

Differences and similarities in the expansion of suburban built-up areas around the different city regions of three Central European countries

Különbségek és hasonlóságok a beépített szuburbán területek terjeszkedésében három közép-európai ország városrégióiban

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ABSTRACT: Examining the urban sprawl around middle-size cities in Hungary and Central Europe, the rural change and suburbanization can be characterized by residential out-migration from cities and at the same time by immigration from the rural areas. These processes have intensified in the former socialist countries after the 2000s and a number of problems have not been addressed, which have become apparent during the eighties and nineties in Western countries. A fast urban sprawl took place with a low level of special control and planning but under the pressure of economic and financial development. The rate of spatial growth often exceeds the rate of population growth, it even occurs in the absence of population growth. In Central European countries, the main destination for migration is the capital cities and their suburbs, therefore suburbanisation studies focus on these areas. However, our aim is to focus on regional centres and their agglomerations, comparing them to capital cities and rural areas. The most dynamic and new urbanisation processes are taking place in urban agglomerations. The phenomena observed in these countries, especially in regional cities, have no historical precedent, but are a novelty from both a social and an economic point of view.

The paper concentrates on the urbanisation tendencies of three post-socialist countries – Slovakia, Hungary and Romania –, on the basis of the expansion of the impervious surfaces and the change in the number of the population. For each country, capital cities, regional centre areas and more remote rural areas are analysed separately. The goal of the paper is to reveal the differences among the three countries in the density of population in areas affected differently by urbanisation. This issue is examined in all three countries that have gone through similar economic and political transitions, together with the differences caused by the diverse historical, geographical, and settlement hierarchy endowments at the time of the development and migration boom following the world economic crisis of 2008. It is hard to detect what role the economic crisis played in this, but it is certain that the crisis led to a significant downturn, which was followed by development in quite different directions in the cities, urban fringes, and rural areas in the surveyed countries. The flow into cities seems to have accelerated, mainly in the case of capital city regions and the edges of regional centres. Besides population movements, the expansion of built-up areas is much faster,



especially in less densely populated areas where the dynamism of these was outstandingly high between 2012 and 2018. This may have several negative consequences. In areas in the vicinity of urban zones of such high population density may emerge, which may lead to societal problems later.

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KULCSSZAVAK: urban sprawl; Közép-Európa; beépített területek; szuburbanizáció

ABSZTRAKT: A magyarországi és közép-európai középvárosok körüli szuburbanizációt vizsgálva, a városperemek növekedése egyszerre magyarázható a városokból való kivándorlással és a vidéki területekről induló bevándorlással. Ezek a folyamatok a volt szocialista országokban a 2000-es évek után felerősödtek. A település- és területi tervezés szereplői azonban nem kezelték számos olyan problémát, amelyek a nyugati országokban már a nyolcvanas-kilencvenes években nyilvánvalóvá váltak. A városok gyors terjeszkedése alacsony szintű tervezési együttműködés mellett, ugyanakkor a gazdasági és pénzügyi fejlődés nyomása alatt zajlott. A területi növekedés mértéke gyakran meghaladja a népességnövekedés ütemét, sőt, népességnövekedés hiányában is zajlik. A közép-európai országokban a migráció fő célpontjai a fővárosok és azok elővárosai, ezért a szuburbanizációs tanulmányok ezekre a területekre koncentrálnak. Tanulmányunk azonban a regionális központokra és agglomerációikra összpontosítva, összehasonlítva azokat a fővárosok agglomerációival és a vidéki területekkel. A legmozgalmasabb és legújyszerűbb urbanizációs folyamatok a városi agglomerációkban zajlanak. Az ilyen térségekben megfigyelhető jelenségeknek különösen a regionális központokban nincsenek történelmi előzményeik, s így társadalmi és gazdasági szempontból egyaránt újdonaságot jelentenek.

A dolgozat három poszt-szocialista ország – Szlovákia, Magyarország és Románia – urbanizációs, szuburbanizációs és urban sprawl tendenciáira koncentrálna, a vizet át nem eresztő felületek nagyságának és a népesség számának változása alapján. Mindegyik ország esetében külön-külön elemezzük a fővárosokat, a regionális központok területeit és a távolabbi vidéki területeket. Tanulmányunk célja, hogy az urbanizáció által különbözőképpen érintett területek népsűrűségének különbségeit, azok változását vizsgálja, s ezeken keresztül tárja fel az urbanizációs jelenségek különbségeit az országok között. Mindhárom, hasonló gazdasági és politikai átalakuláson átesett ország esetében megvizsgáljuk, hogy a 2008-as világgazdasági válságot követő gazdasági növekedés és migrációs boom idején milyen különbségeket okoznak az eltérő történelmi, földrajzi és településhierarchiai adottságok. Nehéz kimutatni, hogy ebben milyen szerepet játszott a gazdasági válság, de annyi biztos, hogy a válság jelentős visszaesést eredményezett, amit a vizsgált országok városaiban, városperemeiben és vidéki területein a korábbiól eltérő irányú fejlődés követett. Úgy tűnik, hogy a városokba áramlás felgyorsult, ami elsősorban a fővárosi régiókat és a regionális központok agglomerációját érinti. A népességmozgások mellett a beépített területek bővülése is jóval gyorsabb ütemű, különösen a kevésbé sűrűn lakott területeken, ahol ezek dinamikája 2012 és 2018 között kiemelkedő volt. Ennek több negatív következménye is lehet; a városok közelében fekvő területeken olyan nagy népsűrűségű övezetek alakulhatnak ki, amelyek a későbbiekben társadalmi problémák forrásai lehetnek.

Introduction

The paper is a study of the characteristic features of recent urban expansion processes through a comparison of current phenomena in three post-socialist

countries of Europe: Hungary, Slovakia and Romania. The aim of the paper is to examine the extent of the expansion of built-up areas, i.e. urban sprawl, in these countries that used to be predominantly characterised, in accordance with the political-economic conditions, by compact urban structures (Czaková 2010; Schmidt, Fina, Siedentop 2014; Taubenböck et al. 2019). A special emphasis is given to this examination by the fact that urban sprawl has accelerated all over the world, including Europe, in the recent decades, which has a strong impact on the environment (EEA 2006, 2016; Angel et al. 2011; Haase, Kabisch, Haase 2013; Fang, Yu 2017; Wolff, Haase, Haase 2018). Suburbanization has led to the birth of a new way of living in the macro-region examined, shrinking the extent of traditional rural space typical of the area. Although looking from a distance these countries seem to belong to the same macro-region, their historical and economic development paths are partly different, and so are their geographical and settlement network features. The approximately thirty years that have passed since the regime changes in the former Central and Southeast-European socialist countries is a historical time-span large enough to allow us to examine the impact of the regime change, the shift in the economic and political system, on urbanisation, the development of urban areas and thereby on the transformation of the environment and the landscape.

The environmental crisis of our time gives special significance to these processes. A growing proportion of the rapidly increasing population of the world lives in cities and urban areas. Urban regions, as the largest factors of consumption, are predominantly responsible for environmental pollution and environmental stress. This is a rather general statement often expressed, with different percentage values assigned to it. However, the environmental impact or urban masses is ever intensifying even in spite of the decrease of the individual emissions. In this process a significant role is played by the spatial expansion and more and more extensive land use of cities (Harangozó et al. 2019; Kovács et al. 2020). It is not the city per se as a concentration of human existence and activity that causes the problem. Luis Bettencourt and Geoffrey West (2010) calculated that the duplication of urban population leads to 85% enlargement of infrastructure, also, the growth of the ecological footprint of urban existence is also only 85%. The figures, however, are valid for compact central urban spaces and do not take into consideration urban sprawl, the extensive growth of urban spaces outside the city boundaries. This strengthens the so-called 'compact or spread' debate as well (Breheny 1992; Wolff, Haase, Haase 2018).

Looking at the post-socialist countries, several questions arise at multiple levels: does urbanisation in the region follow the Western/global tendencies and is it only distinguished from them by its belatedness, or is there a path dependency in the region as a whole, considering the common heritage of the socialist times and the periods before that (Musil 1980, 1993; Szelényi 1981; Timár 1999, 2010; Timár, Váradi 2001; Pichler-Milanovic, Gutry-Korycka, Rink

2007; Szirmai 2011, 2017). Is path dependency valid for the respective countries within this macro-region, depending on their individual socio-economic characteristics? This paper provides an examination of these intra-regional specificities through the phenomenon of urban sprawl. The quantitative and especially the spatial transformation of built-up areas perfectly depict socio-economic-political processes. It indicates the re-stratification of society through changes in working conditions, construction regulations, land market and real estate markets right to the transformation of environmental and landscape values. The decade and a half since the economic crisis has brought marked changes in the suburbs and beyond. In many regions, the rapid growth of built-up areas and the transformation of the urban landscape are visible. A quantitative and qualitative change is taking place simultaneously, which in our view may contribute to a future environmental and social crisis.

The first chapter of the paper deals with theoretical issues of urban sprawl, especially the meaning and potential (mainly environmental and social) impacts of this process, while the second chapter presents the urban development of the three post-socialist countries and the four case study urban regions. The third chapter focuses on data and methodology, followed by results and discussions.

Some conceptual issues of suburbanization and urban sprawl

Understanding the relationship between urban sprawl and suburbanisation

Residential suburbanisation and urban sprawl are currently the most important urbanisation processes in Europe, even in European post-socialist countries, especially in Central Europe (Berg et al.1982; Ilbery 1999; Timár, Váradi 2001; Sturm, Cohen 2004; Csapó, Kocsis 2006; EEA 2006, 2016; Hirt 2007, 2012; Leetmaa, Tammaru 2007; Bajmócy 2012; Csapó, Balogh 2012; Kubeš 2013). When examining the suburbanisation of residential places, it is primarily the spatial rearrangement, the deconcentration of population that is analysed. The expression 'urban sprawl' means the expansion of built-up areas with urban character, especially when this expansion takes place not in a compact form, i.e. adjoining already built-up areas but in a scattered way, in the form of loosely connected built-up patches of different sizes, at a certain distance from each other. Basically, the expansion of urban space itself has accelerated (Angel et al. 2011; Haase, Schwarz 2016; Bielek et al. 2017; Gardi 2017; Wolff, Haase, Haase 2018). A frequent concomitant of suburbanisation is the so-called urban sprawl. Therefore the two concepts are often used as synonyms. The two phenomena, however, do not necessarily depend upon each other. Although the most intensive urban sprawl can no doubt be seen in suburbs (Salamin, Sütő, Kovács 2009), the takeover of artificially built-up surfaces can also start in areas untouched by suburbanisation. It is becoming more and more typical around smaller towns, in fact, even in

urban areas with a decreasing population (Nagy, Hegedűs 2016; Wolff, Haase, Haase 2018). Urban sprawl is now a broadly examined phenomenon, with several definitions. Salamin, Sütő and Kovács (2009) link it to the phenomenon of suburbanisation and define it as the territorial expansion of suburban areas. Hardi, Farkas and Hegyiné Bolla (2021) focus on the urbanised use and describe this phenomenon as the quantitative growth and functional transformation of areas with this characteristic. In these countries it can be seen in its most extended form in the capital city area, but signs of this process can also be seen in the case of other large cities – e.g. Győr, Pécs, or Szeged (Salamin, Sütő, Kovács 2009) in Hungary, Nitra or Kosice in Slovakia, Cluj in Romania.

The importance of the landscape-based approach and the impacts of urban sprawl

Angel et al. (2011) examined the rate of growth of the urban population and urban land cover in a global sample of 120 cities between 1990 and 2000. The rate of population growth averaged 1.60% per annum and that of territorial expansion 3.66%. The world's urban population will double in 43 years, meanwhile the urban land cover in only 19 years. Important studies proved the existence of a bigger gap than this. A basic study is the one written by Julian D. Marshall (2007), according to which the growth of the territories used in an urbanised way may be up to three times as fast as the rate of population growth. The land use by new inhabitants moving in is typically double that of the current dwellers. Of course, numbers may change in accordance with the examination methodology and the definition of built-up areas, but the point is the same: the growth of built-up areas is much faster than that of the population. These differences lead to the rapidly decreasing density of residents in urban areas (density of residents means the quotient of the number of population and the built-up residential area). This phenomenon can be observed all over the world and is a proof for the extensive use of territory (Antrop 2004, 2005; Angel et al. 2011; Wolff, Haase, Haase 2018).

A landscape-based approach is important: especially from the point of view of the environmental questions, the land-use change is a basic aspect. In addition to the growth in residential areas, the growth of the urbanised areas should also be considered as an effect of the changing lifestyle. The results depend on what is included in the analysis: what is taken as an urban area, only the land used by residential buildings or all built-up areas, irrespective of their exact functions? The latter viewpoint can be advocated. The territories of shopping centers, workplaces, and the areas of recreation are also linked to the penetration of urban space use, especially because one of the important features of peri-urban areas is the birth of single-function belts. This means that the appearance of large new residential zones is typical. Besides these residential zones and spatially separated from

them are workplaces, service centres, and leisure and recreational facilities, which can be found growing in the natural or semi-natural areas.

This leads to two important conclusions for examinations using a landscape-based approach: 1) the number of population should be compared to the total of built-up areas, as it is not only the space used for residential purposes that is used in a peri-urban area, but so are shopping centers, playgrounds etc.; 2) it is important to pay attention to the examination of the morphology and functional patterns of built-up areas. The need for this latter analysis is proven by the fact that during the expansion of urban areas the change of the pattern of built-up areas impacts the ecological conditions of the landscape considerably. The more fragmented and scattered the built up areas, the more the natural or semi-natural habitats and/or agricultural lands are separated by the patches of artificial surfaces and the infrastructure lines connecting them (Forman 1995, 2008). The fragmentation of habitats may lead to rapid ecological degradation.

The significance of the patterns for society is derived from the direct and societal costs of use. A low density of residents and dispersed settlement structure will significantly increase the operational costs of public utility services calculated for one person. The low density of residents may make the provision of services almost impossible. The correlation of transportation and the pattern of the settlement network is evident for all. Camagni, Gibelli and Rigamonti (2002) made a classification for the main building up patterns of urban sprawl and compared these from the aspect of public transportation and car dependency. Most of the urban sprawl patterns significantly increase car dependency, which in turn may multiply the societal costs of transportation, due to environment pollution, traffic jams, vehicle parking difficulties, the spatial rearrangement of the services sector etc. (Kovács et al. 2017; Hardi, Farkas, Hegyiné Bolla 2021). Of all consequences of suburbanisation and urban sprawl, the most obvious and most striking effect is the strong increase of transport demand. The increasing transport demand is in direct correlation with the degradation of the condition of the environment. Many have already summarised the impacts of the expansion of urban spaces on environment and human health, like Kahn (2000), Johnson (2001), and Sturm, Cohen (2004). In the extended list of impacts, the top ones are the intensification of air pollution caused by traffic, especially the growing concentration of floating dust, carbon-dioxide and nitrogen-oxides. According to the surveys of Kovács et al. (2017), 19% of the ecological footprint of an average commuter living in the agglomeration of Budapest comes from daily transportation. A logical consequence of this is that in the case of relatively smaller, monocentric agglomerations the efficiency-decreasing impact of urban sprawl is especially strong as the population density will be significantly lower in the continuously expanding area than in metropolitan regions. In the case of big cities, e.g. Budapest, the reaction of decision-makers to the well-known problem is usually the development of public transportation, maybe agglomeration tariffs/season

tickets, and the construction of P+R parking facilities. As a result of these, in the agglomeration of Budapest more than half of the daily commuters use these solutions instead of a car (Jászberényi, Kotosz 2009). It is true, though, that in the metropolitan agglomeration around Budapest the frequency of car use differs across the different zones, according to the study cited: it is higher in the nearer zone (10–20 kilometres) and lower in the more remote ones.

Background processes of the recent suburbanisation and urban sprawl in Slovakia, Hungary, and in Romania

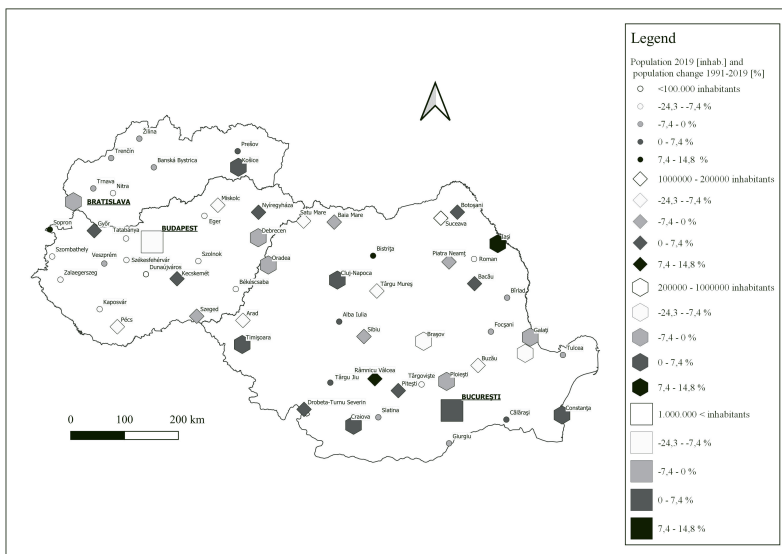
General features of urbanisation from the perspective of population change and in the context of settlement structure

Agreeing with the views of some authors (e.g. Konrád, Szelényi 1971; Enyedi 1984) one of the most important spatial processes of the countries in Central Europe in the second half of the twentieth century was belated urbanisation (of course on different grounds in each country), as an effect of which the level of urbanisation in the region converged (the countries to each other and to the West), but this process had obvious characteristic features (Figure 1). This context can be examined from the aspect of how much this process was determined by the socialist system (Konrád, Szelényi 1971; Enyedi 1988, 2012), and can also be interpreted as the specific urbanisation of a semi-peripheral region (Kennedy, Smith 1989). Classic mass urbanisation slowed down in the eighties. After the regime change suburbanisation, a globally dominant trend, gradually appeared, first in the metropolitan, capital city agglomeration (Kovács K. 1999; Kovács Z. 1999, 2006, 2014; Schuchmann 2012), and then by the 2000s it became a generally observable phenomenon.

It is also interesting from a theoretical aspect how an urban planning system built on a centralised logic transformed into a liberalised market orientation, how the Fordist-post-Fordist turn was intertwined with political transformations (Tosics 2005; Tosics et al. 2010; Ehrlich, Kriszan, Lang 2012; Egedy 2021). It is also a remarkable phenomenon how the emergence of dependence on foreign capital affected the development of towns and cities in this macro-region. Briefly the issue is: how the new directions of urbanisation were influenced by the fundamental social change when the macro-region turned from the relatively developed edge of the socialist world into the semi-periphery of the capitalist world. According to Castells (1977) urbanisation also has basic significance from the aspect of the development direction of towns and cities. Although currently the frameworks of classic industrial capitalism examined in Castells's age do not dominate the macro-region, the characteristics of urban development are still dominantly affected by investments, the spatial distribution of capital and the transformation of the division of labour.

Figure 1.: FUA urban centres of examined countries, categorised by number of inhabitants, and by population change between 1991 and 2019

A vizsgált országok FUA-városközpontjai, a lakosok száma és a népesség 1991-2019 közötti változása szerinti csoportosításban

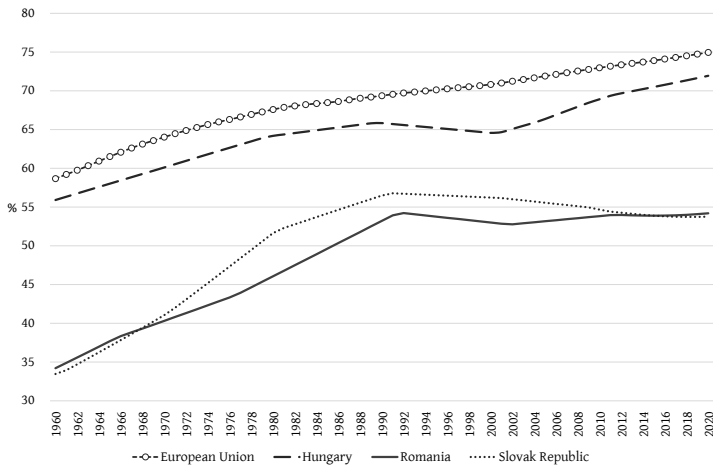


Source: EUROSTAT, Urban Audit data, mapping: Katalin Hegyiné Bolla

Looking at the urbanisation levels of the three countries it can be seen that in the second half of the 20th century they turned from countries of a definite rural character to urbanised states (Figure 2). Hungary had exceeded a 50% urbanisation level by the 1960s, while the other two countries approached 35%. The difference has remained until now: Hungary features a high level of urbanisation, similar to the EU average, while in the two countries it is almost 55%, which is slightly over the world average.

The higher level for Hungary is due to a large extent to the weight of Budapest and its agglomeration within the Hungarian urban network: according to World Bank data, it is home to 25.2% of the country's population, whereas the same proportions in Romania and Slovakia are 17.3% and 14.8%, respectively. These proportions have not changed significantly over the last sixty years, the share of Budapest decreased from 32% (more or less evenly), whereas it was 16% in Bucharest and has reached 17.3% with ups and downs by now. Bratislava started from 17.5%, reached the nadir in the nineties and its share is now growing again. This shows that the positions of the capital cities and their agglomerations in the settlement networks are different in all three countries. During its historical development process, Budapest emerged as the capital city of a country much larger in the early twentieth century. Accordingly, the urban network of modern Hungary is rather centralised, with the dominant role of the capital city and a few major regional centres, with seven of these having more

Figure 2.: Level of urbanisation in the countries examined and in the EU, 1960–2020
 Az urbanizáció szintje a vizsgált országokban és az EU-ban, 1960–2020



Source: author's construction using WORLD BANK DATA

than 100 thousand inhabitants but all below the middle city category by European standards. The location of Bucharest in Romania is less central, and this large country has several significant regional centres that together with their agglomerations reach the European middle city category (300–400 thousand inhabitants). Bratislava is the smallest of the three capital cities: even with its agglomeration it is only in the middle city category. Bratislava has been the capital city since 1993, only, since Slovakia seceded from Czechoslovakia, where it was one of the two significant regional centres (the other one was Brno), besides the capital city Prague, a city of a million and a half inhabitants. Its location is peripheral within the country; it is situated right next to the western border. Thus, Slovakia is now a double-pole country: the other big city, Košice can be found in the eastern part of the country that is less developed economically. Besides these two cities there are only smaller centres with less than a hundred thousand inhabitants (Gajdoš, Moravanská 2013). These disparities of the urban network influence the directions of internal migration as well: in Hungary (Kocsis 2015) the main target of domestic migration is the capital city with its agglomerations, and the population of some smaller regional centres is also growing, but to a much lesser extent (it is also true for Slovakia, despite the double-pole character). In Romania, besides Bucharest there are similarly significant destinations of migration to different regional centres of the country (Cluj, Timișoara, Iași, Brașov, Sibiu, Oradea). Although Romania is unique in that the first wave of internal migration after the regime change in the early 1990s was directed to rural areas (see below). One thing is common in the three countries: internal migration is oriented towards particular destinations, concerning a few cities, and having a rather strong migration push on these.

Meanwhile the rest of the country, including smaller towns, is continuously losing its population due to inner and international migration and aging. At the same time, international immigration – as opposed to the examples from Western Europe – is not so significant that it could have a considerable impact on the directions of urban development.

The impacts of the changing role of housing policies

The urban transformation of the macro-region is undoubtedly the result of decades of socialism. Whereas the rapid development of the capital cities (including Bratislava) started at the late 19th and early 20th century, the urbanisation of the countryside centres took place in the period following World War II. A common feature of all three countries is that urban development happened and the solution of housing problems was implemented primarily through state investments, and also that the pace of these investments lagged behind the speed of industrialisation and the flow of the rural population into the cities, which led to tensions in the field of infrastructure (Konrád, Szelényi 2000). To increase the available housing, all three countries launched mass state housing construction programmes that failed to satisfy demands. In order to prevent this, each government tried to slow down the flow of people into the cities, mainly with administrative tools. Accordingly, besides the overloaded state tenement sector it was mainly private investments that helped the housing problems of families working in the cities, especially in villages and the outskirts of the cities. By the 1980s the growth of suburban zones was an existing phenomenon, which is also called ‘pseudo-suburbanisation’ by some authors (Vasárus 2016). It became a general phenomenon around the cities that the increase of the level of urbanisation was reached by the annexation of the nearby rural settlements to the cities, thus increasing the proportion of urban population, and allowing the birth of ‘quasi-suburbs’. Each case was similar in their form and appearance to the suburban areas, but the causes and the ways of implementation were different from the classic western suburbanization. The main reason for the appearance was the inadequate investment capacities of the public sector to satisfy the needs of urbanisation. The state-controlled housing sector could not provide enough dwellings for those who wanted to move to the city, so they looked for opportunities in the surrounding municipalities. It is a fact that the dominant role of the public sector, central planning and distribution led to a territorial development more compact than the present one. The spatial location of several housing estates of the time was defined with complex planning of transport and other networks. A real excess of economising with agricultural areas was the settlement systematisation programme of the communist government of Romania, valid from 1975 to 1990. This programme, embittering the lives of not only villages but also of smaller towns, wished to

preserve, or rather enlarge agricultural areas by the elimination of the areas dominated by 'less effective' private, detached houses and by moving the residents into central housing blocks. All these phenomena that were the consequences of political intentions and the failure of the centralised management of the economy contradicted both the natural intentions of the inhabitants and market laws (Suditu et al. 2010, 2014; Grigorescu et al. 2012; Suditu 2012; Dumitrache et al. 2016).

The most important outcome of the regime change from the aspect of the topic of this paper is that the state moved out of the housing market and got rid of its tenements (Dövényi, Kok, Kovács 1998). It was usually these dwellers that could privatise their homes. This led to two consequences: one was the almost complete disappearance of the tenement sector in all three countries. While the majority of the urban homes had formerly been tenements, the overwhelming majority of homes are now privately owned in all three countries (with the owners living in their own homes). As regards the proportions of owner-occupied dwellings, these three countries show the highest proportions within the European Union: the share of inhabitants who own their dwellings in Hungary and Slovakia is 85% and 90% respectively, whereas the same figure for Romania is about 95% (Portfolio 2018 based on EUROSTAT). The other impact is that the number of newly built homes drastically declined in the 1990s, especially in towns and cities. New homes were typically built in the countryside, financed by the owners, in the form of detached houses. This led to a significant increase in the prices of used city dwellings, resulting in the accumulation of capital at those who had previously bought them from the state at depressed prices. At the same time, the values of homes in the so-called 'socialist towns' that had been built on certain industries or large-scale production plants fell drastically, which almost completely prevented their residents from moving to regions with better employment opportunities. Cheap living became possible in villages, which led to a considerable migration from towns and cities to rural areas e.g. in Romania (Suditu et al. 2010, 2014; Grigorescu et al. 2012; Suditu 2012). The changing migration patterns in Romania after 1990 were closely related to the process of industrial restructuring and economic decline in certain urban centres, contributing to massive lay-offs. The workers made redundant represent the first generation of migrants, who, by moving back to their native villages brought about a change in the direction of internal migration. As a result, in the mid-1990s, both the share of the rural population and the share of agricultural employment increased in Romania, with the latter rising to over thirty percent. In Hungary poorer families tried to free themselves from the growing living costs in towns and cities by moving into garden zones in the suburbs.

Housing constructions gained a new momentum in each country at the beginning of the 2000s. This was assisted by two, formerly missing conditions: previously non-available/non-existing mortgage credits, and effective state

support. Both conditions favoured the construction of new homes. Self-financed constructions of privately owned detached houses became typical, and the availability of cheap land plots favoured settlements surrounding cities. This phenomenon had become very frequent in the case of capital cities in the nineties (Váradi 1997) while countryside centres joined this process after the start of the 2000s. The world economic crisis of 2008 resulted in considerable decline, but, especially in Hungary, the number of newly built homes started to rise rapidly again due to government support. Similar tendencies could also be observed in Romania, while Slovakia has not seen a significant decline due to the crisis: the upward trend has remained essentially unchanged. Meanwhile, a significant shift occurred: in cities and suburbs housing constructions on business grounds became more and more important, leading to the construction of terraced houses and blocks with several flats, while detached houses were pushed to more remote zones. This was both a reason for and a consequence of the extraordinary rise in land plot prices in these areas. This process first became visible in Romania, followed by Slovakia (Kopecká, Rosina 2014; Haladová, Petrovič 2015; Izakovičová, Mederly, Petrovič 2017; Repaská, Viliňová, Šolcová 2017), and finally by Hungary. The mass of small homes built this way are constructed for sale, they are bought by investors, and so a hidden new tenement system seems to emerge especially in those cities and agglomerations that have become migration destinations for poorer layers. It is unfavourable from the aspect of urban sprawl and the renewal programme of urban homes as governments primarily support the construction/purchase of newly built homes. There are still no major programmes for renovation and for the construction of tenements. In this case there is strong pressure on investors and entrepreneurs to build new homes as cost-efficiently as possible, and this leaves a mark on the expansion of cities as well (Hajdú, Horeczki, Rácz 2018).

The world economic crisis starting in 2008 seemed to have brought a turn in housing constructions, and in building up the suburbs. The combination of the historical legacy of housing shortages in our countries, current internal migration trends and pro-cyclical government support led to an unprecedented increase in housing starts in the mid-2010s. It is typical especially in Romania that in suburbs in the vicinity of cities multi-storey buildings have been erected in masses besides/ instead of the formerly dominant detached houses, while the volume of these is less in Slovakia and Hungary (it is not densely built-up residential blocks but terraced houses that are more typical in these two countries).

The transformation of the regulation of home constructions and urban development is also important for the understanding of the phenomenon of urban sprawl (Szirmai 2011). Before the regime change, as it was demonstrated, central planning had been prevalent, as an effect of which cities in this region had been more compact than cities in the western countries. In the nineties this role, however, almost completely ceased to exist, to different extents country by country.

Figure 3.: Number of finished dwellings in Hungary, Romania and Slovakia between 1990 and 2020

A befejezett lakások száma Magyarországon, Romániában és Szlovákiában
1990-2020 között



Sources: author's construction based on national statistical offices' data

The restoration of the sovereignty of municipalities was of primary importance, and this was also true for construction authority competencies. This meant that municipalities could freely decide on construction issues of their own territories, at the same time regulation, especially the sanctioning of offences became more and more liberal. It was a major problem that the obligation of reconciliations among settlements was no longer enforced, especially not at agglomeration level. In Hungary, construction matters became more and more centralised again in the recent years, although it is a task delegated to the level of districts (i.e. micro-regions), leaving less and less competencies for the municipalities to influence what is built in their territories and how. Strong market pressure, on the other hand, increases the lobbying power of businesses for making municipal decisions favourable for them. A consequence of this is that regulations and constructions became slightly chaotic, especially in Romania. It can also be seen in Hungary and Slovakia that many constructions are more in line with the short-term interests of entrepreneurs than the longer term interests of the dwellers or society (Suditu 2012; Hajdú, Horeczki, Rácz 2018; Izakovičová, Petrovič, Pauditšová 2022). The effect of this will probably be palpable in 10-15 years when the social and technical degradation of the presently very densely inhabited urban and peri-urban quarters, sometimes constructed in inadequate quality, will start.

Data and methodology

The most frequently used sources of the examination of the expansion of urban areas are databases gained from the analysis of satellite photographs (Jat, Garg, Khare 2008), which allow the analysis of the land cover types, their extensions and changes. Several sources for this are now available; the most broadly used of these in Europe is the database of the Copernicus programme created and coordinated by the European Commission. The programme, in addition to the analysis of satellite photographs, corrects the data with ground observations and expert participation, resulting in the availability of more and more accurate data year after year (Farkas, Hoyk 2012). The “Land cover and Land use mapping” package of Copernicus contains the CORINE Land Cover (CLC) database that now contains land cover data of the Union member states and accession countries for five dates (1990; 2000; 2006; 2012; 2018). Of all Copernicus data, layers containing imperviousness values seem to be the most suitable for our research purpose. Imperviousness shows the percentage of a given surface area that is covered with surfaces that are permeable to rainwater and the percentage of the surface area that is not permeable for water (impervious surface). The latter is usually an artificial surface, a building, a paved road, or another man-made feature. The importance of studying them is that one of the most important environmental effects of built-up areas is that they alter the way rainwater runs off and infiltrates into the soil. It should be emphasised, in contrast to the general study of the extent of residential areas, that the study of the impervious surface (due to the high resolution of the database) also takes into account the development of small-scale infrastructure (roads, playgrounds, industrial fields, etc.). On the other hand, it also distinguishes green areas within the residential areas, so these are not included in the calculation of the extension of artificial surfaces. Overall, the Copernicus database is therefore more suitable for examining real residential densities and for estimating the environmental impact of urban development in the future. This database allows us to compare data from rural areas (where expansion involves small units) with data from urban areas.

These are high resolution layers, with a resolution of 20 metres, as opposed to the CORINE database where data recording is done in a resolution of a quarter of a hectare and the published raster figure has a resolution of 100 metres. Further arguments for the use of the imperviousness data are that the processing of these allows us to see the structure of infrastructure elements like a motorway, at the same time green (i.e. pervious) surfaces within the settlements are not taken into consideration in the examination. This is more in line with the above-indicated research principles, i.e. the intention to examine the growth of built-up areas, irrespective of their functions, where an important factor is the detection of the expansion of patches and axes fragmenting the landscape. When applying these data, however, it must be taken into consideration that the imperviousness

raster register distinguishes the impregnating coverage of the respective 20X20 metre area in a percentage value, so the quadrants taken as impervious surfaces contain such areas to various degrees. In our examination this fact was not taken into consideration, all imperviousness patches were taken as equal. Due to the higher resolution, the size of built-up areas detected this way is basically smaller than the size of residential areas calculated in the CLC, as gardens and unpaved surfaces are left out of consideration. The imperviousness database is available for three years: 2006, 2015 and 2018. These can be compared both in time and by countries, as they were compiled using the same methodology, although the intervals between the three dates have different lengths.

Besides the size of built-up areas, the number of population at municipal level is also necessary for our examinations. These were gained from the EUROSTAT database. Unfortunately, population numbers at municipal level are only available for census years and for 2019, so the calculations of population density could only be done with the annual data closest in time to the surface coverage data. Accordingly, the population data of 2001 were assigned to the land coverage data of 2006, the population data of 2011 and 2019 to the surface coverage data of 2015 and 2018, respectively. This does not allow the publication of exact information but is suitable for the demonstration of tendencies in time and space.

The data of the population and the size of built-up areas were examined at several levels for the total combined territory of the three countries and for each country separately: 1) for the total of the settlements, 2) for capital city regions, 3) for urban regions in the countryside, 4) for settlements outside urban areas. The selection of urban areas was done using the list of the Urban Audit, but the areas taken into consideration were not the FUA (Functional Urban Area) areas used in the Audit, as they had been determined in the three countries by extremely diverse methodologies; in this examination the 10 and 20-kilometre radiuses were calculated from the edge of the built-up areas of the centres used. This way the urban areas defined by the authors were examined in a uniform system.

On the basis of these, two main characteristics were examined: the change in the number of population (here: density of inhabitants) calculated for built-up areas and the extension of impervious surfaces at different territorial levels at different times.

Results

Changes of impervious surfaces in the regional centres' regions comparing to the capital city regions and countryside

Looking at the share of impervious surfaces from the total territories of settlements, it is visible that besides a general and rapid growth, in all three countries the capital city regions stand out considerably. The extent of this

jutting out is less in Bratislava than in the other two capital cities, the reason for which is the fact that the administrative territory of the capital city includes several mountainous areas (Smaller Carpathians), and a former rural area annexed to the capital city relatively recently. The extent of building up in the countryside centres is more similar to the rural spaces than to the big city (Table 1).

Table 1.: Proportions of impervious surfaces of the administrative territories of municipalities in the three countries, by spatial types
A három ország településeinek közigazgatási területén lévő vizet át nem eresztő felületek aránya területi típusok szerint

	<i>Share of impervious coverage in (%)</i>		
	<i>2006</i>	<i>2012</i>	<i>2018</i>
Hungary	3.83	3.93	4.54
Capital city region	37.01	38.28	39.86
Regional centres' regions	4.91	5.06	5.82
Countryside	2.96	3.03	3.56
Romania	2.19	2.26	2.77
Capital city region	23.02	24.66	26.93
Regional centres' regions	4.43	4.65	5.52
Countryside	1.62	1.65	2.09
Slovakia	3.51	3.67	4.27
Capital city region	8.84	9.87	11.72
Regional centres' regions	5.30	5.63	6.56
Countryside	2.86	2.94	3.41
Total area	2.76	2.85	3.40

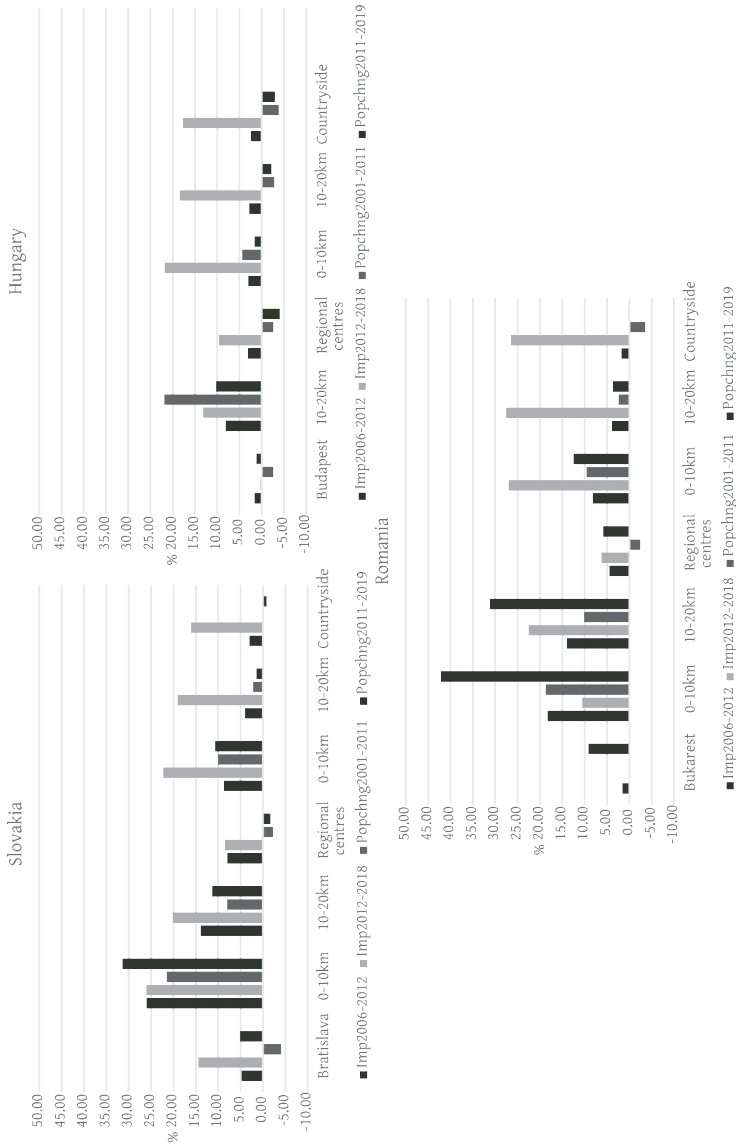
Source: database made by Jenő Farkas, using EU COPERNICUS programme and EUROSTAT; processed by the author

The transition of insulating surfaces and the number of population in time is demonstrated from 2006 to 2012 and from 2012 to 2018 in a breakdown by the capital cities and their belts of 0–10 and 10–20 kilometres radius, regional centres and their belts of similar sizes, and ‘countryside’ areas outside the former ones. (Due to the availability of population data, for the number of population the intervals of 2001–2011 and 2011–2019 could be applied (Figure 4).

In the case of the capital cities, weak transitions can be seen: the number of their inhabitants slightly decreased in the first period, then started to increase again in the years between 2011 and 2019, even though not to a significant extent. The built-up areas grew considerably in one capital city only: Bratislava, being probably in the phase of urban renewal rather than in intensive spatial expansion. Contrary to this, an intensive and accelerating growth of both the population and the built-up areas can be seen in the agglomerations, which generally sped up by the second phase. Budapest is an exception, as its geographical location excluded the built-up areas in the 0–10 kilometre zone, while the pace of population growth has already slowed down in the zone of 10–20 kilometres.

Figure 4.: Transition of impervious surfaces and the number of population in the three countries, by the respective territorial categories

A vízét át nem eresztő felületek és a lakosság számjának alakulása a három országban az egyes területi kategóriák szerinti bontásban



Source: database made by Jenő Farkas, using EU COPERNICUS program and EUROSTAT; processed by the author

On the other hand, as regards regional centres, the growth of built-up areas is more intensive than in the capital cities. These centres are losing their population, with the exception of the regional centres of Romania where a population growth can be detected in the second phase. In their environment a medium-level growth of growing intensity can be seen in the 0–10 kilometre zone in Slovakia and Romania, while this is of declining intensity in Hungary. In the areas outside the 10-kilometre radius population is stagnating or declining in each case in both periods, but the most striking phenomenon is the uniformly and extremely high dynamism of building up, especially in the period after the economic crisis (from 2012 to 2018).

The density of inhabitants projected to the built-up surfaces has considerably decreased in the territories of the three countries (Table 2). This is valid for all three countries; differences can only be seen in the degree. It is evident that the change was much more dynamic in the second phase than in the first one, especially considering that the second period is significantly shorter than the first one. If data are broken down by capital city regions, the territories of countryside centres and areas outside these, the change in the capital cities and their areas differs from that of the other areas: in the second period the decline

Table 2.: Density of inhabitants calculated for impervious surfaces
A vizet át nem eresztő felületekre számított lakószűrűség

	<i>Density (persons/km²)</i>			<i>Density change (%)</i>	
	2006	2012	2018	2006-2012	2012-2018
Hungary	2,863.3	2,721.0	2,316.2	-5.0	-14.9
Capital city region	5,123.0	4,980.6	4,906.4	-2.8	-1.5
Regional centres' regions	2,993.7	2,844.5	2,399.1	-5.0	-15.7
Countryside	2,362.6	2,217.8	1,827.3	-6.1	-17.6
Romania	4,183.3	3,986.4	3,360.2	-4.7	-15.7
Capital city region	8,000.9	7,562.1	7,762.6	-5.5	2.7
Regional centres' regions	4,832.9	4,600.6	4,100.2	-4.8	-10.9
Countryside	3,512.5	3,329.1	2,638.1	-5.2	-20.8
Slovakia	3,126.7	2,999.1	2,601.6	-4.1	-13.3
Capital city region	3,842.3	3,476.8	3,209.0	-9.5	-7.7
Regional centres' regions	3,253.1	3,101.6	2,700.8	-4.7	-12.9
Countryside	2,947.4	2,860.1	2,444.9	-3.0	-14.5
Total area	3,562.4	3,395.2	2,896.4	-4.7	-14.7

Source: author's calculations, using COPERNICUS database

of population density slowed down to some extent in the case of Budapest and Bratislava, while in Bucharest there was actually an increase in the density of inhabitants.

Some results of different regional centers' regions in the three countries

Four sample areas, agglomerations of four regional centres, were selected for the study. All four urban centres are important migration destinations in the country and are therefore under strong population pressure. Migrants typically come from other rural areas of the country with the aim of finding work in the city. Development is driven by the cities' rapidly growing economies. Agglomerations are monocentric, with no sub-centres, for example Győr (133, 000 inhabitants) and Kecskemét (112,000 inhabitants) in Hungary, Nitra (78,000 inhabitants) in Slovakia and Cluj-Napoca (303,000 inhabitants) in Romania. It is true that the cities studied have different population sizes, but each one is the social, educational and economic centre of a part of the country. Their respective roles in the national urban network are similar. Three of them owe their attractiveness primarily to the automotive industry, while Cluj-Napoca owes its attractiveness to IT technology. All three cities have developed a significant suburban ring around them over the last twenty years. All of these agglomerations were formerly traditional villages with significant agricultural employment. Thus, the change may be greater and more pronounced than in the case of metropolitan areas that already had suburban settlements before the change of regime.

Looking at the suburbs it can be seen that the development trends of the past decade and a half are different from the previous ones. The qualitative and quantitative characteristics of constructions have changed, a larger proportion of building up can be seen in smaller residential estates, and so in these settlements the density of inhabitants is rising to an extreme extent. There are several reasons for this: 1) the general increase in wages and labour demand after the 2008 crisis, 2) rising prices in the construction sector due to increasing demand and state subsidies, 3) in parallel, the liberalisation of building regulations leading to a rapid and unplanned increase in suburbanisation. The latter can be characterised by ever denser development, with ever smaller dwellings, and extensive land use (Figure 5–7).

This development does not contradict the statement made in the introduction of this paper about the rapid decrease in the density of inhabitants. Several densely built-up patches are created, in some suburban settlements certain streets, former outskirts freshly declared as residential zones are quickly populated, sometimes overpopulated. This is demonstrated by the expansion of non-impervious surfaces (Figure 7). Győr, Kecskemét and Nitra each show the emergence of a major industrial area. However, the phenomenon of sprawl mainly concerns Cluj-Napoca and Nitra, where a significant amount of

Figure 5.: Suburban residential zone in Florești, on the edge of Cluj (Romania)
Szuburbán lakóövezet Florești-ben, Kolozsvár szélén (Románia)



Source: photo by the author 2019

Figure 6.: Dense terraced housing in the suburban zone of Nitra (Slovakia)
Sűrű sorházazs beépítés Nyitra szuburbán övezetében (Szlovákia)



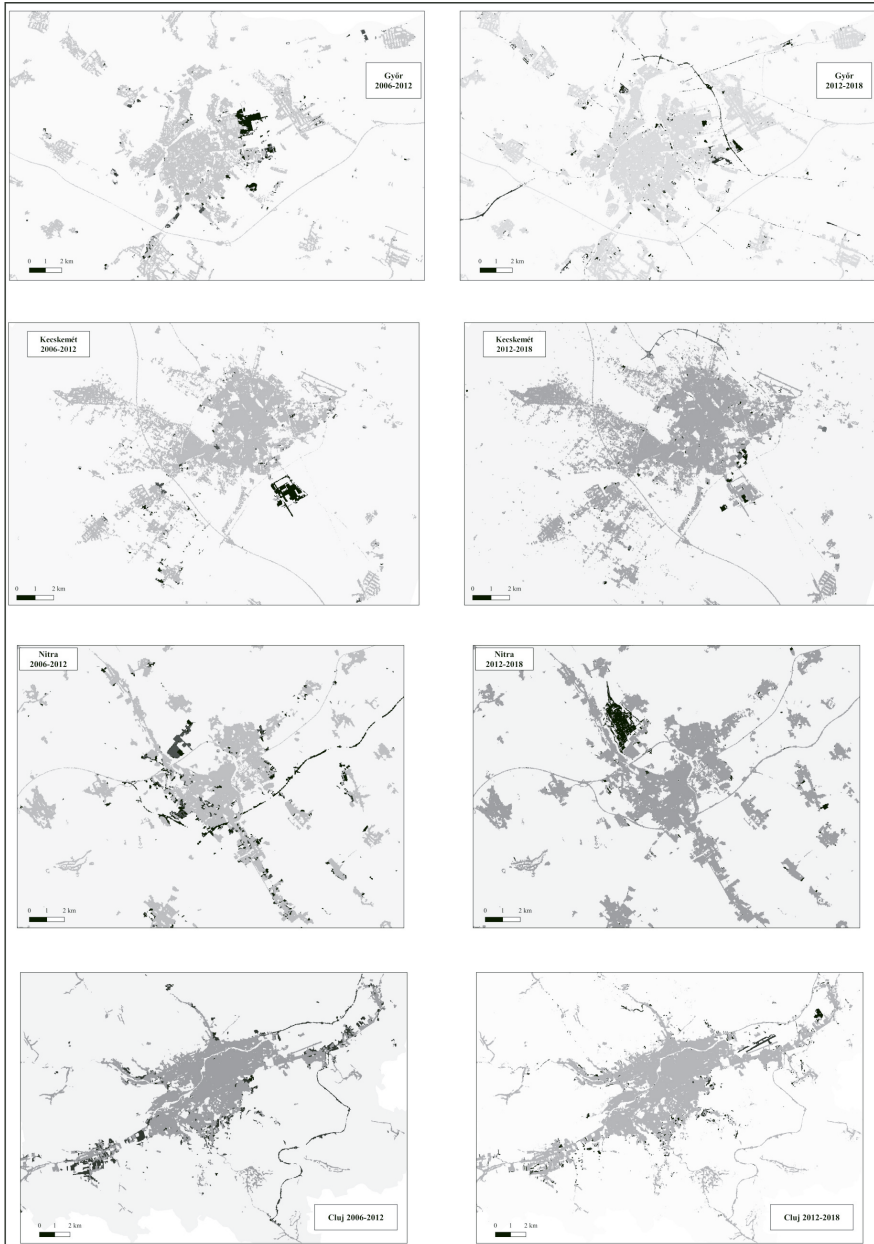
Source: photo by the author 2019

Figure 7.: Family houses on small residential plots in the suburbs of Győr (Hungary)
Kis telkeken épült családi házak Győr szuburbiájában (Magyarország)



Source: photo by the author 2019

Figure 8.: Changing impervious surfaces in Győr, Kecskemét (HU), Nitra (SK) and Cluj (RO) and their surroundings (2006–2012 and 2012–2018) (New impervious surfaces are highlighted by black)
A vizet át nem eresztő felületek változása Győrben, Kecskeméten, Nyitrán és Kolozsváron és környékükön
(2006–2012 és 2012–2018) (Az új felületek fekete színnel kiemelve)



Source: mapping by Katalin Hegyiné Bolla, using EU COPERNICUS database

residential expansion is visible, especially in the first period. However, residential expansion is lowest in the Kecskemét area.

Discussion

The survey demonstrated that the decrease of the density of inhabitants, mentioned by several authors as one of the major features of metropolitan areas, is generally true also in the countryside areas. After the world economic crisis starting in 2008 the dynamism of building up considerably increased, its proportions and the speed of the growth in countryside areas significantly exceeded those in the big city regions. While in the big cities this growth is largely linked to the concentration of the population measured at a national scale, in the countryside areas this process takes place with a stagnating or declining population, i.e. constructions follow more and more extensive land-use patterns.

The paper draws a comparison between three countries that have gone through similar socio-economic transition processes in the last three decades: from a socialist system to a liberal capitalist one that relies on external capital sources. In the development of cities, similar phases can be distinguished, but under different geographical and settlement network endowments and with different historical heritages, which all have an impact on the development of the settlements.

As regards the capital cities, the Romanian and the Hungarian capitals are different from the Slovak one. Both are real metropolises, with a population far exceeding a million and a half. Their histories, on the other hand, are different: the most dynamic period of their development was at different times. The growth of Budapest was dynamic already in the late 19th century, then several early suburbs were annexed to it in the 20th century, keeping its population density at a lower level than in Bucharest, whose dynamic growth happened in the period of socialism, with the dominance of communist ideology and urban development principles, leading to a much more compact residential area. Bratislava is traditionally a middle city, raised to the capital city rank only in 1993. Its administrative territory includes relatively extended mountainous areas not suitable for building up, as well as former villages annexed to the city at the time of socialism (Slavík et al. 2011). This leads to a much lower density of inhabitants in Bratislava than in the other two large capital cities. All three capital cities have been territories of large-scale constructions in the past decades, still, the growth of non-permeable surface is still the lowest in these cities. Behind this there is an evident statistical effect, as the proportion of built-up areas is initially high, keeping the growth rate at a low level. On the other hand, these big cities are the ones that have already entered the period of urban renewal, besides primary expansion. In order to substitute the few and relatively

expensive greenfield areas, the building up of brownfield areas is more and more typical, as is the replacement, renewal and change of functions of the existing buildings. These phenomena are much less typical in the countryside centres for the time being. In these middle cities there are still areas not built up, there are several belts that are situated between the villages formerly annexed to the cities and the central residential zones of the cities. Urban fringes are the target areas of both classical suburban moving out, and migration flowing from the rural areas to the central regions. Although behind the changing numbers of population, the proportion of those leaving the central cities is unknown. From the above-mentioned statistics it could be estimated that suburbanisation is considerable in the capital cities and in a few densely populated regional centres in the first place, whereas the loss of population due to suburbanisation in the capital cities is compensated for by migration from rural areas to the cities. Regional centres show similar patterns at smaller scales, but with a higher proportion of those moving from more remote rural areas to the 0–10 kilometre zones of the centres, maybe renting an apartment in the city in between. Population growth is evidently visible and extremely dynamic in the 0–20 kilometre zones of the capital cities as well, in the case of the regional centres this scale is the 0–10 kilometre zone.

It is due to the differences in the settlement networks that Romanian regional centres have also shown a significant growth of population. As mentioned earlier, the location of the capital city is eccentric in this country, which provides the regional centres with large catchment areas, which have become significant targets of migration. In Slovakia a strong and accelerating growth can also be seen in the 10-kilometre zones around the regional centres. This is especially true for the dynamic cities in the western and northern areas like Nitra or Trenčín. In Hungary, on the other hand, faster growth around regional centres seems to be vanishing, except for the urban regions with rapid economic growth.

It is clear that the dynamism of the expansion of built-up areas is almost independent of the changes in population numbers. Moving out, population growth and new constructions are typically concentrated in some selected settlements, streets and town districts of the agglomerations, which has led to even higher densities of inhabitants. Land plots are becoming smaller and smaller, and especially in territories closer to the cities the construction of terraced houses and blocks built by entrepreneurs is becoming typical. High land plot prices and short-term entrepreneurial thinking, matched by a too liberal regulation, may lead to the construction of residential districts whose market value may significantly decrease in the middle run. In more remote areas, on the other hand, land use is more extensive. It is typical especially in Romania that many old, unpaved roads get paved, formerly earth-covered industrial and agricultural locations are paved with concrete or stones, and one can often see

newly created land plots and built houses and streets next to derelict and deteriorating residential areas. An evident reason for this is general modernisation and the relatively low prices of land areas (inner areas of settlements, and plough-lands). In Hungary this is supplemented by the housing construction support of the government, which is now available in villages too. This explains the extremely high proportions of building up in more remote areas in Hungary in the second period, besides a strong decline in the number of population.

Looking at the four sample areas in the three countries shows differences in agglomerations. The Romanian sample is the densest, but shows the most sporadic expansion. The development of villages close to Cluj-Napoca (Floresti, Baciú) is based on densely built urban-style blocks, often without green spaces. At the same time, on the hillsides and former pastures, isolated patches are built up. Of the three countries, urban sprawl is most prevalent here. We believe that the liberalisation of construction started earlier and is more advanced here, and our interviews suggest that local authorities have less influence on investment than in the other two countries. In Slovakia and Hungary, there is a stronger demand from the population to own their own house as a goal, and the financial possibilities are better. Looking at the area around Nitra, we can see that the city, which is smaller than Győr, is developing a more dynamic agglomeration, with many terraced houses and denser housing. In contrast, in the case of Győr, new terraced houses and multi-storey blocks of flats are only rarely seen in the villages around the city. Rather, single-family houses and semi-detached houses built on increasingly smaller plots are typical. In general, the Hungarian example shows a smaller scale of suburbanisation and urban sprawl. If we compare the number of new dwellings per capita in the three countries, we find a significant difference: taking 2020 data, 289 new dwellings were built in Hungary; 346 in Romania and 641 in Slovakia. The reasons behind the differences in housing data are assumed to be: 1) The Hungarian population is less willing to migrate to another region than the populations of the other two countries. 2) The construction of large multifamily housing is more urban in Hungary: there is enough land within the city that can still be built. This is due to the specific past urban development. To increase the size of cities in the 1970s, surrounding villages were annexed to the cities. Thus, blockhouse construction occurs primarily in the empty areas between connected villages and cities. 3) In the case of the Romanian example, the characteristic feature of the urban network is that Cluj is the centre of a country-wide area (Transylvania), so migration reaches the city from this area.

It can be seen that despite similar urban development histories, the three countries have different urban sprawl and suburbanisation with different quantitative and qualitative characteristics.

Summary

The paper is an examination of urbanisation tendencies in three post-socialist countries, by the comparison of the change in the extension of non-water-permeable, i.e. impervious surfaces (as built-up areas) and the changes in the numbers of population, comparing the data of the capital cities, the areas of regional centres, and rural areas. After the historical overview as the foundation of urbanisation, the survey concentrates on the period from 2006 to 2018, because following the crisis starting in 2008, building up accelerated to an extreme extent in these countries. In the urban areas, the gap between the increase of the number of population and the built-up areas is opening (in favour of building up), although not to the extent observed by several authors in other parts of the world. It is an interesting phenomenon, on the other hand, this gap in rural areas is many times larger!

It is hard to detect what role the economic crisis played in this, but it is certain that the crisis led to a significant downturn, which was followed by a development with quite different directions in the cities, urban fringes and rural areas in the surveyed countries. The flow into cities seems to have accelerated, concerning mostly capital city regions and the edges of regional centres. Besides population movements, the expansion of built-up areas is much faster, especially in less densely populated areas where the dynamism of these expansions was outstandingly high between 2012 and 2018. This may have several negative consequences. In areas in the vicinity of cities, extremely high population density may emerge, which may lead to societal problems later. The rapid growth in the proportion of paved surfaces, at the same time, has negative environmental impacts: changes in the run-off of precipitation, subsoil water tables, the intensification of the heat island phenomenon in densely populated areas, growing fragmentation of the landscape in sparsely populated areas, and the declining efficiency of the provision of public services.

This makes it necessary to highlight the importance of the strengthening of regulation, and of the complex development of municipal and territorial planning, and also the organisation of information campaigns that demonstrate the environmental, climate adaptation and societal problems of unplanned expansions to the population, as these problems may affect the quality of life and the value of the private properties of the respective individuals.

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