and Tucker, 2020) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019) (Karji et al., 2019)
F30	Flexibility/adaptability (design, construction, function)	(Alrashed and Asif, 2015) (Woo, Kim, and Lee, 2018) (A. Olanrewaju and Tan, 2018) (Yildiz, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Colistra, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Kovacic, Reisinger, and Honic, 2018) (Asad Poor, Thorpe, and Goh, 2018) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojevic, 2017) (Soyinka and Siu, 2018) (Kobylarczyk, 2018) (Huang, Mori, and Nomura, 2018) (Vega-Azamar et al., 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Abass and Tucker, 2020) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019)
F31	Neighborhood spatial layout (street layout and network, space between blocks, pedestrian paths, open space layout, human scale features, public furniture, disables accessibility, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Le, Ta, and Dang, 2016) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Roosli et al., 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (A. Olanrewaju and Tan, 2018) (Tomšić and Šijanec Zavrl, 2018) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Seo and Kwon, 2017) (Roshanfekr, Tawil, and Goh, 2016) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Said et al., 2016) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (K. Yang and Cho, 2016) (Tomovska and Radivojevic, 2017) (Kapedani, Herssens, and Verbeeck, 2019) (Lorek and Spangenberg, 2019) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Sánchez-Garrido and Yepes, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F32	Construction method/ techniques/technologies (prefabrication, light/ heavy structure, energy efficient techniques, traditional method, etc.)	(Karji et al., 2019) (Woo, Kim, and Lee, 2018) (Aghimien, Aigbavboa, and Ngwari, 2018) (Tomšić and Šijanec Zavrl, 2018) (Gilderbloom, Riggs, and Meares, 2015) (Chohan, Irfan, and Awad, 2015) (D. Li et al., 2016) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Roshanfekr, Tawil, and Goh, 2016) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Daly, 2017) (Osman et al., 2016) (Said et al., 2016) (Arifin, Rasyid, and Osman, 2020) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Verovsek and Juvancic, 2018) (Kobylarczyk, 2018) (Huang, Mori, and Nomura, 2018) (Vega-Azamar et al., 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019)
F33	Passive/green/ low-energy/ near-zero-energy/plus energy design/principles	(Alrashed and Asif, 2015) (Sanhueza-Durán et al., 2019) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Roosli et al., 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Zhang, Chen, and Jin, 2015) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Chohan, Irfan, and Awad, 2015) (Schneider-Skalska, 2019) (Shama and Motlak, 2019) (Wu et al., 2017) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Djebbar, Salem, and Mokhtari, 2018) (Matthews, Friedland, and Orooji, 2016) (Daly, 2017) (Mohtat and Zargar, 2018) (Perrucci, Vazquez, and Aktas, 2016) (Bazan-Krzywoszańska et al., 2017) (Maciejko and Wojtyszyn, 2020) (Tomovska and Radivojevic, 2017) (Han and Yang, 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cui et al., 2018) (Cheng, Bae, and Horton, 2019) (Päätalo, 2016) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Rydborg, Lauring, and Brunsgaard, 2019)
F34	Lighting systems (indoor lights, street lights, open space lights, etc.)	(Mulliner and Maliene, 2015) (Rid, Lammers, and Zimmermann, 2017) (Adabre et al., 2020) (Rehkopf, Rowlands, and Tobert, 2016) (Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Peruzzini et al., 2016) (A. Olanrewaju and Tan, 2018) (Ezennia and Hoskara, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Wu et al., 2017) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Tupenaite et al., 2017) (Said et al., 2016) (Bazan-Krzywoszańska et al., 2017) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Han and Yang, 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Vega-Azamar et al., 2017) (Zasada et al., 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cheng, Bae, and Horton, 2019) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Adabre and Chan, 2019a) (Popova, Glebova, and Karakozova, 2018)
F35	Housing occupancy rate – Community population	(Rehkopf, Rowlands, and Tobert, 2016) (Le, Ta, and Dang, 2016) (Bintoro et al., 2019) (Peruzzini et al., 2016) (McHunu and Nkambule, 2019) (D. Li et al., 2016) (Ezennia and Hoskara, 2019) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Castellano, Ribera, and Ciurana, 2016) (Kovacic, Reisinger, and Honic, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Daly, 2017) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Bazan-Krzywoszańska et al., 2017) (Maciejko and Wojtyszyn, 2020) (K. Yang and Cho, 2016) (Arifin, Rasyid, and Osman, 2020) (Kobylarczyk, 2018) (Lorek and Spangenberg, 2019) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Adabre and Chan, 2019a)
F36	Overall/lifecycle costs of the building	(Mulliner and Maliene, 2015) (Chan and Adabre, 2019) (Aghimien, Aigbavboa, and Ngwari, 2018) (Nuuter, Lill, and Tupenaite, 2015) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (D. Li et al., 2016) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Shama and Motlak, 2019) (Tsuang and Peng, 2018) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (A. Olanrewaju, Yeow, and Lim, 2016) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Soyinka and Siu, 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Kaoula and Bouchair, 2020) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Sharafeddin, Arocho, and Anderson, 2019)
F37	Operation cost (energy/ water/telephone bills, technology investment price, etc.)	(Mulliner and Maliene, 2015) (Rid, Lammers, and Zimmermann, 2017) (Nuuter, Lill, and Tupenaite, 2015) (Gilderbloom, Riggs, and Meares, 2015) (Yildiz, 2015) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Hostland et al., 2015) (Schneider-Skalska, 2019) (Shama and Motlak, 2019) (Asad Poor, Thorpe, and Goh, 2018) (Osman et al., 2016) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Soyinka and Siu, 2018) (Vega-Azamar et al., 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Zasada et al., 2020) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cheng, Bae, and Horton, 2019) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019) (Bintoro et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017)
F38	Aesthetical quality	(Nasrabadi and Hataminejad, 2019) (Karji et al., 2019) (Chan and Adabre, 2019) (Bintoro et al., 2019) (A. Olanrewaju and Tan, 2018) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (A. L. Olanrewaju et al., 2017) (Willems, 2015) (Schneider-Skalska, 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Manoochehri, 2015) (Said et al., 2016) (Maciejko and Wojtyszyn, 2020) (Dokic, Gligorijevic, and Damjanovic, 2015) (Han and Yang, 2018) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Nguyen, Bokel, and Dobbelsteen, 2019) (Päätalo, 2016) (Abass and Tucker, 2020)
F39	Traffic – Car dependency – Parking area	(Rid, Lammers, and Zimmermann, 2017) (Woo, Kim, and Lee, 2018) (Nuuter, Lill, and Tupenaite, 2015) (Gilderbloom, Riggs, and Meares, 2015) (Yildiz, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Al-Jebouri et al., 2017) (Seo and Kwon, 2017) (Castellano, Ribera, and Ciurana, 2016) (Osman et al., 2016) (Tupenaite et al., 2017) (Hagbert and Femenías, 2016) (Said et al., 2016) (Arifin, Rasyid, and Osman, 2020) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Huang, Mori, and Nomura, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Mou, He, and Zhou, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Ahmed and Alipour, 2019) (Karji et al., 2019)

	Factors	References
F40	Space functionality	(Nasrabadi and Hataminejad, 2019) (Chan and Adabre, 2019) (Roosli et al., 2015) (J. Yang and Yang, 2015) (Zhang, Chen, and Jin, 2015) (A. Olanrewaju and Tan, 2018) (Yildiz, 2015) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Aldossary, Rezgui, and Kwan, 2015) (Schneider-Skalska, 2019) (Asad Poor, Thorpe, and Goh, 2018) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Maciejko and Wojtyszyn, 2020) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Cui et al., 2018) (Verovsek, Juvancic, and Zupancic, 2015) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Rydborg, Lauring, and Brunsgaard, 2019)
F41	Participatory actions (design, management, bottom up governance, educational programs, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Rehkopf, Rowlands, and Tobert, 2016) (Aghimien, Aigbavboa, and Ngwari, 2018) (Adabre et al., 2020) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Adabre and Chan, 2019a) (Yildiz, 2015) (Sang and Yao, 2019) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Tsuang and Peng, 2018) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Hagbert and Femenías, 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (Verovsek and Juvancic, 2018) (Kobylarczyk, 2018) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Zasada et al., 2020) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019)
F42	Housing/community administration and management (cost/time/risk/maintenance management, etc.), and the types (self-managed, co-managing, etc.)	(Henderson, Ganah, and John, 2016) (Rid, Lammers, and Zimmermann, 2017) (Le, Ta, and Dang, 2016) (Bintoro et al., 2019) (J. Yang and Yang, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Yildiz, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Sang and Yao, 2019) (Ezennia and Hoskara, 2019) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Tsuang and Peng, 2018) (Osman et al., 2016) (Said et al., 2016) (Saldaña-Márquez et al., 2018) (Verovsek and Juvancic, 2018) (Kobylarczyk, 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Sharafeddin, Arocho, and Anderson, 2019)
F43	Accessible house (easy physical accessibility for pedestrians/cars/elders/disables/etc.)	(Rid, Lammers, and Zimmermann, 2017) (Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Woo, Kim, and Lee, 2018) (Nuuter, Lill, and Tupenaite, 2015) (Bintoro et al., 2019) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Gilderbloom, Riggs, and Meares, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Shama and Motlak, 2019) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Mihnovits and Nisos, 2016) (Saldaña-Márquez et al., 2018) (Sari, Nuryanti, and Ikaputra, 2019) (Maciejko and Wojtyszyn, 2020) (Arifin, Rasyid, and Osman, 2020) (Kapedani, Herssens, and Verbeeck, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018)
F44	Structural quality and durability	(Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Ganiyu, Fapohunda, and Haldenwang, 2016) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Al-Jebouri et al., 2017) (Ruiz-Pérez et al., 2019) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Mihnovits and Nisos, 2016) (Osman et al., 2016) (A. Olanrewaju, Yeow, and Lim, 2016) (Mohtat and Zargar, 2018) (Maciejko and Wojtyszyn, 2020) (Tomovska and Radivojevic, 2017) (Soyinka and Siu, 2018) (Feng et al., 2018) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Cui et al., 2018) (Ignjatovic, Ignjatovic, and Sudimac, 2018)
F45	Natural hazards and the related resilience/repair (earthquake, flooding, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Bintoro et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017) (Zhang, Chen, and Jin, 2015) (McHunu and Nkambule, 2019) (Tomšić and Šijanec Zavrl, 2018) (Chohan, Irfan, and Awad, 2015) (Gan et al., 2017) (Shama and Motlak, 2019) (Matthews, Friedland, and Orooji, 2016) (Osman et al., 2016) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Sari, Nuryanti, and Ikaputra, 2019) (Dokic, Gligorijevic, and Damjanovic, 2015) (Soyinka and Siu, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Seo, Chung, and Kwon, 2018) (Rydborg, Lauring, and Brunsgaard, 2019)
F46	Building orientation	(Alrashed and Asif, 2015) (Nasrabadi and Hataminejad, 2019) (Le, Ta, and Dang, 2016) (Sanhueza-Durán et al., 2019) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Shama and Motlak, 2019) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Maciejko and Wojtyszyn, 2020) (Han and Yang, 2018) (Huang, Mori, and Nomura, 2018) (Ali and Alzu'bi, 2017) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Päätalo, 2016) (Croitoru et al., 2016) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F47	Natural ventilation	(Rid, Lammers, and Zimmermann, 2017) (Nasrabadi and Hataminejad, 2019) (Sanhueza-Durán et al., 2019) (Chohan, Irfan, and Awad, 2015) (Aldossary, Rezgui, and Kwan, 2015) (Willems, 2015) (Seo and Kwon, 2017) (Kovacic, Reisinger, and Honic, 2018) (Marín et al., 2015) (Asad Poor, Thorpe, and Goh, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Karatas and El-Rayes, 2015) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Feng et al., 2018) (Dong et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Ali and Alzu'bi, 2017) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cheng, Bae, and Horton, 2019) (Seo, Chung, and Kwon, 2018) (Rodrigues Moreno, de Morais, and de Souza, 2017) (Ahmed and Alipour, 2019)
F48	Walkability/bikeability (auto-free zones, sidewalks, bike routes, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Woo, Kim, and Lee, 2018) (Oyebanji, Liyanage, and Akintoye, 2017) (Tomšić and Šijanec Zavrl, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Gilderbloom, Riggs, and Meares, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Shama and Motlak, 2019) (Colistra, 2019) (Castellano, Ribera, and Ciurana, 2016) (Roshanfekr, Tawil, and Goh, 2016) (Wahi et al., 2018) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Maciejko and Wojtyszyn, 2020) (Arifin, Rasyid, and Osman, 2020) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Abass and Tucker, 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Ahmed and Alipour, 2019)
F49	Access to workplaces (distance/time of travel)	(Mulliner and Maliene, 2015) (Karji et al., 2019) (Le, Ta, and Dang, 2016) (McHunu and Nkambule, 2019) (A. Olanrewaju and Tan, 2018) (Haarhoff, Beattie, and Dupuis, 2016) (Tanganco, Alberto, and Gotangco, 2019) (A. L. Olanrewaju et al., 2017) (Shama and Motlak, 2019) (Seo and Kwon, 2017) (Colistra, 2019) (Wu et al., 2017) (Castellano, Ribera, and Ciurana, 2016) (Daly, 2017) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Said et al., 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Vega-Azamar et al., 2017) (Kaoula and Bouchair, 2020) (Abass and Tucker, 2020) (Seo, Chung, and Kwon, 2018)
F50	Local materials	(Chan and Adabre, 2019) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Zhang, Chen, and Jin, 2015) (A. Olanrewaju and Tan, 2018) (D. Li et al., 2016) (Akinyede, Fapohunda, and Haldwang, 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Mohtat and Zargar, 2018) (Perrucci, Vazquez, and Aktas, 2016) (Sang and Yao, 2019) (Dokić, Gligorijevic, and Damjanovic, 2015) (Han and Yang, 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Mou, He, and Zhou, 2017) (Ali and Alzu'bi, 2017) (Cheng, Bae, and Horton, 2019) (Sánchez-Garrido and Yepes, 2020) (Croitoru et al., 2016) (Ignjatovic, Ignjatovic, and Sudimac, 2018)
F51	Construction cost (material, transport, labor, equipment and installation, etc.)	(Roosli et al., 2015) (Ganiyu, Fapohunda, and Haldenwang, 2016) (A. Olanrewaju and Tan, 2018) (Tomšić and Šijanec Zavrl, 2018) (A. L. Olanrewaju et al., 2017) (Nasrabadi and Hataminejad, 2019) (Willems, 2015) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Saldaña-Márquez et al., 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Daly, 2017) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Sari, Nuryanti, and Ikaputra, 2019) (Tomovska and Radivojevic, 2017) (Soyinka and Siu, 2018) (Dong et al., 2018) (Ali and Alzu'bi, 2017) (Pérez-Fargallo et al., 2018)
F52	Household/project team overall satisfaction rate	(Chan and Adabre, 2019) (Peruzzini et al., 2016) (Haarhoff, Beattie, and Dupuis, 2016) (Boeckermann, Kaczynski, and King, 2019) (Sang and Yao, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Schneider-Skalska, 2019) (Seo and Kwon, 2017) (Wu et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Saldaña-Márquez et al., 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Feng et al., 2018) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Abass and Tucker, 2020)
F53	Employment/business activity rate/opportunities in the area	(Karji et al., 2019) (Nuuter, Lill, and Tupenaite, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (Yildiz, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Wu et al., 2017) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Tupenaite et al., 2017) (A. Olanrewaju, Yeow, and Lim, 2016) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Zasada et al., 2020) (Sharafeddin, Arocho, and Anderson, 2019)

	Factors	References
F54	Compatibility with household/community cultural values or heritage	(Roosli et al., 2015) (McHunu and Nkambule, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Shama and Motlak, 2019) (Mohtat and Zargar, 2018) (Sari, Nuryanti, and Ikaputra, 2019) (Dokic, Gligorijevic, and Damjanovic, 2015) (Mou, He, and Zhou, 2017) (Oyebanji, Liyanage, and Akintoye, 2017) (Wu et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Kobylarczyk, 2018) (Zasada et al., 2020) (Sharafeddin, Arocho, and Anderson, 2019) (Seo, Chung, and Kwon, 2018) (Rydborg, Lauring, and Brunsgaard, 2019) (Bintoro et al., 2019) (Chan and Adabre, 2019)
F55	Shading options – Rain protection	(Rid, Lammers, and Zimmermann, 2017) (Woo, Kim, and Lee, 2018) (Roosli et al., 2015) (Aldossary, Rezgui, and Kwan, 2015) (Seo and Kwon, 2017) (Marín et al., 2015) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Tsuang and Peng, 2018) (Djebbar, Salem, and Mokhtari, 2018) (Han and Yang, 2018) (Ali and Alzu'bi, 2017) (Nguyen, Bokel, and Dobbelsteen, 2019) (Cheng, Bae, and Horton, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Croitoru et al., 2016) (Sharafeddin, Arocho, and Anderson, 2019) (Ahmed and Alipour, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F56	Building's/neighborhood's identity/reputation/popularity	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (J. Yang and Yang, 2015) (Yildiz, 2015) (Schneider-Skalska, 2019) (Shama and Motlak, 2019) (Wu et al., 2017) (Marín et al., 2015) (Wahi et al., 2018) (Tsuang and Peng, 2018) (Tupenaite et al., 2017) (Manoochehri, 2015) (Sari, Nuryanti, and Ikaputra, 2019) (Verovsek and Juvancic, 2018) (Feng et al., 2018) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Verovsek, Juvancic, and Zupancic, 2015) (Oyebanji, Liyanage, and Akintoye, 2017)
F57	Private/semi-public outdoor space (courtyard, garden, greenhouse, green roof, etc.)	(Rid, Lammers, and Zimmermann, 2017) (Nasrabadi and Hataminejad, 2019) (Rehkopf, Rowlands, and Tobert, 2016) (Yildiz, 2015) (Prochorskaite et al., 2016) (Castellano, Ribera, and Ciurana, 2016) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Manoochehri, 2015) (Maciejko and Wojtyszyn, 2020) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Zasada et al., 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Cui et al., 2018) (Ahmed and Alipour, 2019)
F58	Privacy	(Nuuter, Lill, and Tupenaite, 2015) (Yildiz, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Wu et al., 2017) (Tupenaite et al., 2017) (Manoochehri, 2015) (Mohtat and Zargar, 2018) (Saldaña-Márquez et al., 2018) (Sari, Nuryanti, and Ikaputra, 2019) (Maciejko and Wojtyszyn, 2020) (Feng et al., 2018) (Huang, Mori, and Nomura, 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Ali and Alzu'bi, 2017) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Sharafeddin, Arocho, and Anderson, 2019)
F59	Presence/preservation of cultural heritage/natural resource (ponds, preserved greenery, topographical contours, etc.)	(Karji et al., 2019) (Yu et al., 2017) (Schneider-Skalska, 2019) (Gan et al., 2017) (Wu et al., 2017) (Wahi et al., 2018) (Asad Poor, Thorpe, and Goh, 2018) (Tupenaite et al., 2017) (Mohtat and Zargar, 2018) (Tomovska and Radivojevic, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Verovsek, Juvancic, and Zupancic, 2015) (Seo, Chung, and Kwon, 2018) (Roosli et al., 2015) (J. Yang and Yang, 2015)
F60	Pleasant view/scenery	(Zare Mohazabieh, Ghajarkhosravi, and Fung, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ruiz-Pérez et al., 2019) (Djebbar, Salem, and Mokhtari, 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Han and Yang, 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Cheng, Bae, and Horton, 2019) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Kaoula and Bouchair, 2020) (Nguyen, Bokel, and Dobbelsteen, 2019) (Rydborg, Lauring, and Brunsgaard, 2019)
F61	Maintenance cost	(Roosli et al., 2015) (A. Olanrewaju and Tan, 2018) (Tanganco, Alberto, and Gotangco, 2019) (A. L. Olanrewaju et al., 2017) (Schneider-Skalska, 2019) (Prochorskaite et al., 2016) (Castellano, Ribera, and Ciurana, 2016) (Said et al., 2016) (Tomovska and Radivojevic, 2017) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Kobylarczyk, 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Seo, Chung, and Kwon, 2018)
F62	Renovation/repair/reconstruction cost (material, transportation, etc.)	(Nuuter, Lill, and Tupenaite, 2015) (Oyebanji, Liyanage, and Akintoye, 2017) (A. Olanrewaju and Tan, 2018) (Tanganco, Alberto, and Gotangco, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Karatas and El-Rayes, 2015) (Mohtat and Zargar, 2018) (Dokic, Gligorijevic, and Damjanovic, 2015) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Arkhangelskaya and Arkhangelskaya, 2020) (Sánchez-Garrido and Yepes, 2020) (Manoochehri, 2015)
F63	Greening the building (plants, green wall/roof, garden, etc.) and types of greening/plants	(Nasrabadi and Hataminejad, 2019) (Aldossary, Rezgui, and Kwan, 2015) (Wahi et al., 2018) (Hagbert and Femenías, 2016) (Maciejko and Wojtyszyn, 2020) (R. Y. M. Li, Cheung, and Shoaib, 2018) (Huang, Mori, and Nomura, 2018) (Zasada et al., 2020) (Cui et al., 2018) (Rehkopf, Rowlands, and Tobert, 2016) (Ahmed and Alipour, 2019) (Karji et al., 2019) (Adabre and Chan, 2019a) (Adabre et al., 2020)
F64	Light pollution/quality – Visual comfort	(Tomšić and Šijanec Zavrl, 2018) (Al-Jebouri et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Marín et al., 2015) (Karatas and El-Rayes, 2015) (Tupenaite et al., 2017) (Saldaña-Márquez et al., 2018) (Tomovska and Radivojevic, 2017) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Nguyen, Bokel, and Dobbelsteen, 2019) (Karji et al., 2019)
F65	Innovation (design, management, technologies, etc.)	(Woo, Kim, and Lee, 2018) (Sang and Yao, 2019) (Al-Jebouri et al., 2017) (Saldaña-Márquez et al., 2019) (Shama and Motlak, 2019) (Wahi et al., 2018) (Tupenaite et al., 2017) (Hagbert and Femenías, 2016) (Saldaña-Márquez et al., 2018) (Perrucci, Vazquez, and Aktas, 2016) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Karji et al., 2019) (Marín et al., 2015)
F66	Socio-cultural mixing of the community	(Bintoro et al., 2019) (Adabre et al., 2020) (Oyebanji, Liyanage, and Akintoye, 2017) (Ezennia and Hoskara, 2019) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (Huang, Mori, and Nomura, 2018) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Abass and Tucker, 2020)
F67	Fire prevention/emergency measures	(Rid, Lammers, and Zimmermann, 2017) (Le, Ta, and Dang, 2016) (Bintoro et al., 2019) (Zhang, Chen, and Jin, 2015) (Tomšić and Šijanec Zavrl, 2018) (Tanganco, Alberto, and Gotangco, 2019) (Wu et al., 2017) (Djebbar, Salem, and Mokhtari, 2018) (Han and Yang, 2018) (Feng et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Mou, He, and Zhou, 2017) (Sánchez-Garrido and Yepes, 2020)
F68	Building age – Year of construction	(Sanhueza-Durán et al., 2019) (Popova, Glebova, and Karakozova, 2018) (Bintoro et al., 2019) (Yildiz, 2015) (Said et al., 2016) (Bazan-Krzywoszańska et al., 2017) (Huang, Mori, and Nomura, 2018) (Nguyen, Bokel, and Dobbelsteen, 2019) (Pérez-Fargallo et al., 2018) (Cui et al., 2018) (Ignjatovic, Ignjatovic, and Sudimac, 2018) (Seo, Chung, and Kwon, 2018)
F69	Cost/value of land – Land use rights	(Mulliner and Maliene, 2015) (Gilderbloom, Riggs, and Meares, 2015) (Adabre et al., 2020) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Chan and Adabre, 2019) (A. L. Olanrewaju et al., 2017) (Gan et al., 2017) (Roshanfekr, Tawil, and Goh, 2016) (Mohtat and Zargar, 2018) (Cui et al., 2018) (Abass and Tucker, 2020)
F70	Household transport costs	(Aghimien, Aigbavboa, and Ngwari, 2018) (Adabre et al., 2020) (Adabre and Chan, 2019a) (Yildiz, 2015) (D. Li et al., 2016) (Seo and Kwon, 2017) (Tupenaite et al., 2017) (Dokic, Gligorijevic, and Damjanovic, 2015) (Mou, He, and Zhou, 2017) (Ali and Alzu'bi, 2017) (Seo, Chung, and Kwon, 2018)
F71	Type of tenure (private ownership, shared/private rent, etc.)	(Mulliner and Maliene, 2015) (Rid, Lammers, and Zimmermann, 2017) (Nuuter, Lill, and Tupenaite, 2015) (Tomšić and Šijanec Zavrl, 2018) (Gan et al., 2017) (Tupenaite et al., 2017) (Hagbert and Femenías, 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (Mou, He, and Zhou, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019)
F72	Property value retention – Balanced housing market – Market trends	(Nuuter, Lill, and Tupenaite, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (Seo and Kwon, 2017) (Manoochehri, 2015) (Hagbert and Femenías, 2016) (Soyinka and Siu, 2018) (Dong et al., 2018) (Lorek and Spangenberg, 2019) (Ellsworth-Krebs, Reid, and Hunter, 2015) (Nguyen, Bokel, and Dobbelsteen, 2019)
F73	Life expectancy of housing – Long lasting house	(Nasrabadi and Hataminejad, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Djebbar, Salem, and Mokhtari, 2018) (Osman et al., 2016) (A. Olanrewaju, Yeow, and Lim, 2016) (Hagbert and Femenías, 2016) (Perrucci, Vazquez, and Aktas, 2016) (Tomovska and Radivojevic, 2017) (A. Olanrewaju, Tan, and Abdul-Aziz, 2018) (Sharafeddin, Arocho, and Anderson, 2019)
F74	Biodiversity/wildlife in the area	(Oyebanji, Liyanage, and Akintoye, 2017) (Tomšić and Šijanec Zavrl, 2018) (Al-Jebouri et al., 2017) (Schneider-Skalska, 2019) (Gan et al., 2017) (Lorek and Spangenberg, 2019) (Wittmann, Kopacik, and Leitmannova, 2019) (Zasada et al., 2020) (Karji et al., 2019)

	Factors	References
F75	Cater for senior citizens/ disables	(A. Olanrewaju and Tan, 2018) (Peruzzini et al., 2016) (A. L. Olanrewaju et al., 2017) (Mihnovits and Nisos, 2016) (Dokic, Gligorijevic, and Damjanovic, 2015) (Tomovska and Radivojević, 2017) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019)
F76	Ease of movement inside the building (elevators, stairs, furniture and decoration placement, etc.)	(Le, Ta, and Dang, 2016) (Chohan, Irfan, and Awad, 2015) (Tanganco, Alberto, and Gotangco, 2019) (Ezennia and Hoskara, 2019) (A. L. Olanrewaju et al., 2017) (Ruiz-Pérez et al., 2019) (Djebbar, Salem, and Mokhtari, 2018) (Feng et al., 2018) (Kapedani, Herssens, and Verbeeck, 2019)
F77	Construction time/speed	(Chan and Adabre, 2019) (Ganiyu, Fapohunda, and Haldenwang, 2016) (Akinyede, Fapohunda, and Haldwang, 2017) (Marín et al., 2015) (Perrucci, Vazquez, and Aktas, 2016) (Dong et al., 2018) (Arkhangelskaya and Arkhangelskaya, 2020) (Sánchez-Garrido and Yepes, 2020) (Rydborg, Lauring, and Brunsgaard, 2019)
F78	Smart home/community (smart technologies/ equipment: energy management systems, smart communication, intelligent controlling of home performance, smart toilets, etc.)	(Peruzzini et al., 2016) (Colistra, 2019) (Castellano, Ribera, and Ciurana, 2016) (Tsuang and Peng, 2018) (Hagbert and Femenías, 2016) (K. Yang and Cho, 2016) (Verovsek and Juvancic, 2018) (Verovsek, Juvancic, and Zupancic, 2015)
F79	Sense of belonging	(Adabre et al., 2020) (Yildiz, 2015) (Gan et al., 2017) (Shama and Motlak, 2019) (Wu et al., 2017) (Tsuang and Peng, 2018) (Abass and Tucker, 2020) (Oyebanji, Liyanage, and Akintoye, 2017)
F80	Odors – Olfactory comfort	(Rid, Lammers, and Zimmermann, 2017) (Karji et al., 2019) (Bintoro et al., 2019) (Saldaña-Márquez et al., 2018) (Feng et al., 2018) (Wittmann, Kopacik, and Leitmannova, 2019) (Kaoula and Bouchair, 2020)
F81	Access to the city center/urban space (distance/time of travel)	(Seo and Kwon, 2017) (Tupenaite et al., 2017) (Dokić, Gligorijević, and Damjanovic, 2015) (Huang, Mori, and Nomura, 2018) (Vega-Azamar et al., 2017) (Abass and Tucker, 2020) (Seo, Chung, and Kwon, 2018)
F82	Skilled/local labor and/ or manager	(Karji et al., 2019) (Adabre et al., 2020) (A. Olanrewaju and Tan, 2018) (Chohan, Irfan, and Awad, 2015) (Sang and Yao, 2019) (A. L. Olanrewaju et al., 2017) (Lorek and Spangenberg, 2019)
F83	Security of tenure	(McHunu and Nkambule, 2019) (Tanganco, Alberto, and Gotangco, 2019) (Gan et al., 2017) (Mihnovits and Nisos, 2016) (Osman et al., 2016) (Dokić, Gligorijević, and Damjanovic, 2015) (Soyinka and Siu, 2018)
F84	Standards of living	(Alrashed and Asif, 2015) (Ezennia and Hoskara, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Hagbert and Femenías, 2016) (Abuzeinab, Oltean-Dumbrava, and Dickens, 2016) (Lorek and Spangenberg, 2019)
F85	Administration/ government/ management/design cost	(Rid, Lammers, and Zimmermann, 2017) (Nuuter, Lill, and Tupenaite, 2015) (D. Li et al., 2016) (Chan and Adabre, 2019) (Roshanfekr, Tawil, and Goh, 2016) (Arkhangelskaya and Arkhangelskaya, 2020)
F86	Ease of maintenance/ cleaning (space, equipment)	(J. Yang and Yang, 2015) (Tomšić and Šijanec Zavrl, 2018) (Chohan, Irfan, and Awad, 2015) (Akinyede, Fapohunda, and Haldwang, 2017) (Tanganco, Alberto, and Gotangco, 2019) (Kapedani, Herssens, and Verbeeck, 2019)
F87	Level of physical deterioration	(Popova, Glebova, and Karakozova, 2018) (Ruiz-Pérez et al., 2019) (Shama and Motlak, 2019) (Castellano, Ribera, and Ciurana, 2016) (Manoochehri, 2015)
F88	Green/electric car usage – Carpooling	(Castellano, Ribera, and Ciurana, 2016) (Tsuang and Peng, 2018) (Daly, 2017) (Hagbert and Femenías, 2016)
F89	Community acceptance/ opposition with the project	(Adabre et al., 2020) (Gan et al., 2017) (Shama and Motlak, 2019) (Said et al., 2016)
F90	Economic mixing of the community	(Karji et al., 2019) (Oyebanji, Liyanage, and Akintoye, 2017) (Dokić, Gligorijević, and Damjanovic, 2015) (Seo, Chung, and Kwon, 2018)
F91	Demographic/ethnic mixing of the community	(Karji et al., 2019) (Dokic, Gligorijevic, and Damjanović, 2015) (Wittmann, Kopacik, and Leitmannova, 2019) (Sharafeddin, Arocho, and Anderson, 2019)
F92	Diversity of building typology and/or spatial/ aesthetic forms in the area	(Schneider-Skalska, 2019) (Hagbert and Femenías, 2016) (Dokić, Gligorijević, and Damjanović, 2015)
F93	Openness/closeness of the community (open/ semi-open/gated neighborhoods)	(Woo, Kim, and Lee, 2018) (Huang, Mori, and Nomura, 2018) (Wittmann, Kopacik, and Leitmannova, 2019)
F94	Community agriculture/ gardening	(Wahi et al., 2018) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Zasada et al., 2020)
F95	Mixed tenure community	(Manoochehri, 2015) (Hagbert and Femenías, 2016) (Dokić, Gligorijević, and Damjanović, 2015)
F96	Access to internet (speed, capacity)	(Saldaña-Márquez et al., 2019) (Colistra, 2019) (Mihnovits and Nisos, 2016)
F97	Access to telecommunication service	(Karji et al., 2019) (Tanganco, Alberto, and Gotangco, 2019) (Ahmed and Alipour, 2019)
F98	Access to television/ cable system	(D. Li et al., 2016) (Tanganco, Alberto, and Gotangco, 2019) (K. Yang and Cho, 2016)
	Other	(Manoochehri, 2015) (Suttiwongpan, Tochaiwat, and Naksuksakul, 2019) (Mulliner and Maliene, 2015) (Ezennia and Hoskara, 2019) (Rid, Lammers, and Zimmermann, 2017) (Wittmann, Kopacik, and Leitmannova, 2019) (Dokic, Gligorijevic, and Damjanovic, 2015) (Arkhangelskaya and Arkhangelskaya, 2020) (Aghimien, Aigbavboa, and Ngwari, 2018) (Soyinka and Siu, 2018) (Tupenaite et al., 2017) (J. Yang and Yang, 2015) (Osman et al., 2016) (Mihnovits and Nisos, 2016) (Karatas and El-Rayes, 2015) (Sánchez-Garrido and Yepes, 2020) (Tomšić and Šijanec Zavrl, 2018) (Hagbert and Femenías, 2016) (Ruiz-Pérez et al., 2019) (Lorek and Spangenberg, 2019) (Sang and Yao, 2019) (Adabre and Chan, 2019b; Chan and Adabre, 2019)

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Fig. 1-2 Sanei, Khodadad and Calonge Reillo, 2022

Author's biography

Mohsen Sanei, visiting Ph.D. candidate at Faculty of Architecture La Cambre Horta, Université libre de Bruxelles, Belgium; Ph.D. candidate at Universidad de Guadalajara, Mexico, in "City, Territory, and Sustainability" programme. MSc in "Multi-scale Sustainable Architecture" from Politecnico di Milano, Italy.

Acknowledgments

This research is done as a requirement of the author's doctoral studies which is funded by the National Council of Science and Technology of Mexico (CONACYT).

Borka Bobovec

Research Reviews on Architecture and Urban Planning

Istraživački ogledi o arhitekturi i urbanizmu

Branko Kincl

Publisher: Croatian Academy of Sciences and Arts, December 2021

523 pages, Croatian, illustrated, biography, list of works [28/23.5 cm, B/W, hardback]

Editor-in-chief: Igor Fisković
Executive editor: Zlatko Karač
Reviewers: Andrija Mutnjaković, Zlatko Jurić

Language revision: Maja Silov Tovernić
Translation: Lidija Tepeš
Proofreading: Ema Pečenković
Graphic design: Sensus Design Factory Zagreb

ISBN 978-953-347-346-8
CIP 001121923 [NSK Zagreb]

In 2016, a representative monograph entitled *Kincl* was published. Its intention was to present Branko Kincl's oeuvre, covering all of his activities, oriented towards architecture, space, design, science and teaching. Alongside Kincl's authorial involvement in the preparation and selection of the illustrative material for the monograph, *connoisseurs* of his *oeuvre* wrote factographic and analytical texts included in the book. Subsequently, in the same edition by the Department of Prints and Drawings of the Croatian Academy of Sciences and Arts, a second comprehensive book by Branko Kincl, F.C.A., was published under the title *Research Reviews on Architecture and Urban Planning*, including the author's selected theoretical and scientific tributes.

It ought to be mentioned that Branko Kincl is one of the few Croatian architects whose comprehensive work has successfully linked intellectual thought with creative, artistic, project-planning and urbanistic work throughout their research and publicist activity. Kincl's vision of architectural activity is a step ahead of the contemporary, both in terms of his expression and in terms of the acceptance and promotion of the virtual and digital, visible both in his teaching and in his creative work. In his opinion, space and people count as value, whereas developing and contemporary options of using digital tools are merely support, and, thus, may not be an end in itself.

The monograph has been divided into three well-structured theoretical units – *Research and Theoretical Tributes*; *Expert Studies and Notes;* and *Public Acceptance and Professional Reflexions – Interviews and Surveys*. These units provide insight into Kincl's continuous interest profiling. The editorial by Prof. DSc Zlatko Karač on Kincl's theoretical *oeuvre* offers detachment from the chrestomathic genre, since it includes, quantitatively and qualitatively, all the information on the monograph and its concept, thereby, respecting the author's expressive personal viewpoints.

In all three units, the author's personality is present; it shows an exceptionally creative architect and engineer, whose artistic creativity is based in research. The texts written by Branko Kincl reflect the possibilities of time and desire, and present an architect whose work is a testament to both time and space. Throughout many years, he has grown in excellence, questioning and searching for what would be best to apply in particular space and time and within the framework of contemporary architecture. With maturity came new and different forms of creation: he shaped his own recognizable style – both in design and in writing. Designer's works dominate Kincl's *oeuvre* – ranging from studies and urbanistic plans to numerous realized and non-realized competition entries – whereby a major portion of the overall work marks his fascination with fine architectural drawing.

Kincl intensified his research upon employment at the Faculty of Architecture of the University of Zagreb, with his predominant interest located in housing architecture, to which numerous theoretical tributes are linked. Their importance lies in combining active designer's practice with work on scientific projects that have become a basis of systematic profiling and drafting guidelines for designing both housing estates and organization schemata for buildings and flats. Added hereto are interest and innovativeness in the research domain through plans and projects, in entirely new forms and shapes accompanying the new, digital time. Innovativeness is additionally reflected in teaching, thanks to using an experimental approach to project leading through stimulating interdisciplinarity by applying contemporary virtual tools.

Expert studies and notes, for the most part made available to the public for the first time, speak of an architect who has been engaged in writing in addition to planning, drawing, designing, teaching and leading a studio that conducted major projects. Here enters the third topic – public acceptance and professional reflections – through surveys, other authors wrote about Kincl's work, as well as his interviews given on diverse occasions over many years.

The monograph has been designed as the author's and the editor's selection of the most prominent scientific and expert texts Branko Kincl has writen during nearly sixty years of his activity not only about the Croatian, but also about the stage of international architecture; it has thus become a theoretical retrospective of his writing. The book numbers 523 pages, though it includes a selection rather than the entire *oeuvre* of Kincl's works created in the domains of architecture and urban planning. The selection includes author's 44 texts written in the period between 1973 and 2020, as well as 22 characteristic texts by other authors, tackling Kincl's work. The 32 texts tackling the topics of expert studies, projects and notes, and most of which have thus far not been published, are especially important. Previously published texts were printed in the original form, with no subsequent language revision, which brings us nearer to the context via linguistic expression. The unpublished texts, as well as those originally published in the English language, have been translated and edited. The benefit in this context is the fact that the texts have been united and made available, considering that there are only a few architects who have been so theoretically informed and at the same time actively involved in project planning, research and education. This offers a specific and entirely individual approach to the problems at stake.

Prof. DSc Zlatko Karač and his associates selected and prepared around a hundred of the author's most important texts for the second book, they made the concept of the book and the introductory study, whilst Nedjeljko and Kristina Špoljar are its graphic designers. The promotion of the book took place on Tuesday, 3rd May 2022 at the Library of the Croatian Academy of Sciences and Arts on 14 Strossmayer Square in Zagreb. The organizer was the Scientific Council for Architecture, Urban Planning and Landscaping of the Croatian Academy of Sciences and Arts. The speakers were Velimir Neidhardt, F.C.A., President of the Croatian Academy of Sciences and Arts; Andrija Mutnjaković, F.C.A. and Prof. DSc Zlatko Jurić, reviewers; Prof. DSc Zlatko Karač, editor; and finally, very briefly and emotionally, the author Branko Kincl, F.C.A., himself.

Branko Kincl, Borka Bobovec

Portraits of Architects, from Texts by Andrija Mutnjaković

Portreti arhitekata, iz zapisa Andrije Mutnjakovića

Author of the concept and editor: Borka Bobovec

The Croatian Academy of Sciences and Arts
Edition: Architectonica, Zagreb, 2021

233 pages, Croatian, illustrated, literature, archival sources, biographies, index of names [29,5/24 cm, black and white, paperback]

Author of the concept and editor: Borka Bobovec
Reviewers: Branko Kincl, Zlatko Karač
Design and layout: Nina Ivanović
Language revision: Maja Silov Tovernic [author's texts by Andrija Mutnjakovic copied from original manuscripts]
Translation: Gorka Radočaj [introduction, biographies]

ISBN 978-953-347-338-3
CIP 001119730 [NSK Zagreb]

Andrija Mutnjaković, Fellow of the Croatian Academy of Sciences and Arts, has authored a number of monographs on the life and work of architects and builders of Croatian origin (Diocletian, Juraj Dalmatinac, Lucijan Vranjanin, Pope Sixtus V, Frane Petrić, Kornelije Budinić, Josip Pičman, and others). He has thereby significantly contributed to the formation of Croatian architectonics, as well as added new information on the life and work of several Croatian architects, belonging to global architectural avant-garde.

The theoretical monograph entitled *Portreti arhitekata, iz zapisa Andrije Mutnjakovića (Portraits of Architects, from Texts by Andrija Mutnjaković)* includes 43 scientific or cultural essays, chosen by the author of the concept and editor Borka Bobovec. They have been written in the form of monograph studies on selected Croatian architects, associated artists and art historians of exceptional personalities, who have left a distinguished mark in the Croatian architecture of the period from 15th–21st century. Among them, there are portraits of those architects, artists and art historians, who have built the most part of their creative oeuvre into the ambient of the city of Zagreb. Selected texts were published either as forewords to books or as articles in professional and public periodicals, or they were presented in radio or television shows. We may find unpublished texts here as well, available to the public for the first time.

This work is characterised by a clear genre profile and a precise methodological approach usually present in chrestomathies, i.e. it consists of critically selected texts, topically chosen and divided. The approach used in analysing individual architects is literary dynamic and interesting – pronouncedly scientific and factographic on occasion, and essay-like and culturally marked in other cases. Mutnjaković's writing style in selected texts has developed over decades of his active publicist activity; thereby, his lively and capturing literary style of interpreting serious topics of scientific research provenance in a clear and interesting fashion has only been repeatedly confirmed. The language belongs to the time when original texts were written, and so does bibliography, quotation references and similar scientific elements, with a thorough composition and expertly design.

The monograph is a product of the collaboration between the author of the concept and the author of selected texts, which are a result of Andrija Mutnjakovic's yearlong theoretical and research activity. The book in a certain way synthetises and comprises his complete tribute to shaping critical biographies and forming a personal understanding of the importance of the leading personalities in Croatian architecture. Same as all other great national syntheses in a certain field, the book offers many new scientific insights, added by the author's novel systematisation of previously published texts and pieces of information, which have hereby gained final critical confirmation and verification. This excellent theoretical scientific work with a potent cultural underlying concept tackles valuable factography from the Renaissance until today, unknown or unrecognised so far, and offers the author's distinctive interpretation thereof – reflexive and intuitive on occasion, but also inspirational and directing for future researchers. The interpretation style he uses, present not only in this, but also in many other earlier monographs, has positioned him as a classic figure of our architectural thought.

The monograph consists of three characteristic parts: it begins with Epistles, which include epigraphic literature, to which personal observations have been added. This part includes Juraj Dalmatinac, Pope John Paul II, Frane Petris, Pope Sixtus V, Fran Vranjanin and Lucijan Vranjanin. What follows are essays, including scholarly analyses of the life and work of selected authors. In Essays, Miroslav Begović, Bogdan Bogdanović, Kornelije Budinich, Srebrenka Gvozdanović Sekulić, Drago Ibler, Viktor Kovačić, Boris Magaš, Andre Mohorovičić, Juraj Neidhardt, Josip Pičman, Friedrich von Schmidt, Vladimir Turina, Ivan Vitić and Ante Vulin are discussed. Sketches, as associations to the essence of authors' architectonics, form the third part of the book. Nikola Bašić, Mirko Benažić, Bernardo Bernardi, Borka Bobovec, Zlatko Bourek, Zdravko Bregovac, Julije De Luca, Igor Emili, Julije Golik, Carlo and Domenico Fontana, Branko Kincl, Dominik Kunkera, Velimir Neidhardt, Budimir Pervan, Vlado Petričević, Jože Plečnik, Ante Roca, Jerko Rošin, Aleksandar Srnec, Zdenko Strižić, Franjo Zvonimir Tišina, Šime Vulas and Ernest Weissmann are tackled here.

Every spoken or written word, drawing, sketch, model or some other manner of architectural expression reflects a unique mental process in creating spatial concepts. The intention of the book is to introduce the public to the key creative characteristics of the oeuvres of selected Croatian architects. The majority of the documentation related to the oeuvres of the aforementioned recent architects forms a part of the collection of the Croatian Museum of Architecture of the Croatian Academy of Sciences and Arts in Zagreb, and is useful for a broader familiarisation with their contribution – through life and creativity – to the development of architecture in Zagreb and Croatia. The original concept of this monograph, authored by Borka Bobovec, is an exceptionally valuable and a rather innovative professional and scholarly tribute to the insight that written medium may contribute to the development of both spatial awareness and culture. In the Croatian context, this bears special and specific weight.

Dubravko Bačić

The Atomised Hotel
A New Type of Hotel Architecture for the Revitalization of the Built Environments

Atomizirani hotel
Novi tip hotelske arhitekture u revitalizaciji grada ili krajolika

Jelena Skorup Juračić

Publisher: ArTresor Naklada, Zagreb, 2020

311 pages, preface, English summary, bibliography and sources, about the author, indexes (terms, names, localities, institutions)
[21/17 cm, Croatian]

Reviewers: Velimir Neidhardt, Zrinka Paladino
Editor and Preface: Katarina Horvat-Levaj
Proofreading and revision: Božica Dragaś
Design and layout: Franjo Kiš, ArTresor Naklada

ISBN 978-953-8012-24-2
CIP 001030204 [National University Library, Zagreb]

Hotels are in a period of significant evolution and opportunity. From online travel agents to the commoditization of hotels, changes in the travel and hospitality industry are challenging hotels to move beyond conventional operating patterns and extend their relationships with travellers. Traditionally, the hotel experience has been limited to whatever a guest encountered within the property's four walls. But as travellers' needs and expectations have shifted and new competitive trends have emerged, hospitality industry is evolving beyond the traditional models to deliver new types of experiences.

Jelena Skorup's book *The Atomised Hotel – A New Type of Hotel Architecture for the Revitalization of the Built Environments* explores such a new type. The book grew out of Skorup's extensive research and her PhD thesis presented in 2016 at the University of Zagreb, Faculty of Architecture. It also reflects the author's long-lasting professional interest in tourist architecture, as demonstrated by her projects (jointly done with architect Dražen Juračić), included in the book, particularly the 2007 Club Med Master Plan, the 2009-13 Pustijerna Dispersed Hotel Project in Dubrovnik and the highly acclaimed 2013-15 Pine Beach Eco Resort Restaurant and Kitchen in Pakoštane.

The book consists of seven chapters and appendices. The introductory chapter outlines the subject matter and briefly summarizes specific characteristics of the new type. The first chapter gives a historical overview of hotel buildings, and includes an overview of historical development of tourist territory. The second chapter discusses the relevant cultural theories since the 1960s and related tourism theories that explain the postmodern society, and thus elaborates the main aspects of modern tourism and its epiphenomenon. The third chapter expands on the reversal in the mainstream tourism industry caused by the rise of globalization, the global neoliberal economy and the cultural theories of tourism that started at the turn of the 1990s and have continued ever since. This reversal has been described as the *millennial tourism* practice. Hotel architecture follows the postmodern paradigm shift in tourism: new kinds of experiences, interests and sensations – excessively unnecessary and, simultaneously, very opposed to everyday life and the commonplace. In the fourth chapter, the author defines the new type and reinforces those features that make it especially suitable for the revitalization of urban or rural areas.

The fifth chapter synthesizes the arguments presented in the previous chapters. The new type of hotel emerged through the decomposition of the hotel (as defined in Nikolaus Pevsner's 1970s typological classification) into its functional and structural elements. Neither their interconnections, nor their morphology are predefined in an *atomised hotel*. According to Skorup, impermanence, transformability and sensitivity towards the cultural and natural landscape are essential to the new hotel type. Due to its discrete and fragmented nature, an *atomised hotel* can be a retrofitting program for the majority of empty or obsolete buildings. Listed buildings can also function as *atomised hotels*, at least up to the moment they gain a more socially and culturally appropriate use. However, the transient nature requires a sustainable economic model, as well as the use of minimally invasive reversible building technologies. Skorup convincingly demonstrates that impermanence, transformability and sensitivity towards the cultural and natural landscape are deeply rooted in the very essence of the new type. The concluding chapter summarizes the central propositions of the book, specifically presenting the requirements for developing *atomised hotels*, location criteria, and criteria for the application of the new type in rehabilitation and revitalization of historic centres and preserving cultural heritage.

The *atomised hotel* emerged as a structural decomposition of the dominant hotel building type to its constituent functional elements. The functional elements of the new type can be located in parts of single buildings or scattered in multiple buildings connected by public spaces: they can be of various sizes, and grouped in various ways. The number of buildings that form such a hotel is not determined or a priori restricted. However, it still consists of one indispensable part (accommodation) and one changeable (administrative and common areas, and services).

Jelena Skorup analyzes numerous examples of *atomised hotels* not only according to their spatial and morphological aspects, but also as settings which enable new social dynamics to take place. The creation of direct and indirect connections between an *atomised hotel's* parts can expand and/or activate social spaces. It is an elastic organizational system in which the morphology, number and the interconnection of functional units is not predetermined. Their composition and size is directly related to a specific context, whether historical, urban, economic, ecological or social. Furthermore, each context is capable of generating a new variation in the number and position of structural elements and their morphological manifestations. Elements can be added or subtracted, the number of accommodation units (rooms) can be increased by adding additional spaces or even entire buildings into the system. A restaurant, a bar or some other common area can change its position in the system or its locale. New facilities can easily be added. The changeable parts of the hotel can seemingly be left out, as long as their function is sufficiently substituted by local services or establishments, as well as new IT and communication technologies.

Metaphorically speaking, as Skorup argues, the *atomised hotel* has the ability to organically grow or shrink, and therefore effectively react to changes, whether economic, social or cultural, or to the *Zeitgeist* itself. The case studies presented indicate that *atomised hotels* can be a sensible way for the revival and reuse of abandoned built heritage, providing that the location itself has the potential for activation and intensification of the surrounding environment. As the author aptly asserts, the expansion of touristscape through active application of *atomised hotels* in brownfield regeneration could also potentially contribute to the reduction of problems related to the excessive use of undisturbed natural environments for new tourist developments. The book was awarded the 2020 "Neven Šegvić Award" by the Croatian Architects Association.

Maroje Mrduljaš

Lebbeus Woods: Zagreb Free Zone Revisited

Co-publishers: Faculty of Architecture, University of Zagreb; Oris House of Architecture
Graphic material and texts by Lebbeus Woods © Estate of Lebbeus Woods.
Zagreb, 2021

Texts: Lebbeus Woods, Joseph Becker, Leo Modrčin, Fedja Vukić, Aleksandra Wagner

Exhibition: LEBBEUS WOODS: ZAGREB FREE ZONE REVISITED. March 30 – April 24, 2021, Oris House of Architecture, Zagreb, Croatia

ISBN 978-953-8042-66-9 [Faculty of Architecture, Zagreb]
ISBN 978-953-6888-65-8 [Oris House of Architecture]

Editors: Leo Modrčin, Lovorka Prpić, Aleksandra Wagner
Graphic design: Sven Sorić

In a series of speculative projects for Sarajevo, Havana and San Francisco gathered in his 1997 book *Radical Reconstruction*, American architect Lebbeus Woods (1940-2012), advocated a third path in the reconstruction of devastated cities. This path differed from the two common methods: facsimile renewal, and erasure of the old to build the new. Woods argued that both approaches seek to disguise historical trauma by advocating the return to the "old normal" – the continuation of life as if nothing had ever happened. Woods saw potential in the ruins and the rubble. While erasure and duplication push traumatic content into the collective unconscious from which trauma continues to act destructively, building on, and in active relation to the ruin, embraces the memory of trauma and promotes its integration into collective identities. Such a task necessarily requires a transformation of the ruin into a new entity, a redirection of the negative energy of destruction into a creative act, a new potential. This is where the second point of Woods' programme of radical reconstruction resides. In his words, building on the ruins creates a "new normal", a new urban and social space in which hierarchies and power relations are deconstructed and *heterarchy* is affirmed. Thus, destruction becomes the starting point for the development of *Free Zones* and *free* (or liberated) *space structures* that are interpolated into the ruins of the old, giving them a new meaning.

In the project statement for the *Zagreb Free Zone*, precisely this programme has been indicated: "Designs for political and architectural transformation of Zagreb, as a heterarchy of free space structures." First contacts with Zagreb and Woods' reflections began in 1989; the exhibition was realized in 1991 at the Museum of Arts and Crafts, in cooperation with the Zagreb Architects Association and with assistance of Leo Modrčin. The idea of realization of a free space structure in the yard of the Museum extended to 1992. In his notes, Woods mentions coming to the city and country undergoing radical social and political changes echoing the fall of the Berlin Wall and the dissolution of the Eastern Bloc that seemed like "the end of history".

Originally developed for Berlin, the concept of *Free Zone* gained new architectural and political articulation in Zagreb. Woods provides a precise overview of the situation: "Would this country... simply start its race to catch-up with the West, becoming a second-rate, or at best, *nouveau* consumer culture, or would something else emerge from the confusion of politics and private aspirations?" Can Zagreb, in a state of radical crisis, create some other form of social reality, even if there is no physical destruction or visible wounds in the urban fabric? The *Zagreb Free Zone* project can therefore be read as a political programme for a new set of conditions: can the ruins of a vanishing society become the basis from which something new would grow, unrealized or unrealizable elsewhere?

The nomadic *Freespace* structures have no pre-determined function, but they are equipped with digital devices that are part of global information flows. They are inhabited by individuals "rooted only in themselves, only in the strangely social isolation of their modernity". Parasites in the urban space and in relation to the existing buildings, they erode boundaries and call into question the hierarchy of public and private, individual and collective. *Freespace* structures and *Free Zones* suggest a new layer of reality. The new state of affairs – populism, elitism, something else? – will depend on the ways they will be used, as they are prosthetic extensions of the capacity and ambitions of their inhabitants. Woods did not prejudge anything; he was aware that even architecture created with the most democratic ambitions could serve as a site of undemocratic events. His provocative, imaginative, dramatic, dynamic and fundamentally modern vision of the transformation of the city also offered a sketch for the development of an open society characterized by resistance to hierarchical systems of power. Woods was interested in the coexistence of different urban and societal strata, and viewed ruptures and frictions between them as productive points of further development. His architecture, advocating self-invention and the construction of individualistic spaces of freedom, emerged as a refusal of complicity in reproducing existing social order. Therefore, viewing his work only through intrinsic architectural procedures would be an intellectually inappropriate reduction.

The exhibition *Lebbeus Woods: Zagreb Free Zone Revisited*, was held at the Oris House of Architecture in the second spring of the pandemic, marking the 30th anniversary of the project. The book which accompanied the show was nominated for the *Neven Šegvić* Croatian Architects' Association Award for 2021. Both re-actualized Woods' research at a time that is, and is not, very different. We continue to witness the destruction of cities and the associated conflicts, crises and traumas. Do we believe that these situations have the potential to become new beginnings? Woods' interest in nomadism and radical non-rootedness took on a new meaning in the digital age. A return to his deliberately "non-operational" proposal is a valuable reminder of the position of the architect who saw the crisis as a challenge and a potential, as opposed to the aspirations for harmonization and obscuring 'solutions'.

The editorial team — Leo Modrčin, Lovorka Prpić and Aleksandra Wagner — with the impressive support of graphic designer Sven Sorić, credibly conveys and contextualizes Woods' position. Woods' drawings, collages, models and texts are accompanied by the critical input from local commentators active in 1991, project correspondence and other documentary material. Fresh interpretive overviews are offered by Leo Modrčin and Aleksandra Wagner, as well as Joseph Becker, the Associate Curator of Architecture and Design at the San Francisco Museum of Modern Art. Becker's text, '*Zagreb Free Zone – Architecture is a Political Act*' is especially illuminating: "The focus of Wood's work... is about the prospect of our evolution." At a time when it is getting ever more difficult to understand the contradictory but still symbiotic relationship between evolution and de-evolution, a return to Woods' work has a global resonance.

Dunja Andrić

Architecture and Visual Arts in the Yugoslav Context 1918-1941

Arhitektura i vizuelne umetnosti u jugoslovenskom kontekstu: 1918-1941.

Aleksandar Kadijević & Aleksandra Ilijevski (Eds.)

Publisher: The University of Belgrade, Faculty of Philosophy Belgrade, 2021

378 pages, illustrated, notes and bibliographic references with the text, summary
[29,7/21 cm, black and white printing, paperback]

Editors: Aleksandar Kadijević & Aleksandra Ilijevski
Reviewers: Zlatko Karać, Lidija Merenik, Irina Subotić, Aleksandra Stupar
Proofreading: Irena Popović
Design: Ivana Zoranović, Irena Đaković, Dosije studio
Print: JP Službeni glasnik

ISBN 978-86-6427-161-5

Architecture and Visual Arts in the Yugoslav Context 1918-1941 is an international art history monograph published in the year 2021. The subject of the study, together with a clear historical and geographical framework, is made precise by the title itself: the publication is dedicated to manifestations, phenomena, and concepts that defined and delineated the architecture and visual arts in the Kingdom of Serbs, Croats and Slovenes (later known as the Kingdom of Yugoslavia) in the interwar period. Since the selected topic is particularly wide and complex, a team of eminent experts from all over former Yugoslavia was assembled for its thorough analysis and scrutiny. Among them, we can emphasize respectable scholars from Croatia: Jasna Galjer, Ana Šeparović, Lovorka Magaš Bilandžić, Vinko Srhoj, Antun Baće and Petar Prelog. By dealing with various related topics, they made a joint scientific contribution to understudied areas, actualizing them, and affirming new knowledge, moreover, encouraging certain questions and polemics.

The scientific monograph is systematized in 378 pages and consists of 45 authors' studies, classified and structured into two thematic units according to the subject of study. It is written in Serbian, except for one work written in Slovenian. The entire publication is embellished with carefully selected black-and-white photo documentation, which complements the presentation, and assists the understanding of narratives. Subsequent contributions are arranged according to the conventional scheme of prepense systemization in two exhaustive thematic chapters, ensuing from comprehensive scientific material and content. The first thematic block, *Architecture,* includes twenty-six observations, additionally classified in three subsections: *Architects and Institutions, Architects and Art Groups, and Architecture and the Public*. This segment focuses on the explication of circumstances, opportunities, and stylistic orientation of Yugoslav architectural practices, interpreting its specific phenomena, tendencies, and participants. With well contemplated and carefully selected subjects and cases, the researchers examined and clarified a wide range of aspects and facets. They questioned crucial architects and their practices in the interwar period, with a detailed morphological and stylistic analysis of works, including peculiar aesthetics, as well as certain exhibitions, publications, art groups, critics, periodicals, legal framework, and the urban-architectural evolution of the Kingdom. Furthermore, *Cultural Context of Visual Arts,* the second thematic chapter, aims to assess various phenomena and eminent individuals in the field of visual arts through nineteen comprehensive articles. It also strives to accentuate the delicate sociopolitical habitus of the observed period, which inevitably reflects on the artistic domain. Through numerous complementary focal points, it has shed light on multifarious problematics. The deliberation and proposal of pertinent matters, from influential artists, their associations, collaborations, and tendencies, to theoretically-philosophical positions, conception and the manifestation of the Yugoslav idea and its manifold ideological occasions, explore Yugoslav visual arts during the interwar period truly to the bone.

The thought-through and elaborate monograph of *Architecture and Visual Arts in the Yugoslav context 1918-1941* is a precious contribution to the research and understanding of the architectural and artistic scene between the two world wars, making it a focal starting point for all further related art history studies. The dynamics, content, and erudition in the approach of all the included observations contribute to the re-actualization of certain issues, correcting previous irregularities as well as reconsidering and revising questionable opinions. All studies feature adequate scientific argumentation, foundation, and consistency in presenting knowledge and observation as the authors combined scientific-synthetic and competent historiographical methods, with necessary descriptive and comparative analyses, excurses, and digressions.

By analyzing numerous phenomena, important individuals, and artistic production, in fusion with the concomitant social, political and cultural habitus, the book offers remarkable insight into the interwar period of the art and architecture in the Kingdom of Serbs, Croats, and Slovenes / the Kingdom of Yugoslavia. Therefore, it is also relevant to the broader audience. Although some researchers chose closely related themes for their contributions, this does not diminish their significance at all, because they have accessed them from various positions of view, thereby further enriching and illuminating the perception of the subjects and accentuating their unmistakable complexity. Another value of the monograph is its actuality, integrity, and completeness, which are a consequence of an adequate choice of scientific methodology. Certain studies are slightly polemically intoned, with valuable impulses for opening up different questions and provoking scientific dialogue. Furthermore, the use of much-needed comparisons and analogies of styles, tendencies, concepts, and ideas should be encouraged on the domestic art scene, as well as outside it, without excluding the European cultural sphere. It is necessary to emphasize the editorial emendation and editing that made the monograph consistent and homogeneous in terms of the conceptual-language style and instructive character. A conspicuous corollary of the mentioned is that, apart from the content quality, the publication has apparent methodical merits and a structural-thematic coherence. Finally, the systematization of the known and the provision of new knowledge have enabled the book to reactualize and reaffirm certain views, and elaborate some problematic subjects more accurately. Because it clarifies, illuminates, and evaluates the composite field of architecture and visual arts in the aforementioned Kingdoms in such a stimulating manner, the monograph can by all means be observed as a foray into the primary literature on this multi-disciplinary field of interest.

Tamara Zaninović

Streets as Heritage – 'Historical gateway-pathways' and their transformation into urban streets

Naslijeđe ulica – Preobrazbe povijesnih prilaznih putova u gradske ulice

Doctoral dissertation [Summary]

Tamara Zaninović (born Marić in 1986 in Zagreb), M.Arch. completed her Master studies in 2011 at the Faculty of Architecture in Zagreb, where she is currently employed as research and teaching assistant at the Department of Urban Planning, Spatial Planning and Landscape Architecture. Doctoral studies and thesis defence were done at Technical University of Vienna (TU Wien).

Supervisor: Prof. Richard Stiles, Ph.D.

Members of the committee:
Prof. Christian Kühn, Ph.D. (president)
Prof. Bojana Bojanic Obad Šćitaroci, Ph.D.
Prof. Thomas Hauck, Ph.D.

Date of public defense: February 10th, 2022

The dissertation has 535 pages, three parts with 9 chapters, 200 illustrations, 92 tables, 144 footnotes, 10 appendices with two catalogues and 168 bibliographic units.

The topic of this doctoral research are urban streets as cultural heritage. Literature review reveals that streets are protected as part of larger urban areas and zones, but rarely as individual (urban linear) street entities. Nevertheless, examples such as the UNESCO protected Andrassy avenue in Budapest and Eggenberger allée in Graz are the main starting points for the hypothesis that streets are a linear component of heritage that is missing in conservation and planning.

The thesis contains three parts forming a theoretical, empirical and planning framework for confirming the hypothesis that streets are linear heritage. In the theoretical part, the dissertation defines a concept of 'historical gateway-pathways' as a specific type of street. In the second part of the thesis, the concept is explored further as ordinary urban heritage of (arterial) routes through comparative case studies, using the Heritage Urbanism (HERU) approach[1] with the Urbanscape Emanation research concept in combination with Space Syntax methodology.[2] The third part combines theoretical and empirical results into a planning framework for upgrading the existing classification model proposed by the ARTISTS project[3] with the link and place status. The proposal for upgrade adds the 'heritage' status or historical context to link-place status duality which enables insight into complex spatial changes of streets when observed as a route.

The spatial and cultural context for the empirical study are cities located in the region consisting of Austro-Hungarian historical provinces. Cities are grouped according to size, growth scale, location on terrain, urban core and matrix of historical gateway-pathways. This indicates that every city is a unique case study that shares specific similarities and differences in correlation to urban growth processes, which is a set-up for investigating historical arterial routes on five case studies (Budapest, Ljubljana, Prague, Vienna and Zagreb). The categorisation of historical gateway-pathways for these five cities was established using an open source database with historical georeferenced maps[4] of three Austro-Hungarian military surveys. Analytical criteria for the categorisation were initial gateway-pathway types and their route transformation models for each city. The five chosen case studies and their 38 observed historical arterial routes were also analysed through space syntax methodology. Every city was simplified to an axial and/or segment map, which together with qualitative historical urban analyses gives a syntactic urban model representing the spatial configuration of open public spaces. Routes are compared within each model through quantitative measurements of integration (probability that the place will be a destination in the overall system) and choice (probability that the place will be a route/passage in the overall system). These numerical analyses of cities and routes have provided a comparative framework and introduced the possible quantitative definition for 'linear density' measure which could be used for detecting specific types of historical arterial transformations.

Overall, the research hypothesis is confirmed by the described route analysis on multiple examples as an element of continuity that can be followed on historical maps and identified in the contemporary urban fabric as systems of open public spaces. The demonstrated study achieved a redefinition of the street as linear heritage through route significance in three ways.

1) Definition and proposal for a new street type of 'historical gateway-pathways' – These specific routes are established based on the importance of their initial (gateway) connection between the periphery and historical urban core. Their development is a testament to heritage urban depth through urban and architectural parts with changing functions, urban conditions and settings, which makes their planning distinct and complex.

2) Arterial routes are successfully identified and categorised in comparative case studies through historical maps and syntactic models – Identification is based on a sample of 38 routes from five cities. The results defined initial categories, their degree of transformation, and three main groups, depending on the overall route assessment.

3) Results are used and tested for the enhancement of the planning framework in the streetscape redesign process by taking into consideration a peri-urban location and route assessment type.

Through these types and analyses of centrality as an arterial urban process, the street is recognised as an urban link that can be an active planning and research tool in rethinking the city, as well as *vice versa*, encouraging a comparative and multi-scalar approach in (re)designing and analysing streets.

Research contribution is multiple. The theoretical contribution is a new view on cities from arterial route development with an established link between streets and heritage that should be evaluated and recognised in new planning scenarios. This contribution complements a current planning (OECD-EC) definition of the city with better understanding of the main defining factors and units in the historical context. The combined comparative tools and methods of this research are a methodological contribution for future studies and planning of streets as a system in connecting the heritage. The conclusion is that these tools are easily and widely available for all since the research tested the possibilities and limitations of open knowledge and online databases with inputs that can be used in GIS. The planning contribution with the classification upgrade confirms the reclaiming of streets by pedestrians, stemming from theory and previous studies with placemaking agendas.

1 This research was a part of the research project "Heritage Urbanism" (HERU HRZZ 2032) led by Prof. Mladen Obad Šćitaroci, Ph.D. from 2014 until 2018 at the University of Zagreb financed by Croatian Science Foundation and it was also part of the "Urbanscape Emanation" research led by Prof. Bojana Bojanic Obad Šćitaroci, Ph.D. financed by University of Zagreb. Both research concepts are elaborated in the paper on Heritage Urbanism inSustainability 2019, 11(9), 2669; https://doi.org/10.3390/su11092669.

2 This research includes results from guest research performed in 2016 at University College of London (UCL) at the Space Syntax Laboratory supervised by Sam Griffiths, PhD and Garyfalia Palaiologou, Ph.D.

3 ARTISTS – Arterial streets towards sustainability was a research project coordinated by Lund University, Sweden from 2001-2002; https://cordis.europa.eu/project/id/EVK4-CT-2001-00059

4 Available from mapire.eu database

Senad Nanić

Geometric Harmonization in Islamic Architecture

Geometrijska harmonizacija u islamskoj arhitekturi

Doctoral dissertation [Summary]

Senad Nanic (1966, Zagreb) has a BA in architecture, MA in philosophy of science and Ph.D. in architecture and urban planning. He designed over 100 projects, wrote approx. 80 papers and published three books. He taught Islamic art, culture and civilization at the Islamic Secondary School in Zagreb since 2001.

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Assist.Prof. Alen Žunić, Ph.D.
Assoc.Prof. Ema Jurkin, Ph.D.
Date of public defense: March 7th, 2022

The dissertation has 858 pages, 6 chapters, 74 subchapters, 268 approximate and 28 detailed geometric analyses, 178 illustrations, 41 tables, 1011 footnotes, 264 bibliographic and 34 internet units.

In order to enhance objective interpretation of the architectural value of 257 selected Islamic architectural monuments, 268 approximate graphic analyses have been conducted via iteration of hypothetical geometric sequences in AutoCAD 2D software on digitized architectural drawings and 28 detailed analyses of architectural drawings as reconstructed according to measurements from the relevant literature. The analyses are contingent upon geometric harmonization derived from only a single starting length in all drawings at the same scale. This allowed for derivation of algebraic expressions with only one variable for all drawings at the same scale. Alternative geometric analyses have been conducted for specific monuments with proportions examined in the literature.

The only published scholarly book exclusively dedicated to geometric harmonization in Islamic architecture is Bulatov (1988), which focuses on geometric harmonization in Central Asian architecture based on the products of a square, equilateral triangle, half-square and the golden section. Geometric harmonization based on the a√n geometric sequence has been demonstrated in the Great Mosque of Córdoba by Fernández-Puertas (2000, 2008). The fundamental use of equilateral triangles in geometric harmonization has been demonstrated on monuments in the Maghreb by Ewert (1986). Many authors suggested harmonization based on a square diagonal by drawing, but with no elaborate demonstration. Geometric harmonization based on the golden section has been demonstrated on single monuments in several articles. The geometric complexity of *muqarnas* vaults has sparked considerable interest, resulting in the reconstruction of 3D variant models based on historical 2D drawings, but with no demonstration of the geometric harmonization.

Approximate analyses prove the golden section as the starting point and main tool of harmonization in Islamic architecture, based on an innovative breakdown of the square layout of the original Messenger's Mosque in Medina, and done by dividing the half-side of the gross layout square in the golden section, thus forming the mosque courtyard by two golden rectangles. The golden rectangle appears as the first product of a starting length in numerous variations and compositions. The demonstrated harmonization of the golden section terms with the proximate terms of one or more other geometric sequences proved a praxis of combinations of the golden section with multiple symmetries as a harmonizational objective. Analyses demonstrate the frequent application of the sequence $a\sqrt{2}/\Phi^n$, supplementing the golden section as a source of harmonious intermediates.

The geometric harmonization of *muqarnas* vaults is executed only by the golden section terms coupled in most cases with a right angle division in a certain number of the same angles, wherein application of other symmetries manifests not before the second harmonization layer (*i.e.*, details). Since precise measurements of the earliest extant monuments are unavailable, the hypotheses that sections of the rotational hyperboloid with rectilinear excerpts are the original and ideal case of *kārbandī* vault structure, as opposed to the traditional construction of *kārbandī* vaults on the curved pointed arch grid, remains speculative.

When defining 19 equal spans between transverse columns, the harmonization of the original Messenger's Mosque applies the thus far unrecognized quality of the golden section, namely, the diagonal of the golden rectangle is equal in length to 19 tenths of the starting side, deviating a mere 1‰ and providing the geometric construction of the number 19, the declared guarantor of the Qur'an's divine origin, and proving its arithmetic key, as a product of the golden section. The Great Mosque of Wasit, as the earliest extant, also applies transversal division in 19 equal spans. We have demonstrated the number 19 as a component of instruction by integers for the construction of the Ka'ba's original golden rectangular layout by Arabic steps coupled with the coincidence of the angle defined by the northward diagonal of the original Ka'ba (19 Arabic steps) and the south-eastern wall (10 Arabic steps) with an azimuth determined by the first shadow cast by the sun on the summer solstice in Mecca.

All detailed analyses prove the respective geometric harmonisations of approximate analyses. There are six detailed analyses with only negligible (<1%) and minor (<5%) deviations. In total, there are 97 (41.4%) negligible, 107 (45.7%) minor, 24 (10.3%) significant and 6 (2.6%) major deviations. In principle, negligible deviations appear in the primary elements of composition, while an increase in deviation values appears parallel to the development of greater detail in the composition.

The conviction that design in Islamic architecture is preferably based on proportions of the square diagonal has proven baseless. 75 approximate and 9 respective detailed analyses have demonstrated the application of products of the square diagonal, but with no possibility of defining all necessary architectural elements without the application of the golden section, except in four late cases. Bulatov's (1988) demonstration of geometric harmonization in Central Asian architecture based on the products of a square, equilateral triangle and half-square and the golden section can thus be generalized for the entirety of Islamic architecture, but only partially, because the golden section is the starting point and main instrument of geometric harmonization in virtually all examined monuments since the beginning of Islamic architecture.

The dissertation proves that the geometry of the golden section harmonized with other geometric sequences based on products of square division forms an efficient designer's tool for achieving unified expression in all layers of a design throughout the history of Islamic architecture and it is deductive to the algorithmic form of algebraic expressions with only one variable per analysis, which is the starting length of the respective geometric harmonization.

Further research is proposed within the scope of detailed surveys of extant monuments, notably *kārbandī* vaults and the foundations of the Ka'ba. The geometric harmonizations applied in ancient architectural traditions encountered by the advance of Islam and in the European traditions contemporary to classical Islam and later, and also in modern and recent Islamic architectural practice, should also be researched.

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Nr. 63 of Prostor was editorially prepared and executed by
Ariana Stulhofer, Ph.D.

The issue was closed on 23 June 2022.
Graphic prepress and printing was concluded on 30 June 2022.

Basic typography: Meta
Paper: 115 gr
Offset printing b/w

Scientific Papers

ISSN 1330-0652

9 771330 065007