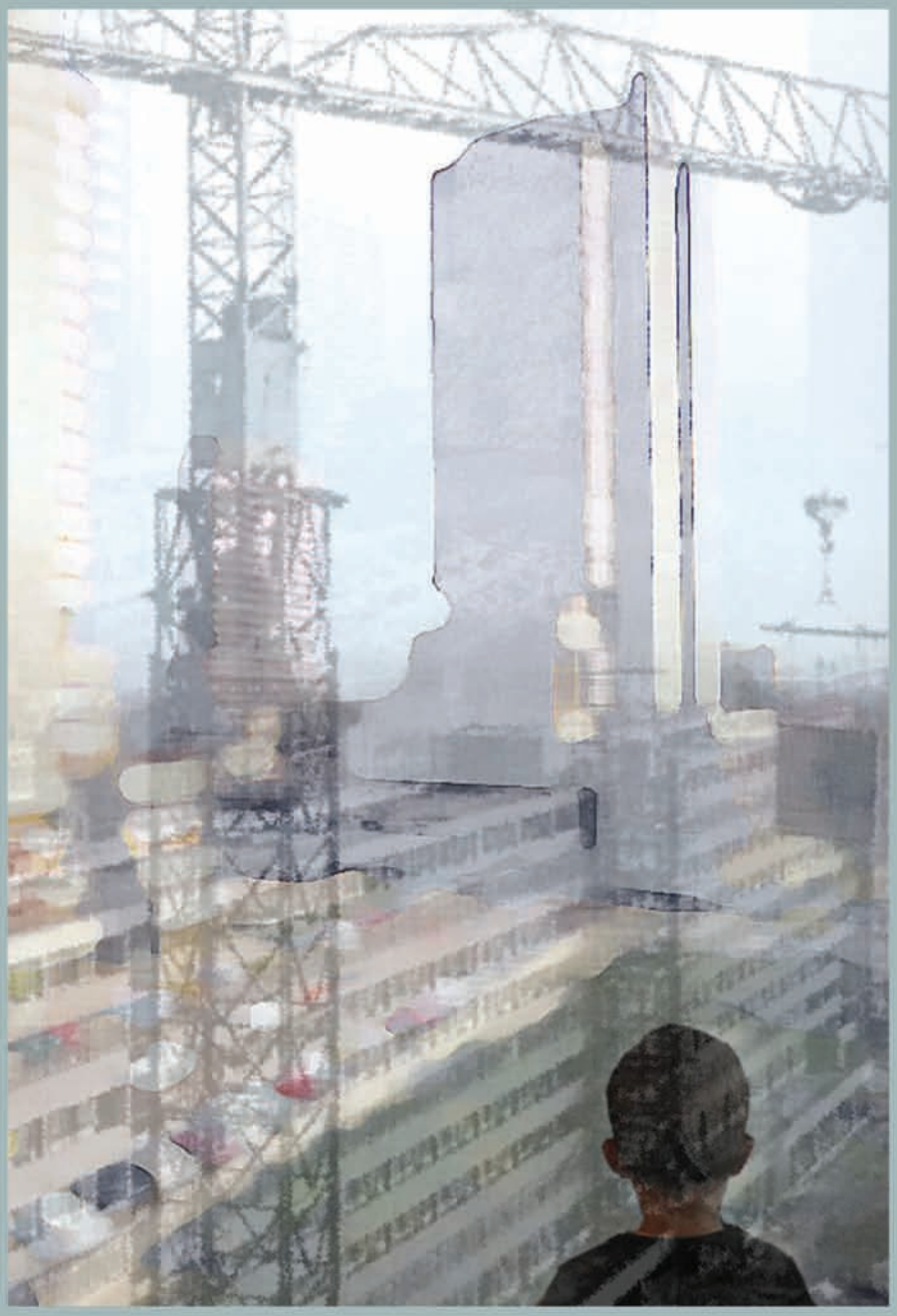
spatium

urban and spatial planning, architecture, housing building, geodesia, environment

December 2015 34



spatium
No. 34, December 2015, Belgrade

ISSN 1450-569X
ISSN 2217-8066 (Online)

SCOPE AND AIMS

The review is concerned with a multi-disciplinary approach to spatial, regional and urban planning and architecture, as well as with various aspects of land use, including housing, environment and related themes and topics. It attempts to contribute to better theoretical understanding of a new spatial development processes and to improve the practice in the field.

PUBLISHER
Institute of Architecture and Urban & Spatial Planning of Serbia, IAUS
Saša Milijić, Director

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IN PUBLISHING SERVICES AGREEMENT WITH
De Gruyter Open Ltd.
Ul. Bogumila Zuga 32a
01-811 Warsaw, Poland

FINANCIAL SUPPORT
Ministry of Education, Science and Technological Development of the Republic of Serbia

Spatium is indexed in SCOPUS and SCImago.

ENGLISH LANGUAGE PROOFREADING
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ADMINISTRATIVE SUPPORT
Milena Milinković, IAUS, Belgrade, Serbia

Printed in Serbia by
"PLANETA PRINT", Belgrade, Serbia

Number of copies: 200

C O N T E N T S
SPATIUM
No. 34, December 2015, Belgrade

EDITORIAL

Dear readers,

In this issue of *Spatium* we publish a further set of contributions of a number of authors, predominantly from Serbia. They all belong to the category of review papers, and mostly reflect findings from current scientific research, focusing on a number of specific themes, viz.: social housing policy; regional development policy; innovative city development; application of the SEA/ESIA procedures in tourism development; flood control; and the role of human capital as a limiting factor for development in Serbia. Also, an article dealing with some specific aspects of socially responsible architecture has been published here.

Miodrag Vujošević
Editor-in-Chief

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 1-9

UDC 728.22(497.1)"1948/1970"
Review paper
DOI: 10.2298/SPAT1534001A

URBAN HOUSING EXPERIMENTS IN YUGOSLAVIA 1948-1970

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In the period from 1948 to 1970 urban housing architecture in Yugoslavia had a distinctly experimental character as it strived intensively towards research and establishment of new architectural patterns and values that would mark the period of economic growth of the country. In conditions of mass housing construction, initiated by the devastated urban housing fund after the Second World War, significant influx of population to towns and the state directed its socialist aspirations at alloting every family acceptable living space. The period of the so-called "directed housing construction", whose imperative was to establish the limits of existential minimum in collective housing, maximal space "packing" and optimal functionality of flats, at the same time represents the most significant period in the development of housing architecture in Yugoslavia. The architects focused their interests in housing in mainly three directions: a) the creation and application of new prefabrication systems, b) innovative application of modernistic patterns in aestheticization of architecture and c) experimenting with space units which will enable a higher level of privacy in high-density housing conditions. The first direction of research emerged in the context of post-war housing construction of a wide scope, which encouraged the advance of technological research in areas of prefabrication and practical application of achieved results on the whole territory of Yugoslavia. The second direction dealt with architectural planning which was strictly subordinated to social and ideological sphere with domineering socialist monumentalism and artistic and sculptural approach to architecture. The third was related to experimental tendency with new urban housing patterns which aimed to search and find more pragmatic, humane solutions within mass high-density housing constructions which were the first to utilize and show examples of "double-tract" buildings. These were primarily realized in Serbia, as continuation of tendencies first expressed in activities of "Belgrade School of Housing".

Key words: **Urban Housing, Socialism, Modernism, Prefabricated system, Experimental housing.**

INTRODUCTION

After the Second World War, like many other socialist countries in the world (the Soviet Union, Poland, Czechoslovakia, Bulgaria, Romania, China, Hungary, Albania, etc.), Yugoslavia also underwent radical social and economic reforms, which to a great extent had an impact on collective housing construction. During the 1950s, housing culture and policy in Yugoslavia were united in a distinctive socio-political system (Ćirović, 2012). Until the 1970s, the state played a strategic role and had decisive responsibility in designing the housing policy. This policy stressed a clearly present social message and was characterized by introduction of "directed housing construction", which was meant to enable every family to have satisfactory living space (Tsenkova, 2008). Directed housing construction is a form of construction organized in such a way that workers in basic labor organizations put aside joint funds for new housing construction, starting from their own economic and social interests (Nikolić, 1981).

After ideological split with Stalin's Russia in 1948 (Perović, 2007; Rusinow, 1978), Yugoslavia turned its back to centralized socialist planning, a model characteristic for economic system in the Soviet Union, and turned towards economic reforms, decentralization and liberalization (Mesa-Lago, 1973). There were two main reasons for emergence of a specific social system in Yugoslavia, different from all other models of communist ideology in the world. The first lies in the fact that it was a federal union of six Yugoslav republics, all with different history, tradition and economic development. On the other hand, the split with the Soviet Union had as a direct consequence, the aspiration towards establishment of an authentic national communist philosophy along with political and ideological

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independence. (Friedmann, 1966; Dunn, 1975; Giofrè and Miletić, 2012; Dyker, 1990; Schrenk *et al*., 1979; Maksimović, 1965; Riddell, 1968).

One of the specificities of socialist socio-political systems was the aspiration to establish and construct the so-called "housing communes" (Stites, 1989), a structure or group of structures designed for collective housing, aimed at showing the society the importance of collectiveness. Depending on the circumstances in which they emerged, the housing communes were interpreted in different ways. The most significant examples were built in the Soviet Union, the so-called ''*Kommunalka*'' or ''*Communal apartment*'' during the rule of Josef Stalin and ''*Khrushchyovka Buildings*'' built while Nikita Khrushchev was in power (Chmelnizki, 2012; Varga-Harris, 2008). Unlike other numerous housing communes built in the Soviet Union, the situation in Yugoslavia was less drastic, since immediately after 1948, all attention turned to mass housing construction, which was meant to bridge, in a more humane way, the gap between the existing housing conditions and mass migration of the population to cities. A significant social change, initiated by the self-management system, had its impact on the architecture, too. Consultation of Yugoslav Architects in Dubrovnik, held in 1950, initiated the first ideas on architecture outside the Soviet influence (Milenković, 1950). From 1953, a large number of public competitions were organized and this represented fertile ground for experiments with new professional reality. Although the programs were rigid, with strict rules limiting architectural style, new ideas still managed to get expressed and achieved (Mecanov, 2008). This is the background to the first "habitology" experiments,[2] which explored the limits of existential minimum in collective housing, maximal space "packing" and optimal functionality, the requirement insisted upon by the state, as the biggest investor (Group of authors, 1979; Ilić, 1950; Group of authors, 1978).

The inclination to look for more humane housing conditions was not characteristic only in the Yugoslav context, other socialist countries of that time also experienced similar tendencies, some of which include prefabricated housing construction in the Soviet Union (*Khrushchyovka Buildings*) (Boym, 2008; McCauley, 1995), Czechoslovakia (*Panelák*) (Schot and de la Bruhèze, 2003; Dufkova and Kozeluha, 1999; Zarecor, 2010), Hungary (*Panelház*) (Molnár, 2005; Finta and Magyar, 1960) and East Germany (*Plattenbau*) (Palutzki, 2000; Rubin, 2006).

THE CONCEPTION AND APPLICATION OF NEW PREFABRICATION SYSTEMS

The development of prefabrication technologies in Yugoslav construction industry, in a wider context of post-war reconstruction and industrialization, was particularly dominant in the filed of housing, infrastructure and public buildings. The need for mass housing construction encouraged the advances in technological research in the area of prefabrication. Large companies, such as Serbian Institute for Testing of Materials ("IMS" system), construction companies ''Rad'', ''Ratko Mitrović'', ''Neimar'', ''Trudbenik'' and ''Komgrap'' (''KSB'' system) in Serbia, as well as ''Primorje'', ''Novogradnja'' (type ''Dubrava''), ''Industrogradnja'' and ''Jugomont-Jugobeton'' in Croatia (systems YU-59, YU-60, YU-61 and YU-71), ''Gradis'' in Slovenia (''PBM'' system), designed and manufactured new prefabricated and semi-prefabricated systems and components (Vukov, 1962; Nikolić, 2013; Lelak and Feldman, 1972; Marković, 1972; Radas, 1972; Šelken *et al*., 1972).

The conventional, "closed" method of construction was of no use in post-war circumstances, since the need for mass construction of larger housing complexes was the society's priority.[3] The main characteristics of "open" system of construction were first of all, flexibility and adaptability of prefabricated elements, which were easy to implement and adapt to every architectural solution, and secondly, the simultaneous construction of different building parts directly on the construction site or in factory plants (Jovanović *et al.,* 2012).

The development of collective housing in Yugoslavia and the experiments in this area were significantly influenced by an invention by Branko Žeželj, who in 1957 promoted, for that time innovative "IMS" skeleton system, based on the use of prefabricated and prestressed modular constructive elements (with 3.6m to 4.8m span), which, as opposed to typified spans of Khrushchovka buildings in Russia (mostly with 3.2m span) offered far better options of functional organization and facade shaping. The main advantage of IMS system was its "openness" and flexibility in design. This innovation proved to have been a significant contribution of Yugoslav engineering to world architecture and industry in the second half of XX century, as the system was implemented in building more than 150.000 flats world wide, from Hungary, Italy, Cuba and Angola to the Philippines (Thaler *et al*., 2012). Later on, this system was improved by introduction of "System 50" with main functional unit on axis distance of 7.2m, which enabled better modularity and compatibility with other sub-systems (Muravljov, 2010).

The first building built in "IMS" system in 1959, was the housing building in residential Block 2 in New Belgrade, and it was the training ground for all kinds of experiments related to architectural design and construction technology. In subsequent years, "IMS" system was used in other housing units, such as residential blocks 21, 22, 23, 28 and 29, also in New Belgrade (Jovanović *et al.*, 2012).

Along with most frequently used "IMS" skeleton system, post-war construction in Yugoslavia was also characterized by implementation of large panel systems, as the simplicity of their production was in accordance with the development level of construction industry.

One of the first examples of large panel systems ''Yugomont YU-61'', constructed by Bogdan Budimirov, Željko Solar and Dragutin Stilinović, used for construction of housing

[2] The term "habitology" stands for scientific area dealing with research in housing. The term was derived from Latin "habitare", which translates as "to dwell".

[3] "Closed" system is massive structure where materials and components rely on each other in order to provide desired functionality. A closed system configuration has a complete set of assembly elements needed for construction and architectural solutions that can be fully accomplished with these elements alone (Mrduljaš and Kulić, 2012; Nikolić, 2013).

complex Borongaj (architect Bogdan Budimirov) and in a Folnegović settlement in Zagreb, Croatia. The authors patented the system of flat concrete plates that made up the constructive structure of multi-storey residential buildings, suitable for industrial production of elements in large series. This resulted in cheap production of a large number of housing units in a short period of time, which was very significant in housing shortage characteristic for the post-war period (Vukov, 1962).

INNOVATIVE APPLICATION OF MODERNISTIC PATTERNS IN HOUSING ARCHITECTURE AESTHETICS

Attachment to the East block in the first post-war years and the attempt to politically impose socialist realism, initiated comprehensive debate on architectural expression suitable for the socialist society. After the split with Stalin's regime in 1948, socialism in Yugoslavia tactfully oscillates between the East and the West, cultural freedom expands and modernistic aestheticism and functionalism become imperatives in realization of larger architectural and urban complexes (Kulić, 2012). The relationship between architecture and ideology was evident in many aspects of the architectural discourse in socialist Yugoslavia: from the debate on "official" architectural style, fit for the developing new socialist society, to the attempt of connecting traditional national heritage and modern architecture (Mrduljaš and Kulić, 2012). Modernism became the prevailing form of construction practice with its implicit meanings: on the one hand, this was one of the styles of the first mass wave of socialist modernization, on the other hand, it was an indicator of difference between Yugoslavia and the Soviet block (Kulić, 2012). Tendencies towards decentralization evident in political and cultural patterns of constitutive republics of Yugoslavia are distinct in their different approach to architectural issues, where every republic had its own particularities and preferences. In Serbia, modernization was primarily interpreted as striving towards functionalism which led to experimental patterns, out of which the double-tract residential units were the most characteristic and which have been explored in this paper in more detail. In Croatia, on the basis of pre-war Zagreb modern architecture, a new tradition emerged, enriched by local color tones and individual signatures of powerful authors (Maroević, 2004). Similarly, in Slovenia and Bosnia and Herzegovina the interest was directed primarily towards aestheticization of modernist expression.

In the 20s and 30s of the XX century, eminent Croatian architects worked as a part of several groups, the most significant of which was "The Zagreb School", gathered around Drago Ibler, marking the beginning of new, modernist tendencies in Croatian architecture (Maroević, 2004). In the first post-war years, architecture was mainly directed at reconstruction of torn down cities. With the imperative of mass construction and country reconstruction, architecture had for the first time turned into public service. The period of poverty characterized by collectivism as the basic model of social action, reflected on the housing construction as well, as it showed domineering multi-storey buildings with simple, elongated, horizontal or vertical shape, with large concentration of housing units. In the post-war period, the construction focused on two directions, on the one hand there was a massive anonymous construction of housing buildings and industrial plants, while on the other hand, design of representative symbolic constructions of the new regime emerged, marked by socialist monumentalism. The period from 1953, which continued into the 60s of the XX century, was the period of emphasized individualism and great advance in style as part of the late modernism (Ignjatović, 2012). Drago Galić in 1953 designs a residential building in Vukovar Street in Zagreb implementing the gallery unit of the building with duplex flats, as the expression of his experimenting with new residential types in socialist construction. One of the early examples of post-war aestheticism in Croatia is also "the Wooden Skyscraper", by architect Drago Ibler in Martićeva Street in Zagreb, constructed in 1955. Innovation of the Ibler's approach to shaping and materializing the building is shown in the earliest application of wooden material in articulation of the facade front, and it was directly confronted with the current tendencies which implemented cold and rough concrete in urban housing architecture (Karač and Žunić, 2004). The works of Ivan Vitić represent a parallel stream of thought in comparison to Galić's work. His residential buildings in Laginjina Street in Zagreb, built in 1958, are an example of architecture with simple cubic volumes and lively colors, with polychrome facades articulated as changing and dynamic abstract pictures, with sliding wooden facade elements-window blinds, which was extremely innovative both for Yugoslavia of the 1960s and the world (Karač and Žunić, 2004). (Fig. 1).

Figure 1. Ivan Vitić, Residential building in Laginjina Street, Zagreb, Croatia, 1958 (author's private collection)

The most significant architect from Split Ivo Radić in his projects like residential towers in ''Špinut'' settlement, built in 1966 and residential-commercial building "Split III", built in 1966, experimented with combinations of loggia and brise-soleil, thus achieving an attractive effect of "depth of surface" (Bilić and Eremut, 2013). (Fig. 2).

During the first post-war years Bosnia and Herzegovina had fewer construction projects characteristic for pre-war Modernism or Soviet socio-realism architecture. Owing to the presence and influence of architects from Belgrade, Zagreb and Ljubljana, who belonged to different architectural groups with prevailing different influences, such as dominant academism in Belgrade or Modernism in Zagreb, gradually the dominant tendencies in Sarajevo architectural circle changed. One of the most prominent residential buildings was built by a Croatian architect Juraj Neidhardt in Alipašina Street in Sarajevo in 1958 (Korov, 2012).

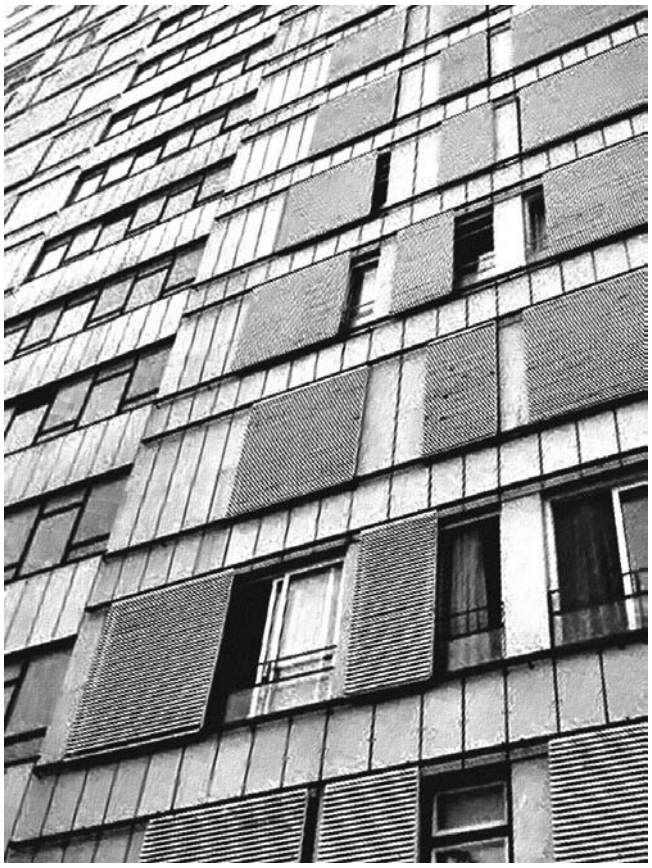

Figure 2. Ivo Radić, Špinut residential towers, Split III, Split, Croatia, 1966 (author's private collection)

Architecture in Slovenia also developed in accordance with post-war ideology that favourited collective awareness. The surrounding area of Ljubljana was expanding as new residential areas were built; a large number of key urban projects were carried out outside the capital. In comparison to other much more modest examples of urban architecture in Slovenia, the residential block ''Kozolec'' in Ljubljana, made by architect Edo Mihevc in 1957 was constructed after the model of Le Corbusier's building *Unite d'habitation* in Marseille (Mihelič, 2003). The second, significant example of Slovenian architecture is a residential building by Stanko Kirstl in Prešernova Street in Velenje from 1960. In this example, modernist implementation of concrete was disrupted by use of bright red brick on the facades (Ravnikar *et al*. 1999/2000).

In Serbian architecture, a residential building by architect Mihajlo Mitrović stands out. It was built in Braće Jugovića Street in Belgrade in 1964 (Fig. 3) and represents a rare example of residential architecture with just a hint of expressionistic tendency.

Figure 3. Mihailo Mitrović, Residential building in Braće Jugovića Street, Belgrade, Serbia, 1964 (Đokić, 1970)

The building has a distinctive early implementation of spontaneous, almost chaotic order of facade elements, as a consequence of author's inclination towards expressive artistic approach and intentional negation of conventional solutions (Mitrović, 1975; Đokić, 1970).

Another similar example is a residential tower for professors of Belgrade University, built in 1966 by architect Rista Šekerinski, in Mitropolita Petra Street, in Belgrade. The tower with its unconventional expressionist appearance contrasts all examples of post-war architecture in Yugoslavia (Anonim, 1966). (Fig. 4)

EXPERIMENTS WITH HIGH-DENSITY HOUSING UNITS

Housing policy in Yugoslavia after the Second World War was determined by the five-year plan (1947-1951), which defined program basis for establishing a standardized existential minimum per capita. However, in practice this led to numerous problems (Milašinović-Marić, 2012). As housing policy represented at the same time an important political issue, the only "solution" to housing crisis proposed by the ruling political party was to construct "communal flats", due to hard economic situation. More than 20 percent of families in Yugoslav towns lived in communal flats, with two or more families residing in one flat (Prosen, 2007). Although it was planned that priority in flat allocation will be given to families with small children and sick family members, the emerging ruling elite quickly ignored their own convictions on social justice and chose the best and most luxurious flats for their own families (Maroević, 2004). The new socialist society at its beginning stripped its citizens of their right to privacy and by adopting the Property Law, dealing with flat disposition (1945). It also encouraged secret control of other tenants, as well as reporting on those

Figure 4. Rista Šekerinski, Residential tower for professors of University of Belgrade in Mitropolita Petra Street, Belgrade, Serbia, 1966. (author's private collection)

who were thought to have excessive living space. All this resulted in the fact that one housing unit was used by 2-3 persons on average (Dobrivojević, 2012). This period lasted for a fairly short time and was under the strong influence of the communist ideology. After ideological split with the Soviet Union in 1948, the first residential buildings which represented a step towards more humane living conditions were built.

The constant gap between the real needs of families and the economic abilities of the state, forced the architects to identify the minimal standards required to secure the same housing conditions for all members of the society. In accordance with egalitarian ideology, new standards reflected the principle of classification of housing with regard to the number of rooms (related to certain number of family members, where the living room was used as bedroom), while the needs, habits and desires of potential group users were not given too much consideration (Bajlon, 1976).

The first regulations meant to define more closely the dimensional and constructive aspects of residential buildings were brought in 1947. However, even though they defined the size of small (50m^2 for 3 people), medium (60m^2 for 4 people) and large flats (70m^2 for 5-6 people), they failed to provide an answer whether a living room was meant to be used as a bedroom for some family members, and this remained an unsolved issue for many years afterwards, even though it met with harsh criticism and a change in regulations (Ćirović, 2012).

A significant point that should be made is the fact that in socialist Yugoslavia, regardless of the previously mentioned circumstances, there was a strong willingness and inclination towards experimenting with new and different residential patterns, even if that meant aberration from the official ideology. These experiments strove to come up with more pragmatic and humane solutions (Friedmann, 1970). The concepts of these housing complexes reflect the main postulates of socialist ideology, as they redefine the idea of a "neighborhood" and are, in fact, the embodiment of the utopist idea of "the happy community" - the core of the communist society, in which it lives and creates in harmony, equality and order (Milašinović-Marić, 2012).

This is the background to the emergence of the first examples of "double-tract" buildings, as an innovative form of collective housing in Yugoslavia, which was to be characteristic for the period of mass residential construction from 1950 to 1970. This was particularly evident in architectural and urban planning competitions, where new, valuable solutions emerged, related to exploitation of minimal spaces and achievement of higher standards (Giofrè and Miletić, 2012). „Double-tract" or „H-Building" is a type of residential unit characteristic of multi-family residences or collective dwellings. Its features are two closely and parallelly placed residential tracts, sharing a common staircase and lift communication, most often set perpendicularly in relation to the direction of tracts. Primary residential areas are, by rule, almost always oriented towards outer facades of the building, while secondary areas face an open, atrium interspace between the tracts (Alfirević and Simonović Alfirević, 2014). Double-tract units were primarily implemented in Serbia, as a consequence of greater interest by Serbian architects in innovative typological units within „Belgrade School of Housing", but also due to the fact that in typological sense, double-tract was interpreted differently in other Yugoslav republics (Bajlon, 1975; Aleksić, 1975). In Serbia, double-tract was interpreted as a set of two separate units, differing in shape and function, partly connected through common vertical communication into a single structure, while in other republics it was seen as a set of two functional zones, separated by a corridor (Alfirević and Simonović Alfirević, 2014). (Fig. 5)

The double-tract concept can be recorded in several places around the world during various periods. The first examples of double-tract system in multi-family dwellings were constructed by the end of XIX century in New York, at the competition for architectural solution of the tenement building popularly called the Dumbbell (Lubove, 1961; Marshall, 1893; Pommer, 1978; Reynolds, 1893; Schwartz, 2002). Unlike other examples in the world, double-tract in Yugoslavia did not appear in its extreme versions, such as the Dumbbell in the USA. Housing architecture in Yugoslavia was oriented towards experimenting with more humane functional solutions (Alfirević and Simonović Alfirević, 2013). The first indication of the double-tract system appears in Croatian architect Neven Šegvić's solution at 1947 Competition for a typified house in Belgrade. In his solution,

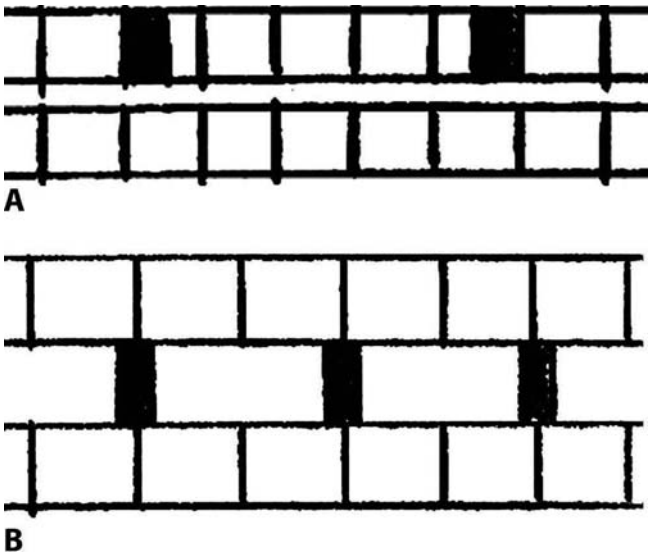

Figure 5. Differences in double-tract interpretation: a) two functional zones as tracts; b) spatial shape units as tracts (Alfirević, Simonović Alfirević, 2014)

the tracts were not visually or functionally clearly divided into separate shapes, although the interior structure of the building was almost completely carried out by following the double-tract principle (Mecanov, 2009). (Fig. 6)

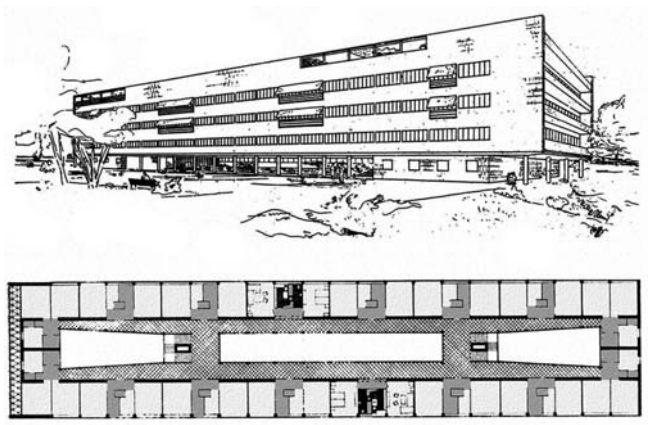

Figure 6. Neven Šegvić, Competition project for typified house in Belgrade, 1947 (Mecanov, 2009)

The first implemented type of the double-tract in Yugoslavia was the urban dwelling ''Metuljček'' in Maribor, built by Slovenian architect Rudi Zupan in 1955 (Pirkovič-Kocbek 1982; Pirkovič-Kocbek, 1983; Ravnikar *et al.*, 1999/2000). Shortly after this, the first double-tract was constructed in Serbia in 1957, in Belgrade, after a project designed by Serbian architect Milorad Macura (Fig. 7), followed by a series of variations of this system, mostly as a consequence of functional research and experimenting in architectural competitions (Mecanov, 2009).

The solution for experimental residential Blocks 1 and 2 in New Belgrade built by architect Branko Petričić in 1959, was the result of the striving to achieve attractive ambience and optimal distance between linear buildings within the block. For 1967 competition for architectural solution of buildings in Block 29 in New Belgrade, architects Mihailo Čanak and Milosav Mitić designed the construction of four housing units per each staircase vertical, thus avoiding the issues

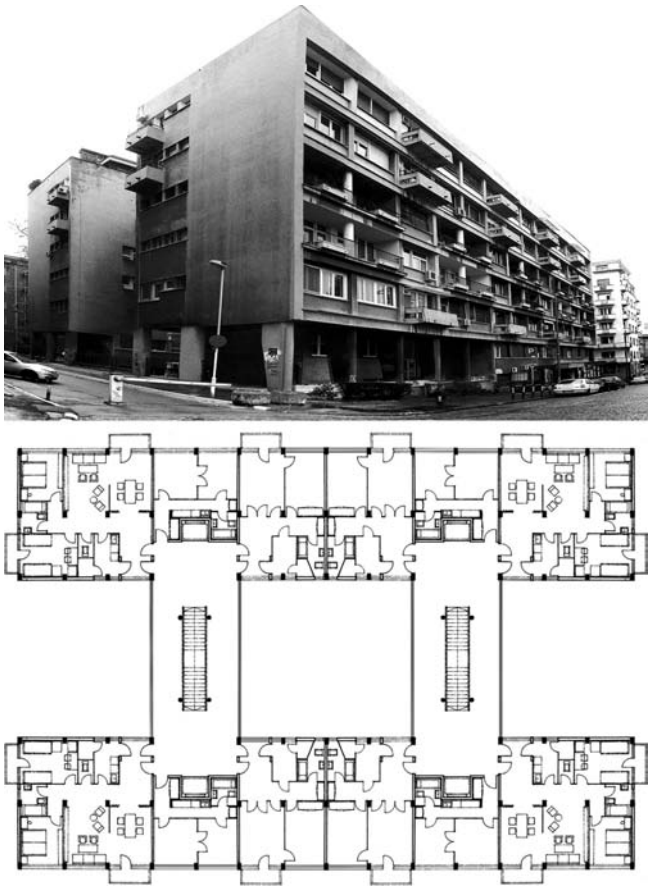

Figure 7. Milorad Macura, Residential building, Belgrade, Serbia, 1954 (author's private collection)

of the lack of privacy with optimal solution of double-tract (Čanak, 2014; Fig. 8) In residential Block 33 in New Belgrade, built by architect Radovan Mitrović in 1968, the distance between the tracts is about 7.5m, which enabled not only

Figure 8. Mihailo Čanak and Milosav Mitić, Competition solution for city Block 29, Belgrade, Serbia, 1967 (M. Čanak's donation 2010)

the utility rooms, but also the bedrooms to be positioned along the interior facade. At the architectural competition for residential buildings in Block 23 in New Belgrade, architects Milan Lojanica, Borivoje Jovanović and Predrag Cagić (Aleksić, 1975) selected to use the double-tract which enabled multiple units within the same width, shortened communication to a minimum and provided better options of natural light, illumination and ventilation of residential units. At the competition for architectural solution of Block 3 and the Liman 3 settlement in Novi Sad in 1970, architects Milan Lojanica, Borivoje Jovanović and Predrag Cagić designed an atypical shape of double-tract, with the space between the tracts reduced to a minimal dimension (3x5m), giving it the character of a lightwell more than an atrium (Cagić and Lojanica, 1972). Further tendencies in developing double-tract functional concept continued during the 1970s in a large number of authentic projects, among which we should mention residential settlement in Banjica in Belgrade, proposed in 1971 by architects Slobodan Drinjaković, Branislav Karadžić and Aleksandar Stepanović (Đukić, 1972) and unexecuted projects for residential buildings in the northern part of city Blocks 61 and 62 in New Belgrade, by architects Darko Marušić and Milenija Marušić in 1971 (Aleksić, 1975), residential buildings in Block 19a in New Belgrade by architects Milan Lojanica, Borivoje Jovanović, Predrag Cagić and Radisav Marić in 1975 (Aleksić, 1983).

Although the double-tract system in Yugoslavia was used as an experimental pattern for multi-family housing, the results of its implementation were not satisfactory in all cases. In this sense, some examples show that double-tract buildings were constructed even in cases when the location did not require space limitation or when double-tract orientation was inadequate, which resulted in inadequate illumination of the flats and in invasion of privacy.

CONCLUSION

This paper presented three key tendencies utilized by Yugoslav architects in conditions of socialist post-war reality, aiming to provide answers to program conditions set by the state as the biggest investor. The first direction of research emerged in the context of post-war housing construction of a wide scope, which encouraged the advance of technological research in areas of prefabrication and practical application of achieved results on the whole territory of Yugoslavia. The second direction dealt with architectural planning which was strictly subordinated to social and ideological sphere with domineering socialist monumentalism and artistic and sculptural approach to architecture. The third was related to experimental tendency with new urban housing patterns which aimed to search and find more pragmatic, humane solutions within mass high-density housing constructions which were the first to utilize and show examples of "double-tract" buildings. These were primarily realized in Serbia, as continuation of tendencies first expressed in activities of "Belgrade School of Housing".

By summarizing the most significant prerequisites which influenced the emergence of experimental approach to design of collective residential buildings, the following can be highlighted:

1. Devastated urban housing fund in Yugoslavia after the World War II,

2. Large migration of population into cities and the need for mass housing construction,

3. The tendency to achieve maximal "packing" of dwelling units up to the limits of acceptable space minimum for its users, while at the same time establishing more humane patterns of living,

4. Research and discovery of new constructive prefabricated systems and the need to use and test them practically,

5. Imitating current world examples of modernism and the aspiration to achieve and surpass them, and

6. Support of the ruling elite, aiming to promote individual intellectual and creative freedom, particularly expressed in architectural competitions.

On the other hand, the most significant consequences which emerged as the result of the tendency to implement innovations and experiment in the filed of housing architecture were the following:

1. The aspiration to test in a practical way new prefabricated constructive systems in construction of larger housing complexes all over Yugoslavia and their subsequent presentation to the world,

2. Devising a specific functionalistic approach to organization of housing spaces, developed systematically back at the time of "Zagreb School" and "Belgrade School of Housing", and

3. Developing new aesthetic expressions, which on the one hand represented a reaction to current architectural trends in Europe, while on the other hand reflected the aspiration to conceive an architectural expression suitable for newly formed socialist society.

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Received December 2014; accepted in revised form June 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 10-17

UDC 330.34.01
338.1:339.137.2
Review paper
DOI: 10.2298/SPAT1534010C

ENDOGENOUS GROWTH THEORY AND REGIONAL DEVELOPMENT POLICY

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The numerous versions of endogenous explanations of economic growth emphasize the importance of technological change driving forces, as well as the existence of appropriate institutional arrangements. Endogenous growth theory contributes to a better understanding of various experiences with long-term growth of countries and regions. It changes the key assumptions of the Neoclassical growth theory and participates in the modern regional development physiology explanation. Based on these conclusions, the paper: a) explicates the most important theoretical postulates of the theory, b) explains the most important factors of economic growth in the regions in light of the Endogenous growth theory messages and c) emphasizes the key determinants of regional competitiveness which in our view is conceptually between the phenomena of micro- and macro-competitiveness and represents their necessary and unique connection. First of all, micro-competitiveness is transformed into a regional competitiveness; then regional competitiveness is transformed into a macro-competitiveness. In turn, macro - influences the microeconomic competitiveness, and the circle is closed. After that, the process starts over again.

Key words: **endogenous growth, endogenous growth theory, regional development, regional development policy, regional competitiveness.**

INTRODUCTION

A region is considered to be a geographic area that is smaller than the national territory in which it is located. As a rule, the region area does not coincide with administrative borders, as its determination depends mainly on the issue under studying.

Regional development means the process of initiating, structuring and achieving sustainable development, while taking into account the complex regional characteristics, by using appropriate instruments and measures. Regional development policy seeks to unify two fundamental and basically contradictory goals: on the one hand, increased efficiency of the national economy, and the balanced development of its individual parts, on the other hand.

The regional policy primary goal is to create economically strong regions which are able to integrate into the global economic trends (Maskell, 2000). Balanced regional development cannot be realized independently of the institutions and instruments that ensure stability, continuity and harmonization of development processes at the national level. Therefore, in recent decades strategic planning of regional development has become increasingly important, given that it takes into account not only economic but social and environmental dimensions of economic development, as well.

Neoclassical school tells us that growth in the value of production at national and regional level is the result of an increase in the quantity and quality of labor (by population growth and labor-saving technological changes), increase in physical capital (by savings and investment mechanism), and the production technological level rise via its own R&D activities or transfer of the knowledge and technology (Barro and Sala-i-Martin, 2004). Less innovative regions with less developed educational system, *ceteris paribus* have more moderate economic growth rates compared to the regions that are characterized by progressive territorial innovation systems, competent educational systems, etc. Research on the economic growth factors in the United States during

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1948-1982 emphasized the role of education, technological innovation and growing know-how (Solow, 1988). The neoclassical explanations of the regional economic growth physiology start from the assumptions about manifestation of constant economies of scale, behavior of economic entities in accordance with the prices established in perfectly competitive markets, absence of externalities, existence of exogenous technological change. The neoclassical explanations also abstract potential impact of institutional factors and neglect the potentially stimulating role of public management on generating economic growth in certain territories (Kurz and Salvadori, 2001: 14-16).

On the other hand, *Endogenous growth theory* argues that the growth dynamics are internal result of forces largely determined by the character of key attributes of the economic system, i.e. economic and development policies of the country or region, and not the forces that act outside (Todaro and Smith, 2011). The numerous versions of endogenous explanations of economic growth also emphasize importance of the appropriate institutional arrangements existence. (Cvetanović *et al.*, 2010). "New approaches point to the fact that specific location of industry can be crucial for regional development, and that synergetic effects of locations are important for technological and other impacts of spillover effects and innovation" (Dragičević, 2012: 20).

At the end of the 20th century largely as a result of the globalization process, a new generation of regional development policies emerged (not only in leading economies but also in developing countries) substantially affirming new development strategies for companies and territories. Previous regional development policies, characterized by redistribution of financial resources between developed and less developed regions, increasingly give its place to policies aimed at strengthening the endogenous potential of the regions. There is a consensus in the regional economy that the Endogenous growth theory represents their most important conceptual framework (Vazquez - Barquero, 2002). The global crisis of 2008 has further underlined the relevance of such statements.

The context for research on Regional Development has been changed significantly in last 30 years. The global changes in economic, political and social relations that happened meantime influenced the treatment of regional growth in economic theory (Capello, 2007). New theoretic concepts has been developed in which space has important role for economic growth of the region (Capello and Nijkamp, 2009). Policy of regional development begun to stress importance of the space in context of efficient allocation of limited resources. Spatial availability and specificity of territorial and social context makes precondition of rational and effective policy of economic growth of the region (Stimson *et al.*, 2011).

By their importance two group of theory inside regional economics stand out: Location theories and Theories of regional growth (Capelo, 2009: 24). Location theory is a theoretical-methodological basis of regional economics. This microeconomic discipline is of a static character. This theory research a space as a cathegory without any limits. This fact enable in location theory that the choice of the microeconomic subjects related to location considers independetly of limitations that exists (physical borders between the states, as well as all other borders without administrative characters, like natural, linguistic, cultural and other barriers). At the other hand, theory of regional growth has mainly macroeconomic characteristics. From pure macroeconomic character it differ by taking into account territorial criteria. Theory of regional growth treats the space as territorial totalities that are mutually separated, but are internally homogenious. By combining the two extremes, there are also different perceptions of space as a research subject, which represent analytical starting point for other groups of theories on regional development. The third way to space included in the economic analysis is his view as full territorial integrity, internally diversified, and associated with other territories. The theories arising from these needs space are theories of regional development based on the interconnectedness and interdependence of the participants in the economic life within each area.

The above three approaches in the spatial conception in economic theory, they are still separate concepts, though newer theories about local growth, which are based on increasing returns microeconomic entities enabled concentration treated as linked. It is an approach that assumes that rising yields achieved at the level of individual companies, not due to characteristics of the area in which the companies operate (Capelo, 2007).

It is an indisputable fact that the Endogenous growth theory to a significant degree contributes to a better understanding of various experiences with long-term growth of countries and regions. It challenges the key assumptions of the Neoclassical growth theory and participates in the modern regional development physiology explanation. Based on these conclusions, the paper: a) explicates the most important theoretical postulates of the theory, b) determines the factors of economic growth of the regions and c) emphasizes determinants of regional competitiveness which is conceptually between the phenomena of micro- and macro-competitiveness and represents their necessary and unique connection.

THEORETICAL POSTULATES OF ENDOGENOUS GROWTH THEORY, WHICH ARE IMPORTANT FOR REGIONAL DEVELOPMENT POLICY

Endogenous explanations seek to find out the way in which market forces, decisions in public policies and various institutional solutions influence the shaping of economic dynamics in individual countries and regions, i.e. they try to explain the causes of difference in growth rates between various countries and regions (Todaro and Smith, 2011: 150). Key differences between Neoclassical (exogenous) and Endogenous growth theories are their diametrical points of view regarding: a) the nature of technological change (exogenous and endogenous), b) the economic growth dynamics (zero growth/constant growth) and c) the existence of market equilibrium (perfect market/market failures) (Fagerberg, 2001).

Endogenous nature of technological changes

The diffusion of innovation and knowledge, flexible organization of production and urban and institutional development generate efficiency growth and high quality of production system key performances. In turn, each of these mechanisms increases the capital accumulation efficiency by stimulating the manifestation of economies of scale, various externalities and reduces transaction costs, thereby contributing to productivity growth and maximizing the rate of return in urban territories (Vazquez - Barquero, 2002: 16-17).

Technological change is the most important factor of economic growth in both Neoclassical and Endogenous growth theories. It increases production for a given set of inputs and is a key growth factor of countries and regions. Endogenous growth theory tends to reveal the processes that cause technological change, as neoclassical economic thought completely abstracted this issue. Endogenous growth theory emphasizes technological change as an outcome that is subject to severe market failures (Samjuelson and Nordhaus, 2009).

Technological changes alter the importance of certain production factors, and also influence the qualitative transformation of all elements of economic potential in the companies and territories, expanding the boundaries of their use, based on increase in available production factors usage efficiency (Togaty, 2009: 29-31). By increasing factors usage efficiency, technological changes enable the development processes to less drastically show their limitation, making economic progress of the regions possible, thanks to the substitution of scarce production factors for less limited ones. The consequence of technological change is an efficient recombination of developmental factors with a tendency toward a more complete utilization of the production factors.

Technological changes also affect the transformation of the regional economic structure, by including a variety of products, groups or sectors, unequally; also they have diverse directions of spreading as well as diverse manifestation effects intensities (Link and Siegel, 2003: 18).

By pointing to the importance of technological changes for the economic advancement of certain regions, many analysts indicate the importance of technology transfer in generating endogenous economic growth (Dragutinović *et al*., 2014). Therefore, technology trade is gaining in importance, as well as numerous ways for transferring technological knowledge from one region to another.

In many cases technological changes push the limits of productivity almost to the theoretical maximum. At the same time, they change the focus in economic value creation from production of goods and services to creation of new knowledge and technologies, whose synergetic character exceeds the total cost of their creation, many times over. Technological development allows creating new or improving existing products, services and processes. The goal and purpose of technological development is to enable faster, more comprehensive and higher-quality meeting of human needs (Pokrajac, 2004). The choice of means and methods for accomplishing the goals of technological development is the issue of strategic orientation of corporations, as well as certain regions and the national economy as a whole.

Endogenous theories explain technological change as an internal outcome of public and private investments in human capital and investment in R&D. All endogenous growth models advocate an active development policy in supporting the regional growth, inter alia, through direct and indirect investments in the education of human capital and stimulating foreign direct investment into research-intensive areas of production (Vukotić, 2002: 779).

Non-diminishing returns of production factors

The endogenous growth theorists reject the neoclassical assumption of diminishing marginal returns. They start from the premise that situation of non-diminishing returns is possible. Thereby, endogenous growth explanations reject the stagnant growth theorem of Neoclassical theory according to which the economic growth is (in the absence of technological shocks) time-limited phenomenon and in the long term tends toward stagnation or zero growth (Barro and Sala-i-Martin, 2004). Quintessence of the explanation of this possibility is in the synergetic nature of technological change impact on productivity growth and economic efficiency growth at the national or regional levels. It is believed that the American economist Paul Romer formulated the idea and constructed an endogenous model in which knowledge leads to continuous economic growth (Romer, 1986, 1987).

In contrast to Neoclassical growth theory, Endogenous growth theory states that developmental convergence of countries and regions might not occur. So, economically advanced regions are able to improve living standards of its residents forever, and less developed may remain poor forever. Assuming that public and private investments in human capital generate externalities and productivity improvements that compensate for the tendency of diminishing returns of factors, Endogenous growth theory attempts to explain the possibility of long-term economic growth of countries and regions.

Market failures

Theorists of endogenous growth emphasize the existence of many market failures in real life. This means that market incentives cannot achieve optimal allocation of resources in case of creating new ideas and innovations (Atkinson and Ezell, 2012). Technological development is not a random phenomenon regulated by the free market operations. To a great extent, economic growth of countries and regions is the result of designed development policy and social capability of the country, and the ability of its regions to organize their institutions that stimulate the creation and the broadest diffusion of technological change (Švarc, 2009: 16).

Special types of external effects, in the theoretical analysis context of new generation of regional development policies, are spillover effects. In short, the spillover effects are external effects of economic activities influencing those entities that are not directly engaged in these activities.

Economic theory knows both positive and negative effects of these spillovers. An example of positive effect can be

knowledge that is acquired in a region and that could be applied in other regions (although they were not directly involved in the acquisition of the knowledge). Usually, negative example is pollution affecting also entities which do not participate in the production of goods that (during its production and usage) cause the pollution.

Elementary retrospective literature on the importance of technological spillovers in the last thirty years enables the following conclusions. *Firstly*, there is no consensus between economic analysts regarding the character of technological spillovers effect on economic growth of the host region. *Secondly*, the disagreement of some theorists range from claims that there are positive technological spillovers whose effect on the economic growth dynamics in the host region is positive, to statements that in general spillovers are of negative character. Thirdly, recent studies highlight the existence of positive technological spillovers whose effect on the economic growth dynamics is essentially positive without doubt, though it is very difficult to quantify those spillovers precisely.

In synergetic way, technological spillovers encourage the value increase in production of goods and services at a regional level. In the contemporary economic conditions the existence of spillovers is most frequently associated with pervasive and propulsive character of new technologies, especially Information and Communication Technologies (ICTs). A higher volume of transfer of new technological solutions into specific region, results in greater spillover effects of knowledge, technologies and productivity, which consequently intensify economic growth of the region (Antevski, 2008).

ENDOGENOUS GROWTH FACTORS OF A REGION

The most important factors of the endogenous development of a region are: 1) human capital, 2) social capital, and 3) innovation.

What follows is an explication of their most important characteristics, primarily in the light of endogenous regional development policy.

Human capital

Human capital is an economic expression for knowledge, skills, competencies and other attributes that individuals have, and which are important when they carry out economic activities. These elements of human capital constitute individual attributes that have a permanent character.

The initiators of the idea of human capital are A. Smith – specialization and division of labor, K. Marx – the role of science and technology in production, J. S. Mill – quantity and quality of human capacity for work, J. Schumpeter – recombination of knowledge into the innovation process as a factor of economic growth (Savvides and Stengos, 2009). According to Gary Becker, Nobel Laureate in economics, human capital is a set of human abilities which enable him to obtain income (Becker, 1992). He is famous for his statement that human capital is formed on the basis of investments in man, including (as the most important) training, preparation for production, costs of a healthy diet, migration and searching for information on prices and income (Becker, 1993).

To a great extent American researcher Theodore Schultz deserves credit for shaping the concept of human capital (Schultz, 1961). Schultz treated the costs of education and health care in an almost identical way as the investments in physical capital. Human capital is reflected in the intangible assets, which have the capacity to initiate or to support production activities, innovation and employment. It is formed through a process of learning in various institutions (educational institutions, family, enterprise). The combination of knowledge, skills and abilities is an individual rather than uniform process. Analysis of the creation and use of human capital must take into account the influence of various social institutions: school, labor market, community, etc.

It can be said that knowledge has become a decisive factor to business success and competitive advantage of companies and territories (Mroczkowski, 2012: 272). Over the last thirty years developed regions have turned to processes which imply less use of simple labor, raw materials and energy, parallel to the growing use of new scientific solutions and increasingly sophisticated equipment. The importance of investment in human capital is recognized in modern economies, especially under conditions of the comprehensive application of scientific results in the production process, intensive development of new technologies and continuous improvement of forms and methods of production management. Certainly, education, skills and knowledge are the key components of the productivity growth of individuals, regions and the economy as a whole in modern society. Nowadays, many relatively rich countries and regions have achieved their progress primarily due to investments in education and improving human capital (Cvetanović and Despotović, 2014).

Social capital

Social capital is the capital of cooperation, mutual operations, mutual trust and mutual help, which are formed during the economic relations of individuals; it cannot be privately owned and has the attributes of a public good. It is not clearly visible because people carry it inside. Different environments support certain forms of social capital differently, resulting in possibility of its different economic valuation. The social capital is a special form of public goods, potentially available to everyone involved in the system of social connections and relationships (Coleman, 1988; 1994).

Social capital includes the institutions, relationships, attitudes and values which govern interpersonal interactions and contribute to the economic and social development. To a great extent, social capital is a result of the legal, institutional and political environments where economic actors operate i.e. perform their functions and achieve their goals. It is a capital of permanent and to some degree institutionalized relations between individuals and organizations, which facilitate activities and contribute to the creation of economic value (Stimson *et al.,* 2011: 10-11.). In a word, social capital is the "glue" that holds the community together. For economists, social capital includes intangible assets (such as rules, habits and relationships) that facilitates the exchange of innovative processes, resulting in economic growth. The proper functioning of the market mechanism assumes the

existence of generally accepted norms, institutions and behavior patterns that work towards reducing transaction costs, ensure contract compliance and quickly resolve any disputes. If we take into account the additional elements of social capital - a sense of belonging to a community that shares the same values and cherishes the same patterns of behavior, participation of civil society in the decision-making processes of importance to the development of the community - then the sites that have a high level of social capital creates "climate" that encourages responsibility, cooperation and synergy (Osborne *et al*., 2007).

Social capital consists of the attributes of society organization such as *trust*, *norms,* and also *various networks*, which can improve social efficiency through coordinated action (Putnam, 1993; 1995). Relationships between people have value and some potential for development, both for individuals who are involved in many social connections, as well as for groups and the entire community.

Networks are a component of social life and they allow participants to efficiently join the realization of a number of common goals. Almost all researchers consider networks as very important prerequisite for the creation of social capital (Baar, 1988). In the economy, networks occur as informal connections (institutions) in already formed formal relations, which complement, enrich and strengthen existing connections and relationships. The most important features of the network in the economy refer to trust, responsibility and punctuality.

Trust is one of the most important elements of all business transactions. Economic literature's approach to trust is mainly based on the observation and analysis of the relationship model seller-buyer, where we can observe influence of several variables associated with confidence, as its prerequisites or its outcomes (Ostrom, 2003).

The regions with a high radius of trust also have a significant level of social capital which is a prerequisite for economic prosperity. Economic activities that rely on future actions of individual agents are achieved at a lower cost, if they are realized in an environment that is characterized by a high level of trust. Conversely, low levels of trust among economic agents will result in higher costs and correspondingly lower economic efficiency. Regions with low overall trust levels are lagging behind in terms of economic development (Vazquez – Barquero, 2002).

As a rule, the regions with low trust levels have an unfavorable innovation climate. By directing available resources to the protection of property rights, prevention of fraud by employees, business partners and the state, entrepreneurs have less and less funds to direct towards the realization of the activities related to creating new products, improving existing ones and increasing the productivity and economic efficiency (Quevit, 1991).

Regions with high trust levels are less dependent on formal institutions dealing with the protection of property rights and contracts. Also, in regions with undeveloped formal institutions, high level of trust among transactors has a positive effect on the volume of economic transactions and is a good substitute for undeveloped or inefficient regional institutions (Vazquez – Barquero, 2002). In regions with high levels of trust, the credibility of the regional administration is also higher, which has a positive effect on investments and economic activity volume.

Furthermore, the high level of trust at a regional level has not only a positive effect on the accumulation of physical capital, but also has considerable effect on the human capital improvement. In those regions, local labor and knowledge markets are much more developed. In contrast, in regions where the level of trust is low, employment decisions to the greatest possible extent are based on connections and corruption and less on objective criteria of abilities, compared with regions where the level of trust is high.

Social capital plays a prominent role in the creation of economic value. It significantly increases the efficiency of knowledge and skills transfer from one part of the organization to another or from one region to another. Economic function of social capital is reflected in the reduction of transaction costs related to the mechanisms of formal adjustments such as contracts (Cvetanović and Mladenović, 2015). No contract can foresee every single detail that could occur between the parties.

Innovations

The 1980s and 1990s witnessed a series of theoretical concepts of regional development based on innovation activities as a source of economic growth. The literature knows them as "new industrial spaces", "industrial clusters", "innovative milieus", "self-learning regions", "regional innovation systems" (Puljiz, 2009).

Although some of the above-mentioned names refer to a slightly lower territorial level (industrial clusters), while others cover wider areas (regional innovation systems, self-learning regions), they are in the economic literature usually under the name of *spatial innovation systems* (Cheshire and Malecki, 2005). In every case, the economic growth is based on regional concentration of innovative companies that continuously invest into new technologies and products development, while maintaining very close relations with other actors at regional level.

The literature on regional development mostly consists of works about clusters as organizational form of spatial innovation systems. In less developed regions, the promotion of clusters is based on less costly labor, natural resources, etc.; in contrast, in more developed regions cluster affirmation is based primarily on high technology, specialization, developed infrastructure, etc.

Development of clusters involving innovative companies and research institutions has become an important priority in many regions; not surprising if we bear in mind that their jobs are distinguished in terms of productivity and earnings. However, the problem is that there is still a huge gap between the results of scientific research and specific advice on particular interventions of regional authorities. Some analysts reasonably note that future research must much more thoroughly examine the nature of regional prerequisites for the formation and success of clusters, necessary organizations and territorial level of their functioning, for researchers to be able to recognize their

economic effects (Armstrong, 1995). The challenge is even more evident when one takes into account the imperative of reducing the growing imbalance in regional development. It is clear that functioning of the high-tech clusters is closely linked to the educational structure and that the majority of such clusters are located in the most prosperous regions. The mechanism of cumulative causation tends to increase the economic advantage of the most advanced regions, while at the same time globalization processes increase the competitive pressure, especially in less developed regions. Therefore, concrete actions aimed at increasing innovativeness in less developed regions, are faced with the additional risks and difficulties. Knowledge, information, skills, innovations and new ideas have become essential wealth and production resources in the post-industrial society.

REGIONAL COMPETITIVENESS – CONCEPTUALLY LOCATED BETWEEN MICRO- AND MACRO-COMPETITIVENESS, REPRESENTING THEIR NECESSARY AND UNIQUE CONNECTION

In theory there are diametrically opposed views on the relevance of the concept of competitiveness. Because of the number and complexity of factors, as well as the very nature of the competitive processes, the concept of competitiveness is often very difficult to understand, and sometimes it's even confusing (Snieška and Bruneckienė, 2009). Some economists believe that competitiveness has characteristics of "the natural law of modern capitalist economy" (Kitson *et al*., 2004), while others think that definition of competitiveness refer to productivity which measures the value of goods and services per factor unit, produced in a particular territory (Krugman, 1995).

Without going deeper into analysis of issues related to the character and nature of the concept itself, it should be noted that level at which the phenomenon of competitiveness is examined is the most important aspect of this phenomenon (Kitson et al., 2004). In short, we should distinguish between *microeconomic* and *macroeconomic* aspects of competitiveness complex.

At a *micro level*, *competitiveness* is the ability of companies to compete, grow and be profitable (Martin, 2004), or the ability of a company to produce and sell products and services at a lower price compared to its competitors and/or under non-price terms that are more attractive than competitors' offer. So, competitiveness is the ability of companies to consistently and profitably produce output that meets the requirements of an open market in terms of price, quality, etc. A company that is more competitive than its rivals will have better chances to gain larger market share.

Unlike the competitiveness of enterprises, the concept of *macroeconomic competitiveness* is theoretically controversial phenomenon. It is often identified with ability to produce goods and services and bring them into the foreign markets, and is expressed through the growth dynamics of real gross domestic product per capita, or the capacity for increasing wealth (Marginean, 2006).

Regional competitiveness is a new phenomenon in economics. It has been considered only in the late 20th and early 21st century. In highly developed countries research in this area is extensive and of high quality; in contrast, it is almost absent in developing countries (Kitson *et al*., 2004; 2008). Regional competitiveness is spatially located between the micro - and macro - and represents their necessary and unique connection. Micro- is first transformed into regional and regional into macro-; in turn macro- influences the microeconomic competitiveness, and the circle is closed. After that, the process starts over again (Figure 1).

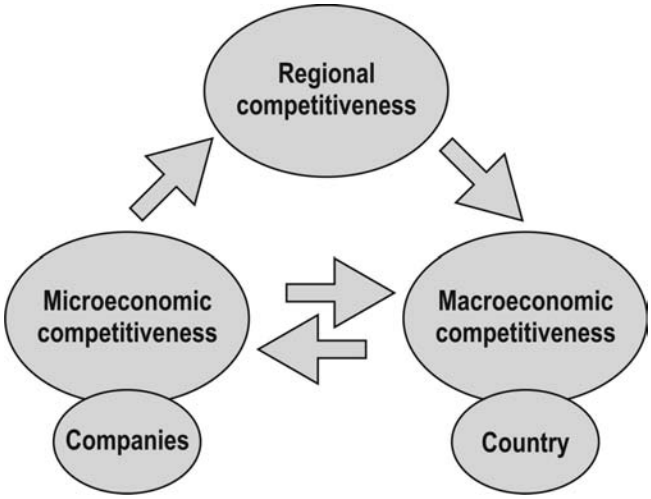

Figure 1. The concept of regional competitiveness (Source: authors)

Regional competitiveness is ability of a region to ensure economic growth over time, including ability to attract and retain productive capital and competent human resources, as well as to be innovative, in the broadest sense.

Regional competitiveness is based on identifying and strengthening the unique combination of specific resources of a region. It is reflected in the region's ability to ensure economic growth over time, including the ability to attract and retain capital and human resources, as well as to be innovative. This indicates that the concept of competitiveness is not just about productivity, but also market structures and institutional arrangements (Porter, 1990). Thus, a region can be characterized by highly-competitive companies in the micro-economic terms, but if these firms generate low value added per employee, then we cannot speak of the competitive region. This statement suggests that regional competitiveness is far more complex phenomenon than productivity of labor, as some authors argue.

In the literature there are many approaches to sorting of key factors of the regional competitiveness. One of them states the following seven factors of regional competitiveness: *economic structure*, *innovative activity*, *regional accessibility*, *skills of the workforce, social structure, decision centers* and *regional identity* (Lengyel, 2004). Another approach to regional competitiveness modeling states the following factors: *quality of human capital, innovations, connectivity and entrepreneurship* (Ecorys, 2007).

Some authors make a distinction between static and dynamic factors of the regional competitiveness (Ručinska

and Ručinsky 2007). The former are source of static competitive advantage of the regions and refer to natural and geographic conditions in a region (constant conditions) such as regional location, natural resources and historical heritage. The latter are source of dynamic competitive advantage of the regions, and they are not the result of natural and geographic relevance of a particular region but they are acquired over time. They may be affected by the companies or regional institutions.

The above-mentioned factors are part of the absolute competitive advantage of a region. This advantage will depend on their presence and development. Regions characterized by development and presence of many different factors (for example, high-quality human capital, clusters, strong support from the formal and informal institutions, good geographic location, developed infrastructure) have better competitive position, meaning that competitiveness of a region depends on superiority and interaction of its factors. The regional competitiveness is based on high-qualitative productive performance and economic ability to produce the output with the highest possible productivity, which in turn generates high levels of real wage. Competitiveness is closely related to the rise in living standards, better employment opportunities and ability of the country (the economy) to fulfill its international obligations. Whether we look at competitiveness only as productivity (Krugman, 1990: 9) and/or through the rising living standards (Porter, 1992), competitiveness is based on the cumulative results achieved on the basis of existence of endogenous factors of the region. Regions which develop faster and own many different factors also have a better competitive position (Vuković, 2003).

CONCLUSION

Endogenous growth theory contributes to a better understanding of various experiences with long-term growth of countries and regions. It changes the key assumptions of the Neoclassical growth theory and participates in the modern regional development physiology explanation.

Key differences between Neoclassical (exogenous) and Endogenous growth theories are their diametrical points of view regarding the nature of technological change, the economic growth dynamics and the existence of market equilibrium.

Endogenous growth theories explain technological change as an internal outcome of public and private investments in human capital and investment in R&D. All endogenous growth models advocate an active development policy in supporting the regional growth, inter alia, through direct and indirect investments in the education of human capital and stimulating foreign direct investment into research-intensive areas of production (e.g. software industry, telecommunications, etc.).

Theorists of endogenous growth emphasize the importance of the market failures. This means that market incentives cannot achieve optimal allocation of resources in case of creating new ideas and innovations. Economic development is not a random phenomenon regulated by the free market operations.

The most important factors of regional endogenous development are human capital, social capital and innovation.

Nowadays regional competitiveness is mostly based on high-qualitative productive performance and economic ability of region to produce the output with the highest possible productivity, which in turn generates high levels of real wage. Competitiveness is closely related to the rise in living standards, better employment opportunities and ability of the country to fulfill its international obligations in a timely manner.

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Received August 2015; accepted in revised form October 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 18-26

UDC 728: 502.131.1(497.11)"1990/..."
316.334.56
Review paper
DOI: 10.2298/SPAT1534018D

TOWARDS SUSTAINABLE DEVELOPMENT OF SOCIAL HOUSING MODEL IN SERBIA – CASE STUDY OF BELGRADE

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Social housing in Serbia has been experiencing drastic transformations over the last 25 years. Although new solutions have begun to develop, they are based predominantly on various types of local supported housing provisions, insufficient in terms of supply and deprived of crucial elements of long-term sustainability. The main hypothesis of this paper is that the national system of social housing should include systemic approach and that improvement of social housing in Serbia towards sustainable development could be achieved by implementation of general criteria and specific indicators of social, economic and environmental sustainability. This paper may contribute to systemic sustainability evaluation of social housing projects in Serbia and consequently propose improvements in regulations and decision-making process, at both national and local levels.

Key words: **social housing, sustainability, general criteria, indicators, Belgrade.**

INTRODUCTION

The aim of this paper is to firmly embed the complex sustainability concept into the social housing system in Serbia by introducing general criteria of social, economic and environmental sustainability according to global demands, but of local relevance. Through analyses of Belgrade's existing social housing projects, we propose a typology based on location, capacity, structure and other planning features, and then rank each type by set of chosen criteria and specific indicators, with the aim to evaluate the level of its sustainability. This pilot mechanism could illustrate the possibility of complex evaluation of either built structures or anticipating the level of sustainability of future social housing projects, and thus generate the key arguments for necessary improvements of the social housing in Serbia.

BACKGROUND

Serbia has been exposed to negative legacy of political and social disintegration, devastating regional or international conflicts, post-conflict defies, and major structural deficits over the last 25 years. The unfinished transition process within a hesitant democracy dealt with complex phenomena of rapid socio-economic polarization, pauperization and high unemployment rate, in the new political and economic landscape of recurring multi-sector crisis. The former, relatively consistent Yugoslav centralized model of housing provision, once a top political priority and element of the socialist welfare state, abruptly collapsed and made place to market-based principles, small scale housing programs developed on *ad hoc* basis, while the existing social housing stock went through massive privatization (Tsenkova, 2009). Although the Housing Act from 1992 defined obligations and purposeful use of funds gathered from massive privatization of the housing stock, the hyperinflation of late 1992 and early 1993 had entirely deflated these funds. While up to 98% of public housing in Serbia were privatized (Petrović, 2004), this privatization did not accumulate funds sufficient to initiate new social housing cycles.

The starting point of the new social housing model in Serbia could be found in: the Strategy for Resolving the Problems of Refugees and Internally Displaced Persons from 2002 and particularly in The Settlement and Integration of Refugees Programme (SIRP), from 2003 to 2008 (UN-Habitat, SIRP, 2008). The main goal of SIRP was to raise local capacities, establish local housing agencies, and design, develop, and

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monitor pilot housing projects. Regardless of these scarce examples, Serbia was lagging behind in the housing reforms compared to other post-socialist countries of the Southeast Europe (Tsenkova, 2009).

After a period of stagnation, housing reform process in Serbia began with the adoption of two documents: Social Housing Law in 2009 ("Official Gazette of RS", No. 72/09) and National Strategy for Social Housing in 2012 ("Official Gazette of RS", No. 13/12). The Law defined the term of social housing as a "housing of an adequate standard provided with the support of the State, in accordance with the social housing strategy and programs for the implementation of the strategy, to households that, for social, economic and other reasons cannot obtain housing on the market", together with necessary instruments and financing. The main goal of the National Strategy and its Action Plan was to ensure effective implementation of the Social Housing Law and additionally promote social housing actors and sustainable system mechanism.

However, when analysing social housing in Serbia and particularly social housing projects in Belgrade, one can observe that these have been realized through a variety of programs and projects, but essentially lacking systematic and the strategic coordination framework and clear relation to relevant national or local social housing policy. In aim to contribute to sustainable development of social housing in Serbia, lacking also planned and coordinated mechanisms of cross-sectorial and inter-institutional cooperation of all stakeholders (Damjanovic, *et al.*, 2014), we propose one possible methodology by introducing complex sustainability criteria and indicators to social housing.

INTRODUCING CONCEPTS OF SUSTAINABILITY TO SOCIAL HOUSING

Although several authors and organizations developed diverse explications of sustainable development in housing, it is important to point out that there is no universal, all applicable, official definition of sustainable social housing, neither its unique indicators. For the purpose of this paper, and based on the review of relevant literature (UNEP, SUSHI, 2013; UN-Habitat, 2012; UN, 2011; UNECE, 2006), indicators of all three pillars of sustainability: social, economic and environmental, and were selected according to their relevance, contextual applicability, impact and benefits for residents, neighbourhoods and wider community. This paper proposes one possible selection of sustainability indicators that could, in the future, assist decision-makers/ housing providers and contribute to the development of more sustainable social housing in Belgrade and Serbia.

Theoretical and Notional Demarcation

Since there is no unambiguous definition, while mono-sectorial analysis does not provide a complete picture, the search for the appropriate model of social housing should include three pillars of sustainability and take into account local capacity (in terms of space, finances, administration, management and maintenance, etc.).

Contemporary model of social housing refers to social, economic and environmental sustainability in provision of decent and quality housing units at lower cost for the members of society who cannot afford it under market conditions, while saving existing resources (UNEP, SUSHI, 2013).

a) **Social sustainability** is of crucial importance in meeting the fundamental human need for shelter that is important for the basic development of the community and society. Social sustainability in the field of social housing is about creating affordable and quality housing that is available to different social groups and takes into account not only the current needs of users, but also the shifting needs of tenants during the use of the apartment. It is about ensuring the mixed use and the adaptability of space for different kinds of users (age, cultural, and income groups), promoting safety, equality and social diversity, and reducing financial disparities, while promoting social values and goals such as social cohesion and social inclusion.

b) **Economic sustainability** includes economic efficiency of the building/settlement at all stages of its life cycle, from construction, through operation and maintenance, renovation and possible reconstruction, to demolition and recycling. In order to achieve economic viability of social housing, it is necessary to consider the available subsidies, the income mix, as well as diversity in the type of lease.

Social housing has been often seen as a measure of the social care system, a tool of poverty reduction, in achieving social justice and ensuring the fundamental human right to housing, but seldom as an instrument of economic development. The impact of economic viability of social housing depends on the mixture of economic functions and housing sector implications: housing and associated infrastructure is one of the most valuable and durable human creations; housing provides the basis for the well-being of people, work productivity and mobility; housing has a large share in household spending and public expenditure; housing construction, services related to housing and real estate market are the key economic activities and play an important role in employment.

c) **Environmental sustainability** implies responsible relations between the housing sector and the environment, by means of efficient use of natural resources and energy during the entire life cycle of construction, renewable energy use, use of ecological building materials, waste and carbon dioxide emissions reduction, in order to cut back on aspects that are harmful to human health and the environment.

A strategic framework for improving environmental sustainability in housing should incorporate: increasing the resilience and adaptability of housing; the provision of healthy living conditions and a healthy environment; the reduction of waste from the use of heating and cooling energy, coupled with carbon dioxide emissions, reduction of water and soil pollution, adequate use of materials and waste recycling.

THE SUSTAINABILITY CRITERIA OF SOCIAL HOUSING

After examining the broad and divergent theoretical basis from which derive different systems of indicators and different methodologies (UNEP, SUSHI, UN Habitat, etc.), it is

possible to stipulate that there are no generally harmonized indicators based on a unique procedure of data collection and analysis.

Therefore, the main challenge is to create a comprehensive method of selecting criteria and indicators that would measure social housing in Belgrade, and relate them to the final goal of evaluating the social housing sustainability performance. In this sense, the great majority of chosen criteria and indicators are connected with social housing programs in the region and worldwide, and their experience in developing, monitoring and evaluating social housing settlements and projects. Especially important in the Serbian context is the low carbon transition and energy vulnerability, recorded here as a specific form of transitional energy poverty. The transition to sustainable models in post-socialist cities is inevitable, especially having in mind unclear spatial transformations, administrative and social practices and land use.

Social sustainability criteria – The importance of social housing in achieving social cohesion has been recognized in key international and European policy documents (Priemus, 2005). Social housing, as a special form of housing provision is largely based precisely on social ethics and social solidarity. Multiple connotations of this topic imply the large extent of criteria of social sustainability, namely:

A1. *Site* – Location is especially important and includes indicators such as: distance from the city centre, from other urban centres, from main city roads, public transport and services, but also from jobs and health and educational institutions etc. Many authors consider that greater social effects can be accomplished by dispersing individual buildings of social housing throughout compact neighbourhoods, than by grouping them in the form of social housing enclaves (Weingaertner and Moberg, 2014; Milić, 2006).

A2. *Quality of architectural design* – This criterion is coupled with social inclusion: sense of safety within residential areas, the degree of identification of tenants with the immediate environment and the neighbourhood (Milić, 2006).

A3. *Diversity* – Social housing projects can vary in urban and architectural typology, density, type of lease, etc. (UNECE, 2006).

A4. *Social mix* – Social diversity, in particular in household income level, in household types (singles, young couples, families with children, etc.), and diversity of use, etc. (UN-Habitat, 2012; Weingaertner and Moberg, 2014).

A5. *Access to services* – The range of services available to tenants takes into account indicators of frequency of use, number of users, and spatial accessibility for all social groups, including children, the elderly and persons with disabilities (UNEP, SUSHI, 2013; Levett, 1998).

A6. *Safety* – Related indicators evaluate the level of safety and the crime prevention in the neighbourhood. Specific urban and architectural design solutions and the subsequent interventions in public spaces can have a preventive role in combating social deviations (Milić, 2006).

A7. *Public participation* – Level of involvement of local community indicators can be considered in planning and design of social housing, as well as the level of satisfaction with housing conditions, security, maintenance, etc. (UN-Habitat, 2012; Weingaertner and Moberg, 2014).

Economic sustainability criteria – Based on comprehensive and detailed analysis of housing needs, the public authorities should shape the economic investment drive, in terms of investment in the existing public housing stock, its improvement and maintenance, but also find ways to reach housing affordability. Criteria and indicators of economic viability are not associated only to the benefits for low-income households, vulnerable or other priority groups, but also to many other elements of economic viability at the level of the wider community:

B1. *Value of the land /housing site* – Within the general criterion of the site value, there are specific indicators, such as the cost of the property (return on investment), ownership relations (ownership, lease), administrative and market setting (land management), etc. (Milić, 2006).

B2. *Sustainability in project financing* – Achieving financial stability means that there are available sources for the social housing program from the city/national/EU funds (Priemus, 2005; Guy, Kibert, 1998).

B3. *Life cycle costs of building/settlement* – Within the criteria related to life cycle costs of the building/settlement, there are several indicators, for instance investment costs, operating and maintenance costs (annual), future repair and replacement costs (at the expense of users), as well as monitoring of the housing condition after moving in, determining the physical condition of the building (Levett, 1998).

B4. *Competitiveness* – Competitiveness of social housing providers, involving some elements of the market to social housing must be preceded by gradual introduction of private housing actors in the field of social housing provision (UNECE, 2006).

B5. *Affordability* – The criterion of affordability is achieved when, on the user side, social housing standards and location correspond to low-income or middle-income households' needs (UNEP, SUSHI, 2013).

B6. *Collection rate of the rent* – The indicator of the realized rate of rent collection and maintenance costs in social housing can serve to evaluate the sustainability of the general rental conditions (UNEP, SUSHI, 2013, Guy and Kibert, 1998).

B7. *Level of infrastructural equipment* – The attained level of infrastructural equipment and the capacity of public services relates to level of public services' costs compared to standard housing construction (UNEP, SUSHI, 2013).

B8. *Economic activity* – There are a number of indicators related to economic activities: employment rate, the diversity of available jobs (at a distance of 2-3 km from the place of residence) and dynamism in community development activities, such as participation in improving the socio-economic well-being of the neighbourhood (UN-Habitat, 2012; Priemus, 2005).

Environmental sustainability criteria – Social housing projects could be evaluated, ranked and even planned by using the following general criteria and the related specific indicators of environmental sustainability:

C1. *Mechanisms for site selection* – Site selection should be compliant with the elements of environmental sustainability and environmental standards, such as natural conditions, the quality of water, air, soil, vegetation, environmental comfort, etc. (UNEP, SUSHI, 2013; Priemus, 2005).

C2. *Environmental site improvement* – Ecological rehabilitation, erosion control and sedimentation, management of surface water, flood control, etc. (UNECE, 2006).

C3. *Land use diversity* – Mixed-used development, multiple and compatible uses (UNEP, SUSHI, 2013; Priemus, 2005).

C4. *Integrated design* – Achieving synergy of disciplines and technologies (UN-Habitat, 2012).

C5. *Environmental design quality* – Addresses the issue of ecological optimization in positioning and orientation of the settlement/building, in line with the insolation parameters (additional indicators: good thermal insulation of external walls and roofs, energy-efficient windows, in order to minimize heat gains and losses; principles of low-energy or passive objects as a way to reduce energy poverty, etc.) (UNECE, 2006).

C6. *Eco-construction* – Using advanced and high-quality eco-friendly construction measures, such as reduced energy consumption, use of natural materials, use of renewable energy for heating, management and reuse of rain waters, sustainable drainage systems, etc. (UN-Habitat, 2012; National Strategy for Social Housing, 2012).

C7. *Sustainable management of construction and demolition waste* – Corresponding indicators include practices that facilitate sustainability in waste management, such as renewal, recycling, reuse of resources, waste minimization, etc. (UNEP, SUSHI, 2013).

C8. Monitoring of energy consumption for heating – The average annual consumption of energy for heating (in kWh/m^2) (Regulations on energy efficiency of buildings, 2011).

C9. *Experimental elements in social housing programs* – Related indicators provide evidence of experimental, innovative environmental elements in social housing programs. After monitoring the effects, the same green features can be applied in other housing formats (UNECE, 2006).

C10. *Low-energy standards in social infrastructure facilities* – Indicators that also raise awareness of the general public, concern the attained amount of low-energy standards in social infrastructure facilities of the settlement, in schools, kindergartens, health and social care institutions, etc. (UN-Habitat, 2012).

C11. *Design of public open spaces and green areas* – Concern the treatment of urban open spaces and green spaces as vital environmental and community resources (e.g. park area/km^2) (UNEP, SUSHI, 2013).

C12. *Sustainability in transport* – Comprises the distance from the place of residence to the local bus stop, the frequency of bus stops, the distance to the network of cycle tracks, etc. (UN-Habitat, 2012).

C13. *Environmental safety* – The focal indicator of environmental safety specifies the level of protection of the social housing site from potential pollutants (UNEP, SUSHI, 2013).

Table 1. Sustainability Criteria of Social Housing: Three pillars

SOCIAL HOUSING: SUSTAINABILITY CRITERIA		
A SOCIAL	B ECONOMIC	C ENVIRONMENTAL
A1 *Site*	B1 *Value of the land / housing site*	C1 *Mechanisms for location selection*
A2 *Quality of architectural design*	B2 *Sustainability in project financing*	C2 *Environmental site improvement*
A3 *Diversity in typology*	B3 *Life cycle costs of building/settlement*	C3 *Diversity of land use*
A4 *Social mix*	B4 *Competitiveness*	C4 *Integrated design*
A5 *Access to services*	B5 *Affordability*	C5 *Environmental design quality*
A6 *Safety*	B6 *Collection rate of the rent*	C6 *Eco-construction*
A7 *Public participation*	B7 *Level of infrastructural equipment*	C7 *Sustainable management of construction and demolition waste*
	B8 *Economic activity*	C8 *Monitoring of energy consumption for heating*
		C9 *Experimental elements in social housing programs*
		C10 *Low-energy standards in social infrastructure facilities*
		C11 *Design of public open spaces and green areas*
		C12 *Sustainability in transport*
		C13 *Environmental safety*

THE SOCIAL HOUSING IN SERBIA: CASE STUDY OF BELGRADE

Overview of the Social Housing Programs

Recently built social housing in Belgrade has been developed within different incoherent programs since 1990, and in diverse legal environments, belonging to social rental housing projects for public sector employees and socially vulnerable groups, or to social owner-occupied housing. Some of the most recognisable programs are: A) *Program for solidarity housing construction;* B) *Program for the construction of 1.100 housing units in Belgrade;* C) *The construction project of 2.000 non-profit housing units;* D) *Program for the construction of apartments for young scientists and artists;* E) *Public rental housing built through international humanitarian programs and projects;* E-1) *Project of social housing for disabled war veterans; and* E-2) *The Program Social Housing in Supportive Environment.*

Typology by location, capacity and structure

In order to objectivise the analyses of social housing in Belgrade built through previously listed programs and in different city locations, we have classified all recently built social housing developments by typology, based on their location, capacity, structure and other planning features (Fig 1, Tab. 2). For each group, one typical example was chosen for evaluation according to selected sustainability criteria with the aim to determine its level of sustainability.

For the purpose of this research, two main groups of social housing developments were further expended, as shown in Tab. 2, Fig 1.

The first group, type (I) relates to singular housing locations, and can be further divided into: I-A) *small-scale projects (15-100 units)*, e.g. Olge Alkalaj Street, Španskih boraca Street, Veliki Mokri Lug; I-B) *one or several buildings forming a group (90-500 units)*, like Jurija Gagarina Street, Vojvođanska Street, and Radnička Street.

The second group, type (II) relates to larger housing zones with public services, divided into: II-A) *settlements continuing or part of the existing urban matrix (300- units)*, e.g. Retenzija in Zemun, Dušana Vukasovića Street, Dr Ivan Ribar settlement; II-B) *satellite-type settlements, autonomous social housing development, in sharp contrast with local urban matrix (300- units)*, e.g. Kamendin and Ovča settlements.

Table 2. Classification of rental and owner-occupied social housing in Belgrade

Size		Program	Type of social housing	Location	Number of units	No. on Map
Location Type	**Building Type**					
I) Singular Location	***I-A)*** Small Scale/ Single Building (15-100 units)	E	Social rental	Jabučki Rit **, Palilula	15**	**1**
		C	Social rental	Between Belo vrelo Street, Palisadska Str., Komovska Str. and Bele Vode Str., Žarkovo**	24**	**2**
		E	Social rental	Mislođin**, Obrenovac	32**	**3**
		A	Owner-occupied	Olge Alkalaj Street, Zvezdara	34	**4**
		A	Owner-occupied	Ivana Ribara Street,New Belgrade	51	**5**
		B	Owner-occupied	Španskih boraca Street, Block 29, New Belgrade	60	**6**
		E		Veliki Mokri Lug, Zvezdara	60	**7**
	I-B) Larger Building/ Group of Buildings (90-500 units)	B	Owner-occupied	Juri Gagarin Street, PFC 10, Block 61, New Belgrade	98	**8**
		C	Owner-occupied	Vojvođanska Street, PFC 5 and 29, Block 63, New Belgrade	173	**9**
		A	Owner-occupied	Klare Cetkin K1 and K2, Retenzija, Zemun	187	**10**
		B	Owner-occupied	Radnička Street, Čukarica	216	**11**
		C	Social rental	PKB, Padinska Skela, Kovilovo	260	**12**
		B	Owner-occupied	Dušana Vukasovića Street, PFC 14.1, 14.2, 4.1, 4.2, Block 61 and 62, New Belgrade	470	**13**
		D	Owner-occupied	Block 32, New Belgrade*	250 (out of 517) *	**14**
II) Settlement	***II-A)*** Settlement continuing urban matrix (300 units and more)	B	Owner-occupied	Dr Ivan Ribar settlement*, Mileva Marić Ajnštajn Street, New Belgrade	731	**15**
		B	Social rental	Dr Ivan Ribar settlement*, settlement, Mileva Marić Ajnštajn Street, New Belgrade	133 (out of 399) *	**16**
	II-B) Satellite Type Settlement (300 units and more)	C	Social rental	Kamendin settlement*	181 (out of 744) *	**17**
		C	Social rental/ Owner-occupied	Ovča settlement*	965*	**18**

*Under Construction; ** In planning phase.

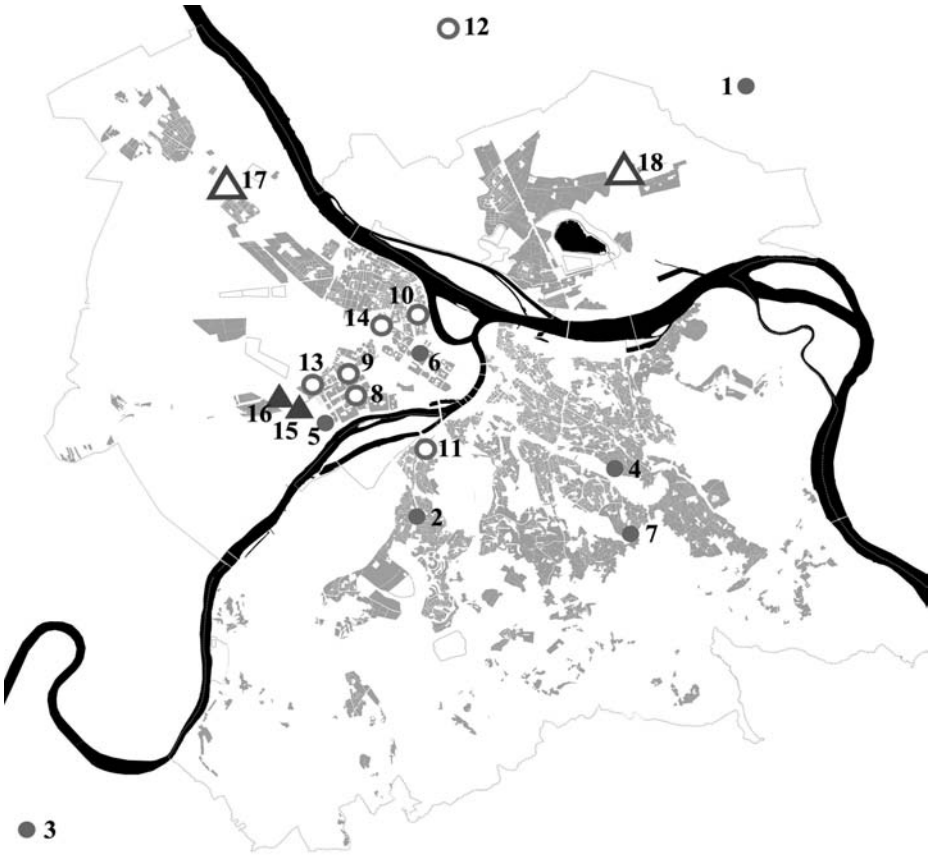

Figure 1. Map of singular locations and settlements of recently built rental and owner-occupied social housing

Figure 2. Group I-A, Social rental housing in Veliki Mokri Lug, Zvezdara

Figure 3. Group I-B, Social non-profit housing in PFC 10, Jurija Gagarina Street, Block 61, New Belgrade

Figure 4. Group II-A, Social non profit and social rentalhousing in Mileve Marić Ajnštajn Street, Dr Ivan Ribar settlement, New Belgrade

Figure 5. Group II-B, Social rental housing in Akrobate Aleksića Street, Kamendin 1.6 settlement, Zemun Polje

PILOT EVALUATION OF CHOSEN SOCIAL HOUSING DEVELOPMENTS IN BELGRADE

The result of the evaluation is shown in number of points (e.g. "•", "••" and "•••") where social housing development with the highest score performs significant overall sustainability, and can be considered as a model for the future developments of the same type. Being aware that the proposed criteria are of different importance for the quality of social housing units or neighbourhoods, the evaluation could be further upgraded through pondering of each criterion.

The results presented in Table 3 show that the scores of sustainability for the Group (I) are predominantly better compared to the Group (II), with scores: (I-A=39, and I-B=37, while II-A=34, and II-B=23 only).

These results show that Group (I) is more sustainable, particularly from the perspective of social cohesion and social inclusion compared to Group (II). This can be explained by the fact that most of the buildings belonging to Group (I) are small-scale projects, located within neighbourhoods of similar typology, connected to public transportation, with schools, health centres and other public facilities nearby (Fig 2, 3), while Group (II) shows more contradictions (Fig 4, 5). For example, in the Dr Ivan Ribar settlement (II-A) coexist both types of social housing, rental and owner-occupied, within much higher densities. Although these two types of social housing are apparently distinct, this settlement creates a neighbourhood of similar typology, well connected to public transport infrastructure and adjacent key public facilities. On the other side, concentration of social rental housing in Kamendin (II-B) is relatively remote as regards to municipal services and infrastructure, which raises significant social inclusion concerns. For this reason, this rigid spatial distribution has created social and ethnic conflicts, a "ghetto" atmosphere and problems of social segregation (Politika, 8th November 2013). Besides a certain social stigma attached to the perception of "social housing" in general, Kamendin also raises the question of negative financial repercussions, as real estate prices in the whole neighbourhood have been severely and directly affected. Thus negative features prevail, such as social and physical segregation, high concentration of poverty and unemployment, lack of social facilities, inefficient management and maintenance, etc.

When comparing the best results (I-A) and the worst (II-B), we can indicate the fact that (I-A) belongs to low density social housing within well-connected neighbourhoods of similar typology and as such creates low concentration of vulnerable households, while (II-B) has extremely high concentration of vulnerable households remote from major services and infrastructure and in sharp contrast to the inserted neighbourhoods.

Table 3. Pilot evaluation of four types of social housing developments in Belgrade through general criteria and specific indicators of sustainability

General Criteria / Specific Indicators			GROUP I		GROUP II	
			I-A	I-B	II-A	II-B
Social Sustainability	Location	*Distance of social housing site relative to the city center*	••	•••	••	•
		Distance of social housing site relative toother settlements	•••	•••	•••	•
		Distance to public transport and service, and major traffic infrastructure	•••	•••	••	•
		Distance of jobs and employment opportunities	••	••	••	•
		Distance to education facilities and health institutions	•••	••	••	•
	Social mix	*Diversity of users by education and economic characteristics (including household income diversity)*	•••	•••	•••	•
		Diversity of household types (singles, young couples, families with many children, etc.)	•••	•••	••	•
		Diversity of housing allocation types	•	•	•	•
Economical Sustainability	Site value	*Land value (return on investment)*	•••	••	••	••
		Sustainability of land tenure relations (ownership, lease)	•••	•••	•••	•••
		Administrative and local market conditions (land policy)	••	••	••	••
	Rent collection rate	*Sustainability of general conditions of lease*	••	••	•	•
		Rent collection rates and maintenance costs	•••	••	••	•
Environmental Sustainability	Site selection by environmental parametars	*Site selection according to the elements of environmental sustainability and standard (natural conditions, quality of water/air/ soil, environmental comfort, etc.)*	•	••	••	•
		Activation of brownfield sites	-	-	-	-
	Enviromental design	*Ecological optimization in positioning and orientation of the settlement /buildings according toinsolation parameters*	••	••	••	••
		Good thermal insulation of external walls and roofs and energy-efficient windows in order to minimize heat gains and losses	••	••	••	••
		Llow energy/ passive housing principles as a practice for energy poverty alleviation	•	•	•	•

These issues need to be intensely considered in future social housing developments, like those planned in Ovča or Padinska Skela, Kovilovo. The capacity of the future settlement in Ovča, located on the outskirts of the Belgrade Metropolitan Area, was optimistically planned for 1.400 housing units, representing almost three quarters of all imminent social housing development in Belgrade (Agency for Investment and Housing, 2011), but was then reduced to 965 units to be built successively, according to the architectural, technical and social infrastructure analyses provided by Urban Planning Institute of Belgrade and CIP Company during 2013. The project asserts its dedication to the economy and rationality of the design, energy efficiency principles and low operational costs. However, creating high concentration of social housing in already impoverished semi-rural areas on the Belgrade outskirts, lacking basic infrastructure, services and jobs, should be reconsidered in terms of all aspects of sustainability. Equivalent concerns can be asserted for the future social housing development in Padinska Skela, Kovilovo.

In that sense, the Belgrade planning experience has raised essential location questions since social housing sites have been traditionally determined in the City general/master plans (1972, 1985, 2003, 2009) according to only few criteria: the vacancy of the land and, recently, the ownership status (state/city owned). Unfortunately, most of the locations for social housing were planned on the city outskirts creating sharp contrast to the existing urban matrix, and thus being potentially unsustainable in terms of land use and social welfare. For the reason of complex planning procedures and land ownership relations, the modifications of urban parameters for social housing, such as land use or density, showed to be remarkably challenging, even when proposed by public institutions implementing particular social housing project. Timely planning procedures for important public amenities have become substantial for successful public housing projects (Damjanović and Gligorijević, 2010).

The evident sustainability deficit in some of the analysed social housing projects calls for judicious methodological improvements, beginning with introducing general criteria and specific indicators, in order to help public providers, as sole providers of social housing services, in successful decision-making process at local level.

CONCLUSION

It is evident from all pertinent references on this topic that the existing social housing sector in Belgrade lacks clear criteria in strategy, planning, designing, implementing, monitoring and evaluating. In this paper, we have proposed a non-exhaustive yet consistent list of criteria of all three pillars of sustainability (social, economic and environmental), selected for their circumstantiality, effects and benefits for users, neighbourhood and even for broader community.

By further thorough methodological elaboration of criteria presented in this paper, and indicators for monitoring and measuring performance of the built structures, the shown principle can be used as part of a more judicious decision-making mechanism in the process of planning and designing of the new, or evaluating of the existing social housing projects in Belgrade. In subsequent research, all the proposed criteria could be evaluated and pondered according to their importance for particular location and the quality of social housing units or neighbourhoods.

Development of the proposed sustainability criteria, as auxiliary mechanism for assessing the capacity and the quality, can contribute to creating successful new social housing programs and projects in Belgrade and to defining guidelines for the improvement of the social housing system in Serbia towards overall sustainability in all phases, from strategy to implementation.

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Received July 2015; accepted in revised form December 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 27-34

UDC 725.6(4)"20"
Review paper
DOI: 10.2298/SPAT1534027F

THE CONTEMPORARY MODEL OF PRISON ARCHITECTURE: SPATIAL RESPONSE TO THE RE-SOCIALIZATION PROGRAMME

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The history of prison architecture concerns the development of various design formats. In contemporary terms, punishment and re-socialization are the two equally important purposes of a prison institution. Rightfully, the contemporary model of prison architecture may be viewed, inter alia, as a spatial response to the re-socialization programme. Based on a comprehensive literature review, critical discussion, and scientific description, this paper defines the main qualitative elements of prison architecture, which responds to the requirements for re-socialization of inmates, and further explains the way in which each response is provided. From these architectural and design attributes, a list of 30 indicators of the spatial response to re-socialization was established. Furthermore, by using the derived indicators, a comparative analysis of four contemporary European prisons was conducted. The results showed both similarities and differences in the spatial response to the re-socialization programme, indicating that the spatial potential for re-socialization of inmates may be developed by using various approaches to prison design.

Key words: **contemporary prison architecture and design, contemporary European case examples, punishment, re-socialization, spatial indicators.**

INTRODUCTION

Prison is the most complex form of punishment (Pollock, 2005), a social institution designed to meet a multiplicity of functions (Galtung, 1958), a mixture of personalities, background stories, ways of thinking, and living habits motivated by the common desire to be free. Prison is also a physical environment with controlled closed and open areas in which individuals are forcibly confined. Through spatial elements and characteristics, prison architecture reflects the bonds between typology, function, and content (Crnič, 2012), while its evolution reflects the changing societal attitude towards crime and punishment (Johnson, 2013). Good prison architecture allows for the development of good relationship between staff and prisoners, provides space and opportunity for a full range of activities, and offers decent working and living conditions (Lord Hurd of Westwell, 2000).

Further, Pevsner (1986) argued that prison and hospital programmes have a lot in common. Developing from the 18th century analogy studies (Dixon, 1850), the meaning of the two types started to significantly overlap during the post-war Treatment Era in the United States, when the "medical model" of prison was born, based on the belief that convicts are merely sick individuals, while their cure is a matter of finding a suitable treatment. The parallels between innovative health centres and progressive prisons are as obvious as are the similarities between traditional hospitals and penal institutions. Both are inscribed with narratives about the individuals confined within them, their supposed characteristics and how they are expected to behave (Jewkes, in: Simon *et al*., 2013).

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Unfavourable social circumstances and an individual's psychological state define the risk of individuals acting beyond legal boundaries as well as their behaviour in prison. On the other hand, the imprisonment itself may in different ways lead to the social exclusion of ex-prisoners. In fact, prisoners and their families appear to be some of the most disadvantaged people in the modern society, even before imprisonment takes place (Murray, 2007). An important role of the contemporary prison is to apply the concept of re-socialization by which an existing identity or social role is adjusted, altered or replaced, by retraining a person psychologically to fit the expectations and behaviour of the common society (Hohnen *et al*., 2012). This inclusion, however, will be successful only when the society accepts the prison and the prisoners.

PUNISHMENT AND RE-SOCIALIZATION

The general association with the meaning of a prison institution developed until the mid-18th century is punishment, often corporal. Prison reform and the work of several reformers, such as that of John Howard and Jeremy Bentham (Dixon, 1850; Johnston, 2009), provided more humane treatment of prisoners, improved hygienic conditions, introduced single-celling established to reduce chaos, and raised hope for individual reform, accentuating positive aspects of work and changes in the administration system and criminal law. The turn of the 18th to 19th century was marked by the transition to statutory prison sentencing and by the introduction of the principle of not publicizing the penalty. On 22 January 1840, according to Foucault (2004), the body was "freed" from torture; this was the day when the reformatory at Mettray was opened. The philosophy of imprisonment significantly changed in the 19th century; prison was seen as redemptive and capable of changing the individuals within to become better people (Conley, in: Pollock, 2005). The separation and silence of the cell, in which the convict was confronted with himself, gradually became the main corrective measures. The additions to secure the "deserved suffering" (e.g. darkness, lack of space, humidity, or cold) started to decrease until the prison punishment finally obtained its present form: deprivation of liberty for a certain period of time (Kanduč, 2003).

While explaining the approaches to interpret punishment, Pollock (2005) emphasised other important characteristics of incarceration unrelated to punishment: incapacitation, which prevents an individual from inflicting further harm for at least as long as the individual is under control, and rehabilitation. Rehabilitation is defined as the internal change that results in a cessation of the targeted negative behaviour. It may include the punishment as a tool of reform (behavioural modification) and other interventions which are not painful, such as self-esteem groups, education, or religion, for example (Pollock, 2005).

The accomplishment of the difficult goal of changing strong habitual behaviour and attitudes (Johnston, 2009) certainly contributes to the (re)integration of ex-prisoners, but there is another significant factor – the outside society that influences the overall success of the process. Foucault (2004) argued that the conditions to which free inmates are faced (such as forbidden others, or the inability to find work) necessarily condemn them to recidivism. In this sense, the prison produces delinquents and encourages their organisation. Garland (1990) addressed the wider scope of events in prisons, such as psychological and physical violence and fatal injuries, and noticed that the exclusion from the society is, in some cases, immoral and inadmissible. The same author concludes that many prisoners are not a danger to the society and could be reintegrated into the society under certain conditions, and proposes that the prison sentence could be, in some cases, replaced by other penalties. Baratta (1991) suggested that, in terms of social reintegration of a prisoner, the best prison is no prison: a prison that is nonexistent. Stating that the "shorter is better", the author proposed fewer custodial sentences, shorter sentences, and fewer "confinements" or closed prisons.

On the basis of these considerations, it may be concluded that re-socialization encompasses rehabilitation as well as the activities involving the society outside the prison. The two aspects of the re-socialization programme meet and mix in the prison environment.

CONTEMPORARY PRISON ARCHITECTURE AND RE-SOCIALIZATION

Contemporary prison architecture, set in a civilized and humane socio-political milieu, can be viewed as a connection between two equally significant, yet contradictive (Hohnen *et al*., 2012), purposes of incarceration. The prison provides the spatial and social context within which the punishment and the deprivation of freedom occur. At the same time, it is the environment in which the re-socialisation programme is conducted. Observed from the perspective of designers (who generally view prisons merely in terms of a building type), the value of contemporary prison architecture depends not only on the typical design principles, but also on sociological, psychological, and ecological aspects.

The contribution of contemporary prison architecture and design to the rehabilitation of prisoners and their integration with the outside world may be explained by several attributes. These are: Location; Spatial concept and design; Appearance of the prison as a whole; Accommodation cells and blocks; and Content and functionality.

The Location shapes the social impact of a prison on the external environment and, vice versa, and hence affects re-socialisation.

Isolated locations, presumably situated in the natural environment, provide the inmates with the therapeutic effects of the landscape. Nevertheless, accessibility, transport communications, visit rate, and links with external institutions (e.g. court or hospital) and the public require special attention when a prison is located far from the built environment. The integration, on the other hand, allows for better links, shorter distances and potentially firmer relationship with the public, but at the same time brings to the fore the deliberation on community's thoughts and feelings (Jewkes and Moran, 2014b). The spatial concept and design, and the appearance of the prison as a whole may, to a certain extent, alleviate the negative attitude towards prisons and prisoners; nevertheless, external factors, such

as local stakeholders and decision makers, have a more important role in achieving this goal. The prisoners' opinion on the obvious dilemma whether it is better to isolate or integrate the facility with the existing built environment still needs to be researched.

The characteristics, especially natural, social, and cultural values of the immediate surroundings, are also the factors that impact the prisoners and the re-socialisation programme.

The spatial concept and design of the contemporary prison should give a message to those arriving to it, i.e. that they are worth something and entitled to treatment that is respectful and humane, as they should give a message to those working there that the people they are guarding are fellow human-beings (Baroness Stern, in: Simon *et al.*, 2013).

The prison format with its main characteristics: size, layout, and volume, has an important role in the creation of a socially functional environment.

Referring to the research results, Jewkes and Moran (2014b) suggest that prisons are healthier, more humane, and more effective when kept to a modest size.

The layout is in direct function of achieving a functional spatial and social context; at the same time, it also provides an efficient application of safety, security, and surveillance measures, while the goal to "punish" through form loses its significance in the contemporary design.

Distribution of volumes, their form, and materialisation shape inmates' impression, create analogy with external built entities, and enable better interaction among various prison contents. Daylight, colours, flexibility, and the level of openness impact prisoners' well-being and perception, as one of the two basic psychological stages (Vasilski, 2013).

Equipment, size, and materialisation of outdoor prison spaces form the image which inmates tend to compare with the motifs existing in the external environment. Landscape design should be based on the measures to draw the surroundings into prison space and to draw the vegetation into the prison interior, with the common goal to raise the awareness and enhance the sense of belonging to the outside world (Kosorić, 2011).

The bars and the wall are both security and design elements. While the bars are reminiscent of a cage, both from the inside and the outside, the wall is reminiscent of a clear separation and a firm border (observed from the outside), i.e. a forbidden free territory (understood from the inside). Contemporary prison architecture should find the way to alter the rooted interpretations by applying interventions in the physical characteristics of these two typical prison elements.

The effects of design elements are joined in the **appearance of the prison as a whole.** From the outside, the prison appearance should give two equally important messages: first, that those who reside inside are there for their punishment and correction; second, that they are human beings who deserve "one more chance". In practice, when contemporary prisons are given a pleasant aesthetic appearance, this chance will, more probably, be their second chance. In Norway, the leading country in developing new, humane prison architecture, the recidivism rate is 20%, while, for comparison, in US and Great Britain it amounts to 50–60% (Adams, 2010).

Indeed, architectural and aesthetic features matter to most people in prison's wider community (Jewkes and Moran, 2014a); design which enhances dignity and promotes rehabilitation through a normalized aesthetic may not appear sufficiently punitive to the public with an appetite for punishment (Jewkes, in: Simon *et al.*, 2013). A compromise can be achieved by involving the external community in the design concept formulation. Apart from the obviously needed unobtrusive expression, prison architecture should establish a proper relationship with the immediate built environment, where visual and aesthetic integration would have an advantage over intrusive accentuation.

Accommodation cells and blocks are the key elements in the prison social and spatial organisation. The cell is the "first place" of prison facility, "the home within a home", the basic personalized space. Cell features, such as size, capacity, daylight, organisation, materialisation, furniture and equipment, safety, security and surveillance, all impact the production of the psychological response. The accommodation block in social terms represents the "first neighbourhood" in the prison living environment, which means that the characteristics such as the number of inmates, the existence of common spaces, or adjustment to various groups of users, all have an impact on the re-socialization process.

Re-socialization-oriented prison **content and functionality** reflect the dynamics of the life outside the walls. Prisoners are compulsorily or voluntarily grouped according to their age, gender, common profile, and interests. A progressive prison environment is enriched by the introduction of "second" and "third" places, typical for healthy communities (Kosanović *et al.*, 2015), and by their diversification, especially of "third" places.

There is a whole range of outdoor or indoor, single or group activities that help an individual in the prison to rehabilitate, (re)socialize and prepare for the (re)integration into external conditions. These include: therapies, work, education, vocational trainings, sports and leisure, religious practice, hobbies and arts, even shopping. Zoning of these activities should include their physical determination to the point of separation, just as this is the case in the outside world.

Various indoor and outdoor common spaces enable prisoners to satisfy their "normal life" requirements and to (re)develop social skills at the same time. The existence of in-prison indoor or outdoor public activities and related spaces, such as that of a training centre or a cultural point, helps prisoners to establish tangible links with the external community and institutions. Extending the programme beyond the physical boundary of a prison facility, such as the purpose of going to work, is even more beneficial. Well-developed spatial communications and mobility assist in connecting the aforementioned activities physically.

INDICATORS OF THE SPATIAL RESPONSE TO RE-SOCIALIZATION

The aforementioned characteristics of prison architecture and design allow for the establishment of indicators based on which the type and scope of the spatial response to the re-socialization programme may be analysed. Below, 30 indicators are grouped into five categories corresponding to the main attributes of prison architecture and design (Table 1).

Table 1. List of indicators of the spatial response to re-socialization

Category	*Indicator*
LOCATION	1. Prison isolation/integration with the existing built environment 2. Characteristics of the immediate surroundings
SPATIAL CONCEPT AND DESIGN	3. Prison size/capacity 4. Layout characteristics 5. Form characteristics 6. Daylight quality 7. Characteristics of building materials 8. Application of colour and artwork 9. Correlation between surrounding and prison space 10. Correlation between outdoor vegetation and prison interior 11. Available size of outdoor areas 12. Materialisation of outdoor areas 13. Characteristics of urban furniture 14. Analogy to motifs typical of the outside world 15. Existence of bars 16. Existence, appearance and visibility of the wall
APPEARANCE OF THE PRISON AS A WHOLE	17. Design aesthetics 18. Relationship with the immediate built environment 19. Impression about the prison from the inside
ACCOMODATION CELLS AND BLOCKS	20. Number of persons per cell 21. Standard cell size 22. Cell design, materialization, equipment, and daylight 23. Number of cells/inmates per block
CONTENT AND FUNCTIONALITY	24. Adjustment to age, gender, and security level 25. Analogy with day-to-day life outside the walls 26. Programme diversity 27. Characteristics of spaces for common activities 28. Establishment of links with external institutions 29. Inclusion of the public 30. Development of spatial communications and mobility

COMPARATIVE ANALYSIS OF CONTEMPORARY PRISONS

Four contemporary examples of European prisons were selected to demonstrate the application of the established indicators in determining the spatial response to re-socialization; the comparison enables the study of similarities and differences in the response characteristics (Table 2). The selection is based on the availability of information, geographical settings (all examples are from the countries with low recidivism rates), and positive professional opinions and reviews. These examples are the following:

- Leoben Justice and Detention Centre in Austria by Josef Hohensinn of Hohensinn Architektur, completed in 2004 (Lewis, 2009),
- Halden Prison in Norway by Erik Møller Architects and HLM Architects, opened in 2010 (Adams, 2010; Fassino, 2012; Vinnitskaya, 2011),
- East Jutland State Prison in Denmark by Friis & Moltke A/S, completed in 2006 (Brun, 2013; Friis & Moltke), and
- New Lenzburg Central Prison in Switzerland by Bollhalder&Eberle Architektur, completed in 2011 (Serafin, 2011; Bollhalder & Eberle Architektur).

DISCUSSION

Four cases of contemporary prisons were analysed and compared to determine the similarities and differences in the spatial response to the re-socialization programme.

There is no universal recommendation for **location** selection; the comparative analysis of new examples of prison architecture confirms that both isolated and integrated locations have their advantages. Moreover, there is a conjunction between location and some other design issues, such as the overall concept, the transferred outside-world motif, or the tendency to draw near or dissociate the external and prison space.

The spatial concept and design of contemporary prison clearly differ from the past models which primarily reflected punishment, security and surveillance; modern technologies and new psychological and social views brought greater freedom in design. However, the prevailing rectangular, atrium, and branched layouts were noticed. The mainly compact form of separate structures and their envelopes reflects contemporary architectural trends in general, and, most likely, represents the response to the local natural settings. The structures built on orthogonal plan are often grouped in a way to form atria with courtyards. The applied method is very efficient to optimize daylight level increment, as well as for bringing the surrounding landscape inside the prison.

The dynamic form and diversification of volumes mimic the vivid built environment and create analogy with active lifestyle; on the contrary, compact forms and concentration of spaces in a single structure resemble rigidity and strictness.

Construction materials applied in the studied examples vary from traditional, local, and natural ones to more modern and universal ones. The glass is used variably, from a modest to a greater extent (Figure 1).

The colour in contemporary prison architecture is applied in a meaningful way and carefully. Artwork is applied to the point of becoming a basic requirement in the contemporary prison design.

The size of prison exterior is adjusted to the overall design concept, varying from the countryside settlement-like concept with abundant outdoor areas, to the imitation of an urban residential block with a compressed open

Table 2. Comparative analysis of the re-socialization potential of four European prisons

	LEOBEN	HALDEN	EAST JUTLAND	NEW LENZBURG
1	Location in the city suburbs	Isolated, remote location	Rather isolated, remote location outside the city	Location within the city boundaries
2	The prison is surrounded by urban tissue from three sides; the southern part is in proximity of motorway and woodland	The prison is surrounded by woodland	The prison is surrounded by agricultural land and farms	The prison is surrounded by agricultural land
3	205 inmates	252 inmates	228 inmates	107 inmates
4	Rectangular and atrium layout	Branched and atrium layout	Branched and atrium layout	Rectangular layout
5	Jagged composition of compact forms and open space partitions	Main longitudinal structure joined with four branches	Multiplied sections of jagged atrium-like structures	Compact, monolithic, longitudinal, all-in-one structure
6	Abundant daylight in the interior	Sufficient daylight in the interior	Sufficient daylight in the interior	Scarce daylight in the interior
7	Materials: concrete, wood and glass	Materials: wood and brick	Material: native brick	Materials: concrete and local slate
8	Colourful interior spaces, wall murals, woodwork, artistic objects	Coloured surfaces used to demarcate space purposes, large-scale photographs and graffiti	Neutral colour scheme, paintings and an artistic "hole in the wall" in the prison chapel	Modest use of colours and wall artwork
9	Drawing the surroundings near prison space achieved by its position on the hill	Exterior space partially represents an extension of the surrounding woodland	Exterior space designed as a continuation of the cultivated landscape	Prison space is cut from its surroundings
10	Integration of the vegetation with and the interior achieved partially, due to the lack of tall trees	Drawing the vegetation into the prison interior achieved by atrium layout and tall trees	Drawing the vegetation into the interior achieved partially, due to the lack of tall trees	Drawing the vegetation into the interior not achieved
11	Modest size of outdoor space	Abundant outdoor space	Abundant outdoor space	Scarce outdoor space
12	Outdoor materialisation: paved and green ground areas and vegetated roof	Outdoor materialisation: large grassland areas, gravel, middle and tall vegetation	Outdoor materialisation: mostly grassland, paving, water body	Outdoor materialization: space is "sealed" with concrete, vegetation is scarce
13	Urban furniture: cast concrete benches	Urban furniture: benches, overhangs, trash cans	Urban furniture: benches and tables	Urban furniture nonexistent
14	Resemblance to a dense urban residential area	Resemblance to motifs of a town, a natural forest and a cultivated garden	Resemblance to motifs of a settlement, a square, a garden lake	Resemblance to motifs typical of the outside world not achieved
15	Barred windows	Windows without bars	Windows without bars	Barred windows
16	Discreet concrete wall appearance from the outside; inner spaces seems "pressed" by the wall	Concrete wall appearance softened both from the inside and the outside with landscape features	Concrete wall appearance softened with its organic form, both from the outside and the inside	Concrete wall almost invisible from the outside; inner space seems "pressed" by the wall
17	Contemporary design, light and open	Simple and deliberated design	Simple and restrained design	Simple and unobtrusive design
18	Court building dominates in the surroundings, while the prison is hidden behind and partially set below grade	Design with non-obtrusive emphases, in compliance with Norwegian building tradition	Design in compliance with typical Danish architecture and settlement pattern	From the outside, modest visibility and unobtrusive appearance achieved with below-grade construction
19	Dynamic appearance from the inside	Synergy with the cultivated nature from the inside	Impression of monotony from the inside, due to equal spacing and uniform design	Rigidity and impression of entrapment from inside
20	Mostly single cells	Mostly single cells	Single cells	Mostly single cells
21	Standard cell size: N/A	Standard cell size: 10 m^2	Standard cell size: 12.6 m^2	Standard cell size: 12 m^2
22	Cells with a sanitary unit, white walls, contemporary simple wooden furniture, refrigerator, TV; sufficient to abundant daylight	Cells with a sanitary unit, white walls, contemporary simple wooden furniture; sufficient daylight	Cells with a sanitary unit, white walls, wooden furniture, refrigerator, TV; moderate daylight	Cells with a sink, toilet, bed, table, chair, cabinet; mostly white walls, few coloured surfaces; sparing daylight
23	10 inmates per block	Up to 12 inmates per block	Up to 6 inmates per block	3 or 10 inmates per block, depending on age/gender

24	Adjustment to age, gender and security level	Adjustment to security level	Adjustment to security level	Adjustment to age, gender and security level
25	Analogy with "urban living"	Analogy with "contemporary living in the village"	Analogy with "living in the countryside"	Analogy with "basic living", without spatial association
26	Programme includes: cooking and dining, washing-up, socializing, work, education, outdoor and indoor recreation, meditation, healthcare	Programme includes: cooking and dining, washing-up, cleaning, socialising, work, education, religious activities, shopping, leisure-time activities and hobbies, sports and recreation, nature walks, private visits, healthcare	Programme includes: cooking and dining, washing-up, cleaning, gardening, work, education, religious activities, sports and recreation, shopping, leisure-time activities, healthcare	Programme includes: cooking and dining, washing-up, work, education, sports, healthcare
27	Common spaces: kitchens, dining rooms, balconies, laundry rooms, areas for random meetings and socialising, sports hall, fitness facilities, outdoor sports fields, library, classroom, meditation space	Common spaces: kitchens, dining and living room areas, laundry rooms, multi-purpose gym, workshops, indoor area for religious purpose, cultural centre, guest house and visit rooms, classrooms, shop, library, designed walking paths, outdoor yards	Common spaces: kitchens, dining rooms, laundry rooms, table tennis and billiards rooms, various workshops, classrooms, computer rooms, small gyms and large central gym, church, prayer room, library, supermarket, music room, visiting area, outdoor yards	Common areas: kitchen, dining room, laundry room, games room, recreation room, classrooms, outdoor yard
28	Work provided outside the facility; various external institutions operate in prison	Links with external institutions: N/A	Links with external institutions: N/A	Links with external institutions: N/A
29	Public included in acceptance and work programmes	Inclusion of the public: N/A	Inclusion of the public: N/A	Inclusion of the public: N/A
30	Division of outdoor space into smaller segments limits communications/movement	The established main footpath connects buildings, inmates and landscape	Inmates move within one of the two large fenced areas demarcating the security level	Communications and movement only inside the building

Figure 1. The interior of the entrance building in Leoben prison (© paul ott photografiert)

Figure 2. Leoben prison façade and designed courtyard (© paul ott photografiert)

space (Figure 2). Larger exterior areas enhance spatial communications and mobility, and contribute to more successful mirroring of the outside life. Observed from the inside, the size of the available outdoor space directly impacts the perception of the whole complex. The ratio between green and paved areas varies; similarly to the overall size, it is compatible with the general concept. Simple and modern urban furniture most often includes benches made of wood or concrete.

The bars placed over glazed surfaces are the best indication of the contemporary prison architecture's tendency to steer away from the traditional meaning; out of four analysed cases, two were free of bars. On the other hand, the concrete wall is still present in all cases. Its appearance, however, is shaped with attention; by carefully levelling and softening the lines, it now seems less blatant. It is expected that the future improvement in the wall appearance will be achieved by its greening.

Appearance of the prison as a whole is treated as a sensitive issue. New architecture tends to be discreet, simple, less visible, unobtrusive, and aesthetically pleasing. Integration with the surroundings is achieved by application of local materials and patterns interpreted in a contemporary way.

Accommodation cells and blocks remain the basic part of the prison complex. The series of single-cell purpose transformations throughout history (from the application of corrective measures, improvement of hygienic conditions, isolation for punishment or achievement of better control over the prisoners, separation for prisoners' rehabilitation, etc.) finally resulted in its establishment as a contemporary response to the necessity for privacy while resting, sleeping, thinking, learning, or maintaining hygiene.

The average size of a cell in the studied examples is 12.6 m^2, meaning that the comfort level is often above the prescribed minimum. Cell design, materialization, and furniture are simple and minimalist. Daylight level and the corresponding window size vary from one case to another. The smaller number of cells (inmates) per block enables the formation of a neighbourhood-like atmosphere and stimulates the socialization within an optimally-sized group.

Content and functionality of contemporary prisons are, according to the analysed examples, adjusted to the age, gender, and/or security level. Analogies with day-to-day outside life in a specific spatial context are present in three of the reviewed examples. The spatial scheme follows the programme which ranges from a basic one to a socially opulent one. All the basic activities carried out under regular circumstances, such as cooking, work, education, or shopping, are translated to the prison environment. The tendency is to create as many common places as possible, in order to enhance the interaction and socialisation. In one of the four studied cases, work activities extend beyond the prison physical boundary; at the same time, certain public activities are carried out within the prison physical space (Figure 3).

Figure 3. The Court of the Leoben Justice and Detention Centre (© paul ott photografiert)

CONCLUSION

Contemporary prison architecture is a multi-layered and multi-scalar contributor to the prisoners' positive psychological and behavioural change and their acceptance by the common society. Based on the considerations as to the meaning and purpose of the contemporary prison, the key qualitative elements of architecture and design that impact the re-socialization of inmates are identified. These are: Location; Spatial concept and design; Appearance of the prison as a whole; Accommodation cells and blocks; and Content and functionality.

The study has shown that the socially functional environment of a prison may be achieved by applying various design approaches. In this regard, the establishment of a common format of new prison architecture seems unnecessary; instead, the model of contemporary prison architecture may actually be interpreted, inter alia, as the spatial response to the ultimate requirement for re-socialization. Architecture responds to the space-time context in which it is set, and prison architecture is no exception.

Prisons built in the 20th century, or earlier, open a new research topic on harmonization with present-day requirements. On this point, the set of indicators, established in order to analyse the response of contemporary cases, may be used to determine the potential for re-socialization of older existing facilities, with the aim of future improvement. Finally, these same indicators may also be used as guidelines in new prison planning and design.

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Received March 2015; accepted in revised form November 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 35-45

UDC 711.42
316.334.56:502.131.1
Review paper
DOI: 10.2298/SPAT1534035I

KNOWLEDGE-BASED INNOVATION AND THE CITY: THE CASE OF BELGRADE

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The critical role of research in overall progress generates a pressing need to study the relationship between a city and knowledge-based innovation. A number of socio-economic and political processes influence the development of contemporary cities by defining the beneficial balance between financial ambitions, environmental awareness and sustainability. Consequently, the role of innovation and knowledge has been emphasized as one of the crucial generators of urban success. The most recent initiatives originating from universities and research establishments stimulate the emergence of new spatial formations and digital upgrading, thus setting up a fertile environment for intellectual exchange and the production and diffusion of knowledge and innovations. This article questions the historical, social and technological implications of research on urban space. The focus is set on the case of Belgrade and the newly proposed project of a university campus with its evaluation based on the latest concepts related to the economy of knowledge. This new type of knowledge-based innovation node is intended to serve as a driver of Belgrade's inclusion into the global network of innovative cities. However, this initiative is still in the domain of paper-architecture due to financial limitations and a change in development priorities by the new government.

Key words: **city, knowledge, innovation, urban transformations, competitiveness.**

Ipsa scientia potestas est.
Francis Bacon

INTRODUCTION

Contemporary society has recognized the importance of a knowledge-based economy, innovation, research and the interdisciplinary approach that guides the current development of the cities (Scott, 1990; Porter, 1990; Hall, 1998; Simmie, 2001; Komninos 2002, 2008, 2014; Jucevičius and Liugailaitė-Radzvickienė 2014). Since the largest share of the overall higher value of communities comes from the improvement of productivity and innovation, it is not surprising that the global interconnectivity of universities, scientific hubs and global finance and production flows has been stimulated through numerous programs of exchange and cooperation, thus generating solutions for evolving urban problems (OECD, 1996; Sassen, 1991). The global rankings of cities usually focus on the presence of research and development (R&D) as the main competitive advantages - alongside the economy, cultural interaction, liveability, environment and accessibility (e.g. Global Power City Index 2014 - Mori Memorial Foundation, 2014). Consequently, urban nodes around the world tend to create a platform for sustainable development, which links science, art and cultural industries, resulting in the stimulation of innovation as a factor leading to urban enhancement.

In this regard, the present article focuses on urban spaces dedicated to research and university education (R&D areas) and discusses the latest trends observed on two levels– general and local. The former is based on contemporary multidisciplinary literature research and provides a review of current efforts in describing the relationship between cities and innovation, mainly through an emphasis of the role of universities and other knowledge-driven innovative nodes on general urban development and spatial transformations. The review of relevant theories and concepts of the cities, innovative processes and their inherited, modified and emerging spaces is presented through the retrospection of the spatial and socio-economic implications of this phenomenon. At the local level, the case of Belgrade and the related project for the Centre for Promotion of Science (designed by Wolfgang Tschapeller in 2010) is discussed for its particular historical, socio-economic and symbolic background, as well as the originality of the proposed

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solution, which suggested a completely new spatial concept and typology for the R&D node model. The related section of this contribution is structured around three main issues - the general context and motives of the initiative; the historical (dis)continuity of idea(s), and the innovativeness of the proposed solution with its anticipated effects.

CITIES OF/FOR KNOWLEDGE AND INNOVATION

Science, innovation and technology, due to their vital role in contemporary society have become the main ingredients of development strategies on the local and global levels (Komninos, 2002). Simultaneously, the rankings of innovative districts, cities and regions have become an effective tool to anticipate urban progress, while the relationship between cities and innovation has been elaborated and reinforced by numerous initiatives based on new environmental concepts with digital, intelligent and innovative premises (Komninos, 2014). They all influence general technological advancement, ecological quality, economy, competitiveness, functional and economic diversification, resulting in increased employment and decreased poverty (Stupar, 2012).

Schumpeter (1943) identified innovation as the critical dimension of economic change and growth. This relationship is further observed in contemporary cities as the development of innovation results in the creation of new products, services, processes and business models, contributing to urban development and improvement of its competitiveness. Therefore, the label of 'innovativeness' represents the preferred element of the urban image applicable to several spheres of urban existence - from social phenomena, spatial typologies, strategies, formal and informal processes, flows and activities, to the latest technologies and their integration into urban space and urban life. At the same time, the types of urban innovation are defined by different processes, which trigger a higher level of creativity within cities (Hall, 2004).

Urban space(s) may be observed as the unique mixture of human resources and technology, embedded in the centre(s) of knowledge and innovation, from localised systems of innovation (e.g. clusters, industrial districts, and innovative agglomerations), larger regional systems of innovation and learning regions, to intelligent districts, cities and regions (Komninos, 2002). For example, the concept of the intelligent/digital city underlines the importance of intelligence, creation of productive knowledge, intelligent decisions and supporting infrastructure (Jucevičius and Liugailaitė-Radzvickienė, 2014). The very concept of a smart city is based on the intensive application of Information and Communications Technology infrastructure (ICT), but additionally considers the significance of environmental issues, as well as the role of human, social and relational capital in urban growth (Lombardi *et al.*, 2009).

It can be concluded that the notion of innovation has acquired a new meaning, which comprises knowledge, management tools, telematics for learning and virtual spaces for interaction and experimentation (Komninos, 2002, 2008). Therefore, this trend has generated new three-layered intelligent environments for innovation: (1) physical space and human resources (observed on the level of agglomerations, or as clusters and companies); (2) institutional mechanisms and policy instruments related to the process of innovation; and (3) the layer of virtual spaces and tools supporting collaboration and user participation (Komninos, 2008). These changes, caused by the flows of the post-industrial era, are believed to influence shifts at many levels, including urban planning (Stupar, 2008). Consequently, the traditional theoretical framework, which usually focuses on the physical aspect of the cities, needs to be modified and redirected toward the social, economic and innovative aspects of urban life, in order to provide an adequate setting for emerging needs - in both the material and digital realms.

Creating the setting

The first nodes of innovation and knowledge exchange are easily observed in the public spaces of ancient cities (Figure 1). Agora (Ἀγορά - square, public place) represents both the main square and the religious centre of the ancient Greek city. It was an urban element that was guided in its form by the development of democracy, in addition to those numerous functions. Generally, it represents an important gathering place for discussion and exchange of ideas (Mamford, 2006; Gallion and Eisner, 1963). The same model and role are seen in the Roman forum, which merged secular and religious spheres of urban life. Ancient Greece was also the birthplace of Plato's academy, often considered the first university in Europe. It had its space for lectures and discussions, dormitories for students, a library and gymnasium, thus representing the forerunner of university campuses. Placed outside of the Athens city walls, it was connected with the city centre and agora by road.

During the period of Hellenism, the most important educational facilities were found in Alexandria - the Institution of the Muses and the Great Library, which were centres of knowledge exchange and research (Bowen, 1972). The educational complex in which they were located was placed within the city, in close proximity to the royal residence.

Higher education in Byzantium continued the ancient tradition, while the medieval period in other parts of Europe was marked by the role of monastery clusters, which supported the links between philosophy and theology. However, the cities in North Italy represented an exception to this practice. Bologna and other urban nodes followed the model of the University in Constantinople, emphasising the secular dimension of education (faculties of philosophy and law) and its importance for civic life. In the second half of the 13th century, the first colleges sponsored by patrons were founded. Representing a city within the city, they provided education and lodging for students (e.g. in Paris, by Robert de Sorbon in 1258). The first college outside the city was established at Oxford, influencing medieval planning and defining the image and identity of the urban setting (Mamford, 2006).

The Age of Enlightenment (1620 –1780) brought the establishment of first academies within the state hierarchy. The Anglo-Saxon model considered a concentration of knowledge in city centres, while university campuses

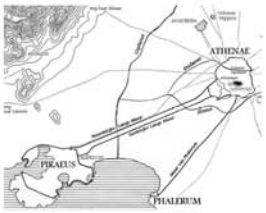
became autonomous urban entities. A good example of this practice is Boston, a city which 'houses' its numerous campuses in the city centre.

Contemporary cities as generators of major social, technological and economic changes (Sassen, 2012) have recognized the importance of knowledge in their development at all scales. The relationship between cities and universities has been analysed with respect to the context of urban competitiveness, the governance of economic development in the knowledge economy and regional innovation systems (Benneworth and Hospers, 2010; Moulaert, 2001; Uyarra, 2010). It has become obvious that spaces of innovation and education nowadays represent strategic places of both urban space and urban society (Figure 1 and 2).

Due to the multiplying roles of universities and research nodes, as well as their growing spatial independence based on the application of the latest ICT tools and networks, their relationship with cities has become challenging. Andersson (2012) defines several problems that are expected to influence the future positioning, (re)structuring and modelling of these areas in our cities:

- synchronisation and interlinking of R&D at the level of a city;
- defining of R&D areas and their potentials;
- evaluation and sustainability of R&D concepts;
- defining a spatial and planning framework for innovative cities.

Academy / Ancient Athens
Academy is outside the city walls. Agora is within the city walls in the center of town.



Forum / Ancient Rome

Forum is within the city walls in the center of town.

University / Middle Ages, Paris

University / one building, is within the city walls in the center of town.

The Humboldt University, Berlin / XIX c.

University / numerous buildings, is within the city walls in the center of town.

	Nature of innovation/knowledge sharing space						Position in the city		The presence of other services as functional support	Types of funding	The impact on the surrounding area	
	Open space	Closed space	Populist	Elitist	Spontaneously formed	Planned	Centrally located	Peripheral location			in terms of the development of spatial concepts	in terms of the development of functional concepts
Agora	X		X		X		X		X		X	X
Forum	X		X			X	X		X		X	X
Academy	X	X		X		X		X		private		
***Museion* and Great Library of Alexandria**	X	X		X		X	X		X	state	X	X
University of Bologna		X		X	X	X	X		X	students	X	X
University of Paris		X		X	X	X	X		X	state	X	X
University of Oxford		X		X	X	X		X		Crown and state	X	X

Figure 1. City vs. spaces of innovation and knowledge - a comparative analysis.
(Source: authors)

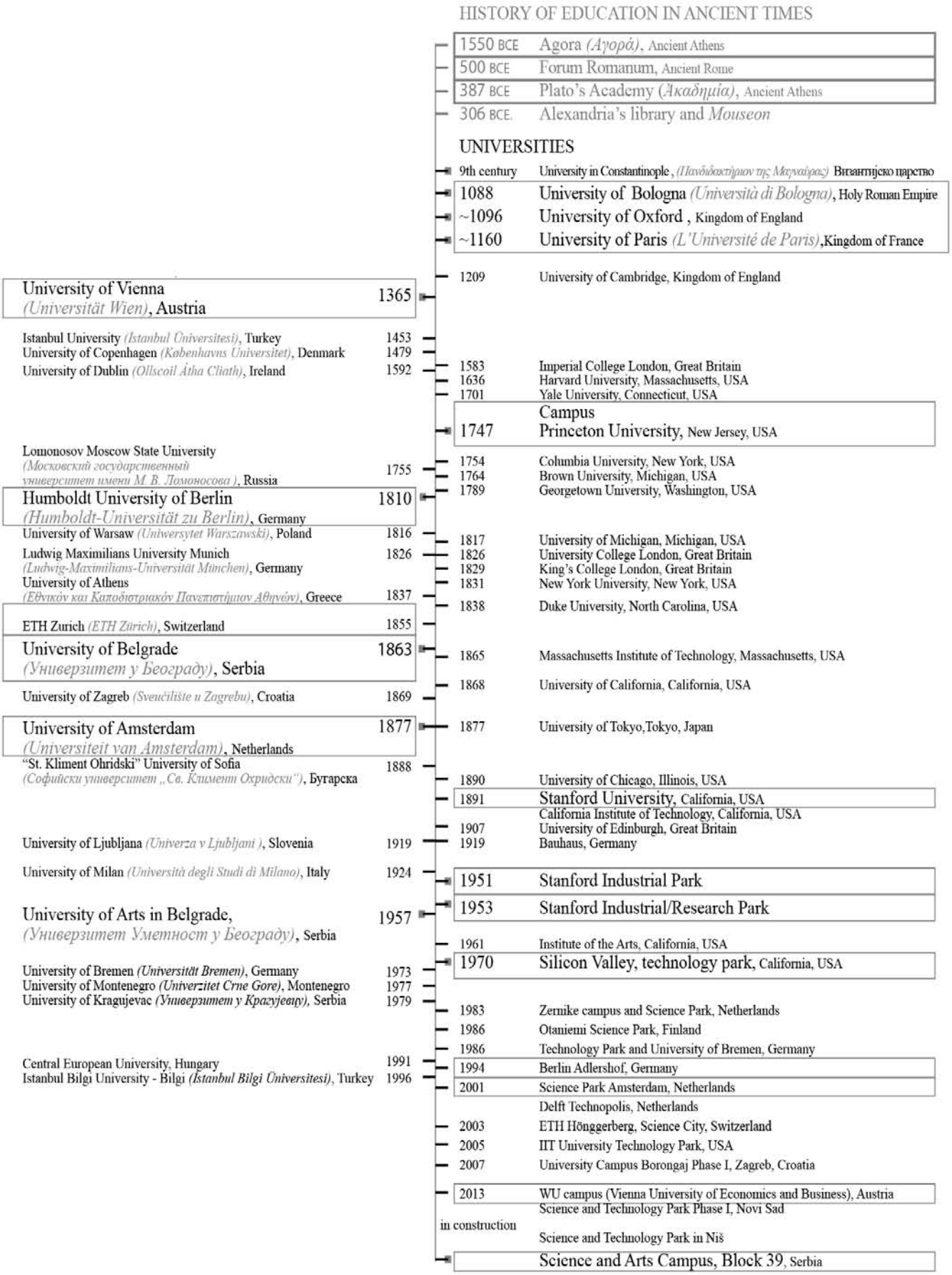


Figure 2. Timeline of the history of education– from the ancient agora to the modern science city.
(Source: authors)

Generating knowledge-based innovation and modification of urban space

Nowadays, the current role of cities as centres of innovation, economic growth and social transformations support a proactive approach to sustainability (Stupar and Đukić, 2007). This trend further demands an improvement of infrastructural systems, modification of previous spatial and functional structures, changes in planning procedures and enhancement of urban management in order to support further research activities (Höger and Christiaanse, 2007).

The innovative cities have become major nodes of economy, culture and science. The relationship between cities and innovation activities may be dependent on several factors:

- location (and its ability to attract people of various educational and interest profiles);
- accessibility and connectivity (to other urban nodes and within city);
- cultural, creative, artistic and scientific potentials;
- spatial possibilities for the development of clusters, centres of knowledge and science parks;
- highly qualified employees; and
- development of entrepreneurial activities and enterprises - from the level of conceptual models to multidisciplinary upgrading of urban economy, urban geography, urban management and urban promotion (Van Winden *et al.*, 2014).

Nowadays, innovation nodes function in different organisational and spatial formations - from productive clusters, technology districts, central-city area of services and technology parks, to university incubator campuses. The role of universities, as specific innovative nodes with a long tradition of knowledge dissemination, is especially important for both urban competitiveness and the general growth of society (Reichert, 2007). Etzkowitz (2003) underlines three basic missions of universities, which have gradually developed through history - the traditional mission of academic teaching, introduction of research (generated in the Humboltian model) and the latest mission - socio-economic development, best described by the model of 'triple helix interactions', dominant in the modern Knowledge society (Etzkowitz, 1993; Etzkowitz and Leydesdorff, 1995). This model explains the emerging triadic relationship between industry, government and universities, which enables the creation of new institutional and social forms of production, transfer and application of knowledge. The triple helix (TH) model, leads to the rise of the so-called 'entrepreneurial university' and also distinguishes four types of spaces (knowledge spaces, consensus space, innovation space and leadership space) which support an increasing proactive role for the three main factors (industry, government and universities) in regional innovation systems (Figure 3). Consequently, Lazzeroni and Piccaluga (2003) define the entrepreneurial university as 'knowledge factory, human capital factory, technology transfer factory and territorial development factory', referring to its multiple impacts on local development. The importance of the TH model was also analysed as an element of the smart-city concept (Lombardi *et al.*, 2012) and an important ingredient of intellectual capital (Etzkowitz, 2008; Caragliu *et al.*, 2011; Leydesdorff and Deakin, 2011 etc.).

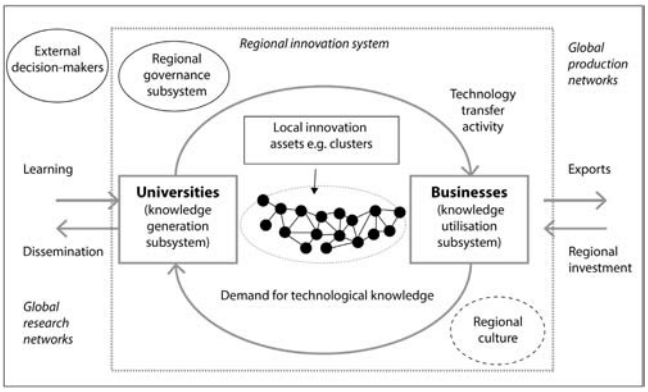


Figure 3. A regional innovation system as local network between global innovators. (Source: after Cooke & Piccaluga (2004) in Benneworth & Hospers (2007))

Obviously, universities could be defined as 'public spaces for interpretation' in the global knowledge-based economy (Lester and Piore, 2004), thus generating a strong integrative and innovative potential while connecting research and education with management, engineering and policy-making (Goddard *et al.*, 2007). Therefore, in spite of the different regulations and funding mechanisms applied by national governments, universities act as central organizations of any innovation system (Borras and Edquist, 2014).

The TH interactions also influence the redefinition of existing and the creation of new urban spaces and networks which stimulate the relationship between universities, cities and the economy. For example, some authors (e.g. Van Winden *et al.*, 2014) identify five key elements which should be considered in this process:

- universities represent nodes of knowledge which could attract important investors and further increase employment of graduates;
- cities provide various spaces which could be used for university activities and/or for mutual investments beneficial for both sides;
- the relationship between city and university could improve the city image, adding the elements of innovativeness and knowledge to urban identity and raising its attractiveness;
- cities represent a positive environment for the incubation and establishment of start-up firms;
- specialized places of knowledge could be an excellent setting for specific fields of university education or research units.

Based on the classification made by Den Heijer (2012), which emphasizes the functional aspect of university areas, it is possible to distinguish three types of complexes - university (as an academic community); campus - as an entity which includes a residential function (residential community); and corporate/scientific complex (the business and science community). The complementary activities within each type may vary (from socio-cultural to business facilities), as well

as be based on their spatial characteristics (i.e. the general position of the complex in the urban area, the morphology of spaces, capacity, etc.).

UPGRADING THE CITY: THE CASE OF BELGRADE

The data related to the share of GDP spent for innovation reveals significant variation between the EU (below 2%), the US (2.6%) and Japan (3.4 %). Therefore, one of the main aims of 'Europe 2020: A Strategy for smart, sustainable and inclusive growth' (European Commission, 2010) is to increase the investments in research and development. In general, Europe may be observed as less competitive in terms of the percentage of its population with a university degree, the ranking of its universities and the development of a digital society to support the innovation process and dissemination of knowledge. Serbia's extremely low share of GDP directed to research (0.3%) makes the country even less competitive than the rest of Europe. According to the Human Development Report (United Nations Development Programme, 2013) Serbia occupies the 64th place (medium human development). The list of global cities created by the Globalisation and World Cities Research Network - GaWC (2012) classifies Belgrade as a 'Beta-minus' city, while the '2thinknow Innovation Cities™ Index 2014' (2014) ranks Belgrade as the 104th on the list (category 2 HUB), which is well below other major Western European cities (for example, Vienna is ranked as 6th and Amsterdam as 8th). However, it is still ahead of some cities in the Balkans (for example, Ljubljana - 199th place and Zagreb on 233rd place). Cities with the highest rank are San Francisco-San Jose, New York and London.

Considering these figures, it becomes obvious that the Republic of Serbia needs an elaborated, well-organized and high-quality development of the education system as one of pre-conditions for the overall improvement of society, based on knowledge, its diffusion and application. The Strategy of Scientific and Technological Development of Serbia (Strategija naučnog i tehnološkog razvoja Republike Srbije za period od 2010. do 2015. godine, 2012) emphasizes the importance of higher education based on research, suggesting the concept of the 'entrepreneurial university' which enables the growth of a knowledge-based economy. The Strategy also supports the establishment of business incubators at universities in order to achieve commercialization of ideas and innovations. One of the aims is to set up networks between centres of excellence (research, education and economy) which would attract foreign partners.

Following these guidelines, the Republic of Serbia and the Ministry of Science and Education have been implementing several projects oriented toward the development of the scientific/research infrastructure. Supported by the European Investment Bank, the Council of Europe Development Bank (CEB) and the EU, these projects include two major investments in Belgrade - the Centre for the Promotion of Science at Block 39 and the Science and Technology Park Zvezdara. Additionally, a number of similar projects exist in Belgrade and Serbia that target different areas and issues related to scientific development. Those that have proved the most prosperous are: the adaptation of the UNESCO research centre IRTCUD, the housing projects for young scientists (Block 32 in New Belgrade, Niš, Kragujevac) and the establishment of the improvement of conditions in research and university facilities in Petnica, Niš, Novi Sad, Svilajnac and Kragujevac (JUP, 2011).

The origins and development

The development of university education in Serbia began in 1838, when the first school of higher education (*Лицеум Кнежества сербског*) was founded in Kragujevac and later moved to Belgrade in 1841 (Kingdom of Serbia). In 1863, the school was transformed into 'Velika škola', which represents the actual beginning of the University of Belgrade. Its three departments – the Faculty of Philosophy, the Faculty of Law and the Technical faculty were relocated to a new building (Kapetan Mišino zdanje). The building of the Technical faculty was completed in 1931 (architect Nikola Nestorović), following the style of academism. The Faculty of Law was designed in the modernist fashion and completed in 1940 (by architect Petar Bajalović). In close proximity to the University site lay a new student residence which was erected in the style of post-academism (architect Georgij Pavlovič Kovaljevski, 1926).

After the Second World War, the improvement of education became one of the most important aims endorsed by the new ideological framework of the Socialist Federal Republic of Yugoslavia. The main idea was to provide an easily accessible and free education system, which would reflect the proclaimed values of a new progressive society, based on general openness and equality. Consequently, a number of new university and research institutions were established, demanding additional space and new equipment that could accommodate new trends in science and education. The area of New Belgrade was frequently perceived as a perfect site for these interventions. For example, the Faculty of Electrical Engineering, founded in 1951, was situated in the historical part of Belgrade, in the existing building of the Technical faculty, but additional spatial needs were obvious from the very beginning. Competition for a new building was launched in 1961 and the winning proposals were presented to the public. However, this new project never came to life (Mecanov, 2009). The faculties of arts (represented by four academies) were facing the same problem. Therefore, another competition for the design of their campus was announced (1964) reflecting the trends of spatial organization of university areas in the US and Europe. The new site was selected in the area of New Belgrade (Block 39) and the winning entry was designed by architects Božidar Janković and Aleksandar Stjepanović. The completion of the construction process was anticipated for 1985, but the Academy for theatre, film, radio and television was the only completed building (Mecanov, 2009). Meanwhile, two important university complexes were constructed in the historical part of Belgrade. The first one in the vicinity of the Main University Building and University park (near Student Square) included the Faculty of Biology, Geography, Mathematics, Physical Chemistry, Physics, Chemistry and the two science institutes (architects: Aleksandar Sekulić and Đorđe Stefanović, 1954). The second one included the Faculties of Mechanical Engineering and Technology, inserted into the existing block of the Technical faculties

(Grigorij Samojlov, Mihajlo Radovanović, 1953-1962). Their architecture follows the modernist approach, dominant in that period. Interesting enough, during the 1960s an increased demand for educational facilities influenced the appearance of smaller architectural offices, specialized in various types of buildings (Milašinović Marić, 2011), while the main financial input came from the Republic of Serbia and economic organizations that also participated in the process of urban renewal.

Today, the areas dedicated to university education and research activities are scattered across the city - both in its historical part and New Belgrade (Figure 4). There are three main areas:

- around the Main Building of the University of Belgrade (includes the Faculties of Philosophy, Philology, Mathematics and Natural Sciences, as well as the Serbian Academy of Sciences and Arts);
- in the vicinity of the Residence of Duchess Ljubica as the original nucleus of university education, consisting of the buildings of the University of Arts, its Rectorate and the Faculties of Arts and Applied Arts;
- the complex of the Technical faculties (the main building incorporating the Faculties of Architecture, Civil and Electrical Engineering, the buildings of the Faculty of Law, Mechanical Engineering and Technology, the University Library and the Student residence).

Considering the classification of innovation districts defined by Katz and Wagner (2014), which distinguishes three main models of innovation districts ('anchor plus model', 're-imagined urban areas' and 'urbanized science park'), these areas contain the characteristics of the 'anchor plus model. They are positioned downtown, while the mixed-use development of the surrounding supports the commercialization of innovation.

Simultaneously, there are two areas that are under extension and construction:

- Block 39 - the site which already includes the existing building of the Faculty of Dramatic arts is planned for the implementation of the Centre for the Promotion of Science and Nano Centre projects (the extended deadline is September 2017) (Figure 5). This complex is anticipated as a variation of the 'anchor plus model', with some elements of the 'urbanized science park', also targeting better interconnectivity of the existing urban tissue and the introduction of new activities;
- 'Zvezdara Forest' - the location of the existing institute 'Mihajlo Pupin' (established in 1946), is recognized at the regional and global level as a node of research and development in the field of high technologies. The area of this innovation district, which could be described as an 'urbanized science park', also includes a new Science and Technology Park Zvezdara (completed in 2014), planned as a new innovative hub and support for small research and business incubators, focused on the development of new technologies and their implementation.

Although all these areas represent knowledge-based innovation nodes comprising economic, physical and networking assets, they have not yet achieved the full potential of an innovation ecosystem/district, with the functional synergy of these three elements (Katz and Wagner, 2014).

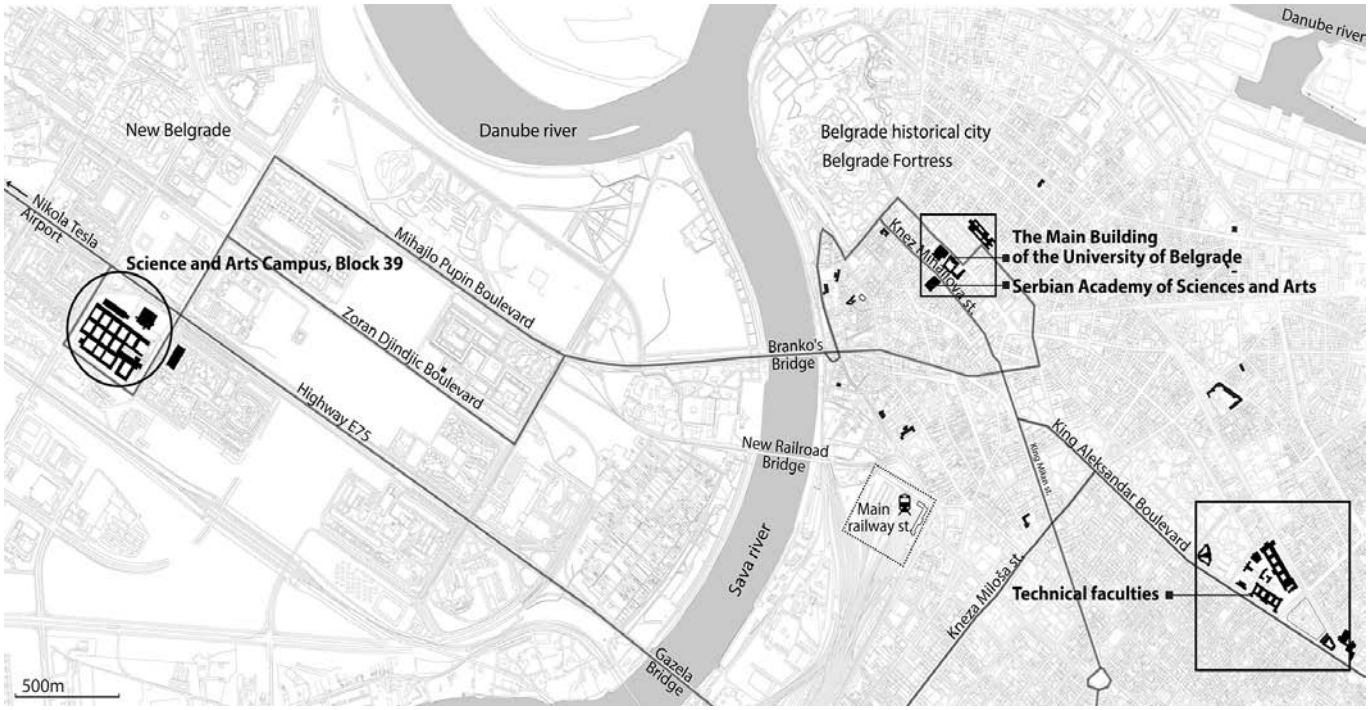


Figure 4. Science and Arts Campus (Block 39, New Belgrade): the positioning in the context of existing nodes of knowledge - the main building of the University of Belgrade and the Serbian Academy of Sciences and Arts in the historic centre of the city and the complex of the Technical faculties, Faculty of Law, the University Library and the Student Residence. (Source: authors)

Triggering change

The area of New Belgrade has always been perceived as a symbol of progress that was reflected in its modernist framework and architecture. However, the initial concept of the 1950 Master plan highlighted the development of the Central zone (1960) which was never fully implemented and later spatial and urban development plans almost completely ignored the original vision (Blagojević, 2007). The physical and functional structure of Blok 39 anticipated as a space for public activities has been re-evaluated through several urban projects during the 1980s, which proposed extensions of the building of the Academy of Dramatic Arts, as well as the clustering of new educational facilities. When it became clear that the original intentions would not be totally implemented, the Ministry of Science decided to revise previous projects and reconsider the addition of new activities (2009), which were intended to contribute to the development of a contemporary and fully functional knowledge-based innovation district.

The overall need for further efforts in this area resulted in an architectural competition for the Arts and Science Campus, supported by the initiative EU HETIP.[2] The Ministry initiated a competition following the guidelines of the Strategy for the scientific and technological development of the Republic of Serbia until 2015, and both the Ministry and the European Investment Bank promoted it. The competition organizers were the Association of Architects of Belgrade and the International Union of Architects and 232 international entries from 47 countries were received.

The case of Belgrade, together with the project for a new research hub, represents just one of numerous examples around the world expressing the imperatives of scientific excellence and reflecting the aspirations of the state. The national Strategy for scientific and technological development defines a favourable direction that is compatible with the EU framework and clearly demonstrates a willingness to support the economy of knowledge. Consequently, the Centre for the Promotion of Science, as the first phase of the project for the new scientific and arts campus, could be interpreted in a number of ways - as a symbol of new ideas embraced by the State, as a generator of innovativeness and as a showpiece of innovative solutions which will be incorporated in the building. However, the slow implementation, which is a result of the current economic crises and governmental shifts, reminds us that science, education and innovativeness demand the sustainable and solid support of the State. Therefore, it is necessary to re-emphasize the benefits of research-oriented activities and education, to stimulate the general mobility of knowledge and academia, and to establish an efficient link with the entrepreneurial sector. Such interaction could enable the implementation of innovations, provide financial gain and carve a path for the further development of science and cities based on creative solutions and inventive proposals.

The outcome

The winning entry of the Austrian architect Wolfgang Tschapeller implemented the principles of re-modernism, since the author perceived New Belgrade as the 'city of our time' (Centar za promociju nauke Beograd and Društvo Arhitekata Beograda, 2011). It also represents an innovative contribution to the general typology of university and research spaces, having in mind that all buildings in this proposal are designed to be elevated from the ground floor. The jury described this project as a surprising and intelligent reinterpretation of the principles of Modern architecture linking previous history of New Belgrade and the potentials of the future architecture. The project provides high accessibility for all users, while movement and vistas are continuous, allowing simultaneous and complex activities. Parking spaces and services occupy the underground level, while the ground level is dedicated to vegetation, pedestrian movement and cycling.

The innovative typology of the proposed campus was generated from a comparative analysis of several examples (Campus Jussieu, Paris, 1959; Freie Universität Berlin, 1967; El Escorial, Madrid, 1563), which influenced the applied grid - 20x48m for buildings and approximately 48x33m for open spaces (Figures 6 and 7). The first phase of the project includes the Centre for the Promotion of Science, the Nano Centre and the Science Institute, while the second phase represents the university campus. The architecture of buildings corresponds with the geometry of the surrounding

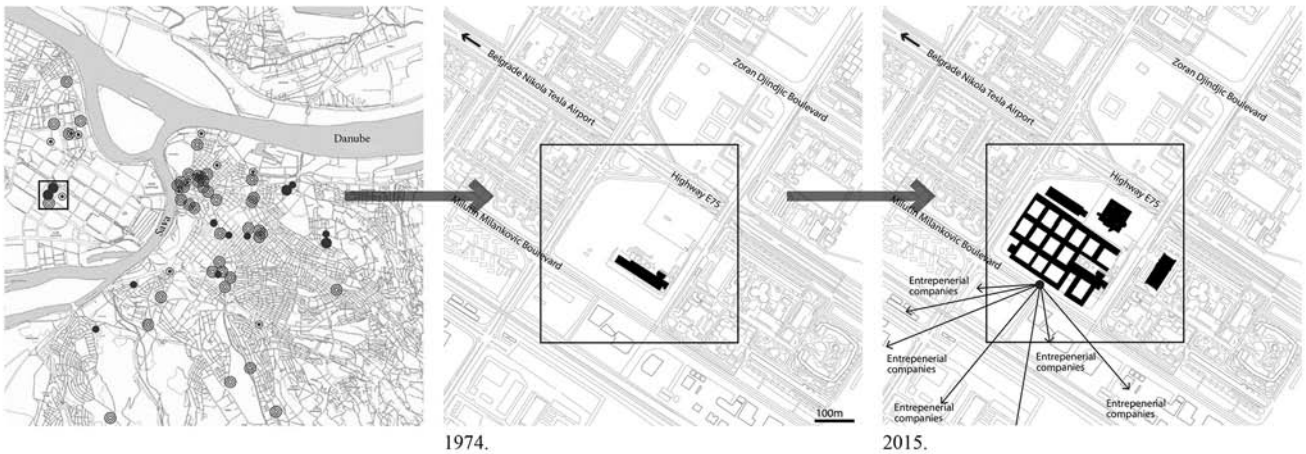


Figure 5. Block 39 - the superposing of development concepts (2014) - The Faculty of Dramatic Arts (1974, existing), Art & Science Campus and the projects for the Centre for the Promotion of Science and Nano Centre. (Source: authors)

Blocks 28 and 38, defining the identity of a contemporary agora as a new public space for the innovation hub, its neighbourhood and the city. Furthermore, the project provides an elaborated setting for the necessary synergy of economic, physical and networking assets, opening possibilities for the implementation of five strategies targeting collaborative networking, inclusive growth, talent and technology as main innovation drivers and creating better access to capital (Katz and Wagner, 2014). The proposed building of the Centre for the Promotion of Science could be interpreted as a display of innovativeness, too. Incorporating energy efficiency principles, it uses renewable energy resources (geothermal and solar power) providing high levels of environmental protection. Therefore, it represents an appropriate setting for innovative activities, connecting roles which contemporary space should fulfil. However, in spite of its numerous positive features, the project has faced challenging situations, especially related to the high technology of its construction, demanding structural solutions and encountering financial limitations. Changes to the original project were authorised in 2012 by Tschapeller. Architect Dejan Miljković was commissioned to design the building of the Nano Centre. The second phase of the project is still on hold.

[2] EU High Education Teaching Infrastructure Project (EU HETIP) is a joint project of the Ministry of Education, Science and Technological Development of the Republic of Serbia and the European Union for whose implementation the EU has secured 30 million EUR from the IPA financial instrument for Serbia (http//: www.hetip.rs, accessed 03rd July 2011).

CONCLUSION

Throughout the millennia, the role of intellectual exchange, innovative ideas and their diffusion has always been the important driver for the progress of society. At the same time, the processes of education and research have directly and indirectly influenced the nature and fibre of cities, establishing multileveled links with the urban environment and its society. In general, the cities, with their natural setting for creating and channelling innovation flows and providing an experimental tissue for their implementation and evaluation, have been perceived as an important hub of knowledge that is vital for all humanity. Therefore, the technological and spatial improvement of urban innovation nodes and networks has always been considered to be an important challenge for future development. Contemporary cities have further incorporated the relationship with innovations by stimulating the economical dimension of the interaction. The typology of urban spaces has been modified and some traditional models of education/research/innovation sites have developed new features and

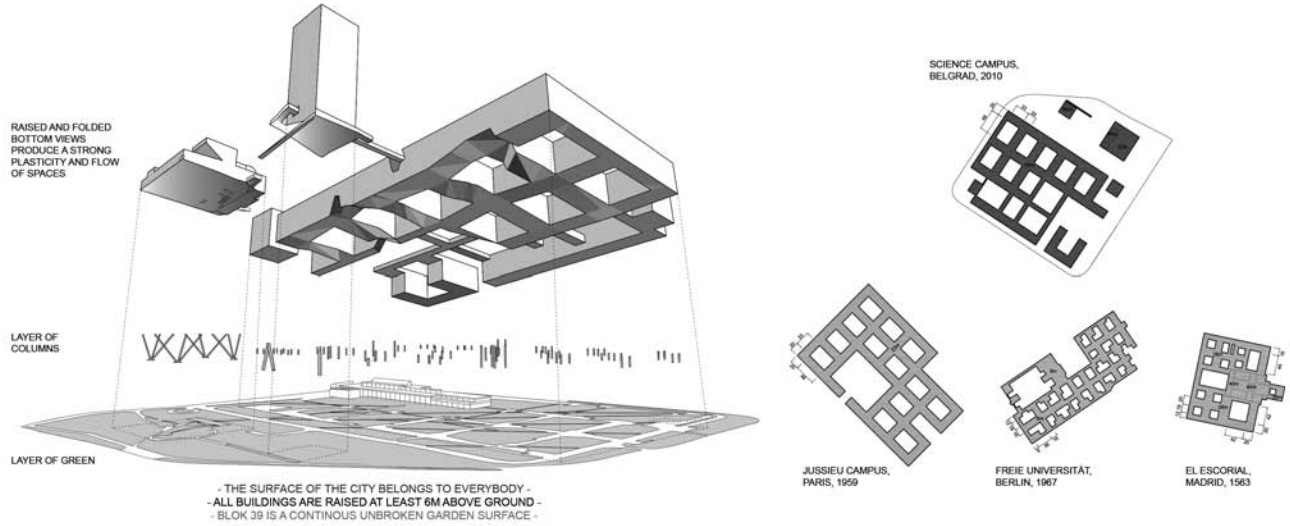


Figure 6. The winning entry of the international open competition for the Campus design by Wolfgang Tschapeller, Austria. (Source: PIU)

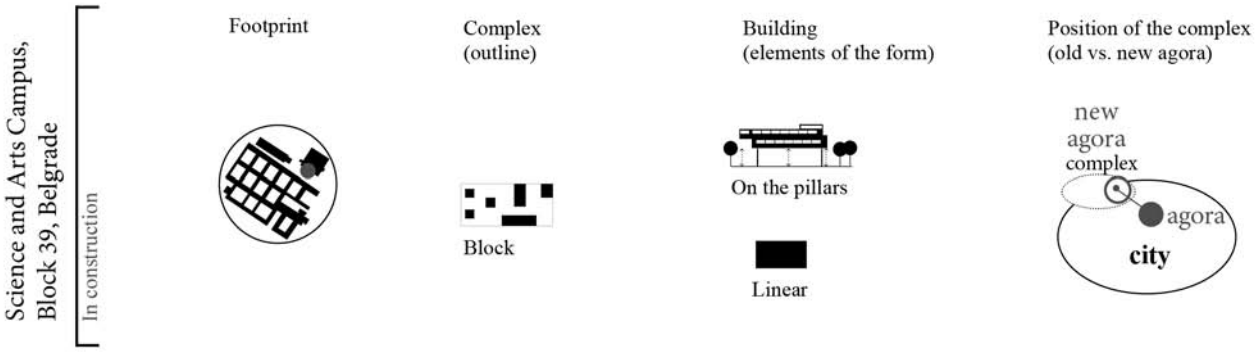


Figure 7. The elements of the winning proposal and its innovative typology. (Source: authors)

the latest technological support. Science and education are now considered as inevitable and necessary drivers of urban success and competitiveness, shifting the urban planning routines, introducing new methodologies and tools and providing a multitude of creative solutions for contemporary setbacks.

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Received December 2014; accepted in revised form September 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 46-55

UDC 331.101.262:37
371:005.961
Review paper
DOI: 10.2298/SPAT1534046J

HUMAN CAPITAL AND ITS SPATIAL DISTRIBUTION AS LIMITING FACTORS FOR THE BALANCED DEVELOPMENT OF SERBIA

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Human capital is one of the key factors of economic and social development. Namely, the growth potential of a territory is largely dependent on human capital that is, on citizen's creative potential and especially on their education. Society with a better endowment of human capital has a greater development potential.

The subject of this paper is Serbia's human capital seen from the point of view of workforce education structure (20-64 age group). In this paper we present spatial distribution of workforce, i.e. the differences in workforce education levels and polarization of Serbian territory in terms of human capital pool. The result is a typology of municipalities in Serbia based on calculated values of average completed education level – the EMN index. Mapping of the corresponding values was done at the municipality level in order to get a clear distinction and a more accurate picture of spatial disparities in human resources.

Key words: **education structure, workforce, human capital, regional polarization in Serbia.**

INTRODUCTION

Many scholars have considered human capital as one of the key factors behind social and economic development (Rodríguez and Vilalta-Bufi, 2005). Based on such approach, the development potential of a territory, apart from favourable demographic indicators (in a narrow sense), largely depends on citizens' creative potentials and especially on their education. Namely, the achieved level of citizens' education is an indicator of the quality of available human resources potentials as agents of future development.

Underconditions of globalization and innovations in information and communication technologies, education gains in importance. Today, in development plans of all developed countries and international organizations knowledge is considered as basis of prosperity, growth and welfare, In other words, education and strengthening of human resources are among the top priorities in national strategies and social, economic and technological development strategies. At the same time, the effects of education are not felt only by individuals, but by society as a whole, due to which education policy is not treated just as a policy for creating human capital, but as a part of development policy (Mitrović and Mitrović, 2015).

In relevant strategic documents on international, regional and national levels, education is one of the main focal points. In the Lisbon Strategy (*The Lisbon European Council: An Agenda of Economic and Social Renewal for Europe*) the European Union stated its view that Europe's increased competitiveness is founded on investment in a productive knowledge-based society. Education is set as one of the most important pillars for achieving the defined goals. In the newest strategic document *Europe 2020 – A European strategy for smart, sustainable and inclusive growth*, education and training development policies represent foundations of the strategy (since knowledge and skills are seen as main resources of progress and development, out of seven initiatives three are directly concerned with education, while education is related to the other four initiatives, too, albeit indirectly).

The World Bank Institute (within Knowledge for Development program) has defined a framework and developed the Knowledge Assessment Methodology for systematic knowledge assessment in accordance with the knowledge-based economy. The framework consists of

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four pillars essential for a country to be able to participate in knowledge-based society and economy. Education and training represent the first pillar. This pillar is particularly important since in order to be included in modern developments, a country must have well-educated and trained citizens which create, spread and use relevant knowledge, strive for the increase in overall productivity and for the acceleration of economic growth. Participation of a large number of highly educated workers is necessary for growth, but the importance of lower levels of education must not be neglected (Chen and Dahlman, 2004).

In summary, today's globalizing economy requires countries to nurture a stock of well-educated workers who are able to adapt rapidly to the changing environment and the evolving needs of the production system (WEF, 2014). In the modern paths of development a systematic and continuous implementation of the learning process and education is becoming one of the main forms of human resources development. There is a common agreement that highly educated population represents the greatest and most important potential and growth resource. Highly educated workforce, or at least a workforce with a solid primary level of education, is much better prepared to adapt to new technologies, innovations and competitiveness at the global level. Countries that predominantly have a primary level of education are more likely to be constrained by low levels of income and fewer opportunities for future development for individuals (WEF, 2015).

In recent decades the relevant literature has shown that regional disparities should be associated with differences in the endowment of the socio-economic characteristics of each region (Karahasan and López-Bazo, 2013). The educational attainment of the population is referred to as the key factor of differences in regional economic growth. In other words, human capital is considered as important factor in explaining differences in economic development among regions and is used to show economic convergence across them (Lucas, 1988, Barro *et al.*, 1991). The results of the combined analysis of cross-regional, institutional, cultural and human capital determinants of regional development show that "more than 1,500 subnational regions of the world suggest that the regional education is a critical determinant of regional development, and the only such determinant which explains a significant part of regional variation" (Gennaioli *et al.*, 2013:152). Namely, from a regional perspective, human capital is considered to be the key ingredient of regional growth. Therefore, the better knowledge of the spatial distribution of human capital could contribute to the better understanding of the origins of regional socio-economic inequality.

The issues of regional disparities in Serbia have been the subject of numerous analyses and documents. However, education of population has never been observed as relevant factor (cause) of such disparities. Also, the intensive research on migration (internal and external) was not understood as an important push factor of regional inequalities (Petrović, 1987, Davidović, 1989). In the last decade in Serbia, one can observe the orientation toward society based on knowledge (education) in many state and civil society organizations' programmes and strategies. However, the analyses have shown the inadequacy of the majority of these documents (Mirić, 2014). Consequently, in this plethora of strategies there is was no adequate strategy for the development of human resources in Serbia, and their efficiency and effective implementation also present a separate problem.

At the same time, Serbia is faced with formidable intra-regional and inter-regional differences which encourage migration flows – migration of human capital, causing ever greater demographic imbalance and multiplying/deepening disparity in all development areas (economic, social, educational, tec.). Under such circumstances the increasing brain drain[2] of young, highly educated people is especially worrying since it contributes to a significant exhaustion of human capital and deepening of problems concerning economic, social, demographic and spatial development of Serbia in general.

This paper presents human capital in Serbia with regard to educational attainment of the working age population (20-64 age group)[3] and spatial inequalities in endowment of educational workforce. With the systematization of data on the educational structure of workforce at the micro-municipal level, it is possible to make a typology of municipalities according to human capital-educational stock.

RESEARCH METHOD

When measuring education, it is important to make a conceptual difference between education flows and stocks. The flow refers to the process of education (formal and informal), that is, to school education, which is basically a "production" of human capital (usual indicators are student enrolment rates, student-teacher ratio, the rate of early dropping out of school, etc.). Human capital refers to the stock of educated adult citizens that is formed as a result of past education flows. Usually, it is measured with regard to the level of formal education (the highest level completed or average length/duration of schooling), but the dimension of quality is also included (general knowledge, capabilities, skills, etc.)[4]. The level of formal education is usually stated for the population older than 15 or 25, showing an overall

[2] The term "brain drain" was first popularised in the 1950s and referred to immigration of the best scientists to the United States of America from countries such as the United Kingdom, Canada and the former Soviet Union. Today, it is used in a broader sense to refer to international transfer of the human capital (people with higher education) from developing to developed countries (Rapoport, 2002). Also, for decades, brain drain has been at the heart of many debates about the impact of this phenomenon on the country of origin and inequalities among countries.

[3] The statistical term "working age population" includes all persons from the ages of 15 to 64 that are able to work (The Statistical Office of the Republic Serbia, Methodological explanations applied in education statistics). For the purpose of this paper it is more important to take into account the population in the age group from 20 to 64, because of the upper limit for the acquisition of secondary education, the minimum level of education necessary for the inclusion into modern development flows.

[4] In the last several years models for measuring the quality of human capital, including cognitive abilities, have been developed. At the moment the data is quite limited (it is being gathered through a panel of researches, diferent testing methods, studies that involve monitoring students after graduation and inclusion in the job market, etc.) (Hanushek, 2015).

human capital of a population in a given moment. However, we can get much more accurate information when we disaggregated this indicator by education levels across different age groups. In that way, we can observe differences in human capital stock between age groups which without doubt significantly affect society and economy.

In this paper the analysis is focused exclusively on the educational attainment of the working age population (20-64 age group) in Serbia as a measurement of human capital stock. The focus is on the spatial dimension, that is, the spatial differences in education of workforce stock. We used the 2011 Census data on the educational structure of the population at the municipal level. Using this data has several advantages (it provides the most complete picture since it includes the entire population and is available at the lowest spatial level) in comparison with other sample based statistical surveys (e.g. The Survey on Labour Force). In addition to that, the intention of this paper is to identify regional and inter-regional disparities pertaining to human resources which become much more visible when we take a smaller territorial unit (municipality) as a starting point.

For the sake of easier comparison of education levels a proxy index was used – average completed education level /EMN (Rodríguez-Pose and Tselios, 2011:371) that is calculated based on the following formula:

$$EMN = \sum_{j} LjSj$$

where $j \in \{1,2,3\}$ is education level, Lj percentage of individuals of the j-level of education, Sj assessment of each category. $S_1 = 2$ for tertiary (higher and high education), $S_2 = 1$ for secondary/high-school education and $S_3 = 0$ for primary education.

Average completed education level was calculated for the entire working age population (20-64 age group), the youngest part of workforce (20-24) and two more groups (25-39 and 40-64) on the level of municipalities. Figure 1 shows the typology of municipalities based on calculated values of the EMN index.

WORKFORCE EDUCATION STRUCTURE IN SERBIA

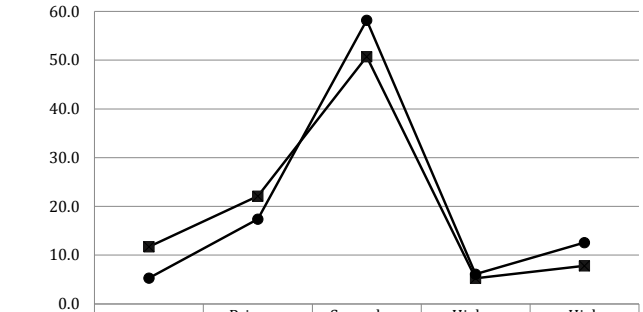
As per 2011 Census, working age population on the territory of the Republic of Serbia amounted to 4,509,274 individuals (around 63% of total population). Compared with the education level (Table 1), more than half of the workforce in Serbia (2,625,424, i.e. 58.2%) has completed secondary education, 17.4% has graduated only from primary school (784,392), 5.3% has not completed primary education (239,983), 6.1% has completed higher (274,466) and 12.6% high education (568,424). Apart from that, human capital stock is larger in urban than in other settlements. The percentage of workforce with high education is higher in urban (18%) than in other settlements (around 4%), where more than one-quarter (around 28%) are individuals who have completed only primary education and 10% have not completed primary education.

In comparison with the 2002 Census data, workforce education structure in Serbia has changed, which is the result of older generations leaving the workforce and younger, usually more educated generations coming of age (Chart 1). It is evident that in younger age groups the share of individuals with higher education has increased considerably: from 0.9% to 6.1% in the 20-24 age group (from 4,409 individuals in 2002, to 27,044 individuals in 2011); from 7.4% to 18.7% in the 25-29 age group (from 37,096 individuals to 89,825) and from 9.4% to 18% in the 30-34 age group (from 45,929 individuals to 89,269). This has occurred due to the opening of new faculties (faculty departments) in Serbia. New faculties have made this level of education more accessible to the younger population living in the provinces. Compared to the academic year 1998/1999, the number of faculties (organizational units) in 2010/2011 has increased by 55 (from 75 to 130). The biggest increase has occurred in Belgrade (from 37 to 69), in Vojvodina (from 16 to 30), in Šumadija and Western Serbia (from 10 to 16), and in Southern and Eastern Serbia(from 12 to 15) (SORS, 1999, 2001). The opening of private faculties was followed by the foundation of large number of organizational units in smaller towns and municipal centres. However, most of these departments were not accredited, due to which in the

Table 1. Workforce education structure (20-64), across regions and types of settlements (in %) – 2011 Census

Territory	Type of settlement	Without ES	Primary education	Secondary education	Higher education	High education
REPUBLIC OF SERBIA	**total**	**5.3**	**17.4**	**58.2**	**6.1**	**12.6**
	urban settlement	2.4	10.8	60.7	7.8	18.0
	other settlements	9.9	27.7	54.4	3.5	4.1
BELGRADE REGION	**total**	**1.5**	**8.6**	**59.0**	**8.5**	**21.9**
	urban settlement	1.1	6.1	57.3	9.3	25.7
	other settlements	3.6	19.3	66.1	5.0	5.6
VOJVODINA REGION	**total**	**5.4**	**18.3**	**59.9**	**5.2**	**11.0**
	urban settlement	3.2	13.2	61.8	6.4	15.3
	other settlements	8.8	26.0	57.0	3.4	4.6
REGION OF ŠUMADIJA AND WESTERN SERBIA	**total**	**6.9**	**21.2**	**57.7**	**5.2**	**8.7**
	urban settlement	2.2	12.7	63.9	7.2	13.7
	other settlements	11.4	29.4	51.8	3.2	3.8
REGION OF SOUTHERN AND EASTERN SERBIA	**total**	**7.4**	**21.1**	**55.9**	**5.7**	**9.3**
	urban settlement	3.8	13.0	60.8	7.8	14.3
	other settlements	11.9	31.0	50.0	3.2	3.3

last several years students have been warned to check if the department is accredited before enrolling[5].



	Without ES	Primary education	Secondary education	Higher education	High education
2002	11.7	22.1	50.7	5.3	7.8
2011	5.3	17.4	58.2	6.1	12.6

Chart 1. Workforce education level (20-64 age group) in Serbia (in %) – 2002 and 2011 Census

Age group	EU-25	EU-27	Serbia		Difference between EU average and Serbia	
	2002.	2011.	2002.	2011.	2002.	2011.
24-29	NA	31,6	11,9	25,1		– 5,5%
30-34	24,3	33,6	14,9	24,8	– 9,3%	– 8,8%
35-39	22,4	30,1	16,1	20,6	– 6,3%	– 9,5%
40-44	20,7	25,9	16,5	18,3	– 4,2%	– 7,6%
45-49	19,7	23,6	14,7	18,4	– 5,0%	– 5,2%
50-54	17,9	21,7	15,6	18,2	– 2,3%	– 3,5%

Regarding the share of workforce with tertiary education, Serbia lags behind the European Union average (EU27) in all age groups (Chart 2). The biggest differences are in the age groups under 44, and they stand at around 9.5% in the 35-39 age group, and at 6.5% in the 24-29 age group. There is no doubt that the emigration of young, highly educated population contingents has much graver consequences for the quality of human capital in Serbia than in most European countries. In 2011, compared to 2002, Serbia has increased the difference (lagging) in the quality of its most valuable part of workforce in all age groups in comparison with the European average, except for a marginal decrease in difference in the 30-34 age group.

Relative to the neighbouring countries (Bulgaria, Romania and Hungary) and the two former SFRY republics (Croatia and Slovenia), all members of the EU, Serbia has better human capital than Romania (across all age groups), similar human capital to Hungary, similar human capital to Slovenia in the youngest age group (24-29) and in the older age groups (older than 50), but it lags behind Slovenia in other age groups. Serbia has similar human capital to Croatia and Bulgaria in the oldest age group (55-64) and the youngest age group (24-29).

The World Economic Forum Report from 2014 also shows Serbia lagging in education. The measured value of index for the education and training[6] amounts to 5.0 for EU28, and 3.8 for Serbia. Serbia is ranked lower than the worst ranked Romania (3.98), but it is also ranked lower than the rest of the EU candidate countries (Iceland – 5.31, Montenegro – 4.28, Turkey – 4.28 and FYR Macedonia – 4.0) (WEF, 2014:14).

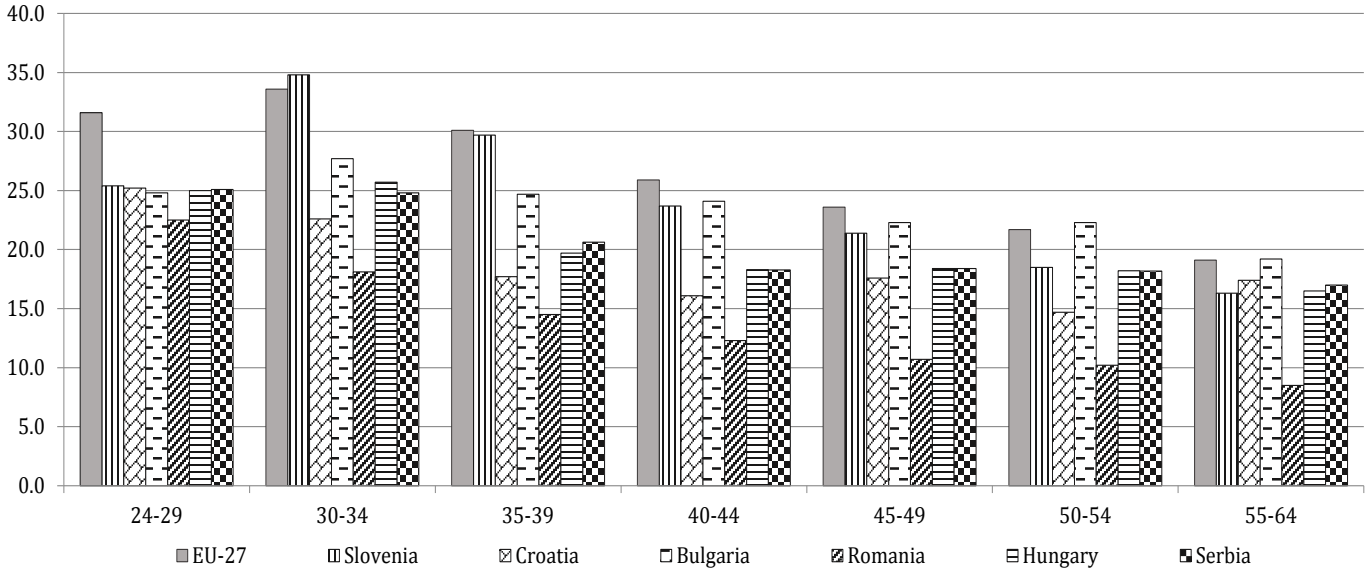


Chart 2. A share of highly educated individuals (tertiary education) in age groups (Source: European Commission, Education, Audiovisual and Culture Executive Agency, 2012) For Serbia: SORS, 2013)

[5] More han 100 faculties were not accredited, that is, just 14 branch departments and 15 higher education departments were accredited in 2014 (*Blic* daily newspaper, 3 July 2014). In April 2015 the Commission for Accreditation and Quality Assurance of the Republic of Serbia published the document "A Guide through Accredited Study Programs in the Institutions of Higher Education in Serbia".

[6] Includes seven indicators: Quality of the education system; PISA scores on education quality; tertiary education enrolment rate; secondary education enrolment rate; availability of training services; quality of management schools and the extent of staff training.

Spatial distribution of Serbia's human capital across regions

Serbia is characterized by pronounced spatial polarization and disproportion in the distribution of workforce and stock of human capital. In 2011 almost a quarter (23.7%) of Serbia's working age population was concentrated in Belgrade, which covers around 4% of Serbian territory. In Vojvodina, Šumadija and Western Serbia regions, whose share in the territory of Serbia is similar (32% and 34% respectively), the distribution of workforce is also similar (27.2% and 27.9% respectively). The region of Southern and Eastern Serbia, characterized by depopulation, has the smallest share in Serbian workforce (21.2%). In the last mid-census period (2002–2011) the number of citizens living in this region has decreased by 190,000, more than 90,000 of which due to migrations (Jokić, 2013).

When we look into the distribution of workforce with regard to the education structure, the polarization of Serbian territory is even more pronounced. The region of Belgrade absorbs the largest share of Serbian quality human capital – more than two-fifths of highly educated people live there (41%), as well as one-third (33%) of individuals with higher education. A little bit less than one-quarter of Serbia's working age population with high and higher education (24% and 23% respectively) lives in Vojvodina, 19% and 24% in Šumadija and Western Serbia, and the smallest share of population with high and higher education is in the region of Southern and Eastern Serbia – 16% and 20% respectively. Most of the workforce without primary education and with primary education only is concentrated in Šumadija and Western Serbia (36% and 34%, respectively), in the region of Southern and Eastern Serbia (30% and 26%) and Vojvodina (28% and 29%), while only 7% and 12% in Belgrade (Jokić and Dželebdžić, 2014).

TYPOLOGY OF MUNICIPALITIES AND CITIES WITH REGARD TO QUALITY OF HUMAN CAPITAL

Based on the EMN values in the 20-64 age group, municipalities and cities were categorized in five groups (Table 2, Figure 1). Group gradation was made based on the national average, that is, on the deviation from the national value of EMN (0.96). There are two basic groups: above and below national average. The table also shows (for each separate group) the average share (at the group level) according to education levels (for the total workforce and for the three sub-groups (20-24, 25-39, and 40-64)), in order to monitor/perceive differences in human capital stock.

There are 20 municipalities/cities in the group which exceeds national average, and they account for more than a third of Serbian workforce (37.2%). Four municipalities (Pančevo, Zrenjanin, Vrbas and Vrnjačka Banja) have the EMN slightly above national average (0.97). Within this group a sub-group was created representing the highest quality Serbian workforce. Ten Belgrade municipalities and the cities of Novi Sad and Niš belong to this sub-group. The municipalities of Vračar (1.52), Stari grad (1.50) and Savski venac (1.45) have by far the highest EMN.

Municipalities below the national average are classified in four groups. The best ranked municipalities are those

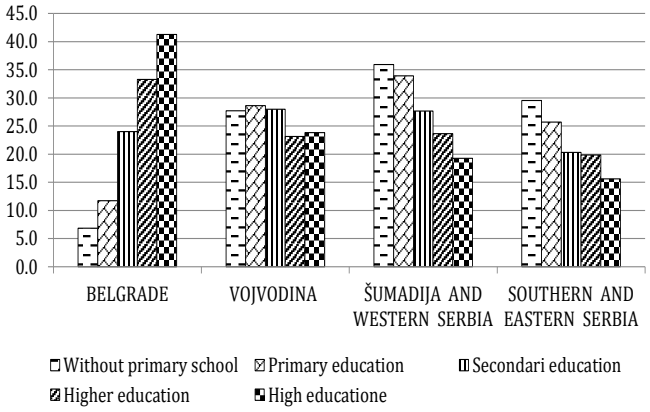


Chart 3. Population distribution in the 20-64 age group according to education level across regions (%) – 2011 Census

with the EMN up to 5% below national average – 25 municipalities in total. Almost a quarter of Serbian workforce is concentrated in these 25 municipalities in which the EMN value ranges from 0.90 to 0.95. The worst ranked are municipalities (group V) with the EMN more than 30% below national average. There are 28 municipalities in this group which has a very small workforce stock (around 6% of total Serbian workforce stock). The biggest concentration of municipalities in this category is in Braničevo District, which stands out as a district with the greatest share of external migrations (massive citizen migrations in search for work abroad since the 1960s). According to the 2011 Census, around 20% of citizens from this region went abroad. In some municipalities (Malo Crniće, Žabari and Kučevo) this percentage exceeds 30%, and in Petrovac na Mlavi and Veliko Gradište it exceeds 25% (Stanković, 2014). Besides that, in two of the above mentioned municipalities (Žabari and Malo Crniće), as well as in Osečina municipality, the deviation from the average national EMN is larger than 50%.

The remaining two groups (III and IV) represent the middle between 5% and 30% deviations. Thus, group III includes municipalities in which the deviation from average EMN ranges from 5% to 17%, and group IV includes those in which average EMN ranges from 18% to 30%. Around 15% of Serbia's workforce is concentrated in group IV which includes 54 municipalities, while a significantly smaller number of municipalities belong to group III (34). However, the human capital stock in group III is larger (18%) and of higher quality.

Municipalities belonging to groups IV and V which have a small stock of human capital and large disproportion in human capital, and that are surrounded by other low human capital municipalities are in gravest danger of remaining trapped by weak human capital and social and economic exclusion.

From the point of view of age groups, far smaller deviations from national average can be seen in the 20-24 age group, although in groups IV and V the share of individuals who have completed only primary education (19.5% in group IV and 28.8% in group V), and who have not completed primary education (4.5% in group IV and 5.5% in group V) is very high in comparison with other groups. Workforce in the age group 25-39 within groups II and III is better "positioned" (deviations from national average are smaller) across all

Table 2. Typology of municipalities/cities with regard to the quality of human capital

Tipology according to EMN	Number of municipalities	Able-bodied (number and share)	Territory (ha)	Share (group average) according to workforce education level completed, in total and across age groups (in %)				
				Education level	Age groups			
					20-64 years	20-24 years	25-39 years	40-64 years
Republic of Serbia	168	4,509,274 (100.0%)	77,466 (100.0%)	**High and higher education**	**18.8**	**8.2**	**22.2**	**17.6**
				Secondary education	58.2	79.7	61.1	51.1
				Only primary education	17.4	9.1	13.7	22.4
				Without elementary school	5.3	2.6	2.5	8.4
ABOVE AVERAGE FOR THE REPUBLIC OF SERBIA								
I	20	1,675,902 (37.2%)	7,181 (9.3%)	**High and higher education**	**29.1**	**10.6**	**34.3**	**29.0**
Above average				Secondary education	59.0	82.2	57.6	56.2
				Only primary education	9.6	5.4	6.7	12.1
				Without elementary school	2.0	1.6	1.2	2.4
BELOW AVERAGE FOR THE REPUBLIC OF SERBIA								
II relatively good	25	1,087,068 (24.1%)	16,323 (21.1%)	**High and higher education**	**14.4**	**7.7**	**18.2**	**13.3**
(up to 5% below average value in Serbia)				Secondary education	62,8	81,9	67,5	57,6
				Only primary education	17.8	8.2	12.0	22.4
				Without elementary school	4.6	2.0	1.9	6.4
III bad/low	34	812,173 (18.0%)	17,936 (23.2%)	**High and higher education**	**12.6**	**7.5**	**16.2**	**11.6**
(5-17% below average value in Serbia)				Secondary education	59.0	80.3	65.1	51.8
				Only primary education	21.4	8.9	15.4	27.0
				Without elementary school	6.6	2.9	3.0	9.3
IV very bad/low	54	665,299 (14.8%)	24,689 (31.9%)	**High and higher education**	**9.7**	**6.5**	**12.3**	**8.9**
(18-30% below average value in Serbia)				Secondary education	54.3	76.9	61.3	47.2
				Only primary education	26.0	12.2	20.9	30.9
				Without elementary school	9.6	4.1	5.1	13.0
V extremely bad/low	28	268,832 (6.0%)	11,337 (14.6%)	**High and higher education**	**7.2**	**6.0**	**9.2**	**6.4**
(more than 30% below average value in Serbia)				Secondary education	44.9	70.0	53.9	37.3
				Only primary education	33.0	19.5	30.6	36.2
				Without elementary school	14.4	4.5	5.8	19.7

Note: The cities of Novi Sad, Niš, Požarevac and Vranje which have two or more urban municipalities were taken as a whole, that is, the data was not given, nor mapped separately for those urban municipalities

education levels. In groups IV and V a share of citizens who have completed only primary education is much higher than the share of citizens with higher and high education (20.9%:12.3% and 30.6%:9.2%, respectively).

Noticeable differences in human capital on the territory of Serbia (Figure 1) are undoubtedly related to migrations (internal and external) and to the increasing depopulation of certain districts. According to the 2011 Census, population has increased only in 16 (11 on the territory of Belgrade) out of 168 municipalities/cities. The most severe decrease occurred in Bor District (by approximately 15%), followed by Zaječar and Pirot Districts (by approximately 13%), all on the region of Southern and Eastern Serbia.

REGIONAL AND INTRA-REGIONAL INEQUALITIES IN ENDOWMENT OF WORKFORCE

The Table 3 summarizes data by region according to the adopted typology of municipalities, that is based on the data of workforce stock (average completed education level). In comparison with Table 1, which shows workforce educational structure in the region, Table 3 presents the spatial distribution endowment of workforce. In addition, Table 3 presents regional and intra-regional educational inequalities within workforce, as well as its territorial polarization.

Belgrade region has by far the highest quality human capital - about 80% of workforce are above average quality, and the remaining 20% belong to category II – relatively good workforce.

Compared to that, Vojvodina has about 34% of the workforce with above average quality concentrated in city of Novi Sad and four in municipalities (15% area of the region), and 28% of workforce with relatively good education cover about 24% of the territory. The share of workforce with low educational attainment is around 15%; and a little bit more than one fifth of the workforce (21.5%), covering a large part of the territory (41%), has a very low educational attainment. This workforce is concentrated mainly in border municipalities in three districts (Northern Bačka, South Banat and Middle Banat).

The area south of Belgrade has a much lower quality human capital and intra-regional disparity is much more pronounced here.

The region of Šumadija and Western Serbia has about 20% of the workforce with above average quality concentrated in four municipalities (7.7%) that cover less than 10% of territory of the region. About 25% of the workforce with relatively good educational structure is concentrated

Figure 1. Classification of municipalities and cities according to work potential EMN (20-64 age group)

Table 3. Distribution of municipalities, workforce and area according to quality of the workforce (EMN values)

		Tipology according to EMN				
		Above average	II (relatively good)	III (bad/low)	IV (very bad/low)	V (extremely bad/low)
SERBIA	municipality (%)	12,4	15,5	21,1	33,5	17,4
	workforce (%)	**37,2**	**24,1**	**18,0**	**14,8**	**6,0**
	area (%)	*9,3*	*21,1*	*23,1*	*31,9*	*14,6*
BELGRADE	municipality (%)	58,8	35,3	5,9	0,0	0,0
	workforce (%)	**78,6**	**20,3**	**1,2**	**0,0**	**0,0**
	area (%)	*31,4*	*60,0*	*8,6*	*0,0*	*0,0*
VOJVODINA	municipality (%)	11,1	17,8	15,6	51,1	4,4
	workforce (%)	**33,7**	**28,1**	**14,7**	**21,5**	**2,0**
	area (%)	*15,0*	*23,8*	*16,6*	*40,9*	*3,6*
ŠUMADIJA AND WESTERN SERBIA	municipality(%)	7,7	13,5	28,8	26,9	23,1
	workforce (%)	**20,3**	**25,5**	**26,4**	**17,0**	**10,8**
	area (%)	*8,8*	*20,3*	*26,2*	*27,2*	*17,4*
SOUTHERN AND EASTER SERBIA	municipality (%)	2,1	8,5	23,4	36,2	29,8
	workforce (%)	**17,4**	**21,4**	**30,1**	**19,7**	**11,4**
	area (%)	*2,3*	*14,8*	*27,3*	*33,0*	*22,6*

on approximately 20% of the territory. Almost similar percentage (26.4%) of the workforce with low education attainments settled in 15 municipalities that cover 26% of the territory. Workforce with weakest characteristics (IV and V category) – 28% covers 23% of the area. In total, human capital stock is bad on around 71% of the territory (categories III-V)

The region of Southern and Eastern Serbia has generally low EMN values (III-V categories) and human capital is the weakest in Serbia. Only the city of Niš has quality of the workforce above average (17,4%) but it covers only 2% of the territory of the region. The share of relatively good quality workforce is around 21%, but it covers relatively small territory of around 15%. The rest of the territory (around 83%) has low quality workforce: 28% of low quality workforce on 28% of the territory; around 20% of very low quality workforce on 33% of the territory; and extremely low quality workforce covers 23% of the area.

It is obvious that all regions, except Belgrade which has a strong concentration of human capital, are characterized by intra-regional inequalities in the spatial distribution of workforce, in particular the region of Southern and Eastern Serbia and the region of Šumadija and Western Serbia.

Such state of spatial distribution and quality of human capital is the result of decades-long lack of appropriate regional development policies, which are supposed to respond to regional disparities. However, the increasing spatial imbalance had initiated permanent migration from the less developed territory (region of South and East Serbia and region of Šumadija and Western Serbia). This is best illustrated in the data on population numbers in Serbia in the period from 1991 to 2011. Two decades ago, there were 532,145, or more than half a million, more citizens in the South (Šumadija and Western Serbia, and Southern and Eastern Serbia regions) than in the North (Belgrade and Vojvodina regions). However, by 2011 the population in the North increased by 68,903 citizens, while it decreased by 460,000 inhabitants in the South. In total, the number of citizens in the region of Southern and Eastern Serbia decreased in the last two decades by around 300,000, out of which 160,000 due to migrations. In the region of Šumadija and Western Serbia the number of inhabitants decreased by 165,000, out of which 60,000 due to migrations.

When we add all this to the number of emigrants that left during the 1990s, when a large number of highly educated people left the country (so-called brain drain phenomenon), becomes clearer issue of human resources in Seria. According to data provided by Grečić (2002) in the period 1990–2000, a total of 73,000 citizens from Serbia and Montenegro went to transoceanic countries, of which number more than 17,000 were people with higher education. When it comes to Europe and other parts of the world as emigration targets, the author estimated that the exodus of university-degree citizens probably counted over 30,000 (Grečić, 2002: 255-257).

There is no data on the exact number of emigrants in the last decade of the 20th and the first decade of the 21st century. This lack of a data base presents a particular obstacle in analysing migration trends and drafting projections for the future. It is evident that the process of migration of young educated population continues. In the last mid-census period (2002–2011), a total of 175,021 Serbian citizens left the country, of whom 96,000 have been abroad for longer than one year (the ones that left between 2002–2010). Also, in 2011, the number of Serbian citizens abroad equalled 313,000 (4.2% of total population), mostly people from the region of Southern and Eastern Serbia (6.7% of the population in this region) and Šumadija and Western Serbia (4.9%), with much fewer from the Belgrade region (2.8%) and Vojvodina (2.6%) (Stanković, 2014).

Moreover, in addition to 31,580 citizens with university degrees, in 2011 there were also 12,000 students abroad. The most intense brain drain is from the Belgrade area given that of the total number of students, a little under one-third (31.8%) are from this region, 31% are from Vojvodina, around 22% from Šumadija and Western Serbia and 15% from the Southern and Eastern Serbia region.

This constitutes one of the biggest problems for Serbia – a growing trend of highly educated and talented population leaving Serbia and depleting the country's human capital. There is no doubt that the exodus of this category of population, increasing day by day, is an irreparable economic, demographic, cultural and intellectual loss for Serbia.

CONCLUSION

The issue of evidently unequal development of regions in Serbia that has been neglected for decades and the fact that the consequences of external and internal migrations that caused a demographic depopulation of certain parts of Serbia as early in the second half of the 20th century that were largely ignored led to a very pronounced territorial polarization in every respect (economic, social, demographic).

Results of the analysis into the quality of human capital in municipalities and cities suggest a high discrepancy and polarization regarding the total workforce. There are no significant differences in the younger contingent either, because migrations continued and increased in the first decade of the 21st century, both internally (from smaller towns mainly to Belgrade and Novi Sad) and externally (abroad), depleting the human capital particularly in areas with small stock of workforce.

Taking into account the importance of educational attainment and of the quality of human resources for the future economic and general development of the region, it is evident that only the region of Belgrade, and to some extent the region of Vojvodina, fulfil necessary preconditions for development. The region of Šumadija and West Serbia has approximately 20% of above average quality workforce, and 25% of relatively good quality workforce covering around 30% of the territory. In the region of Southern and Eastern Serbia approximately 17% of workforce belong to the above average category, and around 21% to the relatively good category, but this workforce is concentrated on just 17% of the territory. In total, the largest part of the territory of these regions has small workforce stock, and some parts could rightfully be called the "wasteland" of human capital.

In summary, the results have confirmed the existence of a very pronounced spatial discrepancy and polarization with regard to concentration and distribution of human capital quality. From this perspective, we can hardly talk of a balanced spatial development on the territory of Serbia.

It is obvious that Serbia is looking at an insoluble problem, and that is to retain (preserve its human capital) and, which is even harder, attract experts, as indicated by the data of the Global Competitiveness Report 2013–2014 (WEF, 2014). Two new indicators are used: the country's capacity to keep talent, according to which Serbia ranks as 146th, and its capacity to attract talent, where Serbia occupies the second but last position out of 148 countries. Countries in the neighbourhood are in a somewhat better position (Bulgaria 142nd and 144th), Romania (138th and 132nd), Croatia (134th and 143rd), Hungary (126th and 115th), whereas Albania is far better ranked (60th and 63rd).

Evidently, Serbia today lacks the economic strength to provide employment for working-age population, most notably among the young. However, bearing in mind the biological exhaustion of rural areas and the increasing brain drain from towns and cities, Serbia must waste no time and start developing mechanisms and incentives to stop young people from leaving.

Acknowledgement

The paper was prepared within the research project „The Role and Implementation of the National Spatial Plan and Regional Development Documents in Renewal of Strategic Research, Thinking and Governance in Serbia", number III 47014, financed by the Republic of Serbia, Ministry of Education, Science and Technological Development.

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Received October 2015; accepted in revised form December 2015.

DE GRUYTER OPEN

SPATIUM
No. 34, December 2015, pp. 56-63

UDC 005.21:338.48-44
338.484:502.131.1
Review paper
DOI: 10.2298/SPAT1534056N

ADVANTAGES OF COMBINED APPLICATION OF SEA WITH ESIA IN STRATEGIC PLANNING FOR SUSTAINABLE TERRITORIAL DEVELOPMENT OF TOURISM DESTINATIONS

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Whereas standard SEA (Strategic Environmental Assessment) and EIA (Environmental Impact Assessment) methodologies aim to assess the impacts of certain activities solely on environmental quality, new tendencies in spatial and environmental planning are directed towards the application of environmental social impact assessment (ESIA), which implies assessment of the impacts on the quality of life, as well as on natural and cultural heritage. In the ESIA procedure, identification and assessment of direct, indirect and cumulative effects of tourism-related and other different activities are of key importance. The paper presents two case studies of ecologically vulnerable tourism destinations to explore whether the application of SEA/ESIA to strategic planning helps control, minimize or avoid negative effects of tourism; in addition, the case studies are analysed to check the efficiency of SEA/ESIA as instruments for coordination between spatial and tourism planning for sustainable territorial development of tourism destinations. The results/findings of the analysed case studies show that the application of combined SEA and adapted ESIA methods contributes to better understanding of the specific problems related to sustainable territorial development of tourism destinations, and provides support to the planning options and solutions aimed at addressing these problems n a more ecologically and socially justifiable manner.

Key words: **tourism destinations, sustainable territorial development, strategic environmental assessment, environmental social impact assessment, controlling and coordinating role.**

INTRODUCTION

Strategic planning is one of the instruments for achieving sustainable development, in particular, the spatial planning that can offer an integral view of future territorial development. The implementation of a holistic approach and coordination between spatial, sectoral and environmental planning is crucially important for an integrated strategic planning for sustainable territorial development.

Tourism destinations should be the first to adopt the strategic planning and management with the aim to achieve the sustainable territorial development, and by this the competitiveness as well. In order to achieve sustainable development of tourism at a destination level, different concepts and tools need to be combined and integrated, as they cover specific areas and contribute to different aspects of achieving sustainable development at destinations (Lee, 2001; Schianetz *et al.*, 2007). The outcome of comparative evaluation of assessment tools and concepts for sustainability implementation (Schianetz *et al.*, 2007) is that environmental impact assessment tools (EIA - Environmental Impact Assessment and SEA - Strategic Environmental Assessment), as well as most site-specific assessment tools, have difficulties when dealing with cumulative impacts. The evaluation of negative cumulative tourism effects on a territorial development is of particular importance in ecologically vulnerable areas, such as protected areas with natural heritage, and in socially and economically depressed areas which contain resources for tourism development.

Practiced in many countries around the world, SEA is a systematic decision-making support process designed to help ensure that the environmental and sustainability aspects are adequately considered in the process of preparing

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policies, plans and programmes (Fischer, 2007; Bragagnolo and Geneletti, 2012; Fischer, 1999; Dalal-Clayton and Sadler, 1999). The SEA Directive 2001/42/EC has been effective since July 2004. Therefore, since tourism plans fall within the scope of the SEA Directive, they are to be subjected to the SEA procedure (Lemos *et al.,* 2012; Fischer, 2007). This legal framework and its requirements raise methodological questions with regard to the manner in which SEA should be adapted and integrated into sectoral planning - tourism planning (Lemos *et al.*, 2012). Whereas standard SEA and EIA methodologies aim to assess the impacts of certain activities solely on environmental quality, new tendencies in spatial and environmental planning are directed towards the application of ESIA, or some elements of social impact assessment, namely evaluation of impacts on the quality of life (Fischer *et al.*, 2010), as well as on natural and cultural heritage. The application of SEA and EIA in tourism planning does not follow any established procedures or methodologies, nor are there specific legal provisions to regulate it. The assessments are often more sociologically-oriented and concerned with the quality of life/tourist stay rather than the quality of air, soil, etc. According to Lemos, Fischerand Souza (Lemos *et al.,* 2012), there is no such thing as a predefined, generic set of criteria which are suitable for reviewing SEA or EIA practices in tourism planning. Thus, there is a need for establishing a new type of assessment, similar/derived from environmental social impact assessment (ESIA). In the socially and environmentally oriented assesment, identification of direct, indirect and cumulative impacts of tourism-related and other activities on quality of environment and life are of key importance (Lemos *et al.*, 2012; Gunn, 2002). This paper indicates the differences between socially-oriented assessment methodologies on the one hand, and the standard SEA/EIA methodologies prescribed by the EU directives, on the other and gives new type of methodology which is conglomerate of SEA and ESIA methods.

The aim of this study is to contribute to increasing knowledge on the above issues by means of SEA/ESIA case studies in strategic planning of tourism destinations with natural and cultural heritage in Serbia. Different planning and institutional context, according to Lemos, Fischer and Souza, can be challenging for evaluating SEA and EIA practices in tourism planning in developing countries (Lemos *et al.,* 2012), .This paper focuses on the implementation of new, adapted SEA/ESIA methodology and its controlling role in spatial planning for sustainable territorial development of tourism destinations. Case studies are used to explore whether the application of adapted SEA/ESIA in tourism planning helps control, minimize or avoid negative effects of tourism, and to check the efficiency of adapted SEA/ESIA as instruments for coordination between spatial and tourism planning for achieving sustainable territorial development of tourism destinations.

THE ROLE OF ADAPTED ESIA AND SEA IN STRATEGIC PLANNING FOR SUSTAINABLE TERRITORIAL DEVELOPMENT

Strategic environmental assessment is envisaged to diminish or neutralize adverse effects of sectoral and spatial planning on the environment, and to have a coordinating role regarding planning decisions, with a view to achieving sustainable territorial development. This should be applied to tourism destinations as well, since "tourism is an element in spatial plans and the extent of its coverage will frequently depend upon its significance and impact on the local economy" (Lemos *et al.*, 2012).

Advantages of adapted ESIA over SEA and EIA

Various development activities have both positive and negative implications for the environmental quality, the quality of life, and economic development of local communities and regional surroundings. For this reason, the evaluation of these activities must include all dimensions of sustainable development – environmental, social and economic dimensions of their impacts. Compared to the standard approach to the evaluation of effects of these activities on the environment applied in SEA and EIA, as prescribed by EU directives (Directive EC 2001/42/EC on SEA, Directive 2011/92/EU on EIA) and analysed and improved by many authors (Dalal-Clayton and Sadler, 1999; Stojanović and Maričić, 2008; Kuoa *et al.*, 2005), new tendencies in spatial and environmental planning for sustainable territorial development of tourism destinations are directed towards ESIA. While standard SEA and EIA methodologies evaluate only effects of certain activities on the environmental quality, adapted ESIA (developed for this specific research and partially based on standard ESIA process) has a wider scope. It takes into consideration the evaluation of all potential positive and negative impacts of activities on physical, geographic, biological, and socio-economic characteristics of space. The scope of this adapted ESIA is also extended by the evaluation of the mentioned effects on the quality of life of local residents, as well as on the protection of natural and cultural heritage.

In the adapted ESIA procedure, it is crucial to identify and evaluate direct, indirect and cumulative effects arising from tourism-related and other activities. These activities are compared with the so-called null alternative (meaning to say that these activities will not be carried out) in order to quantitatively and qualitatively determine their effects. Based on the evaluation of the effects of almost all activities, the final conclusions of adapted ESIA provide an insight into direct and indirect effects of planned activities, and enable the formation of a set of measures for offsetting or diminishing adverse effects.

This adapted ESIA should necessarily take into account both the existing state of the environmental quality (water, air, land, noise, ionizing and non-ionizing radiation) and the quality of life (the percentage of the local population and tourists exposed to the increased pollution of air, water, land, noise, then the percentage of the local population and tourists who consider the conditions in the environment they live in to be satisfactory/adequate, as well as the quality of jobs in tourism and those generated by tourism, the quality and availability of public and tourism infrastructure and services, etc.). It should also take into consideration the status and condition of the protected natural and cultural heritage, including the data on the manner and intensity of the use of space for tourist facilities, infrastructure

and activities (characteristics of tourist facilities and infrastructure, number of visitors and intensity of the tourist use of space at monthly and annual levels and during peak season, etc.). Also, tourism development in special purpose areas, such as protected areas, can be a major economic justification for their protection, but it can also pose a great risk (Lemos *et al*., 2012).

This paper indicates the differences in methodologies used for adapted ESIA application compared to the standard methodologies for SEA and EIA applications prescribed by EU directives.

Methodology for ESIA Application

While SEA is conceived only as an instrument for accomplishing environmental protection objectives, the protection of the quality of life and human health is increasing in importance, as well as the determination of socio-economic effects which activities can have on the investigated area. Since tourism development activities have significant recorded effects on the socio-economic development of tourism destinations, the assessment cannot be reduced only to the analysis and evaluation of negative and positive environmental effects of these activities. For this reason, the existing methodology for undertaking strategic environmental assessment and environmental impact assessment necessitates improvement by including socio-economic parameters and goals, which are recognized as ESIA goals.

ESIA practice in spatial planning for tourism destinations and urban planning for tourist resorts has indirectly made this assessment an important instrument for controlling and coordinating sectoral plans in tourism with sustainable territorial development of areas.

Compared to the standard instruments in SEA, ESIA introduces new parameters for quantitative and qualitative assessment of the effects of planned development activities in order to improve the existing methodological framework. Namely, by taking into account socio-economic parameters as well, ESIA should give a comprehensive idea about the consequences which development activities may have for a certain area.

EXPERIMENTAL PROCEDURES: CASE STUDIES IN SERBIA

Challenges in Strategic Planning for Sustainable Territorial Development of Tourism Destinations in Serbia

SEA is a relatively new tool in the planning process, both in Serbia and across the European Union (Fischer, 2007; Arts *et al.,* 2004). The challenge is that the legal basis in Serbia (laws on planning and construction, environmental protection, transport, tourism, etc.) does not establish the obligation to coordinate sectoral planning with environmental and spatial planning. The Law on Tourism (National assembly of the RS, 2009) does not mention integral planning or coordination with spatial and environmental planning, nor the obligation of carrying out Strategic Environmental Assessment for sectoral plans. After the adoption of tourism development master plans for certain primary tourism destinations in Serbia, a significant problem occurred in developing spatial plans for special-purpose areas and regional spatial plans.

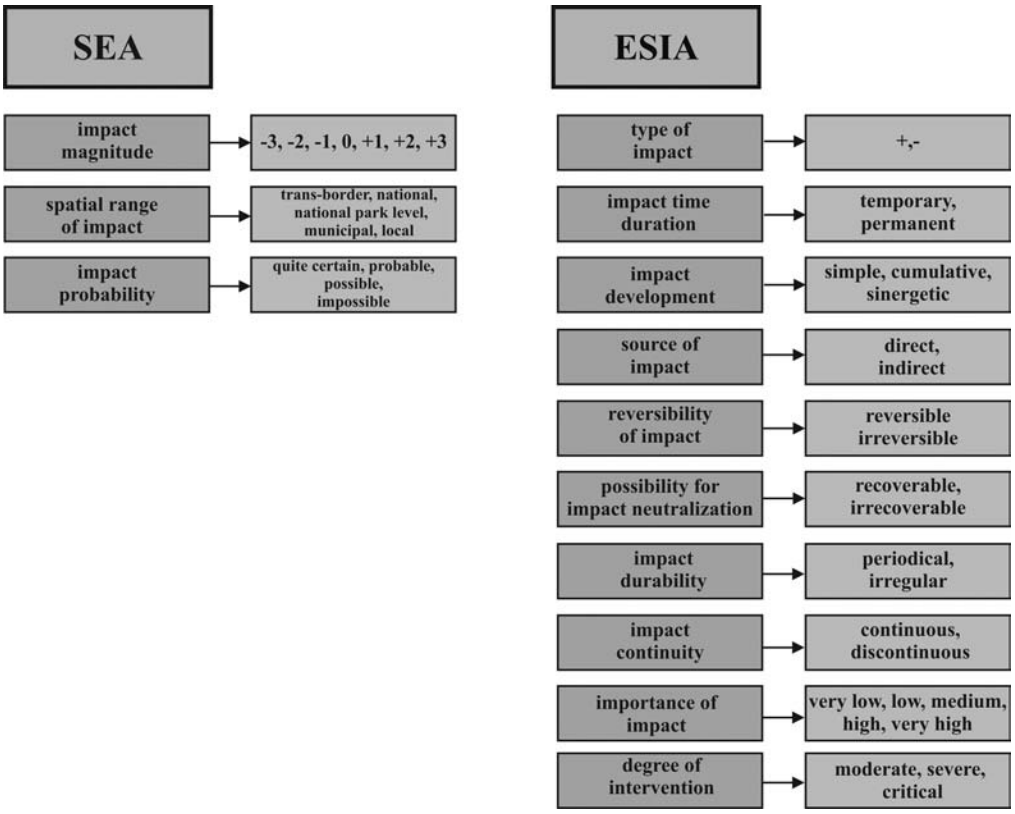

Figure 1. Differences between evaluation parameters in SEA and ESIA (Source: authors)

The integration of SEA into the spatial and urban planning in Serbia has produced good results in evaluating different territorial development options and contributing to the improvement of the quality of life and environment so far. Non-implementation of legal requirements pertaining to the development of SEA for sector plans in tourism represents a limitation in the implementation of coordinating and integrative role of strategic environmental assessments in Serbian planning system. Under such conditions, the implementation of SEA, with the extended methodology of adapted ESIA, in spatial plans for tourism destinations and binding regulation plans for tourist resorts (the plan of general regulation and the plan of detailed regulation) is the only control instrument enabling the coordination between sector-oriented strategic master plans and spatial and environmental planning.

Methodology for ESIA Application in Serbia

Environmental impact analyses, i.e. SEA and EIA, have been conducted in the Republic of Serbia over the past 10 years, based on the theoretical research by Fischer (Fischer, 2007; Fischer *et al.*, 2010), and Therivel (Therivel, 2010). Although the legal basis for the implementation of SEA and EIA in Serbia has been innovated several times since 2004, SEA and EIA methodology still remains vaguely defined. This has encouraged a more comprehensive research work on developing the specific and widely applicable methodology for carrying out SEA and EIA (Stojanović and Maričić, 2008; Stojanović and Spasić, 2006; Maksin Mićić *et al.*, 2009; Nenković Riznić *et al.,* 2010). A common feature of these methodologies is that they have been mainly based on the determination of a set of goals of SEA, i.e. they have primarily had an environmental character. ESIA has not been recognized in the legal basis and strategic documents in Serbia.

The major problem which appeared in the elaboration of spatial plans for tourism destinations and special-purpose areas in Serbia (nature parks, national parks, water basins, cultural heritage in the UNESCO World Heritage List etc.) was caused by the failure of SEA to provide precise quantitative and qualitative determination of cumulative and synergistic effects of planned activities, determination of reversibility, durability and continuity of impacts, and thereby their neutralization. Due to the mentioned problems, in 2006 IAUS (Institute of Architecture and Urban & Spatial Planning of Serbia) started to implement the adapted ESIA methodology (initially based on the work of Alonso *et al.,* 2002), an innovative, adjusted and improved research instrument which enabled the application of ESIA for the purposes of evaluating the effects of planned activities on territorial development of tourism destinations and special-purpose areas. The mentioned methodology (hereinafter referred to as "adapted ESIA methodology") has the basic systematization of impacts (type, duration, development, sources, reversibility, possibility of neutralization, durability, continuity, importance, and degree of necessary intervention). In addition, it has significantly improved the impact evaluation of tourism-related and other activities by introducing socio-economic dimension as equally important in the evaluation process.

However, ESIA methodology cannot be used as the one and only methodology in impact assessment either, considering that more detailed evaluation of the effects (particularly with regard to their territorial distribution and impact strength) is carried out by the initial SEA methodology. Table 1 presents a comparison of the two methodologies with their positive and negative characteristics. Comparative analysis is based on the results of more than 40 SEA and ESIA studies conducted in IAUS, and their positive and negative effects, advantages and disadvantages on planning, which were also used in this research.

Table 1. Comparison of ESIA and SEA methodologies in relation to the degree to which criteria are observed

Type of impact assessment Pos./Neg. Assessment of methodology according to criteria	**ESIA**	**SEA**
Diversified quantitative assessment	-	+
Assessment of simple, cumulative and synergistic effects	+	-
Evaluation of variant solutions	-	+
Assessment comprehensiveness (ecological, economic, social indicators)	+	-
Legal grounds	-	+
Degree of necessary intervention	+	-
Territorial distribution of impact	+	+
Possibility for neutralizing the impact	+	-

(Source: authors)

This table leads to the general conclusion that there is a strong necessity for combining these two methodologies, especially if we consider the importance of the evaluation of the effects of planned tourism-related activities on the protection of environmental quality, nature and cultural heritage, and sustainable territorial development.

RESULTS

Case Studies of Combined Complementary Methodologies for SEA and ESIA Application in Spatial Plans for Tourism Destinations

The role and the results obtained by the combined complementary methods for carrying out environmental impact assessment for tourism destinations will be discussed on the examples of spatial plans of special-purpose areas (SPSPA) for Đerdap National Park and Stara Planina Nature Park (IAUSa, 2011; IAUSb, 2011). These cases are taken into consideration because they are two of the most important primary tourism destinations in the territory of Serbia. Also, there are significant conflicts between protection and development in these areas, which makes them an interesting field of research.

An ESIA study was developed for the needs of elaborating the Spatial Plan for the Special-Purpose Area of Đerdap National Park – SPSPA Đerdap (IAUSa, 2011). Occupying the area of 637 km^2, Đerdap National park is included in the lists of Important Plant Areas, Important Bird Areas, Prime Butterfly Areas, Carpathian protected areas, as well as in the programme of the European Green Belt Project and in the

Tentative List of UNESCO World Heritage. It is also part of the Emerald Network of Areas of Special Conservation Interest in Serbia. Valuable immoveable cultural heritage of the National Park from prehistoric, Roman and medieval period is an important element of its cultural identity. Besides this, it is a primary tourism destination with all-year-round offer, and it is a section of the Danube international waterway E-80. At the same time, this is a peripheral rural area comprising 27 settlements. The key problems in achieving sustainable development of the National Park are as follows: underdeveloped presentation of natural and cultural heritage (now under development for two archaeological sites - Lepenski Vir archaeological site and Golubac medieval fortress), undeveloped tourism products and unattractive tourist offer, poor accessibility from Pan-European Corridors VII and X, pronounced depopulation and rural unemployment, low level of awareness of local population and entrepreneurs about the value of heritage for local economic development and non-engagement in its protection (e.g. uncontrolled deforestation by private owners), etc. Also, these are some of the reasons for tourism development not to be at its peak, achieved in the 1980s. Therefore, the positive effects of tourism on the socio-economic development of local communities are not sufficient, taking into account its potentials.

The protection regimes for the nature and immoveable cultural heritage prescribed for the National Park territory can have great comparative advantages in tourism (taking into account the potential attractiveness of the protected assets, on the one hand), while they directly influence the quality of life of people and socio-economic development of local communities with regard to limitations in carrying out and developing the activities, as well as limitations for the construction of facilities in the protected area, on the other hand. Therefore, it is necessary to precisely determine the cumulative and synergistic effects of certain planning solutions on the environment and local community, as well as the strength and territorial distribution of these effects, and to prescribe, after the detailed evaluation, the measures for reducing and eliminating the conflicts and their negative effects on the sustainable territorial development. Through the use of combined ESIA and SEA instruments, the effects of certain planning solutions have been specified according to the type of impact, impact time duration and development, impact source, impact reversibility and possibility of neutralizing the impact, as well as impact durability, continuity and importance, and the degree of necessary intervention. The prescribed goals of SEA/ESIA concern the effects of tourism-related and other activities on the air, water and land, waste evacuation, etc., and the effects on cultural heritage, biodiversity, geo-diversity and landscapes, population and human health, socio-economic development of local communities, development of local infrastructure and public services, as well as on strengthening the institutional competences in environmental protection and tourism development at the level of the National Park. The goals of the strategic environmental assessment have been expressed through indicators and elaborated in more detail through specific goals for each of the mentioned fields.

ESIA and SEA methodologies have enabled a more detailed classification of the environment in the territory of Đerdap National Park, according to the assessed effects of planning solutions on the protection and improvement of environmental quality (Figure 2) and socio-economic development. The planning solutions for tourism development proposed by the Master Plan for Lower Danube Tourism Destination (Ministry of economy, 2007) and implemented in SPSPA Đerdap have displayed several potentially negative effects on the environment, the quality of life and socio-economic development of local communities,

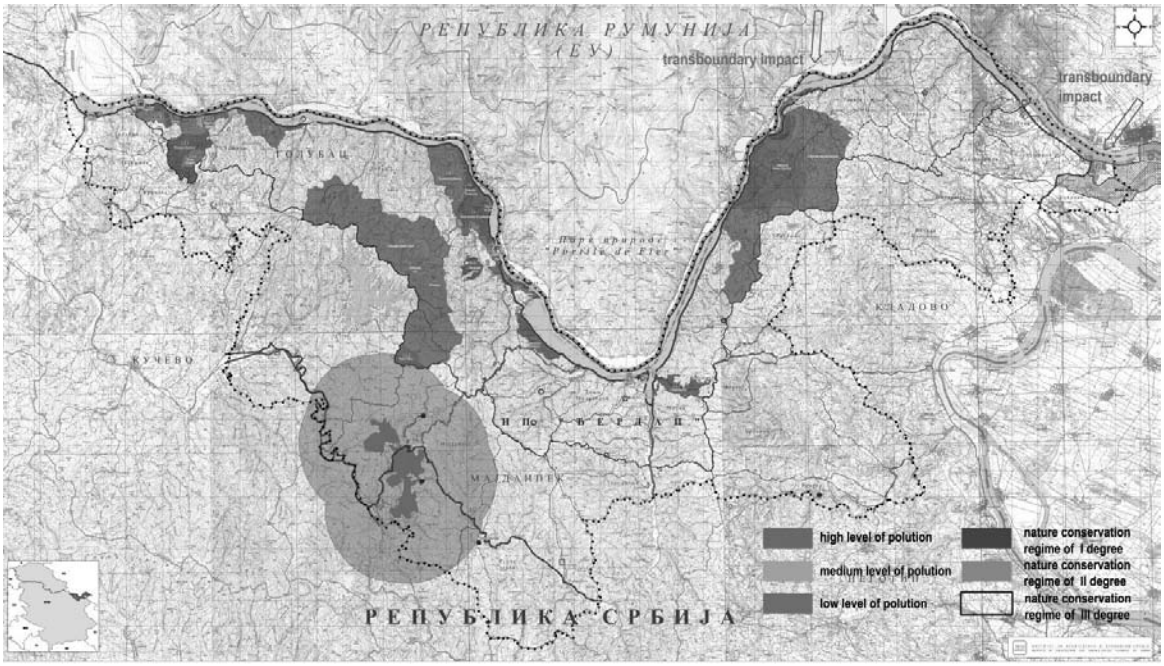

Figure 2. Classification of the environmental quality in the SPSPA Đerdap (Source: IAUSb, 2011)

which can be controlled by adopting the measures proposed by ESIA. The necessary public insight implied and enabled the participation of local community, while also facilitating easier acceptance of proposed measures.

ESIA was carried out (IAUS, 2009; ECOSIGN, 2007) for the purposes of the Spatial Plan for the Special-Purpose Area of the Stara Planina Nature Park (hereinafter: SPSPA Stara Planina). Occupying the area of 1,143 km^2 Stara Planina Nature Park has been designated as one of Important Plant Areas and Important Bird Areas site. It is also an area containing a great number of cultural monuments, as well as authentic old mountain villages, water sources of national and regional importance, etc. At the same time, this is a peripheral rural area comprising 78 small settlements. The key problems in achieving sustainable development of the Nature Park are as follows: undeveloped presentation of natural heritage, undeveloped tourism products, poor accessibility from Pan-European Corridors X and VII and at tourism destination, undeveloped communal infrastructure and services, depopulation process well underway with serious problems of poverty and ageing rural population, low level of awareness of local population and entrepreneurs about the heritage value and its protection, etc. Although it is regarded as the primary tourism destination with all-year-round offer in Serbia, tourism is still in the initial phase of development.

Based on ESIA, the tourism development has been evaluated for the zones with different protection regimes (Figure 3). Based on the results of the assessment, it is concluded that significant positive effects of implementation of the SPSPA Stara Planina will be particularly manifested in: the protection and improvement of the natural environment; conservation, presentation and adequate use of natural and cultural heritage; overall economic effects and uniform growth in local employment (in the field of tourism, agriculture and other complementary activities); protection and improvement of health of local population; uniform development of infrastructure and improvement in the quality and accessibility of public and tourism infrastructure and public services; creation of conditions in which tourism and recreation will be accessible to all tourists, etc. It is concluded that, with the concept of a dispersive development and construction which has been implemented in most parts of the area covered by the SPSPA Stara Planina (in about 88% of the area), none of the planning solutions will generate significant long-lasting unfavourable effects on the environment that cannot be kept under control. However, in addition to the SPSPA Stara planina, the Master Plan of the Jabučko Ravnište-Leskovac Tourist Resort (Master Plan) (ECOSIGN, 2007) has also been elaborated, without harmonizing the development of this resort with the development vision and concept of Stara Planina primary tourism destination. This Master Plan has doubled the accommodation capacity in the mountain zone compared to the capacity envisaged by the SPSPA Stara Planina. ESIA indicated that the concept of high construction concentration, which was implemented in the Jabučko Ravnište-Leskovac Tourist Resort with long-lasting adverse effects on the nature and environment, particularly with regard to water supply, wastewater disposal, access and internal traffic, solid municipal waste elimination, electric power supply and accommodation of the employed, the quality of life of local residents (due to the uneven distribution of workplaces, planned dominant participation of the employed from further surroundings, etc.), was implemented only in the smaller part of the area covered by the SPSPA Stara planina (in about 12% of the area). The mentioned concept is much more difficult to control than the concept of dispersive development, which is more

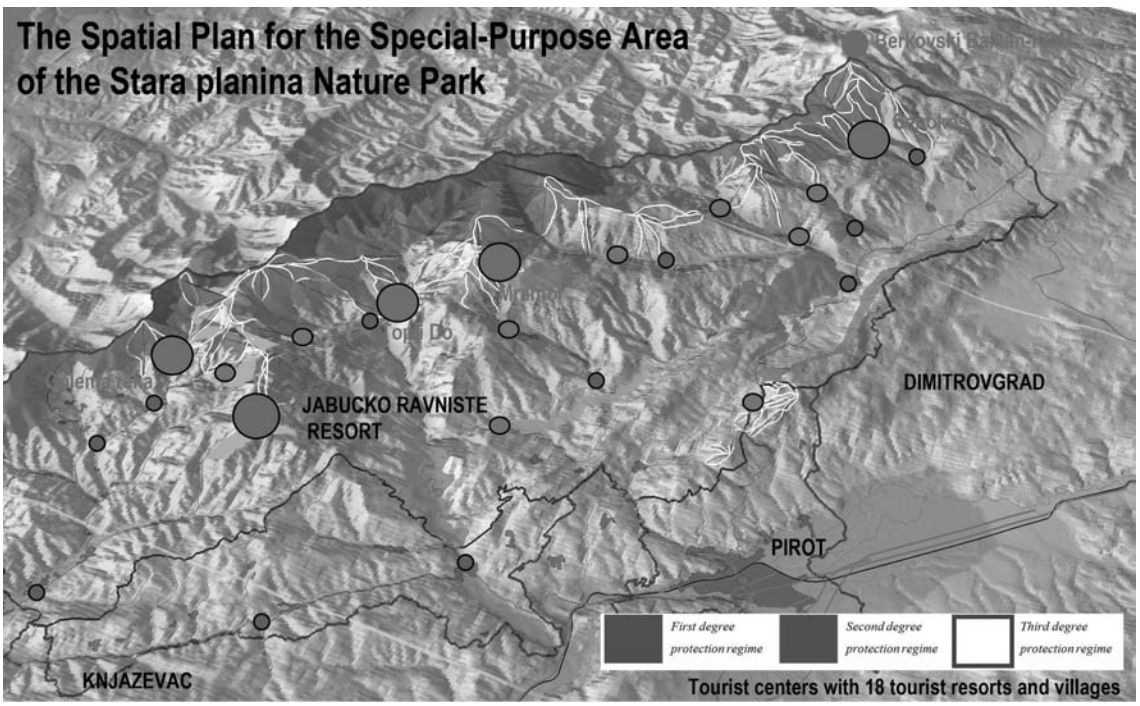

Figure 3. Classification of environmental quality in the SPSPA Stara planina (Source: IAUS, 2009)

suitable for the protected area of Stara Planina Nature Park) (Maksin, 2012). ESIA has provided recommendations for the reduction of accommodation capacities of Jabučko Ravnište Tourist Resort to the level which would not endanger the environment. It has also defined measures for diminishing or neutralizing the negative effects of planning solutions on the socio-economic development of local communities and on the quality of life of local residents.

By introducing ESIA instruments into solving the planning conflicts between the integral spatial plan and economy-oriented tourism sector plan, certain tradeoffs were made, owing to which the sustainable territorial development of tourism in the most vulnerable area of the Nature Park has been retained. By doing so, the main purpose of ESIA application has been accomplished.

DISCUSSION OF RESULTS

The results of the previous studies elaborated for the needs of two primary tourism destinations in different phases of development – Đerdap National Park and Stara Planina Nature Park, indicate that the use of combined ESIA and SEA methodology has directly influenced a more comprehensive consideration of problems in developing tourism-related activities in ecologically vulnerable areas. While standard SEA and EIA solely focus on determining the effects of planning solutions on the environmental quality, these case studies also indicate the necessity of determining the effects of tourism-related and complementary activities on the socio-economic development of local communities, the quality of life of people and protection of natural and cultural heritage. They provide a relatively comprehensive evaluation of the effects on all dimensions of sustainable tourism development, and suggest a corrective modification of the planned tourism, all for the purposes of achieving sustainable territorial development of tourism destinations and its surroundings. Indicators defined for the needs of ESIA application have been significantly extended compared to the standard goals and indicators prescribed for the application of SEA and EIA. Namely, they primarily refer to the incorporation of the effects of planning solutions on population and human health, the quality of life of local residents and socio-economic development of local communities, natural and cultural heritage, but also on the possibility of strengthening the institutional competence of local administration in the field of environmental protection and sustainable development of local communities.

Through combining these two methodologies, the planning solutions with significant negative effects on the environment and the quality of life have been eliminated. Furthermore, this also allowed the simultaneous evaluation of the different type of effects which have not been independently considered in the structure of the planning solutions, but evaluated synergically.

Through the analysis of the area and activities using these two methods, the planning solutions whose realization would not cause significant conflicts in space have been clearly defined. In cases when conflicts were inevitable, ESIA has defined measures aimed at diminishing these conflicts. Therefore, it is possible to comprehensively consider heterogeneous space of tourism destinations through establishing the system of measures for improving the quality of life and sustainability of tourism development as an integral part of sustainable territorial development of the area and local communities.

Through a combined use of complementary ESIA and SEA methodologies, an indirect control of sustainability of the planning solutions offered by the master plans for tourism destination/resort has been achieved, as well as an indirect coordination with spatial planning.

Although SEA is not applied to master plans in tourism sector for the time being, its application in spatial plans can contribute to achieving a certain balance between the sectoral and holistic approach to development and protection, with a view to achieving sustainable territorial development of tourism destinations.

CONCLUSIONS

The coordination and integration of strategic planning is one of the priorities for achieving sustainable territorial development (Dalal-Clayton and Sadler, 2005), primarily with regard to spatial planning, environmental planning and tourism planning. SEA/ESIA is an important control instrument for the support to coordination and integration of strategic planning with a view to achieving sustainable territorial development. Although ESIA is not legally grounded in any EU directive, its application can contribute to better consideration of the specific problems of sustainable territorial development and provide a support to planning options and solutions that will solve them in an ecologically and socially justifiable way.

The integration of ESIA in spatial and urban planning provides an adequate basis for the evaluation of different variants of planning solutions for developing and spatially organizing the tourism-related and other activities which have direct effects not only on the environmental quality, but also on the quality of life and overall economic development.

A precondition for SEA and ESIA to have a controlling and coordinating role is to initiate their application in tourism planning, using as the starting basis experiences related to SEA and ESIA implementation and integration into the spatial planning process, as well as to enable their adequate integration into the strategic planning process – from preparation to implementation, monitoring and auditing of planning documentation.

However, in spite of all abovementioned issues and obvious advantages of ESIA methodology application (or evaluation of environmental and social consequences of tourist activities), the question remains whether there is sufficient institutional capacity to implement their recommendations for minimizing and monitoring effects on sustainable territorial development of tourism destinations and protected areas, given the problems of depopulation, unemployment and underdevelopment which are evident in the protected areas. The same question refers to the whole territory of Serbia.

The introduction of the ESIA methods will, in perspective, certainly have to be followed by the adoption of this multicriteria analysis in the Serbian legislature, and

consequently, by the proper implementation of the ESIA objectives in the planning of the tourism destinations (regardless the social trends in Serbia).

Acknowledgement

This work has resulted from research within the scientific project No TR36036 "Sustainable development of the Danube area in Serbia", and No III 47014 "The role and implementation of the National spatial plan and regional development in the renewal of strategic research, thinking and governance in Serbia", financed by the Serbian Ministry of Education, Science and Technological Development of the Republic of Serbia.

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Received August 2015; accepted in revised form November 2015.

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SPATIUM
No. 34, December 2015, pp. 64-69

UDC 556.166(282.243.744)
Review paper
DOI: 10.2298/SPAT1534064P

SPATIOTEMPORAL REVIEW OF THE TORRENTIAL FLOOD PHENOMENON IN THE MORAVA RIVER BASIN

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Phenomenon of torrential floods as the most destructive and the most frequent natural hazards in Serbia with serious socioeconomic, cultural and environmental consequences deserve special attention. In this paper, data collection strategy and data analysis with the aim of spatiotemporal characterization of the torrential flood phenomenon in the largest national, Morava river basin, are presented. A dataset (derived from the Inventory of torrential floods in Serbia) of 479 registered torrential flood events with over 84 casualties for the period 1926-2013 is presented. Monthly distribution of registered torrential floods indicates that the majority of events with the highest share of death toll occurred in the late spring, from May to the end of June. According to the annual distribution there is a linear increase of torrential flood occurrence in the course of 88 years, but decrease of death toll is found. The greatest number of torrential flood events and casualties is registered in the Južna Morava river basin (watersheds of Nišava, Toplica, Veternica, Jablanica). The results of this work can be of great value in the implementation of the Flood Directive of the European Commission on a river basin level as well as for the future natural hazards information system in Serbia.

***Key words*: torrential floods, spatiotemporal distribution, Zapadna Morava, Južna Morava, Velika Morava.**

INTRODUCTION

The frequency and magnitude of the torrential flood phenomenon have made many countries in the world suffer the large human and economic losses in the recent period (Hershy, 2005; Münchener Rückversicherungs-Gesellschaft, 2009; Marchi *et al.,* 2010; Gourley *et al.* 2010, Shao *et al.,* 2014; Wang *et al.*, 2015; Abbas *et al*., 2015). Torrential floods are the frequently reccuring water-related natural hazard in Serbia that deserves a special attention (Ristić *et al.*, 2011a; Dragićević *et al.,* 2011; Dragićević *et al*., 2013; Kostadinov *et al.*, 2014). This kind of natural hazard is related to the hilly-mountainous regions in Serbia, on the territory south of the Sava River and the Danube River, endangered by intensive soil erosion processes, having as a consequence specific hydrological and sediment transport regime in the torrential riverbeds (Petrović, 2014). Torrential flood wave occurs after a short-duration heavy rainfall as a sudden appearance of maximal discharge with a high concentration of erosion sediment lasting from one to several hours (Ristić *et al.*, 2012; Garambois *et al.*, 2014). Torrential flood wave discharge can be larger than 1000 times than mean discharge having destructive energy. However, these extremes are mostly ungauged despite the need of special kind of surveying (Borga *et al.*, 2008).

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Torrent network at the territory of Serbia numbers more than 12000 torrents (Kostadinov *et al.*, 2006), mostly situated in the Južna Morava, Zapadna Morava and Velika Morava river basins due to relief dissection as well as extent of area. The most striking torrential flood in the course of the 80ies occurred in Lještarska dolina (Južna Morava, July 1982), Sejanička (Južna Morava, July 1983), Lugomir (Velika Morava, February 1986) and Vlasina (Južna Morava, June 1988) watersheds. Recent large-scale torrential flood events in studied river basins happened in watersheds of Lugomir, Gruža, Jasenica and Lepenica in July 1999 (Velika Morava, eight fatalities), Resava in June 2002 (Južna Morava, one death), Vlasina in November 2007 (Južna Morava). Although the extreme flood events in April and May 2014 occurred mainly in north-western part of Serbia, flood events in Jagodina, Požega and Lučani in the Morava river basin left noticed material damages.

However, a small number of historical torrential flood events in Serbia were analysed, mostly they are poorly documented and mainly described with some photos and rare measured data. Although population and local economy is highly affected by torrential floods in the Morava river basin, there was no centralized and consistent collection of data on torrential floods. Databases on natural hazards in several developed countries which contribute to better understanding of torrential floods as extreme hydrological

hazards, records this phenomenon for the past several centuries (Swiss database on natural hazards numbers over 20,000 events; Austrian database on natural hazards numbers about 28,000 events, of which torrent events share is over 20000; the first record is situated in the 6th century) (Petrović *et al.*, 2014). The purpose of this work is to present a phenomenon of torrential floods in the Morava river basin through spatiotemporal characterization of historical torrential flood events in order to give contribution to the improvement of the torrential flood policy which should be in accordance with the European Union Flood Directive.

METHODOLOGY

Study area

The research focus is on the greatest "national" river basin in Serbia (Figure 1), which is mostly hilly-mountainous area, with the confluence to the Danube River. It covers 41.5 % of the Serbian territory and homes of 53% of population are situated within. According to the Water Management Plan of the Republic of Serbia (2001), 38,890 ha in the Južna Morava river basin (A=15,465 km^2), 19,110 ha in the Zapadna Morava river basin (A=14,653 km^2) and 26,400 ha in the Velika Morava river basin (A=6,810 km^2) are potentially flooded area of a return period of 100 years. Beside meteorological extremes, geological and soil properties unfavourable for water infiltration, deforestation, land use changes and topography are the direct factors of torrential regimes of water discharges, i.e. disbalanced ratio between high and low waters in watersheds of torrential tributaries in the Morava river basin.

Figure 1. Study area – Morava river basin

Materials and methods

The dataset of torrential flood events in the Velika Morava river basin is derived from newspaper articles gathered for the period from 1926 to 1970 in the book by Gavrilović (1975), archival documentation of the newspaper "Politics" for the period from 1970 to 2013 and data from papers and studies with detailed analysis of past events. Absence of data and reports on torrential events in archives of public organizations on the state and local level mainly impeded them to contribute to this dataset. Method for building the dataset consists of five important steps: (1) defining spatial and time framework and needed parameters, after the insights into data availability, (2) data collection, (3) organizing data, (4) data analysis, (5) data publishing, distribution and use (Petrović *et al.*, 2015). Collection of minimum data (as shown in an example of river Koritnička, Table 1) facilitated analysis of spatial and temporal distribution of torrential flood events in the Morava river basin. The research question of data analysis consists in examining the trend changes of frequency of torrential flood occurrence as well as in exploring the most frequent localities with material damages and casualties.

Table 1. An example of minimum data for registering torrential flood event

Torrent	•Koritnička river (Južna Morava)
Date of event	•27/10/1939
Affected locations and settlements	•Bela Palanka
Number of casualties	•17
Damage description	•20 houses were razed to the ground, 142 tended to decline, while 264 severely damaged, over 500 head of cattle disappeared in the torrents.
Event description	•After heavy rainstorm in the evening, ferocious torrent from the Suva Mountain made a local calamity. Disaster lasted 2 hours.
Source of informaton	•"Politika"

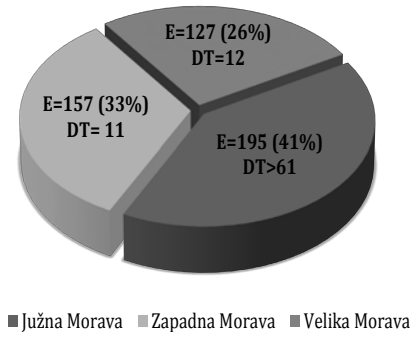
Rare torrential flood events were recorded with full meteorological (rainfall quantity and duration), hydrological (discharge and water level) and sediment transport data. Mainly they are modestly documented. For example, in the case of information about an affected location, but not the torrent, for identification of micro-torrential catchment as a subject of flood event, geo-referenced topographic maps in scale 1:25,000 (printed by Military Geographic Institute, 1980) for the whole area of the Morava river basin were used. Therefore, affected locations are given geographic coordinates in this database becoming geospatial data on natural hazards.

RESULTS

One of the oldest records of torrential flood events in studied river basin dates from the sixteenth century and refers to the flood of the Raška river (Zapadna Morava river basin) on 18th May in 1518 (Šakota, 1989). Some flood descriptions were found in monastery chronicles dating from XVIII and XIX century representing introductory historical information of this dataset. Dataset consists of data on the torrential floods during XX century up to date. The first data in the previous century we avail is the torrential flood of the Skrapež in May 1926. The following 20 torrential flood events were located in "torrential" 1929 in May, June and August.

Dataset on torrential floods in the Morava river basin records 479 events with over 84 casualties for the period 1926-2013. The largest number of torrential flood events and casualties took place in the Južna Morava river basin (Figure 2) which

is a result of an inadequate soil management, extreme forest exploitation and destruction and intensive soil erosion processes (i.e. inadequate watershed management) having as a consequence severe economical damages in agriculture and traffic (for example, many times in history damaged international routes Belgrade - Atina and - Sofia). The greatest number of torrential floods in sub-basins is registered in watersheds of the Ibar (Z. Morava), the Nišava (J. Morava), the Jasenica (V. Morava) and the Veternica (J. Morava). Spatial distribution of the most destructive torrential flood events in terms of material damages and death tolls in the Morava river basin is given in Figure 3. According to distribution of locations, it can be concluded that material damages in the Južna and Zapadna Morava river basins are the greatest at the confluence of the torrents to greater rivers.



Watershed	E	DT
Ibar	49	10
Đetinja	16	-
Lepenica	21	4
Nišava	43	-
Veternica	26	-
Jablanica	17	3
Toplica	19	-
Lepenica	21	4
Jasenica	27	3

Figure 2. Number of torrential flood events (E) and death toll (DT) per river basin and selected watersheds

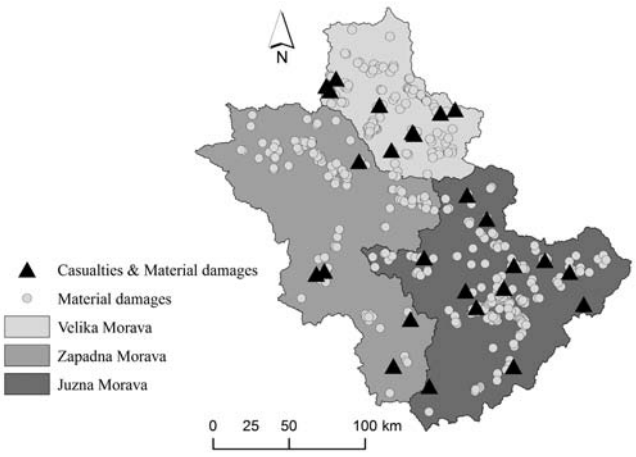


Figure 3. Locations with the most destructive torrential flood events recorded in the Morava river basin in the period 1926-2013

Hydrological statistical analysis according to the most fitted theoretical probability function is given in this work for some examples of extreme torrential flood events of selected watersheds in the Morava river basin (Table 2) which are naturally characterized by extreme discharges with high return period (T) and low probability of occurrence (P). The randomness of time series of maximum annual discharges is tested by methods of Newman and Wald-Wolfowitz. The homogeneity of average values is tested by Student test, dispersion homogeneity by Fisher test and distribution function by Wilcoxon test. Theoretical probability distribution functions: Normal, Log-Normal, Gumbel, Pearson III and Log-Pearson III are calculated. Kolmogorov-Smirnov and Kramer-Mizes tests are applied for concordance between empirical and theoretical distribution which decided on the most competent theoretical probability distribution.

Distribution of registered events within a year (Figure 4) indicates that the majority of floods occurred in June (E=159 or 33.2%) and May (96 or 20%), followed by July (57 or 11.9%), February (40 or 8.4%) and March (33 or 6.9%). Therefore, two peaks can be distinguished: the primary peak of torrential flood occurrence in warmer part of the year (June and May) and the secondary peak in the colder part of the year (February and March). Monthly distribution of registered torrential floods greatly corresponds to peaks of the rainfall regime in hilly-mountainous regions in Serbia as well as to the earlier domestic findings of research in the area of frequency of maximal discharges in torrential watersheds. Ristić *et al.* (2009) defined two critical periods of occurrence of the maximal discharges south of the Sava and the Danube - primary at the end of spring (May & first half of June) and secondary at the end of winter (February & first half of March). This result also corresponds to the findings of monthly distribution of recorded events at the level of the Inventory of torrential flood events in Serbia (Petrović *et al.*, 2014).

According to annual distribution (Figure 5) for an observed period of 88 years there is a trend of linear increase of number of torrential flood events. The peak years distinguished on the basis of number of events are 1969 (E=37), 2005 (34), 1992 (32) and 1975 (32). The annual mean of registered torrential flood events for the observed period is 5.4.

The changes in the frequency of torrential flood events is noticed in their distribution per periods: 1931-1960 and 1961-1990, which are recommended by the Republic Hydromethorological Service of Serbia to analyze the precipitation and air temperature trend changes, and

Table 2. The frequency of occurrence of maximal discharges of extreme torrential floods

Watershed: Profile	River basin	Year	Q_{max} (m^3/s)	Function	P (%)	T (yr)
Vlasina: Vlasotince	J. Morava	26.06.1988	780	Log-Pearson III	0.89	113
Visočica: V. Ržana		20.04.2000	202	Pearson III	0.79	126
Gruža: Guberevac	Z. Morava	12.07.1999	43	Pearson III	1.82	55
G. Moravica: Ivanjica		13.05.1965	362	Log-Pearson III	0.92	109
Crnica: Paraćin	V. Morava	11.06.2002	242	Log-Normal	0.51	195
Lepenica: Batočina		10.07.1999	193	Log-Pearson III	0.54	184

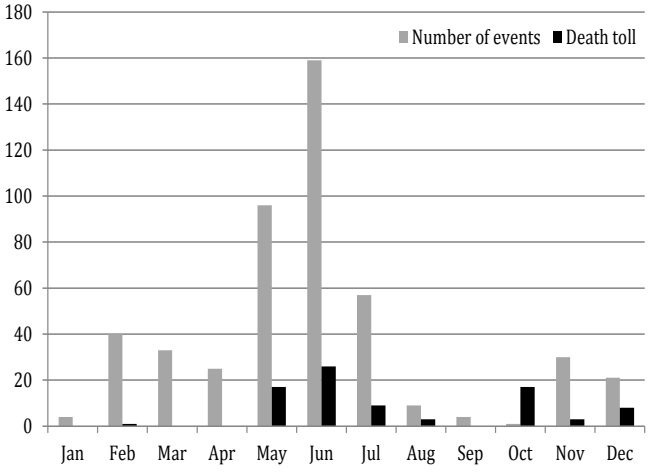


Figure 4. Monthly distribution of registered events and fatalities

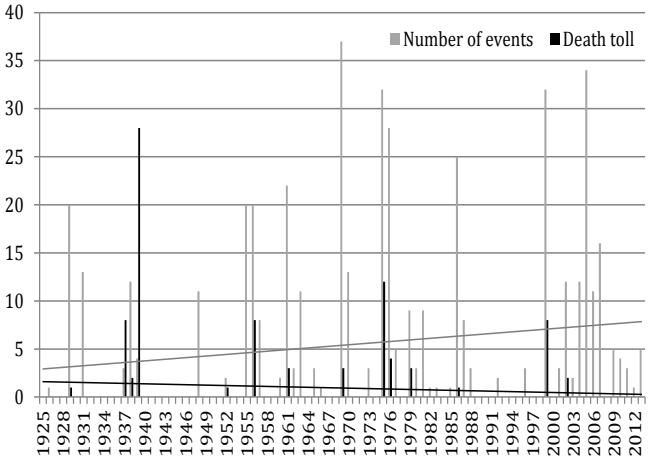


Figure 5. Annual distribution of registered events and casualties in the observed period with trend lines

remaining, the first period from 1915 to 1930 and the last period from 1990 to 2013. The increase of torrential flood frequency in the last two periods (averages of number torrential flood events per year for periods 1961-1990 and 1991-2013 are 7.3 and 6.3 respectively, in comparison with averages for the first period a=1.3 and the second one a=3.2) goes in line with the data from the literature about high increase in average annual hydrological natural hazards in the world per decade (Abbott, 2008; Munich Re, 2009; Ristić *et al.*, 2011; Llaset *et al.* 2014; Petrović *et al.*, 2014; Modrick *et al.*, 2015; Petrović, 2015a). Although there is a linear decrease of death toll per period (average for II period is 1.5 deaths, IIIa=0.9, IVa=0.7), there is still a need for risk education of affected local population. Flash floods with a high mortality rate account more than 5000 deaths annually on a global basis (Jonkman, 2005). Considering the number of fatalities and people affected, the torrential floods are top natural hazards in Serbia so that the following data should draw attention to the improvement in prevention and response of the torrential flood risk management cycle (Petrović, 2015b). In terms of death toll, the peak years are 1939 (28 deaths), 1975 (12), 1937 (eight), 1956 (eight) and 1999 (eight) and peak months are June (26 deaths), May (17) and October (17). Top torrential flood events in terms of fatalities took place in Koritnička river - October 1939 (17 deaths), Korbevačka river - May 1975 (12), Selska river - June 1939 (11).

In the Morava river basin, torrential flood events occurred in a wide range of intensity in sense of consequences and material damages which are inseparable part of the torrential flood phenomenon. Therefore, the idea is to show different stages of torrential flood event intensity (Table 3) according to the suggested categorization of the intensity of torrential flood events (Petrović *et al.*, 2014). The highest number of recorded historical events belongs to excessive (34%), high (23%) and very high intensity (21%), confirming the fact about catastrophic consequences of torrential flood on the local level.

Table 3. Categorization of torrential flood events in the Morava river basin

Category of flood event	Flooded area	E
I (excessive intensity)	>500 ha/>100 housing units	165
II (very high intensity)	101-500 ha/51-100 housing units	101
III (high intensity)	51-100 ha/21-50 housing units	110
IV (medium intensity)	21-50 ha/6-20 housing units	59
V (low intensity)	<20 ha/1-5 housing units	44

However, even when the ability to forecast events and warn population at risk in modern flood risk management systems increases, an increase in flash flood impact in the recent years is also noticed, which is a result of combination of a higher frequency of the extreme events and a higher exposure of the vulnerable population (Calliano *et al.*, 2013). Due to expected future changes in climate conditions, the adverse impacts of flash floods could unfortunately further increase (Ballesteros-Canovas *et al.*, 2015).

CONCLUSIONS

According to the analysis of dataset of torrential flood events in the Morava river basin, there are four main conclusions: 1) The greatest number of torrential flood events and casualties are registered in the Južna Morava river basin and belonging sub-basins of Nišava, Veternica, Toplica, Jablanica. 2) The primary maximum refers to summer months, June and May and the secondary maximum refers to winter months, February and March (which is triggered not only by strong showers but also coincidence of rain showers with sudden snow melting), according to intra-annual frequency analysis. 3) The highest death toll of registered torrential flood events follows the primary maximum of their occurrence, i.e. summer months June, May and July. 4) In terms of the extent of material damages, the excessive intensity or I category of torrential flood events is the most common.

Therefore, well-structured and systematic dataset of historical torrential flood events for each river basin enabling data analysis and leading to valuable findings can be of great importance for decision making in the torrential flood risk management and integrated river basin management. Although there was no centralized documentation of torrential flood phenomenon on the national level in previous period, this gap should be overcome in decades to come.

Acknowledgement

This work is supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia under Grant 47007 III.

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Received August 2015; accepted in revised form December 2015.

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71/72

SPATIUM : urban and spatial planning, architecture, housing, building, geodesia, environment / editor in chief Miodrag Vujošević. - 1997, no. 1 (sept.)- . - Belgrade : Institute of Architecture and Urban & Spatial Planning of Serbia, 1997- . - 29 cm

Polugodišnje

ISSN 1450-569X = Spatium (Belgrade)

COBISS.SR-ID 150289159

Institute of Architecture and Urban & Spatial Planning of Serbia
11000 Belgrade, Bulevar kralja Aleksandra 73/II * E-mail:journal.spatium@gmail.com

ISSN 1450-569X * spatium 34/2015 * International Review
ISSN 2217-8066 (Online)