

**THE PERI-URBANISATION EFFECT: EMERGING  
FUNCTIONAL SPATIAL PATTERNS IN ROMANIA.  
CASE STUDY ON 4 MAJOR CITIES:  
BRAȘOV, CLUJ-NAPOCA, IAȘI AND TIMIȘOARA**

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**Abstract**

Spatial planning is currently facing conceptual and practical challenges caused by an increasing number of issues required to be addressed at the intercommunal level. The aim of this paper is to discuss the concept of functional urban areas as emerging spatial patterns generated by the extensive peri-urbanisation process in the Romanian territory, employing both morphological and functional analytical approaches. The study focuses on the analysis of the territorial dynamics registered over the past 10 years around the major urban centres in Romania. The methodology compares two different contours – on one hand, the administrative limits of the metropolitan areas set according to the Government Decision (GD 998/ 2008) and on the other hand, the analytical limits of the functional urban areas, delineated through a recent World Bank's study. The selected case studies include four major cities in the Romanian settlement's network, namely Brașov, Cluj-Napoca, Iași and Timișoara, considered among the fastest growing urban centres in the past decade. The results of this study confirm the initial hypothesis that the spatial impact of peri-urbanisation around large urban centres (mainly reflected by population growth, increase in the built-up area and the development of residential units) is not limited to the outline of the current metropolitan areas. Based on this argument, we support the need to review the current boundaries of the metropolitan areas, following a set of methodological guidelines driven by both morphological and functional considerations. This approach will not only solve the problem of updating territories in which priority investments from European and national financing programs will be made, but it will also provide a well-grounded preliminary framework for a potential future metropolitan reform.

**Keywords:** spatial planning, intercommunity, functional urban areas, territorial dynamics, metropolitan areas

## 1. INTRODUCTION

### 1.1 Key facts on the urbanisation phenomenon

The subject of urbanisation and the subsequent peri-urbanisation phenomenon are defining the global reality of the 21<sup>st</sup> century without any doubt. In fact, these trends have constantly changed the configuration of settlements, giving birth to new spatial patterns driven by dynamic functional relations. Ever since the industrial revolution, the pace of population growth accelerated considerably, producing an unprecedented increasing urbanisation. At the beginning of the last century, about 16% of the world's population lived in urban areas, while in 2015 the percentage of the urban population exceeded the 50% threshold, the increase being estimated at 75% for 2050 [1]. This trend applies to the European territory likewise, where the share of urban population reached almost three quarters (72.5%) in 2014, with the EU-28 inhabitants living in cities, towns and suburbs [2]. Obviously, there are significant variations in the size and spatial distribution of urban areas worldwide, from emerging megacities in different parts of Asia and the United States on one side, and under-developing countries and cities in Africa, on the other. Considerable differences are also registered among the Member State of the European Union, where a concentration of urbanisation is witnessed in the so-called Blue Banana, "a discontinuous corridor of urbanisation spreading over Western and Central Europe" [3]. In this urbanisation landscape, Romania indicates a similar trend with smaller values, as its urban population counted 10.5 million people at the beginning of 2018, representing around 53.8% of the country's population [4]. Furthermore, statistics show that Europe is confronting with a significant gap between population growth and artificial surface area growth. According to various projections resulted from the scenarios developed in the PLUREL project, the gap between population and artificial surface growth is expected to increase in the coming years, leading, ultimately, to an increase in land consumption per capita [5]. In the post-war period, European cities increased between 40% and 300% in size, but considerably less in population [6]. On average, the data shows that changes in the built-up area were almost three times higher than population changes for the period 1990-2000. The same trend applies also to the period 2000-2006, but the changes in built-up area were only two times higher [6]. Continuous urban expansion at rates much higher than population growth has resulted in a pattern of low-density settlements and suburban areas around cities, leading to an increased demand for transportation systems and socio-cultural services. This process has intensified functional relationship between urban cores and their areas of influence. For instance, according to land cover changes between 2000 and 2006, this trend can also be observed in Romania. Specifically, the urban residential sprawl grew with 806 ha per year (two times more compared to the previous ten years), while the sprawl of economic sites and infrastructures increased with 733 ha per year (similar to the period from 1990 to 2000) [7]. This artificial area growth was not backed by an increase in the total population. Contrarily, Romania witnessed a national population decrease from 2000 to 2006 with almost 4%. However, the total population drop does not contradict the urban expansion trend, since sprawl is regularly observed around major cities attracting population from other territories. In other words, competitive cities attract both commuters from the surrounding areas (intra-regional migration), as well as migrants from the whole country (inter-regional and inter-city migration). This phenomenon in Romania has been documented through the Magnet cities study conducted by the World Bank, which indicates a growing

migration between 2001-2011, compared to the previous decades. While industrial-based cities (such as Ploiești and Pitești) attract more commuters from the close-by territory, cities with a service-based economy (such as Cluj-Napoca and Iași) attract more migrants from the whole country. By applying a magnetism index, the findings show that factors such as large population, jobs market, university offer, as well as an overall good quality of life operate as attractiveness drivers for the migration of population [8]. Peculiarly, the study employs functional urban areas as the analytical unit, emphasizing their level of magnetism. Results show that over 35% of migrants in Romania moved to functional urban areas such as Cluj-Napoca, Timișoara or Iași between 2001 and 2011. Empirical data confirms that these three cities witness considerable changes in the urban dynamics and expand their area of influence, being the most likely candidates as the strongest secondary cities in Romania [8]. The growth of the urban population coupled with an extensive sprawl in the territory facilitated by convenient mobility, imposes new conditions for the spatial planning process, including a unitary and coordinated vision for the main urban core and its territory of influence. This relationship between population dynamics and the urban area expansion (artificial surface and housing units) is to be studied in detail to determine the extent of the influence area.

## 1.2 The peri-urbanisation effect

The urbanisation phenomenon has usually been studied in the context of migration patterns (from rural to urban or inter-urban), but the attention of our discourse is the subsequent peri-urbanisation trend, focused on the areas surrounding cities which gradually became the second target of population migration. What does peri-urbanisation mean and how is it observable within the territory? Areas surrounding cities have constantly been subject to high development pressures for two reasons – firstly, due to the growing consumption of limited land within city boundaries and secondly, due to increasing estate prices in the urban centres. In many cities, people have tended to move from the inner city to suburban areas or even the outskirts of existent metropolitan regions. This phenomenon has produced a new typology of areas marked by fragmented urban and rural characteristics, a "transition zone between urban settlements and rural territories" [5]. Looking beyond the conventional urban - rural dichotomy, this new spatial typology distinguishes by a non-contiguous built-up area surrounding the main urban core. More specifically, the most frequent definition of the peri-urban implies a built tissue under continuous development, containing settlements with a population of less than 20,000 inhabitants and an average density of at least 40 inhabitants/ ha [5]. In fact, peri-urban areas are the territories that have experienced the fastest change in the past decades [9]. Among the main features of these areas, one can count the spatial dissociation between the place of residence and the place of work, facilitated by lower transportation costs, which fosters spatial connections within the peri-urban territory. This relationship is defined by a ratio of inverse proportionality – in other words, the higher the distance between the main urban centre and any settlement in the peri-urban, the less intense the connection and the volume of population employed in the centre. It applies with predilection in monocentric spatial patterns, dominated by a main urban core, a situation specific to centralized states, as it is the case in most Eastern-European countries, but also France. This type of functional relationship generated by pendular commuting is not solely limited to access jobs in the urban

core. Urban-periurban links include residential and commercial development, as well as access to goods and services such as health facilities, education, leisure activities and tourism and exchange of resources [9; 10]. The complexity of the connections between the peri urban area and the city were the object of concern in Romania for over five decades, one of the flagship studies being the Periurban Area of Bucharest [11]. The subject is still under research attention, even though several attempts have been made in the past ten years to delineate the limits of the metropolitan area of Bucharest. Unfortunately, none of them has gained the political support to become a functional territory under administrative jurisdiction. Although problems are slightly different in the case of other constituted metropolitan areas around major cities in Romania, the current limits depict an artificial construction based on a narrow theoretical background. As a matter of fact, according to the current law, the main criterion for establishing metropolitan borders is the 30 km radius of commuting area around the main urban centres, as the county seat municipalities [12].

### **1.3 Spatial concepts associated with peri-urban boundaries**

The dilemma of conceptualising spatial typologies is far from new, but it is still a topical issue for the spatial planning domain. References to the transformation of the urban form driven by the interaction with its adjacent territory have been made since the beginning of the 20<sup>th</sup> century, with pioneers such as Ebenezer Howard, who studied and conceptualised the dynamics between the city and the surrounding countryside through the spatial model of the garden-city [13]. His work was followed by Patrick Geddes, who focused its study on the concept of con-urbanisation in contrast to sub-urbanisation and garden cities, employing an organic perspective to understanding cities. This interpretation illustrates the city as a developing organism, which evolves in relation to its environment, by following its own principles of growth [14]. Later on, the notions of urban agglomeration and city-region has emerged to designate a much larger territory than the city with its immediate vicinity, implying a rather polycentric morphological pattern, characterized by the presence of several economic centres [15; 16]. This brief chronological overview shows that the boundaries of urban development are constantly expanding. The process usually starts with an over-concentration of industrial and economic activities in cities, followed by several waves of outgrowth. In the recent decades, the effect associated to the peri-urbanisation in Europe has been the emergence of functional urban regions [17] or functional urban areas [18]. According to the first generation of ESPON and OECD studies, FUA represents a functional subdivision of territories, determined by the labour pool localised within the 45-minute accessibility isochrone in relation to the main urban centre [18; 19]. FUAs consist, therefore, of a densely populated city and a less populated, but economically integrated hinterland, which also contains the peri-urban territory [20]. Before addressing the relationship between peri-urban and functional urban areas, a short outline on the current terminology associated with the peri-urban territory is rather needed. For instance, Iordan discusses in his study on the peri-urban area of Bucharest different spatial concepts starting from suburbs, basin, banlieue, agglomeration to notions such as region and urban environment [11]. With the expansion of literature, the emergence of different spatial concepts produced, to some extent, confusion due to the inconsistency of definitions. Among these spatial concepts we mention the ones similar or related to the subject of this study: Functional Urban Area (FUA),

Metropolitan Area (MA), Functional Urban Region (FUR), City-Region (CR). Their common features include concentration of population and jobs in the main urban core, spatial contiguity and interdependence relationships with the peri-urban territory [11; 19; 21], higher density of population and built-up area in the urban core compared to the adjacent territory, dominant power exerted by the urban core over the surrounding territory [16; 22], containment area of labour force [19; 23], as well as functional relationships driven by the access to jobs displayed through daily commuting patterns [18; 19]. Although concepts seem quite similar, they actually reveal a number of differences depending on certain factors, such as: size of the spatial extent, internal morphology (differentiation between continuous and discontinuous urban fabric) [24; 25] and size of the urban settlements, structure and spatial distribution of economic activities and interaction frequency. In this context, the relation between peri-urban and FUA is determined by the transitory character of the peri-urbanisation phenomenon [9], which produces a series of concentric areas around the main urban centre, differentiated by the particularities of the urban growth process. Thus, the emergence of new spatial typologies is dictated by several types of urban growth, such as: low-growth cities with modest rates of infilling; high-growth cities with rapid fragmented development (this case applies even to the fast-growing cities in Romania), expansive-growth cities with extensive dispersion at low population densities (generally in the North America); and cities with frantic growth, with very high land conversion rates at high population densities (specific to developing countries) [26]. Each growth typology implies different spatial patterns, such as scattered or constrained, widespread or contiguous built areas within the wider FUA [9].

It is worth mentioning that the terminology shows a high degree of variability according to the geographical context in which the term was adopted, producing broad interpretations caused by slightly different criteria or threshold values (i.e. for the population size and/ or density). The ambiguity of different functional subdivisions of the territory amplifies the improbability of their integration into the spatial planning systems and territorial policies of different European states; especially in circumstances where intercommunal planning is not a tradition, as it is the case in Romania. However, in some situations when spatial concepts were adopted in territorial development policies and strategies, the results were quite unsatisfactory. This could be explained by two main factors – either the methods for establishing the spatial extent of the concept were not backed by theoretical considerations, or the mismatch between administrative and functional nature of the metropolitan areas, informally solved through artificial (non-institutionalised) constitution leading, eventually to inoperability. Both situations apply to the current metropolitan areas in Romania, as we will discuss later in the paper.

## **2. METHODOLOGY**

### **2.1 Research strategy, objectives and questions**

In essence, the research methodology of this article is founded on a critical review of the international literature on the spatial phenomenon of peri-urbanisation and the emergence of the functional subdivisions of territories. The research strategy starts from deepening the peri-urban and FUA substantiation framework and aims at testing the arguments in support of demonstrating FUA's relevance in the Romanian spatial planning context. For this matter, a comparative analysis among few major cities in Romania is employed. However, the implementation of the strategy is not straightforward. The literature review shows a wide variety of quasi-

similar definitions for areas surrounding major urban cores, doubled by different methods for delineating peri-urban areas. According to the OECD's methodology based on population, density and contiguity criteria, the World Bank has defined FUAs for Romania's county capitals (40 cities) as territories where urban development projects could be financed from regional development funds in the framework of the 2014-2020 programming period. Therefore, our study focuses on the analysis of the spatial dynamics within the contours of FUAs, referring to two spatial extents: the metropolitan areas defined according to GD 998/2008 [27] and the boundaries of peri-urban territories, where they exist. In case they were not established by national or regional studies, they were determined according to the PLUREL method [5]. The objective of the study is to determine the contours of the areas that registered a strong territorial dynamics over the past 10 years. The initial hypothesis is that the spatial impact of peri-urbanisation around large urban centres (mainly reflected by the increase in built-up area and the development of residential units) is not limited to the outline of the current metropolitan areas. Consequently, the paper proposes the analysis of the territorial dynamics within the four selected FUAs: Braşov, Cluj-Napoca, Iaşi and Timişoara, based on data collected and interpreted from national statistics. The study has a strong practical dimension, providing a consistent evidence-based background for spatial policies to acknowledge the complexity of peri-urban areas. To address the objective, three research questions were proposed to guide the discourse: Which are the current limits of the most dynamic areas around the developing cities in Romania? To what extent do they correspond to the current metropolitan boundaries? Is a new wave of peri-urbanisation expected to manifest as a densification of the existent peri-urban areas or as an expansion of the built-up areas towards FUAs limits? Finally, the comparative study has a three-fold approach: 1) analysis of the morphological spatial model: the settlements' network within FUA (status data on number and size of cities, population size and density); 2) study of the territorial dynamics of growth (to determine waves of growth, stagnation or contraction related to population, artificial surface, housing units and employed population); and 3) land use model analysis (based on data from Corine land Cover and the Urban Atlas).

## 2.2 Working method for FUA and peri-urban delineation

The European NUTS levels do not always capture the reality of the functional subdivisions of territories. Since LAU1 level, which covers metropolitan and functional areas is not defined according to a common methodology, comparable statistics are difficult to reach. For the purpose of acquiring a harmonised framework for territorial typologies, several convergent taxonomies have been developed, including the urban-rural typology [28], the degree of urbanisation [29], as well as a detailed classification of six categories defined by population size and density thresholds [5]. The latter is highly relevant for the purpose of this article since it serves as model for the establishment of peri-urban limits, following population and density criteria (territorial administrative units with over 10,000 inhabitation and a density over 40 inhabitants per ha.). The correlation between these major classifications is presented in the table below.

Table 1. Corelation taxonomy - indicators

Taxonomy			Indicators' threshold	
Urban-rural typology[29]	DEGURBA [20]	PLUREL project [8]	Population size	Density (inhab/ ha)
1 predominantly urban	cities (> 50% pop. living in urban areas)	U1 urban with high density		
		U2 urban with low density	> 20.000	
2 intermediate	towns & suburbs (< 50% pop. living in rural/ urban areas)	P1 periurban with high density	> 10.000	> 75
		P2 periurban with low density	> 10.000	> 40
3 rural	rural areas (>50% pop. living in rural areas)	R1 rural with high density		> 10
		R2 rural with low density		< 10

Therefore, the comparison between the four selected cities in Romania denotes to three territorial typologies, as follows: the main urban core/ nucleus (formed by the county seat municipality, characterised by high density and contiguity of the urban fabric), the peri-urban area (consisting of urban and rural administrative units around the main core, formed by a dispersed pattern of settlements with lower population and density than the main core) and the rest of the FUA (including predominantly adjacent rural territory, economically integrated with the main urban core, linked through the catchment area of the labour market). FUA limits were taken from the World Bank study, which followed the OECD procedure for delineation [18]. The peri-urban identity is defined by the hinterland attached to an urban core, but segregated from it, shifting the emphasis to the former. Hence, the peri-urban is a component of the wider functional urban area.

### 2.3 Data analysis: data collection, processing and quality

The comparative study focuses mainly on analysing the territorial dynamics over the past 10 years (2010-2020). This time series is completed by evidence of peri-urbanisation trends since the early 2000s. The analysis of territorial dynamics is based on the following indicators: population growth or contraction (in absolute number as well as in density; percentage of employed population), artificial surface growth or contraction (represented by the built-up area and infrastructures), as well as the evolution of the housing units. The indicators have been calculated at the level of each administrative territorial unit composing FUAs and conclusions have been drawn for three territorial typologies contained by FUA: the main urban core, the county level (NUTS 3), and the metropolitan areas defined by law. The main data source is the National Institute of Statistics in Romania [30]. The overall data quality is good, except for some indicators which could not be traced for the entire analysed period. For instance, the territorial coverage data from national statistics is no longer completed after 2014. However, changes in the proportion of the artificial surface have been confronted and completed with data from the Urban Atlas for periods 2006-2012-2018 [31]. The data source for artificial areas is Corine land cover, providing information on different land use classes, among which continuous and discontinuous urban fabric were of high interest.

### 3. RESULTS

#### 3.1 Findings of the comparative study of four major cities and FUAs in Romania

The results of the comparative study are further discussed according to the three-fold analysis approach. Firstly, the analysis of the morphological spatial pattern shows that each of the four cities is part of an urban system under consolidation, constituted, over the past decades, around former regional capital cities [32]. This aspect reveals, to a large extent, a set of characteristics such as: the existence of extensive functional areas surrounding the main urban core and the presence of administrative units which register massive population growth (i.e. emergent cities and communes within 6-8km distance: Florești near Cluj-Napoca; Miroslava near Iași and Giroc near Timișoara, where the population growth exceeds 100% between 2010 and 2020 and the actual population is larger than 15,000 inhabitants). It is worth mentioning that, according to the national law, the threshold of 10,000 inhabitants represents the minimum population for a settlement to be declared a city [33], but there are still communes with over 10,000 inhabitants and cities with a population of less than this number. In particular, the most frequent situation of communes with a population exceeding this threshold is witnessed in the vicinity of the major developing cities or within their influence areas, usually indicating the area of residence for the workforce. Another feature of the settlements' network is related to its development in connection with two structural elements: the main river basins (as the case of Cluj-Napoca along the Someș River; Iași along Bahlui River and Timișoara along Bega River, as well as Brașov in connection with the upper valley system of Prahova). A second structuring role is played by the road and rail network, which stimulates the system's extension of localities in continuous band along the main transport axis (the East-West axis in Cluj, the radial pattern in Timișoara with predilection for Timișoara – Recaș urban subsystem and Brașov with its subsystem formed by a network of small cities Săcele - Ghimbav - Codlea - Râșnov - Zărnești; and lastly, the North-West to South-East axis in Iași). Overall, the settlements' network within the four FUAs does not register a quite different spatial pattern – as a matter of fact, the average number of administrative units is 39, varying from 31 to 57. In general, FUA hosts over 60% of the county's population (Cluj-Napoca 67% and Iași 61%), while Timișoara and Brașov exceed 75%, respectively 82%. In the same note, the main urban centre hosts approximately 60% of the FUA population. At county level, regardless of its size, the county seat municipality represents approximately 43% of the entire county population, differences between the four cases being extremely small (+/- 1-2%). At the same time, FUAs gather almost 50% of the county population, with a maximum percentage of 53 registered in Cluj and a minimum value of 29 in Iași. However, this fact confirms the need to establish functional urban systems starting from nodes of urban agglomerations and to determine their size and boundaries based on cumulated population from actual grouping of localities, instead of the conventional sizes of NUTS. The raw data on administrative constitution, area (available only for year 2014), population size and density for the time being (year 2020) is presented in the table below.

Table 2. Population data

Indicator	Unit	Braşov	Cluj-Napoca	Iaşi	Timișoara	Average
No. of LAU	UC	1	1	1	1	1
	FUA	31	40	28	57	39
	County	58	81	98	99	84
Area (ha) 2014	UC	21,975	17,953	9,561	12,927	15,604
	FUA	262,481	356,583	159,971	320,180	274,803
	County	536,309	667,440	547,558	869,665	655,243
Population size (inhab)	UC	289,622	327,360	387,834	325,522	332,584
	FUA	526,284	495,473	592,632	575,143	547,383
	County	638,406	737,242	967,103	758,842	775,398
Population density inhab/ha	UC	91.02	108.94	113.04	50.69	90.92
	FUA	32.54	47.08	66.27	48.89	48.70
	County	20.92	38.00	50.84	25.37	33.78

Data source: National Institute of Statistics, TEMPO ONLINE

As the analysed data confirms, the effects of peri-urbanisation are visible around major developing cities. These emergent spatial patterns are distinguished by large concentration of population not only in the urban nucleus, but also into agglomeration areas surrounding it, functioning as magnets of gravitation for county, regional and national flows of capital and labour force [34]. The spatial effect generated by growth poles of regional significance lies in the diffusion of economic prosperity as a result of two opposite phenomena. On the one hand, growth tends to concentrate in certain centres and erodes the economy of the surrounding areas (polarising force), while, on the other hand, development expands on the surrounding areas as a result of the expansive growth of the urban core (force of dispersal) [35]. Consequently, peri-urban areas and wider FUAs bring a relevant contribution to growth and have an incredibly significant development potential [36]. For the purpose of this article, the aim is to identify the limits of the areas characterised by these features and to compare them with the current metropolitan boundaries. In order to establish these boundaries, a further analysis of territorial dynamics over the past 10 years has been employed. The second approach of the comparative study is, thus, covered by the analysis of the territorial dynamics around the 4 Romanian major cities, aimed at determining waves of growth, stagnation or contraction, based on which further projection can be drawn. The results show that, in the recent decades, the peri-urbanisation trend in Romania highlights important morphological and structural changes in the territories around large urban centres. Over the past 10 years, demographic trends show a population growth in FUAs, with less than 10% in Braşov (2.9%), Cluj-Napoca (9.4%), Timișoara (6.9%) and over 20% in Iași (21.6%). This growth is explained by significant changes – on one hand, a decrease in population in the main urban centre (county seat municipality), applied to Braşov (-1.6%) and Timișoara (-2.7%), but not to Cluj-Napoca (+2.8%) and Iași (+16.1%), while, on the other hand, a total population growth at county level (inter-regional or international migrations): Braşov (1.9%); Cluj (3.7%), Iași (12%) and Timiș (4.4%). Compared to the previous 10 years, quite similar trends have been registered, confirming an overall increase of population at FUA level, coupled with a population decline in all urban centres except for Iași and a population growth for all counties, except for Cluj. As a consequence, functional urban areas have become the main target of population migration either from the rural side of the county or from the main urban core to the peri-urban areas, generating a constant

pressure on infrastructure and public services, residential areas and the land market. Conclusions regarding the evolution of the housing units depict a steady growth from 2000 to 2020, with the highest growth registered in Cluj, at all levels: urban core municipality (+34%), FUA (+46%) and Cluj County (+32%). Significant increases in the last decade (over 10%) are emphasized particularly at FUA level: around 25% in Cluj-Napoca and Iași and between 10-20% in Brașov and Timișoara. This data confirms a dispersion of housing towards the communes located in proximity to the main urban core. The previous model of locations concentrating services and jobs in compact urban nuclei [37] is emerging in new spatial patterns driven by urban expansion and functional linkages, defined by the separation between the place of work and residential area, causing the phenomenon of commuting [38]. To illustrate the dynamics of the distribution of the employees in territorial profile, the study analysis data according to the locality in which the population carries out their activity between 2010 and 2019. Except for Cluj, where the employed population growth at FUA level is a direct result of the increase in the county seat municipality (45.1% in FUA compared to 46.7% in Cluj-Napoca), the other three FUAs register a significant increase in the number of employees (+25% in Brașov compared to 13.3 in the city, +23% in Iași compared to 16.3% in the city and +28% in Timișoara, compared to a slight decline in the city). These findings indicate a de-concentration of economic activities location in the peri-urban areas of the FUA [39]. Over time, successive waves of peri-urbanisation have produced additional traffic generated by commuter population. Unfortunately, evolutionary data on commuting is not available in national statistics over the past ten years, the only reference being the 2011 Romanian census. According to this data, a substantiation study has been conducted for the peri-urban area of Cluj-Napoca, using as method for delimitation the 40% threshold of active population commuting to other localities than the residence one, with flows predominantly oriented towards Cluj-Napoca, located in the 45-minute isochrone of combined accessibility (road and rail) [40]. The results are convergent with ours from two main angles: firstly, the peri-urban areas are defined by the spatial distribution of certain important urban functions, such as population density, as well as residential and commercial functions and secondly, it designates a peri-urban limit which does not completely overlap with the current metropolitan area. For instance, four communes of the current metropolitan area have been excluded and three communes outside the metropolitan boundary have been included into the peri-urban area of Cluj-Napoca. Although differences are minor, they still capture a gap between the artificial nature of the current metropolitan areas and the functional reality in the territory. Furthermore, the study indicates a dominant commuting flow of approximately 20,000 people per day in 2011 [40], which has certainly been amplified up to now. In what concerns the dynamics of the built-up area (calculated as % of the administrative territory surface represented by the land occupied with constructions and communication routes), relevant positive changes between 7 and 15% can be traced in all FUAs, except for Cluj, where there are no major changes between 2010-2014, the latter being the last year with available data. The table below outlines the interpretation of data analysis [30].

Table 3. Interpretation data analysis indicators

Indicator	Unit	Braşov	Cluj-Napoca	Iaşi	Timișoara	Average
Population dynamics (%) 2010-2020	UC	-1.6	2.8	16.1	-2.7	3.6
	FUA	2.9	9.4	21.6	6.9	10.2
	County	1.9	3.7	12.0	4.4	5.5
Artificial area dynamics (%) 2010-2014	UC	3.9	0.4	-0.9	0.8	1.0
	FUA	15.7	0.4	9.6	7.8	8.4
	County	6.6	0.5	3.6	3.4	3.5
Housing units dynamics (%) 2010-2019	UC	13.0	24.8	15.3	10.1	15.8
	FUA	12.8	26.9	23.4	17.5	20.2
	County	10.9	19.5	16.3	14.3	15.2
Employed population dynamics (%) 2010-2020	UC	13.3	46.7	16.3	-1.8	18.6
	FUA	25.3	45.1	23.4	28.1	30.5
	County	23.6	33.9	23.4	28.4	27.3

Data source: National Institute of Statistics, TEMPO ONLINE

The last part of the comparative study is represented by an analysis of the land use pattern, based on 5 classes of data: artificial surfaces, agricultural areas, natural and semi-natural areas, wetlands and water [6; 31]. Since the analysis of the built-up area dynamics was conducted for period 2010-2014 according to national statistics, land cover changes from CLC have been drawn for the period 2012-2018, to complete the study. The results from the table below confirm two directions of the peri-urbanisation trend: on one hand, a growth in the artificial surface with more than 5% in all FUAs and a maximum value of 11% in Cluj, as well as a slight decline of agricultural areas in all FUAs. Natural and semi-natural areas have remained stable, with small increases in all FUAs except for Timișoara. These changes in the land use pattern must be seriously taken into consideration, since the fluctuation of the share of urban or rural character inside FUAs denotes various levels of change in the peri-urban system in terms of land consumption, housing, access to services, equipment and transportation, as well as jobs.

Table 4. Land use patterns

Data	Unit (%)	Braşov	Cluj-Napoca	Iaşi	Timișoara
Land cover changes 2012-2018	Artificial surface	+4.59	+11.63	+7.17	+6.67
	Natural and semi-natural areas	+0.58	+1.22	+0.60	0.00
	Agricultural areas	-2.18	-2.52	-1.80	-3.36
	Water	+5.95	+2.27	+0.09	-0.44
	Wetlands	-29.59	-19.63	+24.37	+0.68

Data source: Urban Atlas, Corine Land Cover, Copernicus

The growth of artificial surface leads to a transformation of urban form and extent, resulting, ultimately, in the emergence of larger areas of influence around major developing cities, namely the functional urban areas. The main characteristic of these areas lies in the dependence of the rural environment on economic activities in urban areas, the main function of rural localities being that of a residential area

for the labour force employed in urban centres. This functional linkage claims for the reorganisation of the housing - work relationship within FUAs and peri-urban areas, triggering implications at the level of spatial planning and territorial policies. The image below illustrates the conclusions regarding the spatial dynamics at FUA level, validating the initial hypothesis that the most dynamic area does not correspond entirely to the current metropolitan limits. A further inquiry is required to determine the precise boundaries for new metropolitan configurations in Romania, based on spatial dynamics, coupled with functional considerations.

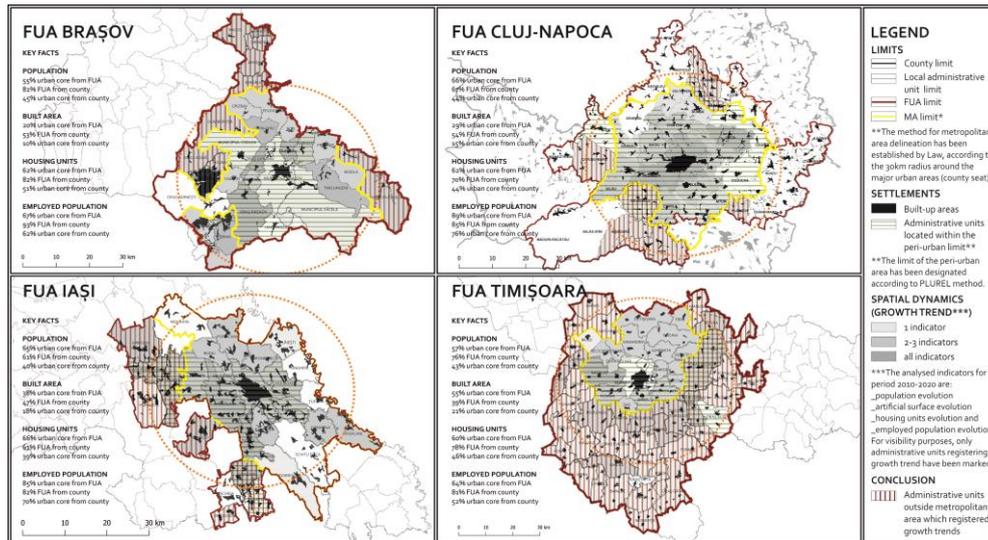


Fig 1. Spatial dynamics within FUAs (Source: author's representation, based on GIS data)

### 3.2 Positioning peri-urban territories in the Romanian planning system

The landscape of the Romanian spatial planning activity started with a relatively centralized exercise of top-down economic and spatial planning, organically combining the criteria of economic efficiency with those of a social nature [41]. The current administrative – territorial units are the successors of an outdated law from 1968, which is still in force [42]. The past 30 years reveal a sequence of legislative changes without much impact on the administrative organisation of the territory. Few mentions about metropolitan areas have been made in the laws related to urban and territorial planning, defining them according to a 30-km distance around a main urban centre [33; 43]. However, in the context of Romania's accession to the European Union, metropolitan configurations have been determined for the major developing cities, the so-called growth poles, defined according to GD 998/2008 [46]. Since 2007, these areas in Romania have acquired the status of metropolitan areas, being managed by Intercommunity Development Associations (ADI) and have been the subject of strategic planning and implementation of urban development projects funded by the European Regional Development Fund, in the last two programming periods. This suggests a privileged position of the urban and metropolitan areas on the EU agenda for spatial development policies, without mentioning a concrete method for delineation. Consequently, the current metropolitan areas in Romania are constituted by voluntary associations between the administrative-territorial units

representing an urban core and its surrounding territory, thus outlining an informal nature of interjurisdictional cooperation. In fact, the existing configurations, with few exceptions, reflects a series of territorial structures set up in the absence of well-founded criteria and methodology. It is for this reason that the present paper intends to compensate for the current limitations of the legislative framework.

#### 4. CONCLUSIONS

The gradual outgrowth of the city outside its formal, administrative limits is the spatial expression of the peri-urbanisation phenomenon. Several conclusions have been drawn from the comparative analysis of the four selected major cities and FUAs in Romania (Braşov, Cluj-Napoca, Iaşi and Timişoara). Firstly, population growth in areas surrounding major urban centres is a clear indication of the peri-urbanisation. Hence, a direct correlation has been registered between population trends in the peri-urban territory, the main urban core and the entire county. The explanation of peri-urban population growth is two-fold: on one hand, it is caused by the population decline from the main urban centre, which chooses to relocate in the adjacent communes (urban to peri-urban migration), while, on the other hand it results from a total population growth at county level, driven by the attractiveness of certain locations (inter-regional and inter-county migration). The higher the rate of population growth, the more intensive is the spatial impact of peri-urbanisation. This leads to the second conclusion, related to the accelerated changes in the land use pattern that generate fluctuation of the share of urban or rural character inside FUAs. From this outcome, another idea can be depicted, respectively, that the increased share of artificial land coupled with a form of urban sprawl denotes an emerging spatial pattern with several shortages. Among the most critical ones, we mention the deficient transportation offer, the limited access to socio-cultural services and facilities, as well as the increasing pressure on the land and residential market. Lastly, peri-urban areas are defined by a dissociation between the place of residence and the place of work, generating a daily-commuting need. This has been proven by the analysis of the employed population and the dynamics of housing units in FUAs. The results confirm that housing facilities grow faster than the employed population, which means that the latter still need to access jobs in the main urban core. All in all, this trend of peri-urbanisation is expected to continue and even intensify in the near future. Therefore, consequences of peri-urbanisation do not exclusively concern the current situation, but also future waves of population migration. However, to find out if future growth manifests as a densification of the existent peri-urban or a wider expansion of built-up areas towards FUA limits is yet to be researched based on potential projections. The dynamics of land use and development is, ultimately, a function of the overall development trends that can, to some extent, be adjusted or influenced through public policies, allowing for alternative consequences. However, this process must be fuelled by policies to encourage various forms of cooperation and the power that these entities have, should not only be understood as authority, but also as the capacity to perform [44]. Consequently, land use change and the coordination of new developments must be shaped according to social redistribution policies, instead of pursuing purposes exclusively related to economic development [44]. The available planning tools include inter-municipal normative plans and restrictive zoning rules and density requirements (general urban plans for peri-urban areas) and strategic development plans (integrated

development strategies at metropolitan level). Both instruments are extremely helpful in shaping a coordinated land use development.

In conclusion, this paper is a brief overview on the phenomenon of peri-urbanisation and its consequences in the Romanian national context. We explored the physical and socio-economic aspects of change dynamics, stressing on the need to reconsider the current boundaries of metropolitan areas around the major developing cities. Although not statistically representative of all metropolitan patterns, the four selected case studies still reflect the spatial and demographic conditions prevailing in Romania. However, we admit that additional factors of socio-cultural or political nature might be relevant in the process of determining the precise boundaries for new metropolitan configurations. Among these factors one should consider the national disparities which indicate, over the past 30 years, an increase between urban and rural segments within counties, rather than between counties themselves, with Cluj and Iași witnessing the maximum gap at intra-county level [45]. Another relevant factor to be taken into consideration is the social development of historical regions, which proves to be lower for extra-Carpathian regions (Moldova, Muntenia and Oltenia), compared to Transylvania, Banat and Bucharest-Ilfov [45]. These differences are highly relevant for the artificial nature of population growth, which is driven by the magnet function, or the power of cities to attract population in other localities [8], favouring certain urban areas to grow faster, sometimes even with the cost of eroding the economies of the neighbouring counties, as it is the case of Sălaj, next to Cluj [45]. Nevertheless, the findings of this study reinforce our position to keep and strengthen urban areas as a key priority on the research agenda and spatial development policies, stressing upon the need to rethink the metropolitan configurations in Romania, based on morphological and functional considerations.

## ANNEX

Table 5. Database information

Datasets	Data description	Year availability	Source
<b>ADM101A</b>	Administrative organisation of the territory, by categories of administrative units, macro-regions, development regions and counties	2020	National Institute of Statistics,
<b>POP107D</b>	Population by domicile on January 1 by age groups and ages, sexes, counties and localities	2010 - 2020	TEMPO ONLINE <sup>1</sup>
<b>FOM104D</b>	Average number of employees by counties and localities	2010 - 2020	
<b>LOC101B</b>	Existing homes at the end of the year by forms of ownership, counties and localities	2010 - 2019	
<b>AGR101B</b>	Land area by use, by counties and localities	2010 - 2014	
<b>Urban atlas</b>	Land cover changes by typologies	2012 - 2018	Corine Land Cover

Source: author

<sup>1</sup> Data available online: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table>

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