

STADT- UND REGIONALENTWICKLUNG

URBAN AND REGIONAL DEVELOPMENT

TRANSFORMING METROPOLITAN REGIONS – EVIDENCE FROM BELGRADE

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*Initial submission / erste Einreichung: 06/2019; revised submission / revidierte Fassung: 06/2020;
final acceptance / endgültige Annahme: 09/2020*

with 6 figures and 8 tables in the text

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Summary

The paper seeks to identify and assess the polarising, indirect and direct favourable influence of Belgrade, as the capital and the largest city in Serbia, in the development of settlements and centres within its administrative area, i.e. the territory administratively named the City of Belgrade. The paper includes an analysis of demographic trends, including commuting trends, and the functional and morphological changes in the settlements of the Belgrade region between 1971 and 2011. Various analytical and synthetic

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methods have been used to assess the investigated territory's degree of transformation, including both positive effects and the negative consequences of the impact of various factors.

Suburban areas are not clearly delimited. Belgrade's urban area is not marked by social segregation. The initial hypothesis that the Belgrade region underwent a complex and multifaceted transformation has been confirmed, which will significantly determine future planning solutions, especially as regards the identified causes of the transformation, the factors of which have not been significantly changed in the transition, post-socialist period. The appropriateness of development planning measures and governing policies in this area is of crucial importance for the country as a whole.

Keywords: Transformation processes, favourable impact, environment, demographic trends, settlement changes, planning measures, governing policies, metropolitan region, Belgrade

Zusammenfassung

TRANSFORMATIONSPROZESSE IN METROPOLREGIONEN – DAS BEISPIEL BELGRAD

In diesem Beitrag wird versucht, die gegensätzlichen direkten und indirekten positiven Einflussfaktoren auf die Siedlungsentwicklung und die Entwicklung von Zentren in Belgrad, der Hauptstadt und größten Stadt Serbiens, innerhalb ihres Verwaltungsgebiets, das ist das Territorium bzw. die Region, die administrativ als „City of Belgrade“ bezeichnet wird, zu analysieren und zu bewerten. Ausgehend von einer Analyse der demografischen Entwicklungstrends einschließlich der Veränderungen der Pendlerbewegung und der funktionalen und physiognomischen Veränderungen in der Siedlungsstruktur zwischen 1971 und 2011 werden verschiedene analytische und synthetische Methoden verwendet, um das untersuchte Ausmaß des Transformationsgrades zu beurteilen, wobei sowohl positive Effekte als auch negative Konsequenzen der verschiedenen Einflussfaktoren analysiert werden.

Die suburbanen Gebiete der Region Belgrad können nicht klar angegrenzt werden, auch ist das Stadtgebiet von Belgrad nicht durch soziale Segregation gekennzeichnet. Die Ausgangshypothese, dass die Region einen komplexen und vielfältigen Transformationsprozess durchlaufen hat, wurde in der vorliegenden Studie bestätigt. Diese Transformation bedingt signifikante Auswirkungen auf künftige stadtplanerische Entscheidungen und Lösungen, vor allem in Bezug auf Ursachen der Transformation und Faktoren, die in der post-sozialistischen Transformationsperiode keine wesentliche Veränderung erfuhren. Die Angemessenheit und Richtigkeit von Planungsmaßnahmen und von Strategien der politischen Entscheidungsträger zur künftigen Entwicklung der Hauptstadtregion „City of Belgrade“ ist von entscheidender Bedeutung für Serbien als Ganzes.

Schlagwörter: Transformationsprozesse, günstige Einflussfaktoren, Umwelt, demografische Entwicklung, Siedlungswandel, Planungsmaßnahmen, politische Steuerung, Metropolregion, Großstadtregion, Belgrad

1 Introduction

Areas bearing regional features cover larger territories and have a complex internal structure in terms of function and development. This also applies to Belgrade, i.e. its territorially defined metropolitan area, which is a specifically developed regional entity within Serbia. The official administrative name – the “City of Belgrade” refers to the administrative area of Belgrade, which includes 17 municipalities and extends across 3,222 km², accounting for 3.6 percent of the total area of the Republic of Serbia; its population of 1,659,440 inhabitants accounts for 23.09 percent of the total population of Serbia (Central Serbia and the Autonomous Province of Vojvodina). According to the last population census (2011), Belgrade had 1,166,763 inhabitants.

The status of Belgrade as an independent settlement or the centre of the administrative area (i.e. the City of Belgrade) is clear because it is territorially defined (Figure 1). However, the ambiguity arises in relation to the metropolitan area of Belgrade, because this area has not been defined either in theory or in practice, regardless of the generally accepted assumption that the model of Belgrade’s metropolitan area implies a central position of the metropolis in its gravitational area. Therefore, for the purpose of this paper, Belgrade’s administrative area will be understood to cover the region of Belgrade (the City of Belgrade). To the north, this area encompasses parts of the Banat and Srem regions, which belong to the territory of the province of Vojvodina; to the south, it includes a part of Šumadija, a geographic area in the territory of Central Serbia.

In Serbia, the Belgrade region is by far the most developed area, the hub and the driver of development and prosperity, but also the most sensitive developing area (the ratio of the GDP per capita in Belgrade and the poorest region of Serbia is 5:1 (JAKOPIN 2018); however, among the 271 NUTS 2 EU regions, the region of Belgrade occupies the 231st place (MERR 2012). Therefore, special attention must be paid to the planning of its future development.

The internal socio-economic structure of this area has changed mainly under the influence of growth and development. This process has not been linear, but rather fluctuating, i.e. cyclic, as it has been accompanied with numerous hindering circumstances. A massive demographic influx, the constant growth of the economy and the creation of new production capacities after World War II led to population and labour concentration and the agglomeration of productive and non-productive and social activities in Belgrade’s urban core and its surroundings. This has had a cumulative influence on infrastructure development, accessibility improvement, the modernisation of communal facilities, leading to an increased competitiveness compared to other regions in Serbia (MITROVIĆ 2016). On the other hand, the pace of intensive demographic and functional changes has been considerably faster than that of morphological changes, primarily as regards rational land use and environment protection, which were not compliant with the principles of sustainable development.

The research period of 40 years covers several development phases in the Belgrade region. These include the end of the polarisation phase in the development of the Belgrade’s urban core, marked by attracting labour force and common population from the surrounding areas, i.e. in-migration. Furthermore, the indirect favourable influence of the city has been assessed based on the emergence and intensification of commuting from the surrounding

settlements, accompanied with deagrarianisation and functional changes in these settlements. Finally, the direct favourable influence of Belgrade's urban core has been explained. This kind of influence is typical of large cities and it manifests itself through the establishment of minor poles of development in the urban surroundings, as centres of services and employment.

Keeping in mind the specific features of the Belgrade region and its role and importance in the regional development of Serbia, special attention must be paid to the planning of the region's future development. As a spatial category developing in accordance with the socio-economic conditions in individual countries, the metropolitan region is a convenient instrument for spatial analysis. In the context of urban geography and its application in various forms of social practice, and primarily spatial planning, the study of the transformation of metropolitan regions, and above all metropolitan zones in capital cities, emerges as an imperative, as a prerequisite in the process of defining adequate planning solutions and designing development policies, both on the regional and national levels.

The aim of the paper is to examine the forms and intensity of the transformation of the Belgrade region, i.e. to determine the factors that had key influence on development in the studied area and identify the consequences of their action. This should create the basis for anticipating future developmental trends and help define optimal planning solutions for the future.

2 Previous research

Metropolisation, as a form of urbanisation or a stage in urban development, emerged in the late 19th century and the process has continued to this day. It was intensified in Europe during the 1960s. The spatial evidence of metropolisation is the development of metropolitan regions (D. Tošić 2019). They appear in various forms in some parts of the world. City outskirts are marked by an intensified population redistribution and socio-economic restructuring, as well as settlement transformation. Therefore, this form of region consists of a city of a certain demographic size and a major functional importance and the environment transformed under its influence (a field of urban influence).

The examination and evaluation of the recent course of metropolitan development is subject of many articles covering these issues in America (SOJA 2002; PUTH and BURNS 2009; THIERS et al. 2018), Europe (BERRY 1973; VAN DER HAEGEN 1982; HALL 1980; CHAMPION 2000; PACIONE 2005; LE GOIX et al. 2019), East-Central Europe (BRUNET 1989; CATTAN et al. 1994; TREUNER and FOUCHER 1994; KORCELLI and KORCELLI-OLEJNICZAK 2015; KORCELLI-OLEJNICZAK 2015) and other regions.

In socialist countries, urbanisation was more intensive than in market economy countries (SLAEV et al. 2018). After 1990, the transition from highly centralised socialist economies to democratic market-oriented societies proved to be particularly severe in the countries of Southeast and East Europe, including Serbia (ZEKOVIĆ et al. 2015).

Urban growth in capital cities and their regions in Eastern and Central Europe was the dominant factor in the development of the metropolis during the communist period. According to many authors (LEETMAA et al. 2009; KRISJANE and BERZINS 2011; SZIRMAI

2011; SÝKORA and STANILOV 2014), suburbanisation is certainly the process that has dominated urban development in post-socialist metropolitan areas since the mid-1990s. Recent studies highlight that post-socialist suburbanisation is marked by various spatial aspects with controversial ecological, economic and social consequences (STANILOV and SÝKORA 2012; SÝKORA and STANILOV 2014).

Belgrade's periphery shows the characteristics of both built urban forms and illegal construction. During the transition period, after the 1990s, the built environment of Belgrade's periphery was inherited from the socialist period. The collective housing sector accounted for 73 percent of the total housing inventory (GRUBOVIĆ 2006). With the new century, the state monopoly was replaced with market mechanisms and private initiatives (NEDOVIĆ-BUDIĆ and CAVRIĆ 2006; NEDOVIĆ-BUDIĆ et al. 2012; SLAEV 2016, 2017; SLAEV and KOVACHEV 2014; ZEKOVIĆ et al. 2015).

The rough outlines of emergent metropolitan regions around major urban centres in the territory of Yugoslavia emerged in the 1970s (Belgrade, Zagreb, Ljubljana, and partly Sarajevo and Skopje). The following authors have provided significant contributions to the study of regional forms of urbanisation: Igor VRIŠER (1974), Dolfe VOGELNIK (1961), Vladimir ĐURIĆ (1970), Jovan ILIĆ (1970), Branislav BUKOROV (1980), Olga SAVIĆ (1955), Aleksandar VELJKOVIĆ et al. (1995), Dimitrije PERISIĆ (1985), Milan VRESK (2002), and more recently Branka Tošić and Zora ŽIVANOVIĆ (2018), Aleksandar SLAEV et al. (2018) and Dragutin Tošić (2019).

Studies dealing with Belgrade's metropolitan area may be found in some spatial planning documents, primarily the Belgrade RPPAP (Regional Spatial Plan of the Administrative Territory of the City of Belgrade), in monographs (ŽIVANOVIĆ 2008; NEVENIĆ 2009; KREVCs et al. 2010), and in some research articles (ŽIVANOVIĆ and B. Tošić 2016; ŽIVANOVIĆ and GATARIĆ 2013).

3 Methodology

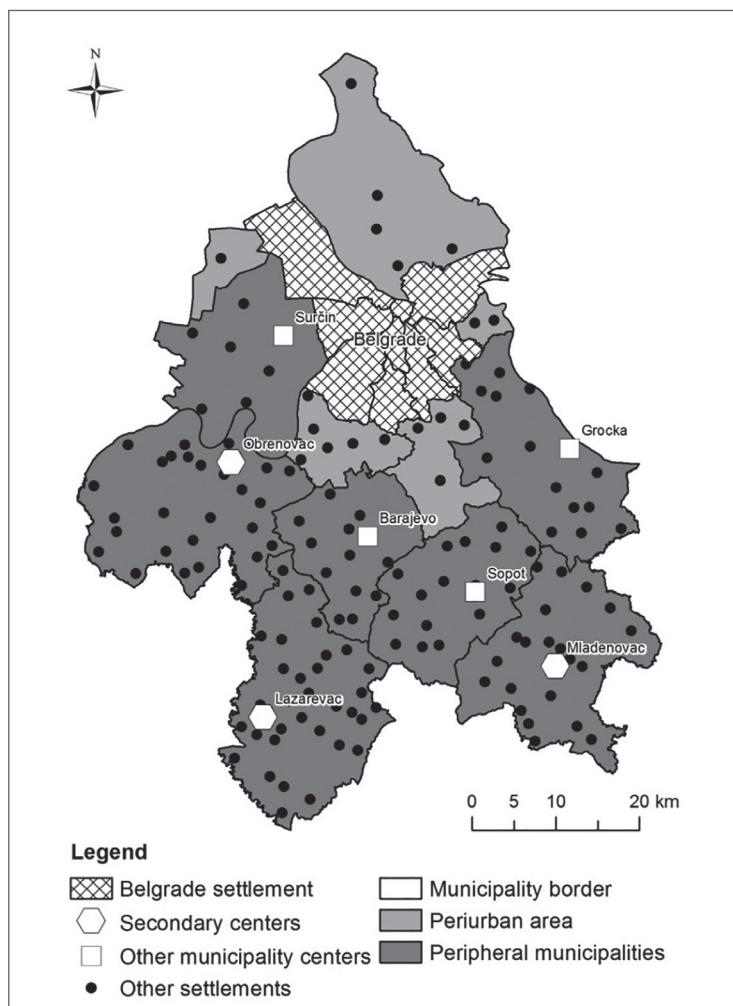
The present research covers the Belgrade region, i.e. the administrative area of Belgrade, or the "City of Belgrade", which is divided into 17 municipalities and 157 settlements. All analyses are done at the settlement level. The data used were obtained from the Statistical Office of the Republic of Serbia.

Keeping in mind the specific features of the Belgrade region, as the largest urban agglomeration and complex functional system of urban and rural settlements, its complexity and its role in the territorial organisation of the Republic of Serbia, as well as the qualitative differences between urban and peri-urban areas, the analysed territory is divided into three sections (Figure 1):

- Urban areas or Belgrade's urban core (Belgrade settlement on Figure 1), consisting of the urban sections of ten municipalities;
- Peri-urban belt, including other settlements¹⁾ within the four municipalities that belong to Belgrade's urban core;

¹⁾ All settlements in Serbia are divided into urban and other settlements.

- Other urban, peripheral municipalities that are more similar (in terms of size, population, number of settlements) to other municipalities in Central Serbia than to the urban municipalities of the Belgrade region (hereinafter referred to as suburban municipalities).



Source: Authors' analysis, own design

Figure 1: The administrative territory "City of Belgrade"

The paper covers a four decade-long inter-census period from 1971 to 2011, i.e. the period since 1971, when Belgrade's administrative area was expanded to the current boundaries.

In order to understand the development process of the Belgrade region and identify its essential characteristics and specific development opportunities and limitations, it was

necessary to elaborate several analytical aspects. The analysis of the studied issue has required appropriate scientific analytical methods, applied independently or combined in order to reach conclusions that stand up scrutiny and provide substantial evidence confirming the starting hypothesis that the Belgrade region underwent a complex multifaceted transformation, which will determine future planning solutions.

The applied methodology is typical of urban geographical research and it ranges from the description of the current situation and the previous developments to the application of various quantitative methods to determine what actually happened in this area and identify the processes that took place in the hierarchy of the settlement system. Based on this information, it is possible to determine development trends and to direct processes in the future, while applying integrated planning and sustainability principles. This type of methodology is focused on objectivity and rationality. It is scientifically and professionally founded and acceptable.

Having established that the population growth had been intensive, we examined the contribution of the mechanical and natural components of the population change in the settlements of the Belgrade region. The functional influence of Belgrade is defined through the degrees of urbanisation and sectoral transformation in the occupational structure of the settlements in the Belgrade region, i.e. using a method that indicates the direction and intensity of the deagrarianisation process. The significance of Belgrade's gravitational influence has been determined on the basis of its attracting power as an economic and service centre, measured by the intensity of commuting towards Belgrade's urban core. The last development phase in the Belgrade region has been studied using a qualitative approach that has made it possible to identify the development nucleus and secondary service centres and to assess the morphological changes in settlements and space use.

The following quantitative methods have been used:

Out- and in-migration types of settlements

In order to elucidate the process of the territorial redistribution of population, we tracked the changes in the main components of demographic growth in the settlements (and municipalities) within the Belgrade region.

The analysis relied on FRIGANOVIĆ's model (FRIGANOVIĆ 1974) of population trends and distribution, i.e. on the relationship and significance of the natural and migration components of population growth or decline. Two types (in-migration and out-migration) and eight subtypes of population trends were distinguished (Table 1, see next page). The analysis covered two inter-census periods 1971–1981 and 2002–2011.

Functional types of settlements

The occupational structure of the employed population is directly dependent on the functional capacity and the diversity of the functions of the centres where they are employed, i.e. the deagrarianisation degree in the employed population's places of residence depends on the number and quality of jobs in the centres of work.

Out-migration types	In-migration types
E1 Out-migration <ul style="list-style-type: none"> • Natural gain • Population growth recorded in the census • Natural gain rate exceeds the population growth rate recorded in the census 	I1 Expansion through in-migration <ul style="list-style-type: none"> • Natural gain • Population growth recorded in the census • Population growth rate recorded in the census exceeds the natural gain rate
E2 Depopulation <ul style="list-style-type: none"> • Natural gain • Population decline recorded in the census • Natural gain rate exceeds the decline rate recorded in the census 	I2 Regeneration through in-migration <ul style="list-style-type: none"> • Natural loss • Population growth recorded in the census • Population growth rate recorded in the census exceeds the natural loss rate
E3 Distinct depopulation <ul style="list-style-type: none"> • Natural gain • Population decline recorded in the census • Natural gain rate lower than the decline rate recorded in the census 	I3 Weak regeneration through immigration <ul style="list-style-type: none"> • Natural loss • Population growth recorded in the census • Population growth rate recorded in the census lower than the natural loss rate
E4 Dying out <ul style="list-style-type: none"> • Natural loss • Population decline recorded in the census • Natural loss lower than the decline rate recorded in the census 	I4 Extremely weak regeneration through immigration <ul style="list-style-type: none"> • Natural loss • Population decline recorded in the census • Decline rate recorded in the census lower than the natural loss rate

Source: FRIGANOVIĆ 1974

Table 1: FRIGANOVIĆ's model of population trends and migration types

Functional type of settlement	Requirement (occupational sectors I, II, III)
Agricultural	I >= 60 %
Agricultural-industrial	I > II > III
Agricultural-service	I > III > II
Industrial	II >= 60 %
Industrial-agricultural	II > I > III
Industrial-service	II > III > I
Service	III >= 60 %
Service-agricultural	III > I > II
Service-industrial	III > II > I

Source: D. Tošić 1999

Table 2: The requirements that a settlement has to meet in order to be classified as a specific functional type

The model used for tracking changes in functional relationships and connections is based on the changing shares of individual occupational sectors in the active employed population. According to this model, nine settlement types have been identified. In order to be classified into a particular functional type, a settlement has to meet some conditions relating to the share of individual occupational sectors in the employed population (Table 2). The analysis was done for two census years: 1971 and 2011.

Urbanisation degree

The degree of urbanisation, namely of an urban lifestyle in socio-economic, technological, cultural and other senses, is difficult to determine without adequate indicators and it is even more difficult to express it in a qualitative form. The degree of urbanisation can be determined sufficiently precisely if the following parameters are used:

- the share of the active agricultural population in the total active population;
- the share of households without agricultural land in the total number of households in a settlement;
- the share of employed population²⁾ in the active population.

Degree of urbanisation	Agricultural population in the total active popul. %	Households without agricultural land %	Employed population in the active popul. %
Urban	≤ 10	≥ 70	≥ 70
More urbanised	≤ 15	≥ 20	≥ 70
Less urbanised	≤ 30	≥ 10	≥ 50
Urban borderline	Two out of three requirements are met		
Rural	Does not meet two or three requirements		

Source: D. Tošić 1999

Table 3: Model for determining the degree of settlement urbanisation

Based on these parameters, five groups of settlements can be distinguished (Table 3). The analysis covers two census years: 1971 and 2002, since the necessary data at the settlement level have not been published for the latest census (2011).

Convergent commuting

The daily urban system is defined as the area around a city where commuting takes place (BOURNE 1975), i.e. as an area where there is intensive population mobility – commuting

²⁾ The number of employed inhabitants for each settlement was obtained by subtracting the number of active agricultural inhabitants from the active employed population. This number does not precisely reflect the actual situation, since there are some actively employed inhabitants in agricultural pharmacies, veterinary stations, etc., but this does not significantly affect the final results of the analysis.

from the place of residence to the place of other socio-geographical activities (GOODALL 1987).

The daily urban system and the metropolitan region share some similarities and they often coincide in spatial terms. However, the fact that they are two distinct spatial categories should not be disregarded (VRESK 2002). A metropolitan region consists of a city and its urbanised neighbourhood, whereas the commuting system consists of a city and that part of its neighbourhood where the daily interaction takes place (BOURNE 1975), i.e. the part that is functionally connected with the city. Nevertheless, the daily urban system is considered a key criterion in defining an urban or metropolitan region.

The validity of the obtained results significantly depends on the territorial level of the analysis. Settlements, as the smallest administratively defined areas, have rarely been the basis for the analysis of commuting. The data presented in this form are not available in the official statistics of the Republic of Serbia. The information relevant for this research was for the first time provided by the 2002 Census data, after additional data processing. The number of commuters to Belgrade was compared to the overall active population of the place of residence.

The research conducted in the Netherlands (VAN DER LAAN 1998) and Belgium (VAN NUFFEL and SAEY 2005) indicates that commuters are the determinants of change in the structure of urban agglomerations. Three types of urban systems have been identified (D. Tošić et al. 2009). Keeping in mind the specific conditions that determined the development of Belgrade's commuting system, it is reasonable to assume that a traditional hierarchical type, in which commuting is directed to and from the central city, is absolutely dominant.

4 Analysis of various types of settlement transformation in the Belgrade region

4.1 Demographic changes

The territory and the population of the Belgrade region have been growing in accordance with urban, functional, political and socio-economic trends and the causal principles of demographic development, creating a specific intra-agglomeration spatial structure of population dynamics.

Until the 1970s, Belgrade's urban core showed a more dynamic population growth than the overall territory of the Belgrade region. In this period, population growth in the central area accounted as much as 90 percent of the total population growth in the region (VOJKOVIĆ and DEVEDŽIĆ 2018). In the following decade, i.e. the 1971–1981 census period, population dynamics began to depolarise, as the population declined in most central parts of the city. This trend was associated with the conversion of housing into business space, which in turn resulted in the reduction of the demographic capacity of the observed settlement.

In 1971–2011, population growth was recorded in all three parts of the Belgrade region and was the most evident in the centres of suburban municipalities, especially in Lazarevac (Table 4), where it was encouraged by the availability of employment opportunities in the mining and energy complex. The beginning of the 21st century, presented by the last

inter-census interval (2002–2011), was marked by an unfavourable homogenisation of natural growth, which was equally negative throughout Belgrade's urban core, while the migration balance became the main modifier of the overall population mobility (Figure 2).

Area	Number of inhabitants		Change index 1971–2011
	1971	2011	
The Belgrade region	1,209,361	1,659,440	137.2
– Belgrade's urban core	899,004	1,166,763	129.8
– Peri-urban belt	91,295	133,232	145.9
– Suburban municipalities	219,062	359,445	164.1
Centres of suburban municipalities	59,038	112,768	191.0
– Lazarevac	7,994	26,006	325.3
– Obrenovac	14,785	25,429	172.0
– Mladenovac	15,858	23,609	148.9
– Sopot	1,272	1,920	150.9
– Grocka	4,956	8,441	170.3
– Barajevo	3,519	9,158	260.2
– Surčin	10,654	18,205	170.9

Source: The comparative population census 1948–2011, Vol. 20 (2012). Belgrade: Statistical Office of the Republic of Serbia

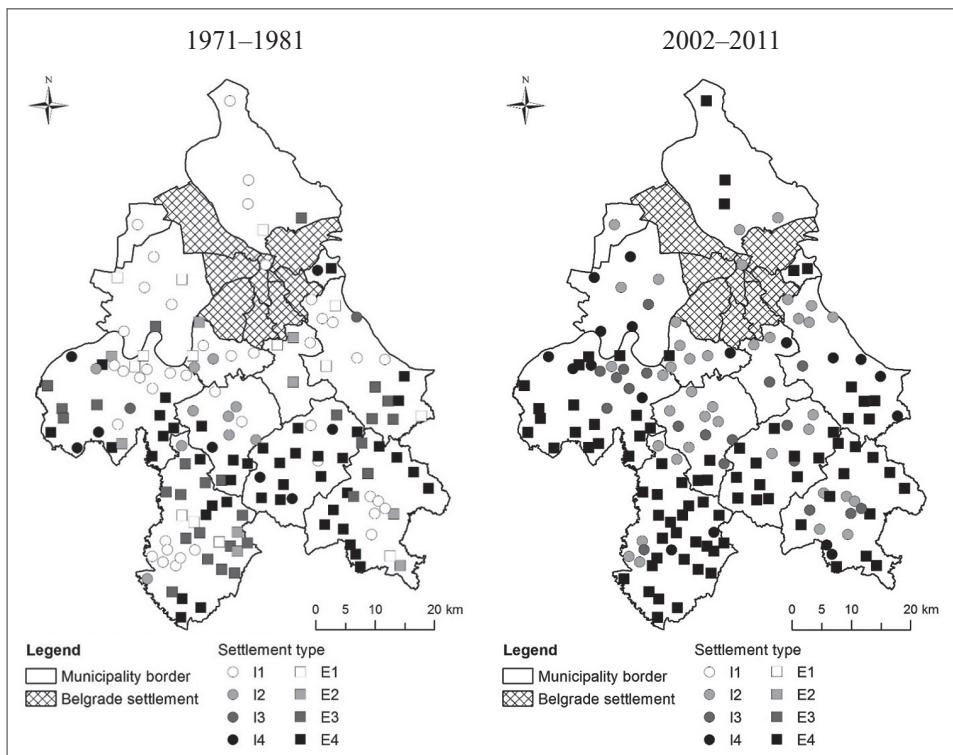
Table 4: Dynamics of population change in the Belgrade region 1971–2011

Industrial development or the construction of satellite residential settlements gave rise to intensive demographic changes of the peri-urban belt, which unfolded in various directions, depending on the City's development policy and expansion directions (VOJKOVIĆ and DEVEDŽIĆ 2018). In the 1980s, the peri-urban belt assumed primacy in the growth dynamics. In 1971–1981, the population concentration in the settlements on the left bank of the Danube was higher, which was in line with the development policy of the City of Belgrade and the strategic commitment to expand the city precisely into that area.

Furthermore, during the last decades of the studied period, it was possible to observe population concentration in the settlements along the traffic route in the Srem part of the Belgrade metropolitan area and along the traffic routes to the south. The need for a number of accompanying facilities along these routes, generating employment opportunities, good infrastructural connections with both the north and the south of the country, the proximity of Belgrade, etc. acted as pull factors and led to demographic growth in the surrounding settlements.

In the early stages of Belgrade's development after World War II, numerous settlements from its hinterland and suburban municipalities lost their population because inhabitants moved to Belgrade's urban core. However, the accelerated demographic growth of suburban municipalities began in the 1970s. Accordingly, the population analysis in the first

analysed census period showed that the expansive population growth in all municipalities, as a whole, was due to in-migration (Table 5).



Source: Authors' analysis, own design

Figure 2: Out- and in-migration types of settlements (explanation of the migration types – I1 to E4 – see Table 1)

The administrative centres of suburban municipalities were the generators of the urbanisation process and they concentrated population when the natural growth was negative. For example, with the development of industrial activities in the secondary regional centres which are at the same time the country's most important mining and energy centres, the expansive growth in the central settlements of the Obrenovac and Lazarevac municipalities was due to in-migration, as they became attractive as the places of residence for people from all parts of the former Yugoslavia (VOJKOVIĆ et al. 2010). This was especially evident in the Lazarevac municipal centre, where the population increased at a rate as high as 68.6 percent during the 1980s, while the surrounding area was depopulated. At the municipal level, the highest growth rates were observed in the Municipality of Grocka (Table 5). An enormous growth was also recorded in the settlement marked by illegal construction, Kaluđerica, which expanded extensively and merged with Belgrade.

Area	GR	RNI	TM	GR	RNI	TM
	1971–1981			2002–2011		
Belgrade's urban core	14.39	7.48	I1	4.13	-1.95	I2
Barajevo	7.58	1.16	I1	9.54	-4.72	I2
Grocka	38.33	5.14	I1	10.59	-5.37	I2
Lazarevac	8.31	5.30	I1	0.19	-5.27	I3
Mladenovac	7.24	5.08	I1	1.15	-5.06	I3
Obrenovac	12.03	6.00	I1	2.16	-5.11	I3
Sopot	5.10	-2.17	I2	-0.11	-4.26	I4

GR – growth rate (in percent); RNI – rate of natural increase (in percent); TM – type of migration (see Table 1)

Source: Vital statistics, special processing of census data (2016). Belgrade: Statistical Office of the Republic of Serbia

Table 5: Population trends, periods 1971–1981 and 2002–2011, in Belgrade's urban core and in the centres of suburban municipalities

Similarly to Belgrade's urban core, in the last analysed census period, a very similar rate of negative natural increase (about 5 percent) was observed in all suburban municipalities. As opposed to urban municipalities, the influx of new inhabitants in suburban municipalities resulted either in population increase, or at least in stagnation, concealing the effects of biological depopulation. All municipalities grew due to in-migration, although unevenly. However, in this census period, the number of settlements labelled as migration type E4 – dying out – according to the applied methodology (Table 1, Figure 2) grew significantly. The values of the examined indicators were slightly higher only in the municipal centres and their immediate surroundings.

4.2 Spatial and functional changes

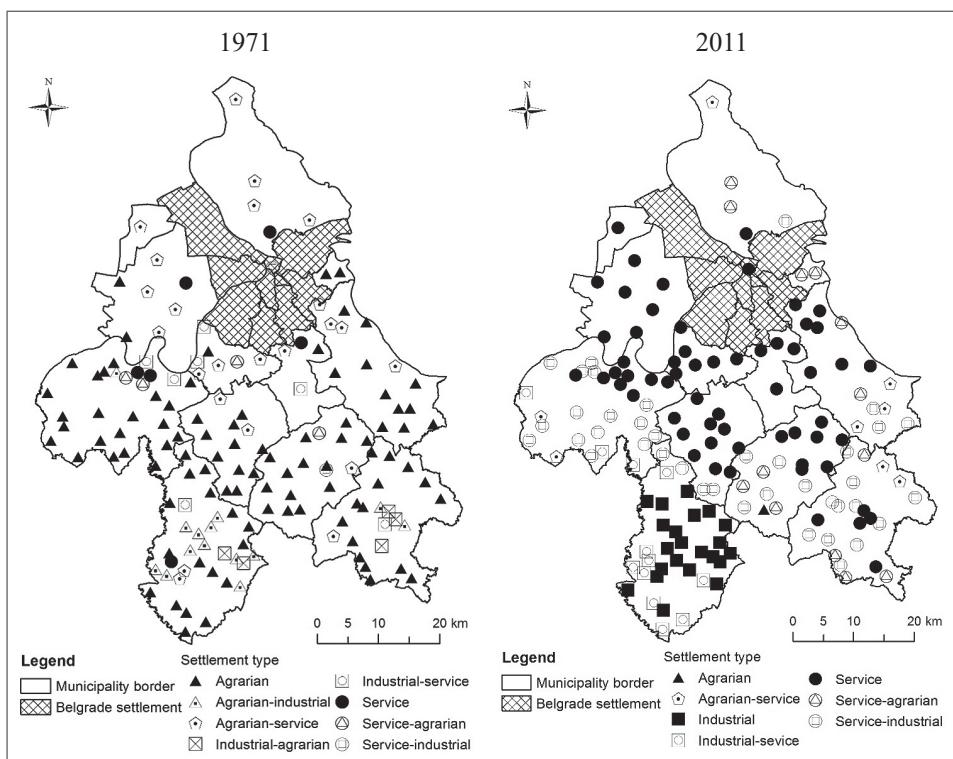
Every urban settlement has some impact on the immediate and wider environment depending on its development status. The degree of transformation in a settlement in the vicinity of an urban centre reflects importance of the centre for the area in which it was formed.

The results of the transfer of the active agricultural population to non-agricultural activities and a whole series of changes determined by this transfer, primarily in the socio-economic structure of the population and the agrarian-geographic landscape, are used as reliable indicators not only in determining spatial and functional relations and connections, but also in determining the functional types of settlements. Based on these results, conclusions can be drawn on the role of some settlements in the functional organisation of the Belgrade region.

In the studied period, it was possible to observe the functional diversification of settlements in the Belgrade region. The character and trends of this process were determined by

the intensity of deagrarianisation, reflected in the decreasing number of purely agricultural settlements and the growth of settlements that belonged to other functional types, where service activities prevailed.

According to the applied model, based on the 1971 census data, most settlements in the studied area belonged to the agricultural functional type (92 or 58.6 percent). This was especially emphasised in suburban municipalities, where all settlements, apart from the municipal centre and a small number of its boundary settlements, were agricultural (Table 6, Figure 3). In addition to the insufficiently developed functions of work in municipal centres, the out-migration of the rural working-age population also contributed to this. Accordingly, as they were getting employed, the population in villages declined, but the structure of activities did not significantly change.



Source: Authors' analysis, own design

Figure 3: Functional types of settlements in the Belgrade region 1971 and 2011

The development of the functions of work in municipal centres and several boundary settlements encouraged migration to centres, and, over time, commuting was intensified. With a partial transfer of the working contingent into the activities of the secondary and tertiary-quaternary sectors, the process of functional diversification began in other set-

Functional types of settlements	1971	2011
Agricultural	92	1
Agricultural-industrial	13	0
Agricultural-service	24	9
Industrial	0	22
Industrial-agricultural	5	0
Industrial-service	7	14
Service	6	58
Service-agricultural	4	14
Service-industrial	6	39

Source: Authors' calculation

Table 6: Change in the number of settlements in the Belgrade region 1971–2011 by functional type

tlements, predominantly rural. It was reflected in the reduced share of solely agricultural settlements and the increased share of agricultural-industrial and industrial-service settlements, as well as those where the population was involved in services, in the overall number of settlements (Figure 3).

The 2011 census shows a significantly reduced number of agricultural settlements (from 92 to only one) and an increased number of other categories, especially those where the service sector was dominant (Table 6). The settlements where the population was predominantly involved in services were the most numerous (58, accounting for 37 percent). Tertiary-quaternary activities, i.e. the number of employees in the service sector, grew especially in the 1991–2011 inter-census period.

The stable function of Belgrade's urban core had been established in an earlier period. It relied on the settlements where the population was predominantly involved in services, and an even more distinct prevalence of the tertiary-quaternary sector (82 percent), as confirmed by the 2011 census data. Most settlements in the peri-urban belt also belonged to the functional type focusing on services, and the number of service-industrial or service-agricultural settlements was insignificant.

The classification of the Lazarevac and Obrenovac municipalities as production-type settlements (industrial, industrial-service, etc.) was determined by the fact that a mining and energy complex was located in the former and a complex of national importance for the production of electric power in the latter municipality. The centres of these municipalities belonged to the service (Obrenovac) or service-industrial type (Lazarevac). The administrative centres of other suburban settlements belonged to the service type, while other settlements in these municipalities could be classified as service-production types. In these settlements, the process of socio-economic transformation, intensive deagrarianisation and the expansion of the tertiary-quaternary sector are clearly visible.

Keeping in mind that the employment rate in the tertiary-quaternary sector significantly exceeded the value of the same indicator for the secondary sector, which is reflected in

the transition from one settlement type to another (Table 6), the occupational structure in the economy of the Belgrade region can be considered rather favourable. Namely, such an occupational structure indicates that the local development was in line with the corresponding processes in more developed countries, where a sudden increase in the share of tertiary and quaternary activities was due to the technological information revolution, which marked the end of the dominance of industrial mass production. However, in the least developed suburban municipalities, the insufficiently diversified economic structure, i.e. the underdeveloped secondary sector, was the main reason for an increased share of tertiary sector employees. In terms of service quality, the third sector in these municipalities was far below its counterpart in the most developed parts of the Belgrade region.

4.3 Intensity and directions of urbanisation expansion

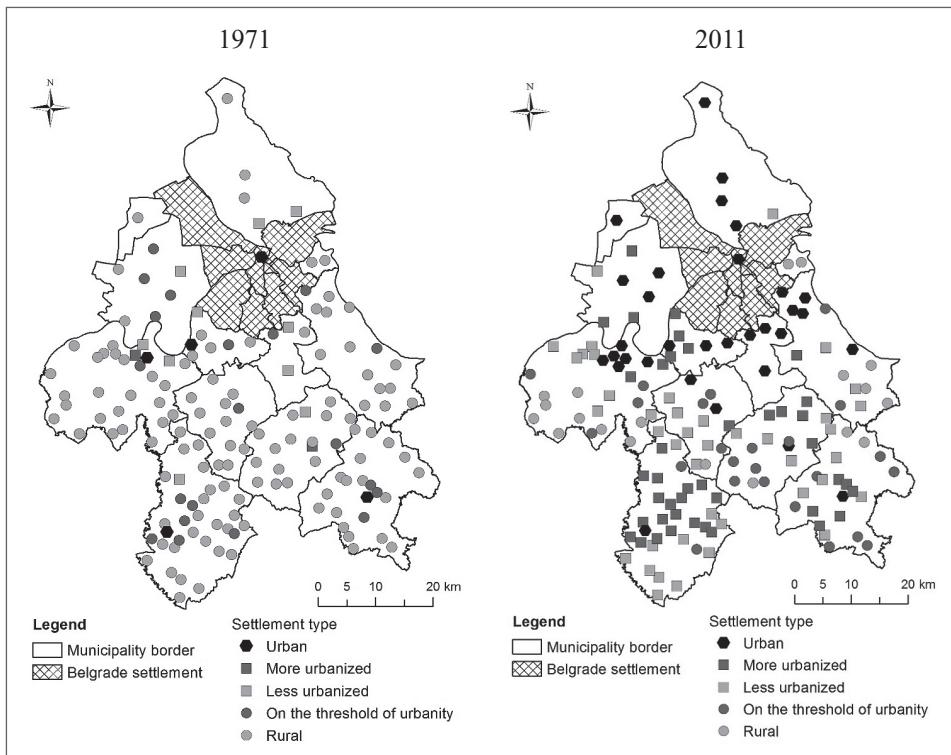
In the process of socio-economic transformation of the Belgrade region, which was based on the spatial and social mobility of the population, it is possible to observe different phases of urbanisation, manifested in demographic, morphological and functional changes of rural and urban settlements. Within the studied territory, individual spatial units differ in the forms and degree of urbanisation, primarily determined by the transitional character of development in the urban core to whose influence they were exposed (D. Tošić 1999).

According to the 1971 census data, the results obtained by applying this model in the Belgrade region show a clear differentiation of the central urban core. It is also possible to observe a belt where the degree of urbanisation was lower, including other settlements in urban municipalities, which was associated with the presence of agricultural areas and the development of the economic structure. A significantly lower degree of urbanisation marked the settlements belonging to suburban municipalities. The mapping of the obtained results indicated a large area under rural settlements within which it was possible to find enclaves with a higher degree of urbanisation (Figure 4).

Due to the concentration of functions and population, the stimulating influence of the administrative centres of suburban municipalities is more evident. Mladenovac, Lazarevac and Obrenovac influenced the socio-economic, functional and morphological transformation of settlements in their immediate and wider environment. Their sphere of influence was mainly formed within the municipal boundaries. Positive socio-economic transformation reflected in the diffusion of an urban character from the urban core was the most pronounced in boundary settlements, where commuting is the most intensive. Some areas gradually grew and merged morphologically with the city, acquiring the features of an urban-rural continuum.

In 2002, it was still possible to distinguish the most urbanised zone of the central urban core (significantly expanded compared to 1971). Its immediate neighbourhood was a little less urbanised, whereas suburban municipalities were urbanised to a considerably lower degree (except for municipal centres and their boundary settlements).

Based on the model applied, 32 urban settlements were identified, which is a 158 percentage point increase compared to the 1971 situation (Table 7). Most of them belonged to one of Belgrade's urban municipalities (only 7 settlements in this area could not be identified



Source: Authors' analysis, own design

Figure 4: Changes in the degree of settlement urbanisation from 1971 to 2011

Degree of urbanisation	1971	2002
Urban	14	32
More urbanised	3	40
Less urbanised	10	43
Urban borderline	20	22
Rural	117	20

Source: Authors' calculation

Table 7: Change in the number of settlements in the Belgrade region by urbanisation category (explanation of the urbanisation category see Table 3)

as the most urbanised). The evident expansion of urbanisation in the settlements of the suburban municipalities, encouraged by the strengthening of municipal centres, on the one hand, and the impact of Belgrade, on the other, resulted in a reduction of rural settlements in the observed period by as many as 97.

4.4 The commuting system of Belgrade's urban core

The distinct polarisation of Serbia's territory was, among other things, reflected in the volume of convergent commuting in Belgrade. Namely, 13.9 percent of all commuters in Serbia were coming to Belgrade's urban core (Table 8). One-fourth of all commuters had some big city in Serbia as their destination and 50 percent of them were commuting to Belgrade's urban core (ŽIVANOVIĆ and GATARIĆ 2013). Belgrade's strong central position within the present state territory and a relatively low level of urbanisation in Serbia were the reasons for the emergence and formation of its extensive daily urban system.

Area	Convergent commuting
	Number
Belgrade's urban core	108,046
Serbia	776,486

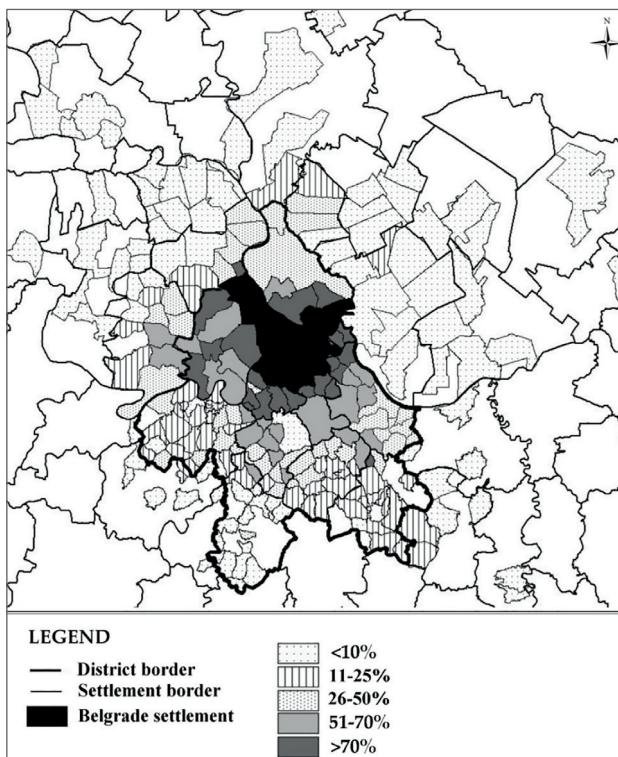
Source: Authors' calculation

Table 8: Share of Belgrade's urban core in the commuting system of Serbia

The fact that the share of commuters in the total active population of a resident settlement decreased as the distance from the centre (Belgrade's urban core) increased confirms that it is justified to use the modified rule of gravitation in the local context. The system of convergent commuting can be divided into several zones by grouping the territories of settlements sharing similar migration properties in terms of the intensity of daily migrations (Figure 5):

1. The zone of intensive influence, where more than 70 percent of the active population commute to Belgrade's urban core.
2. The zone of strong influence, where 50–70 percent of the active population commute to Belgrade's urban core.
3. The zone of medium impact, where 25–50 percent of the active population commute to Belgrade's urban core.
4. Areas of weak impact, where less than 25 percent of the active population commute to the centre.
5. The periphery of the daily urban system consisting of settlements where less than 5 percent of the active population commute to Belgrade's urban core.

Over 108,000 inhabitants from almost 1,200 settlements were involved in convergent commuting to Belgrade's urban core, which was nine times more than the number of commuters from Belgrade to other settlements (STAMENKOVIĆ and GATARIĆ 2008) and accounted for one-fifth of the active population of Belgrade's urban core (21.58 percent). More than two-third of the incoming commuters came from the territory of the Belgrade region. In accordance with the overall domination of Belgrade in Serbia's settlement network, its system of convergent commuting was by far the most developed, both in terms of



Source: ŽIVANOVIĆ and B. Tošić 2016

Figure 5: Belgrade's convergent commuting system (the share of commuters to Belgrade in the total active population of the settlements)

spatial coverage – which certainly exceeded the administratively defined area of Belgrade, especially as regards the settlements in the territory of Vojvodina – and by the number of commuters, i.e. the intensity of settlements' functional dependence.

4.5 Belgrade's direct favourable influence on the development of the region

Among the cities of Serbia, Belgrade had the most intensive development impact and the most complex effects, i.e. the widest scope and spatial distribution of the generated changes in the surrounding area.

The impact of Belgrade, as a distinct pole of development in the Serbian urban system, was largely marked by a direct favourable influence, along with the effect of a polarised, indirect favourable influence. The result of the direct favourable activity of Belgrade's urban core was the urban agglomeration in the form of a complex polynuclear system comprising smaller poles of development.

Polynuclear agglomeration was made possible by the existence of a large city, Belgrade, with a diversified, distinctly non-agricultural structure of activities, where employment in the service sector had prevailed over the manufacturing sector since the 1950s (B. Tošić et al. 2017). In the spacious peri-urban belt around Belgrade's urban core there were many non-agricultural settlements and those belonging to the service type or some functional type involving services, with a growing population. The extremely non-agricultural structure of activities in many of these settlements was determined not only by a large number of commuters to Belgrade but also by the location of economic, and above all, service facilities. In many of these settlements, deagrarianisation acted as a development factor. Trade, hospitality, crafts and services intended for the inhabitants of suburban settlements were intensively developed. Besides, in some of these settlements small manufacturing businesses, functionally connected to the city, were established, usually as primary production sites or service providers. Also, scientific research centres were built there. The focus of development in Belgrade's agglomeration shifted to the nearest suburban settlements. This created a large polynuclear system of settlements – a polynuclear agglomeration.

Favourable conditions for the formation of secondary centres in the surroundings of Belgrade's urban core also included low land price for business premises or for residential construction. Recently built roads (parts of the Pan-European Transport Corridors X and XI, parts of a ring road around Belgrade's urban core) were also an important factor in the formation of some settlements in Belgrade's vicinity as secondary development nuclei.

Regardless of the already mentioned processes in the immediate and wider surroundings of Belgrade's urban core, the intensity of transformation and the favourable effects were weaker than expected. Namely, the degree of development of the secondary nuclei in the Belgrade region was not in accordance with the potential and size of Belgrade's urban core, i.e. with its significance in Serbia's settlement network (the index of urban primacy of Belgrade is 5).

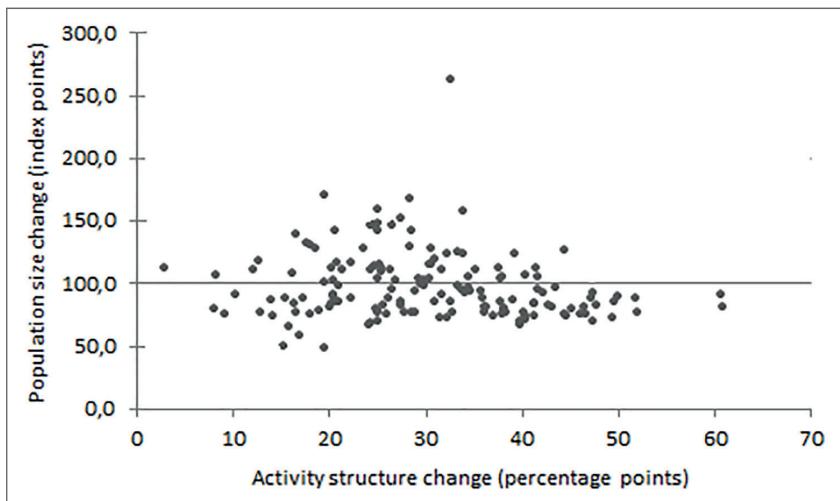
Judging by the spatial-functional quantitative indicators, the development of Belgrade's urban core was stabilised, since the population growth rate slowed down significantly and the changes in the functional structure were insignificant. A number of the nearest settlements gradually merged with the built fabric of Belgrade's urban core. By the end of the 20th century, the focus of development and the construction of residential and commercial buildings shifted from the agglomeration's centre to the surrounding and growing belt of suburban settlements. However, over the last two decades, when construction activities in the central parts of the city were intensified, it was possible to observe the characteristics of reurbanisation, which were related to the principle that construction land should not be expanded at the expense of other land-use types and primarily agricultural land.

5 Assessment of the transformation of the Belgrade region

The results of the analysis indicate that the studied territory was heterogeneous and that tentative division into urban, peri-urban and suburban areas is justified, keeping in mind that these were very different areas with different development degrees within their boundaries. There were significant differences at the municipal level, both in terms of demo-

graphic and economic strength, the territorial coverage of the observed municipalities, and, consequently, the position, or the role and significance of each of them within the Belgrade region. In particular, differences were emphasised between urban and suburban municipalities.

All settlements in the Belgrade region shared very intensive changes in the activity structure in the 1991–2011 period. First of all, the shared features included intensive deagrarianisation and growth of development activities, predominantly services. However, the population change in the territory of the Belgrade region in the last two census periods was uneven, ranging from an intensive increase to an equally intensive population decline, especially in the settlements with a less favourable traffic position and a lower position in the hierarchy of the settlement system (Figure 6).



Source: Authors' analysis, own design

Figure 6: The development of settlements 1991–2011 measured by population size change and activity structure change

Belgrade's urban core, with a population of 1,166,763 (2011), was marked by population stagnation in almost all areas, but also by constant depopulation in the central part of the city. The city core had characteristics of a long-established, stable and developed functional structure with a small share of the active population in the primary sector and the dominant share in the service sector, compared to the manufacturing sector. Commuters to Belgrade accounted for 5.4 percent of the total population of the Belgrade region (STAMENKOVIĆ and GATARIĆ 2008). Morphological changes in Belgrade's urban core were in line with the new approach in urban planning – the internal construction of the city within the framework of the construction land, but, unfortunately, increasingly marked by elements of unplanned and illegal construction, affecting not only the central but also the elite part of the city.

The process of privatisation, which mostly affected the processing industry in Belgrade, took place during the transition period, over the past three decades. However, due to unfavourable external circumstances (civil war in the former Yugoslavia, economic sanctions, NATO intervention), industry collapsed, while privatisation was more or less unsuccessful. Growing motorisation did not lead to a radical relocation of industry from the urban core to the periphery, since industry had not been present in the urban core. The establishment of service facilities was a distinguishing feature of some parts of Belgrade – primarily New Belgrade, which was transformed from a distinctly residential part of the city to an area supplied with modern economic zones, private service activities and healthcare facilities, shopping centres, etc., which occupied free areas of flat land between residential areas.

Nowadays, some commercial functions, e.g. large office parks and hypermarkets, are located outside the city centre, around socialist housing on the left bank of the Sava River, i.e. in New Belgrade. Until two decades ago, New Belgrade had been exclusively a residential part of the city, which was later supplied with multifunctional facilities. This process was taking place with such intensity that the most service jobs were moved to that part of the city. The expansion of the old part of the city followed different lines, in a morphologically less accessible terrain with a tendency to incorporate the surrounding settlements into the urban fabric.

Expansion trends in Belgrade's periphery were different and they had local specific features. Two basic types of suburbanisation in Belgrade have just been mentioned: planned, in the area of New Belgrade, and unplanned, especially in the settlement of Kaluđerica, as the most representative example of illegal construction.

The settlements of the peri-urban zone were exposed to a strong influence of the capital and the largest city, but the characteristics and manifest forms they took in the surrounding area were either slightly or completely different. Almost 360,000 people lived 2011 in 20 of these settlements – about 18,000 inhabitants per settlement on average. They differed in terms of population size, ranging from about 300 to over 46,000 inhabitants. In the last ten-year period, depopulation was increasingly evident even in some settlements of the peri-urban belt, mainly due to the negative natural increase, which could not be mitigated by in-migration (including the influx of refugees from the former Yugoslav republics).

Belgrade's strong polarisation influence on peri-urban settlements was reflected in the emergence of a large number of settlements where economy was focused on services. The level of the provision of public services and communal facilities depended on the area in which the settlements were located. In the northern part of the region, belonging to Srem, the service provision level was similar to all other large rural settlements in Vojvodina. In the Šumadija region, and especially in the settlements of the Banat region, both infrastructural and supra-structural facilities were significantly poorer (the insufficient capacity and the lack of diversity of educational and healthcare facilities are particularly evident).

According to their functional organisation, these settlements were different in character. Some of them were residential suburbs, as distinct, purposefully formed settlements, arising from the nuclei of former rural settlements, previously located in Belgrade's distant periphery. Others were mostly recreational and residential-industrial settlements that had already been formed or were being formed. The settlements of the Banat, Srem or

Danube regions had a role in the primary (or higher) level of the processing of agricultural products. In general, most settlements in the urban-rural belt had a function in the production and services for the urban area. Accordingly, they were marked by high participation of the population employed in non-agricultural activities and by stable commuting.

Illegal construction affected almost all neighbourhoods of the boundary belt and it was especially distinct in the settlements belonging to Banat (towards the city of Zrenjanin) and Srem, as well as in the suburban settlements in Šumadija, where the construction of recreational settlements was very intensive. Along with being affected by illegal construction, Belgrade's peri-urban belt did not have a clear economic orientation. It was also inadequately supplied with communal facilities (especially the Banat part), it lacked adequate public service facilities and was affected by increased spontaneous development, requiring intervention by urban planners.

Suburban municipalities in the southern part of the Belgrade were, on the one hand, exposed to a strong influence of the centre and, on the other, acted as independent areas where development relied on the resources of local or wider, regional and national importance.

The population size, the number of settlements and the density of the settlement network are uneven in individual municipalities. The settlements outside municipal centres have 1,900 inhabitants on average (2011). Due to the domination of municipal centres, the population mostly stagnated in all municipalities, although most settlements were affected by depopulation. Only in the municipal centres, major settlements, those at more attractive locations (along major roads) or in the settlements in the vicinity of major municipal centres it was possible to observe growth or stagnation. However, the population growth in the last period (2002–2011) was considerably reduced even in these settlements.

The structure of the active population across settlements was rather diversified, and it was the most diversified in Mladenovac and the municipalities where the mining and energy complexes – Lazarevac and Obrenovac – are located. The provision of public services facilities and infrastructure corresponded, in general, to the average level for Central Serbia, or was slightly below average, due to the proximity of Belgrade. The apparently diversified economic structure of the population in the centres of suburban municipalities was due to a large share of commuters to Belgrade or to the mining and energy complex. The common feature of the entire area was the lack of boundaries between settlements. It was a continuous built-up area, with irrationally occupied land, mainly under illegal and unplanned structures for permanent or, more often, for occasional housing. An excessive number of holiday homes could be found not only in the settlements but also throughout the inter-settlement space.

Belgrade's administrative area, which was finally defined in the 1970s, has a peripheral position due to the restrictions to its development imposed by establishing the Autonomous Province of Vojvodina. The administrative area of Belgrade is certainly smaller than the area that could be described as the metropolitan area, especially as regards the Srem and Banat sections, as well as the connections with the areas in the valley of the Velika Morava and Kolubara rivers (B. Tošić et al. 2004). If the boundary of the gravitational area were proportionate to demographic, economic and functional strength of the city, then some municipalities of the Banat and Srem regions should be included in the Belgrade region, rather than being part of Vojvodina.

The administrative boundary of Vojvodina was an obstacle to the functional expansion of the administrative area of Belgrade. This was even more evident when the rights of provinces were defined more firmly and in greater detail (BOJOVIĆ and BOROVNIĆ 1998). Belgrade was not able to establish its functional region in its administrative area because its boundaries were not harmonised (ŽIVANOVIĆ and B. TOŠIĆ 2016). Therefore, it did not properly constitute its metropolitan area. Due to this, it could not pursue a comprehensive urban and development policy. Such a policy covers planning the use of public service facilities, the provision of communal facilities, defining public transport routes, etc.

The harmonisation of the administrative and functional boundaries of the Belgrade metropolitan area would greatly contribute to Serbia's internal coherence, which would be the result of decentralisation and polycentric development. The harmonisation of boundaries would also help Belgrade gain a better position of Belgrade in the European system of centres, i.e. in achieving the goal related to the spatial integration of the metropolis into the European regional space. The fragmentation of the metropolitan area bears a risk of weakened competitiveness.

6 Conclusion

By comparing the results obtained using the proposed methodology in the study of the Belgrade region, which tracked demographic changes, changes in the occupational structure of the active population, the degree of urbanisation, and commuting, it was possible to identify some regularities: the settlements with a higher degree of functional transformation coincided with the zones of higher urbanisation degree; the zones consisting of settlements marked by in-migration and more intensive commuting to Belgrade. The areas with opposite characteristics also coincided: the ones that included settlements with a higher share of agrarian activities, weaker functional changes, those marked by out-migration, lower degree of urbanisation and a lower share of commuters in the active population.

The main carrier of intensive transformation processes in the studied territory was Belgrade's urban core with minor contribution from three municipal centres of suburban municipalities (Lazarevac, Obrenovac, and Mladenovac), whose importance in directing the movement of people and material goods is far less distinct. The expansion of the influence of Belgrade's urban core transformed 20 neighbouring settlements and created a peri-urban ring. Some of these settlements are statistically associated with Belgrade's urban core, others are areas where business facilities are located; the third group continues to play the role of residential suburbs, while some settlements are gradually becoming centres of new municipalities (e.g. Borča on the left bank of the Danube). The entire Belgrade region is dominated by a business zone in central municipalities (which are part of Belgrade's urban core), and in recent years, this zone has been intensively transferred to the territory of the municipality of New Belgrade, on the left side of the Sava. The reason for this is certainly the availability of spacious, unoccupied, flat and cheaper land, which has a satisfactory infrastructure.

The analysis of the municipal centres of suburban municipalities and their role in the transformation of their local areas leads to the conclusion that there is a *hierarchical rela-*

tionship among them. The most important municipal centres Lazarevac, Obrenovac and Mladenovac can be analysed in the same context. In addition to the existence of a mining and energy complex in the territory of Lazarevac and Obrenovac, a minor importance of manufacturing and service activities in all three centres is the basis of their role as the secondary poles of development in the immediate or wider local or subregional environment. The next hierarchical level consists of the remaining municipal centres, where the service sector dominates. The impact of these centres on the transformation of the surrounding settlements is somewhat weaker and is largely supported by the influence of Belgrade.

The results of the conducted analyses and the conclusive assessment of the processes observed in the region of Belgrade confirm the starting hypothesis that the region of Belgrade has undergone a profound multifaceted transformation. The current situation is largely the result of disorganised and uncontrolled, often unplanned processes, regardless of the existence of relevant strategic development documents (RPPAP Beograd). Along with the inadequate measures taken by the local authorities in Belgrade and suburban local self-governments, the current situation is also determined by numerous external limitations and difficulties (the civil war, economic sanctions, etc.) faced by Serbia over the past several decades, which inevitably affected the Belgrade region.

A detailed analysis and assessment of all forms of transformations in the Belgrade region presented in this paper, provides the starting point for defining future development solutions. Strategic development documents, regional planning documents, local self-government plans, and documents related to international cooperation are important development instruments, and their drafting and implementation must be of major priority. The adequacy of planning measures and governing policies for the development of this area, which should be fully compliant with the principles of sustainable development, is of crucial importance for the country as a whole. Therefore, local planners should be encouraged not to support further expansion of the city and land acquisition in planning. Although further development of infrastructure and economy is necessary, a balance between the centre and the periphery must be established and excessive expansion of construction must be prevented (SLAEV et al. 2018).

In Belgrade's case, the official translation of the term "urban sprawl" is not fully applicable. Significant progress in overcoming urban sprawl could be made through the use of various mechanisms, including taxation and other fiscal and legal instruments against urban expansion, while making improvements aimed at strengthening development control (stricter sanctions); and, last but not least, by raising public awareness (among citizens, investors and local governments) about the negative effects of urban sprawl (PICHLER-MILANOVIĆ 2014).

Acknowledgement

The paper is the result of the research conducted within the projects no. 47006 and 176017 funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

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