Babeş-Bolyai University Cluj-Napoca
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PhD Thesis

-Abstract-

The Impact of the Demographic Changes on the Residential Function in the Metropolitan Area of Cluj Napoca

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PhD Thesis Content

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1. Introduction

The research project seeks to build a methodology to analyze and diagnose how demographic changes affect the residential function at the scale of settlement networks of metropolitan type, with application to the Cluj-Napoca Metropolitan Area (CNMA). For this purpose, the paper proposes the development of a scientific toolkit adapted for the analysis of specific problems of CNMA, but, at the same time, flexible enough to be reused with minor alterations for the diagnosis of other urban networks.

One of the consequences of the settlement's population changes is reflected in changes of the demand and need for housing (Garzena and Petsimeris, 1984; OCSTAT, 2005; DCLG, 2010). In case of mistakenly estimating the need for housing, two types of imbalance can occur at the local policies level: oversizing the housing stock, respectively subdimensining it. The first situation has implications regarding the costs of providing public services and urban infrastructure to a large number of unoccupied dwellings, while the latter may lead to the overcrowding of existing dwellings and an increase of the number of homeless people. In order to prevent these imbalances, it is necessary that local and metropolitan housing policies take into account the ongoing changes of population and their implications for the residential function.

Within the framework of the subject, the dissertation brings novelties both through the analysis carried out, but also through the scientific instruments it proposes. Thus, the paper proposes analysis such as those of the suburbanization of the CNMA in comparison with other Central and Eastern European metropolitan areas, the differential development of the settlements of the metropolitan network, the risk of draining the population of the main settlements that feed through migration the demographic growth of the CNMA, the *youthification* phenomenon or the housing units situated in T-770 buildings in the Zorilor neighborhood. Regarding the research methods and tools, the novelties brought by the dissertation consist in changes brought to the differential urbanization model and in the precise identification and mapping of the T-770 buildings in the Zorilor neighborhood.

2. Methodology

The research project aims to achieve a set of different objectives, both in terms of the scale of the studied elements and by their nature. Starting with the categorization of Cluj's suburbanization characteristics in Central and East European trends, continuing first with the study of the evolution of the migratory relations underlying the suburbanization and the growth of the metropolitan population, and then with the analysis of the housing stocks and their evolution at the level of the main settlements of CNMA, the dissertation uses methods tailored to each objective, based on four pillars:

1) qualitative analysis of comparative study type;

2) adapting and testing models;

3) quantitative analysis;

4) case studies.

Thus, in order to achieve its first objective, the dissertation proposes an analysis based on comparing specific features of the Cluj suburbanization with those observed by existing literature for metropolitan areas from Central and Eastern Europe. Then, for the second objective, the thesis proposes the adaptation of the *differential urbanization model* (Geyer and Kontuly, 1993; Geyer, 2002b) in order to make it suitable for use at metropolitan scale and testing the modified model on CNMA's network of settlements. Further on, quantitative methods based on statistical data analysis are used for the third, fourth and, partly, for the fifth objective of the research. Additionally, for the fifth objective, the research proposes a case study that attempts to verify and complement the image resulting from the quantitative analysis of the housing stock.

3. General Context

”*Without changes in the levels of fertility, mortality and migration the overall ESPON population will reduce by about 40 million until 2050, i.e. a decline of about 8 per cent. There are considerable regional differences: 40 per cent of the regions would experience a population increase and 60 per cent a decrease. In most of the regions with an increasing population, this is caused by extra-European migration. In those regions where the population would decline, the main cause is the negative natural change. Eleven regions would even face a decline by over 50 per cent. These regions can be found in Romania, Bulgaria, Poland and Germany. In 86 other regions population would decline by 20 per cent or more.*” (Espon DEMIFER, 2010, p. II)

3.1. European Context

During the last decade, at the level of the Espon countries (EU27, Switzerland, Iceland,Liechtenstein and Norway) there was observed a slowdown of demographic growth accompanied by population ageing. At the same time, all four Espon scenarios for the evolution of the European population for the 2005-2050 period predict population decline for most of the NUTS2 regions from Central and Eastern European countries (Espon DEMIFER, 2010). In the case of Romania, there are expected population decreases of 25-50% or 50-68% for all NUTS2 regions (except Bucharest-Ilfov), depending on the region.

Regarding the distribution of population by area types, in 2011 most of the population of the EU27 countries lived in urban areas (*see* Eurostat, 2012). At the same time, in 2010 was observed a general trend of population growth in urban and intermediate areas and of population decrease in rural areas (*see* Eurostat, 2012).

In the case of the Central and Eastern European countries, a survey of 150 cities (Mykhnenko and Turok, 2008) found a slowdown in demographic growth between 2000-2005, both in comparison to the '60s and the '80s. The same study (Mykhnenko and Turok, 2008) observed negative values of the average annual urban population growth rates since 1995, within a context of demographic decline at the level of the studied countries.

Regarding the main housing indicators recorded around the year 1990 in several Eastern European countries, one can observe a significant difference between the habitable areas of the dwellings from these countries and the average area of dwellings completed between 1981 and 1990 in Switzerland. At the same time, it is important to note that most of the studied indicators had the lowest values in the case of 1995's dwellings from Romania.

3.2. National Context

In the years 2008-2009, the evolution of the national population was characterized by a *quasi*-stability of the demographic decline (Gheţău, 2010), on the background of negative external migration and of a mortality rate higher than the birth rate. Moreover, while considering the hypotheses of an increasing life expectancy at birth, a relatively stable fertility rate of 1.3 children / woman and ignoring external migration, Gheţău (2010) estimates a significant depopulation of the country by 2050.

Regarding the age structure of the population as compared to 1990, the data for 2015 indicates a general aging, due both to the decreasing share of people aged 0-14 years and to the increasing share of those aged 65 and over.

In terms of living conditions, Romania has an unfavorable gap compared to other European countries (Dan, 2009). The main problems concerning the dwelling stock are the low values of some of the main indicators of housing, the expired service life of dwelling buildings and the lack of appropriate public utilities.

4. The Population of the Cluj-Napoca Metropolitan Area

Demographic changes trigger changes in the general housing need, transport infrastructure, social utilities and many other types of needs. These population changes occur as a result of natural evolution or migration (the difference between immigration and emigration). According to Espon, within the studied area (EU27 plus Iceland, Liechtenstein, Norway and Switzerland), migration is by far the dominant force of demographic change (Espon DEMIFER, 2010). At the same time, the study reveals that, at the level of NUTS2 regions, the two components of migration (internal and international migration) differ from one region to another even within state borders (Espon DEMIFER, 2010). Thus, significant differences can occur in the migration balance between regions of the same country. Of course, at a lower scale, these differences can be observed even between NUTS3 territories belonging to the same NUTS2 region, the reasoning being further expandeble to lower geographic scales. For example, the positive migratory balance of an entire NUTS2 region can, in some cases, be determined by significant positive migration in only one of its territories or even only in one of its centers. For this reason, a truly relevant image can be obtained by studying migratory relations at small geographic scales such as that of the settlements network of a metropolitan area or, more generally, that of settlements networks dominated by a single urban core. Further, at a greater scale, this method could be extrapolated by analyzing a network of networks.

4.1. Changes in Number and Structure of the CNMA Population between 2009 and 2018

The study has determined, based on the classification of the CNMA municipalities according to the size of their population and its relative evolution, a typology that can be used to determine the level or the potential of the settlements' centrality. Thus, we proposed to continue the analysis of CNMA settlements as elements of an urban network with the center in Cluj-Napoca and which has three secondary centers in the municipalities of Apahida, Baciu and Floresti (settlements that meet both the mass and the speed of population growth criteria). The other municipalitiess were considered, according to the proposed classification system, as peripheral settlements (noting that Gilau and Chinteni present some potential for centrality).

Using the proposed classification, we observed that the urban core of the CNMA had a much lower relative population increase than that of the secondary centers. In absolute terms, the settlements with the most significant population growth were, in descending order, Floresti, Cluj-Napoca, Apahida and Baciu. At the same time, as a whole, the peripheral settlements of the metropolitan network have had a population decrease of 2% between 2009 and 2018.

Regarding the structure of the population by settlements, we found that the city of Cluj-Napoca and the CNMA have *quasi*-identical structures (due to the very high share of the urban population within the metropolitan population). For the secondary centers, the age pyramid analysis for 2009 and 2018 reveals a significant increase of the active population (especially in the younger age group of this category) due to migration. At the same time, the phenomenon of migratory growth was accompanied by an increase of the birth rates (the pyramid of the ages of 2018 shows a significant increase of its base, as compared to that of 2009).

In the case of the peripheral settlements of the CNMA, the demographic structure shows an aging population and a tendency to aggravate the aging process. At the same time, for these settlements we observed imbalances regarding the gender structure of a part of the active population that presented a high masculinity coefficient. The analysis of these imbalances led to the hypothesis of a higher level of definitive departure among the feminine population, due probably to continuation of studies (the age of 20 years from which the imbalance starts is very close to the minimum age for starting tertiary education).

4.2. Suburbanization in Central and Eastern Europe

This section tries to frame the suburbanization phenomenon of CNMA within the CEE context, while trying to answer two research questions:

(1) Is the suburbanization in CNMA typical for Central and Eastern Europe?

(2) What are its distinctive features?

To this end, we propose a comparison between the features identified by Kiril Stanilov (Stanilov, 2007) for the suburbanization phenomenon in Central and Eastern Europe and those observed for the Cluj-Napoca Metropolitan Area.

Concerning the condensed evolution, the CNMA suburbanization is rather spontaneous, no Western models being implemented directly. Given that the low price is the main driver of sales, promoting an alternative lifestyle was not necessary: here it is all about meeting the basic housing needs. This model, aimed at providing low-cost periurban properties, is probably not unique to the CNMA, but it is certainly different from the typical central and eastern European one.

The simultaneous suburbanization of housing, retail and offices corresponds to the typical pattern observed in Central and Eastern Europe. However, it is important to note that the presence of office buildings in periurban municipalities is rather scarce, while big-box stores and shopping malls tend to gather at the fringe of the urban core.

The speed with which suburbanization has taken place in CNMA is very high, both in absolute and in relative terms. The municipality of Floresti alone, beeing the main exponent of suburbanization in the metropolitan area, recorded an increase of its population by over 3.8 times (in absolute terms, a population growth of almost 20,900 inhabitants) between 2009 and 2016, while its housing stock has multiplied by more than 5.7 times (in absolute terms, over 16,400 new homes). Given a general context of demographic contraction at national level, the speed of growth of the periurban municipalities of CNMA is even more spectacular.

Regarding the patterns of suburbanization, we observed a low level of dispersion, noting that high density is achieved by agglomerating housing constructions of doubtful quality (the land is occupied at maximum allowed potential -with as many as possible of marketable properties- fact that has repercussions in both quality of public space and quality of housing). Thus, far from embracing the concept of smart-growth (*see* Daniels, 2001; Stanilov, 2007; Larco, 2009; Bhatta, 2010; Girling, 2010), high density is, in this case, a simple reflection of the investors' efforts to maximize profits by minimizing investments.

With regard to administrative separation and segregation, the CNMA situation is significantly different from the typical Central and Eastern European one: while unitary metropolitan entities such as Moscow, Prague, or Sofia have absorbed under their administration neighboring settlements several decades ago, the CNMA was established as a voluntary association between separate administrative entities that retain their decisional independence within the boundaries of integrated development strategies.

Due to the fact that suburbanization in the Cluj-Napoca Metropolitan Area affected mainly existing rural settlements, social homogeneity is not as pronounced as in the typical suburbs of Central and Eastern Europe. However, a general trend towards homogenization can be observed: the new population (generally young and with an urban profile -suggested by the level of education) is growing rapidly, while the initial population (generally aged and predominantly rural) is decreasing.

Half of the CNMA suburbanization characteristics analyzed in this section are different from those expected for Central and Eastern European metropolitan areas (Tab.1). However, this fact does not necessarily indicate a uniqueness of the observed situation, but rather the existence of a suburbanization type that manifests itself differently from those studied by Kiril Stanilov (Stanilov, 2007). The identification of such a type can be achieved by applying the same filters to other metropolitan areas in order to find similarities.

	condensed evolution	simultaneous suburbaniza-tion of functions	speed of suburbaniza-tion	suburbaniza-tion patterns	lack of adminstrative separation and segregation	social homogeneity
presence of the criterion	NO	YES	YES	YES	NO	NO

Table 1: The presence of common characteristics of Central and Eastern European suburbanization in CNMA. Source: the author.

4.3. Using the Differential Urbanization Model for the Purpose of Analyzing Sub-national Networks of Settlements

The *differential urbanization model* (Geyer and Kontuly, 1993; Geyer, 2002b) attempts to explain the formation of national urban systems with the help of three phases: *urbanization*, *polarization reversal* (Richardson, 1977) and *counterurbanization* (Beale, 1977). Because of the changes in migratory relations between these phases, the urban system goes through seven stages: 1) the early stage of the primate city; 2) the intermediate stage of the primate city; 3) the advanced stage of the primate city; 4) the early stage of intermediate cities; 5) the advanced stage of the intermediate cities; 6) the early stage of small cities; 7) the advanced stage of small cities. During the *urbanization* phase, the system gains in centrally, most of the migration being geared toward one of its settlements – the future primate city. In this phase, the system goes through the early, intermediate and advanced stages of the primate city. Further on, during the *polarization reversal* phase, part of the migratory flows from within the urban network are reoriented towards other settlements -these would become the *intermediate cities*. Thus, the system goes through the *early stage of intermediate cities*, then through the *advanced stage of intermediate cities*. Finally, during the *counter-urbanization* phase, migratory flows are directed towards small cities. Thus, the system goes through the *early stage* and, finally, the *advanced stage of small cities*.

When trying to apply the differential urbanization model in its original form in order to diagnose the problems of a network of settlements, some practical limitations become evident. The first of these limitations is the scale issue: the differential urbanization model analyzes national urban networks, but, whitin the European Union, while disparities between Member States are fading, interregional disparities are increasing (Barna, 2008, Benedek and Kurkó, 2011). Moreover,

whitin the Romanian system of settlements, there was an increase in the *general hierarchy index* (GHI) gap between the city of Constanta and the regional metropolises of Iasi, Cluj and Timisoara, on one hand, and other large urban centers, on the other hand (Ţurcănaşu, 2006). Thus, from a planning point of view, an analysis of the situations at a lower scale would be much more relevant.

The second problem observed with the direct application of Geyer's model consists in the absence of cyclicality of the phases and stages of differential urbanization. Thus, even after an urban system can be considered as being constituted, changes in migratory flows might occur, based on iterations of a limited number of possible relationships between the nodes of the network. In this respect, a *reurbanization* stage is considered by some studies (Klaassen *et al*., 1981; van der Berg *et al.*, 1982) in succession of the *counterurbanization* phase. This phase is characterized through the reorientation of the main migration flows towards the primate city, being analogous to the urbanization phase. The study considers that this kind of analogy can be further generalized and extended to the other phases, so that the changes of the migration flows from within a constituted network can be described through a cyclic sequence.

Another issue with the differential urbanization model, closely related to the scale problem, is that of the monocentrism of the studied network. At present, especially at national scale but in many cases also at regional scale, monocentric systems represent particular cases (Vandermotten et al., 2007). Thus, it would be necessary to adapt the original model to make it applicable to a geographic scale where monocentric systems can easily be found -for example, that of metropolitan urban networks.

Further, there is a problem with the terminology used by the differential urbanization model, that uses notions such as *urbanization*, *counterurbanization* or *primate city*. Even the fact that the model analyzes networks composed exclusively of cities might be a problem when trying to directly apply the model for studying a network that comprises rural settlements as well.

Last but not least, there is a problem related to the omission of migratory flows between the urban network and its exterior. Thus, although a scenario where these flows greatly exceed the migration that takes place between the cities of the network is possible, the differential urbanization model does not take it into account.

Of course, the differential urbanization model complies well with the purpose for which it was developed - that of studying the historical evolution of the formation of national urban networks - the issues listed above being strictly related to the possibility of applying the model without any modifications for a completely different purpose: analyzing the continous changes of the migratory relationships between the settlements of a metropolitan network. Thus, in order to

obtain a model that suits the purpose of this study, some modifications are required - as summarized in the following table (Tab.2):

element of the model/feature	the differential urbanization model	the modified model
scale	național urban network	sub-regional urban network
settlements	priamate city	center
	intermediate cities	secondary centers
	small cities	peripheral settlements
phases	urbanization	polarization
	polarization reversal	polarization reversal
	counterurbanization	decentralization
stages	early stage of the primate city	early stage of the center
	intermediate stageof the primate city	intermediate stage of the center
	advanced stage of the primate city	advanced stage of the center
	early stage of the intermediate cities	early stage of the secondary centers
	advanced stage of the intermediate cities	advanced stage of the secondary centers
	early stage of the small cities	early stage of the periphery
	advanced stage of the small cities	advanced stage of the periphery

Table 2: Proposed changes to the differential urbanization model. Source: the author.

Further, the problem of finding a monocentric network can be solved by selecting the scale of the study. Thus, if the system has several first-rank centers that have quasi-equal weights within the network, it is possible to build subsystems around these centers and, afterwards, to study the interrelation of these subsystems.

Finally, the problem regarding the study of the relationship between the urban network and its exterior can be solved by adding the migratory flows between each node and the exterior.

4.4. Differential Urban Development in the Metropolitan Area of Cluj-Napoca[1]

"In Romania, between 1991 and 2003, there was a positive evolution of the internal migration flows, so that the number of those who changed their residence within the borders of the country increased from 11.3 ‰ (in 1991) to 15.3 ‰ (in 2003). The urban-rural migration flow has seen a spectacular evolution (it has increased almost 4 times during the considered period), while the number of those who migrated from rural to urban areas decreased by over 40%. Within this context, between 1991 and 1996, the rural-urban migration balance was positive (leading to population growth in the urban area), but the 1997-2003 period was marked by a negative rural-urban migration balance with consequences on the increase in the share of the rural population in the total population." (Lupei, 2006, p. 366).

When identifying the types of settlements proposed by the modified model in CNMA (*see* Tab.2), it is obvious that Cluj-Napoca plays the role of the center, being the only urban settlement of the network. Further on, for the correct identification of secondary centers, we propose the use of the method and results presented in section *4.1*. Thus, in 2018, the municipalities of Apahida, Baciu and Floresti could be considered as secondary centers of the CNMA. At the same time, the municipalities of Gilau and Chinteni had some potential of centrality, but they did not meet both the criteria proposed by the study. Of course, it is important to note that the thresholds proposed for awarding the score (the average number of the population and the average population growth coefficient) vary according to the studied period, the settlements losing or gaining in centrality over time. However, for simplicity, in this study we will not use a dynamic classification, assuming the centrality relations of 2018 being valid for the entire duration of the studied time range.

Whitin the studied period, the study discovered an evolution of a *polarization reversal* phase, that manifested itself in the CNMA network by a gradual increase in volume of the migratory flows from the center towards the secondary centers. This increase of the migratory flows happens whitin a period of general population growth in the secondary centers of the metropolitan network, which gain distance from the peripheral settlements. At the same time, although the city of Cluj-Napoca - center of the metropolitan network - attracts significant migratory flows from whitin the CNMA, they did not lead to a significant increase of the urban population (between 1992 and 2002 the population of the urban core decreased from 328,602 inhabitants to 317,953 inhabitants, and between 2002 and 2011 it increased by about 2% -below the average population growth rates of

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1   Note: this study resumes results published in Cocheci, V. (2014), Differential Evolution of the Settlements in the Metropolitan Area of Cluj-Napoca, *Acta Technica Napocensis: Civil Engineering & Architecture* **57(3)**: 26-34.

the CNMA settlements), suggesting that a large number of departures from the city have taken place.

During the period between 2008 and 2011, there was a tendency of increase in volume of resident arrivals in the peripheral settlements of the metropolitan area. This could indicate the beginning of a transition from the *polarization reversa*l phase to the *decentralization* phase according to the definitions proposed by this study.

4.5. *The Risk of Draining the Population of Migration Sources*

In the center-periphery relations, in addition to the *spread* (Gaile, 1980) or *spillover* effect (Richardson, 1976), that is characterized through a diffusion of the center's growth towards the periphery, a *backwash* effect (Myrdal, 1957; Richardson , 1976, Gaile, 1980) can occur, that manifests itself through the economic and demographic drainage of the periphery by the center. A study of the center-periphery relations in Finland shows that, in the case of large or fast-growing centers, the negative effects on the periphery prevail (Tervo, 2009). Of course, it is worth mentioning that the area of influence of a center depends on the analyzed function: ”*the area of influence of the city of Cluj extends over the central-western part of Transylvania, while the education or health service functions (services) have a more extensive area, covering the entire territory of Transylvania*” (Benedek, 2004, p. 38). Thus, the university function of Cluj-Napoca (Păcurar, 2011) has the capacity to attract a large number of people from whitin a vast area of influence.

The study reveals that CNMA exerts its attraction force mainly on the population of two regions (but not limited to): Northwest and Center. It is noticed, however, that a small number of settlements provided a significant part of the resident arrivals in the metropolitan area. Moreover, most of these settlements have gone through demographic declines of 10% or more during the period between the last two Censuses (2002-2011). At the same time, in the case of some of the most important of these settlements (in terms of the number of residents provided to the metropolitan area), there was a deceleration of the migration to CNMA during the 2002-2011 period (the cases of the cities of Turda and Gherla, underlined by the study, are certainly not singular - the cities of Dej, Huedin and, probably, Campia Turzii are in similar situations). Moreover, without being the sole factor, the metropolitan area plays an important role in the population decline of these settlements trough the attraction it exerts on their population.

In view of these observations, we can state that there is a real risk of draining the population of main migration sources of the CNMA, with potential impact on the future demographic growth of the metropolitan network. Thus, in the future planning of the development of the metropolitan area, it is advisable to reduce the dependence of population growth on resident arrivals from settlements affected by demographic decline, either by identifying new sources (possibly external) or by adopting scenarios based on a deceleration of growth.

4.6. The "Youthification" Phenomeneon in the Metropolitan Area of Cluj-Napoca[2]

The term "*youthification*" (Moos, 2016), which we translate into this work through "*întinerire*", represents a relatively new concept used to describe the spatial concentration of young adults: "*Whereas gentrification is described as a class-based process, resulting in displacement of lower income earners, youthification sees the in-movement of young adults across the income spectrum, both in owners and renters, and sees their departure as those young adults age*" (Moos *et al.*, 2015). The term refers only to the age structure, but because of the common needs of age groups, it also has social and economic implications. The existing housing structure, as well as certain urban functions related to it, can cause this type of demographic concentration: "*Youthification and gentrification are not mutually exclusive concepts—In fact, gentrification appears to set the stage for subsequent youthification to occur. Gentrification raises prices/rents, which has generally resulted in a decline in unit size of condominium apartments*" (Moos *et al.*, 2015).

The research attempted to adapt the relatively new "*youthification*" concept (Moos, 2016) to an European context using a case study focused on the spatial concentration of young adults in the Metropolitan Area of Cluj-Napoca. To obtain images of other types of demographic concentrations, the methodology used needs only minor changes. Next we present in a summarized form the results of the study for the two analyzed aspects: areas affected by *youthification*, respectively specific characteristics of the young adults that live them.

As far as the areas affected by *youthification* are concerned, they are situated, as expected (Zanni et al., 2008; Olfert and Partridge, 2011), either within the urban core of the metropolitan area or in its immediate proximity. Most of these areas (especially those where the *youthification* phenomenon is pronounced or very pronounced) include relatively recent real estate developments that have housing stocks and urban infrastructure of poor quality. The main advantage of these areas consists in the low cost of properties and rent (Cluj-Napoca City Hall, 2015; Cocheci, 2015; Racu,

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2   Note: this study resumes results published in Cocheci, V., Mitrea A. (2018) Youthification in the Metropolitan Area of Cluj, *Urbanism.Arhitectură.Construcții* **9(2)**: 121-130.

2015), which appears to be an important attractor for most young adults (Moos et al., 2015). However, the low price is not an attractor that acts alone, given that high-unemployment areas might offer even lower costs of living (Drachal, 2016). Also, one can notice that, although they have cheap housing and good infrastructure, the areas in the vicinity of former industrial platforms (such as Iris or Bulgaria) are avoided by the young adults. This could be caused by a negative perception associated to the image of degradation of *brownfield* areas (Chelcea, 2008). In the European Union, only a few Member States have identified *brownfield* areas as policy issues at national level and are trying to address them properly (Baing, 2010). Romania is not among these states.

With regard to the specific characteristics of young adults, by age and participation in a form of education, the study found that members of the younger age group of young adults are more likely to be enrolled in different forms of education. This suggests that a higher share of young people aged 25-29 have dependency relations, by comparison to young people aged 30-34, fact that implies a latent need for new housing.

Concerning the distribution by age of young adults within the metropolitan area, we have noted that the proportion of the 30-34 years old is lower than that of the 25-29 years old whitin the urban core. Of course, in absolute figures, the majority of young adults live in the urban core (irrespective of the age group to which they belong), but a higher concentration of the younger age group in the city than in the other studied settlements suggests a trend in making housing choices based on the proximity of urban functions and facilities.

The other indicators analyzed by the study - the civil status, respectively the average number of children / young-adult woman – provide further information on the households in areas where *youthification* occurs. Thus, we observed that, while the urban core attracts in *quasi*-equal measure young-adults that either married or in consensual communion and those outside these categories (unmarried, divorced or widowed), the situation is different in the municipalities of Apahida, Baciu and Floresti – that are preferred by married people. This probably occurs because of the lower prices of large dwellings in the periurban satellites than in the city, a hyphothesis that is also supported by the high share of young mothers whitin the population of these municipalities.

An indirect effect of the *youthification* phenomenon is the creation of a completely different type of social homogeneity in the source areas of the migration of young adults: "*on the whole, it is the better-off who move out, leaving behind marginalized communities with little power to tackle negative conditions*" (Power, 2001). Whitin the CNMA, this effect can be noticed in its most

isolated settlements that are already showing signs of population aging and demographic decline. The depopulation might be caused by a deprivation of basic household needs (Shucksmith et al., 2009; Ward and Brown, 2009) or by a *backwash* effect of polarization (Myrdal, 1957; Richardson, 1976). Moreover, one must take into account that the city of Cluj-Napoca and its suburbs attract young adults even from other regions, the effects of depopulation and aging of the general population being not limited to settlements of the metropolitan area..

Due to the uncertainties induced by demographic change, flexible strategic planning should be mandatory even for cities that go through expansion periods (Wiechmann, 2008). At the same time, in order to combat the negative effects that occur in the source areas of the migration, there are two possible approaches, which are not mutually exclusive: the confrontation of the causes of urban contraction, respectively tackling its effects. For example, limiting urban dispersal addresses one of the possible causes of urban shrinkage (Reckien and Martinez-Fernandez, 2011), while implementing urban regeneration strategies (Hulsbergen and Stouten, 2001, Chelcea, 2008, Bernt, 2009; Martinez-Fernandez, 2011; Cocks and Couch, 2012; Moţcanu-Dumitrescu, 2015) addresses one of its effects. In both cases, continuous monitoring of the urban form is recommended, in order to obtain a clear and up-to-date image of the situation (Castano and Wadley, 2012).

5. The Residential Function

"Alongside access to food and health, we consider that the need for shelter (in extenso, the access to adequate housing) is a fundamental component for social integration and inclusion." (Dan, 2009, p.119)

5.1. The Housing Stock

The study found that, while in the urban core and in the municipality of Floreşti the housing stock is mainly composed of units situated in collective housing buildings (most of them apartment blocks), in the other secondary centers of the metropolitan area and its peripheral settlements the dwellings situated in houses prevail. At the same time, in the municipality of Baciu, there is a tendency towards the reversal of the ratio between the dwellings in houses and those in appartment buildings trough the delivery of a significantly higher number of apartments than houses during the last years of the studied period (dwellings in buildings completed between 2008 and 2011 are distributed in shares of 12.79% in houses and 87.21% in appartment buildings - shares recorded during the time period in which the maximum value of the average annual number of completed dwellings was reached in Baciu).

From the point of view of the period of completion of the buildings, the study found that most of the dwellings whitin the urban core are located in buildings dating from the socialist period, while in the secondary centers of the CNMA a significant share of dwellings is located in constructions completed after 1992 (the case of Floresti is the most relevant, more than half of the entire housing stock being situated in buildings completed between 2008 and 2011). At the same time, we observed that the housing stock of the peripheral municipalities of CNMA is situated mainly in constructions completed before 1977.

With regard to urban endowment, the main problems identified are related to the relatively large proportion of dwellings in the peripheral municipalities of CNMA and, to a lesser extent, in the secondary centers of Apahida and Baciu, that do not have sewage or water supply. In Cluj-Napoca and Floresti, the share of dwellings with problems related to the lack of urban amenities is much smaller, but it is important to mention that they relate to much larger housing stocks.

The analysis of housing stocks based on the building materials used for the exterior walls of the buildings provided predictable information for the urban core (where most of the dwellings are located in appartment blocks built during the socialist period), but proved to be inconclusive in the CNMA municipalities due to errors in statistical data (confusions might have occured between reinforced concrete, prefabricated units and masonry during the identification of building

materials). We have found as relevant for determining a part of the inappropriate dwellings the data about the number of dwellings situated in adobe or mud buildings (dwellings located in timber constructions, contrary to current practice, cannot be considered as inappropriate in absence of other information). In the case of peripheral municipalities, the proportion of dwellings in buildings with external walls of adobe or mud was over 13%, most of them being situated in constructions completed before 1977.

5.2. Case Study: the Appartment Buildings Project Type T-770 in the Zorilor Neighborhood

As noted in the previous section, there are some issues related to the quality of available statistical data on housing. Thus, we found that there may be some inconsistencies regarding the building materials used for the exterior walls of the buildings, but there might also exist problems regarding the surface of the rooms (these areas are not measured during the census but are estimated by the users of the dwellings - errors might occur because of possible erroneous approximations, confusion between the useful and built-up area, addition of the surfaces of other rooms than those of the habitable rooms, etc.). In order to overcome some of these problems, the study proposes an analysis of the possibility of using information on standardized housing buildings in order to obtain a more detailed picture of the existing housing stock. For this purpose we propose, as a proof of concept, the analysis of the dwellings in T-770 buildings in the Zorilor neighborhood of Cluj-Napoca. This district was chosen for the study because it has a very high share of this type, the other districts in Cluj where T-770 blocks were built -Manastur and Mărăşti - have a rather heterogeneous distribution of the types of standardized housing constructions built during the socialist period. At the same time, Zorilor district is relevant for the study because of the high level of *youthification* (Moos et al., 2015; Moos, 2016) of its population.

The T-770 appartment blocks are housing constructions built on a standardized project developed by IPCT (the Institute for Design, Research and Computing Techinques in Construction) and are specific to the construction industrialization period of the 1970s and 1980s. These buildings are characterized through a height of 4 stories, a constructive system based on the use of prefabricated elements (structural panels with triple layered structure for the exterior walls, respectively reinforced concrete for the interior walls, prefabricated concrete slabs, stairs and floors) and the layout of their apartments. The exterior image of these buildings is typical for socialist constructions for collective living: uniform (Hirt et al., 2016) and subordinated to technical and constructive logic (Cocheci, 1984). In some cases (in high-visibility locations), they might have decorative elements on the façade or a tilted roof (most of these blocks have terrace roof). At the

same time, as a result of the adaptation of projects for sloped terrains, the buildings may have, in some cases, a semi-basement level used for garages (because of the structural system, garages are individual, each with separate access) and storage space (Tudose, 2011). In Cluj-Napoca, buildings of this type were built especially in the Manastur, Marasti and Zorilor neighborhoods. In the Zorilor neighborhood, all three major socialist housing complexes (Zorilor Noth, Zorilor South 1 and Zorilor South 2) were developed during the period when the T-770 buildings were widely used at national level.

The proposed analysis comprises several steps, as follows:

1. the identification and mapping in GIS on an *OpenStreetMap* support of the T-770 constructions in the Zorilor neighborhood;

2. GIS mapping, on OpenStreetMap support, of the T-770 building according to the number of sections and the type of sections used (since there were several types of sections of the standardized project);

For the first stage of the study, in absence of the *systematization details* from the socialist period - on which the buildings would be marked according to the type of project proposed - the study was based on the visual identification of the T-770 buildings by using *Google Map*s and *Google Street View* and GIS mapping on an *OpenStreetMap* support (Fig.1).
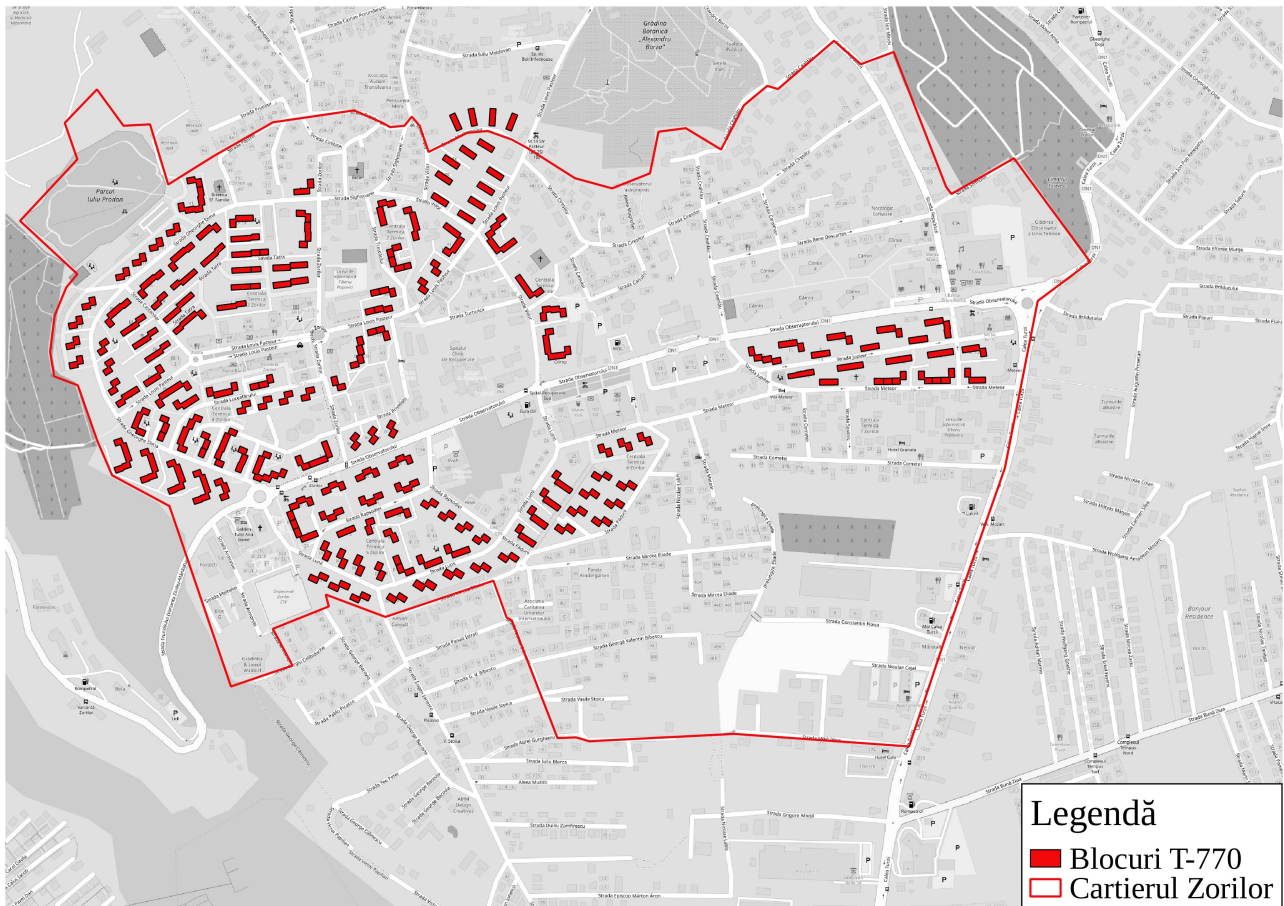
Figure 1: Standardized large-panel buildings project type T-770 in the Zorilor Neighborhood. Source: the author.

For the second stage, the study attempted to determine the number of sections of the studied blocks. This indicator is necessary, but not sufficient, in order to determine the number of dwellings located in the T-770 buildings. Thus, we assumed that, from the perspective of the study, it was relevant that in the Zorilor neighborhood two types of sections were used in terms of the number of dwellings (with 10 apartments and 14 apartments each) that can be further grouped into three categories according to their planimetric layout:

1) Pa4 sections (Annex 4), that have 7 3-room apartments and three 4-room apartments;

2) Pa2 sections (Anexa 5), that have 13 2-room apartments and one 3-room apartment;

3) Pc2 sections (Anexa 6), that have two 2-room apartments and 8 3-room apartments.

Based on this classification, the OpenStreetMap entities representing T-770 blocks were separated on sections or groups of sections with similar features. Then, we added in GIS a new parameter in order to retain the number of sections of these entities, respectively a parameter that retains the type

of the sections. Thus, we found that in the Zorilor neighborhood were built 200 sections of T-770 with Pa4 layout, 101 sections with Pa2 layout and 142 sections with Pc2 layout. These sections contain 4,834 dwellings (approximately 3.6% of the total stock of the city in 2011), distributed as follows (Tab.3):

	Pa4 sections	Pa2 sections	Pc2 sections	total
2-room appartments	-	1,313	284	1,597
3-room appartments	1,400	101	1,136	2,637
4-room appartments	600	-	-	600
total	2,000	1,414	1,420	4,834

Table 3: Number of apartments by building section and by number of rooms. Source: the author.
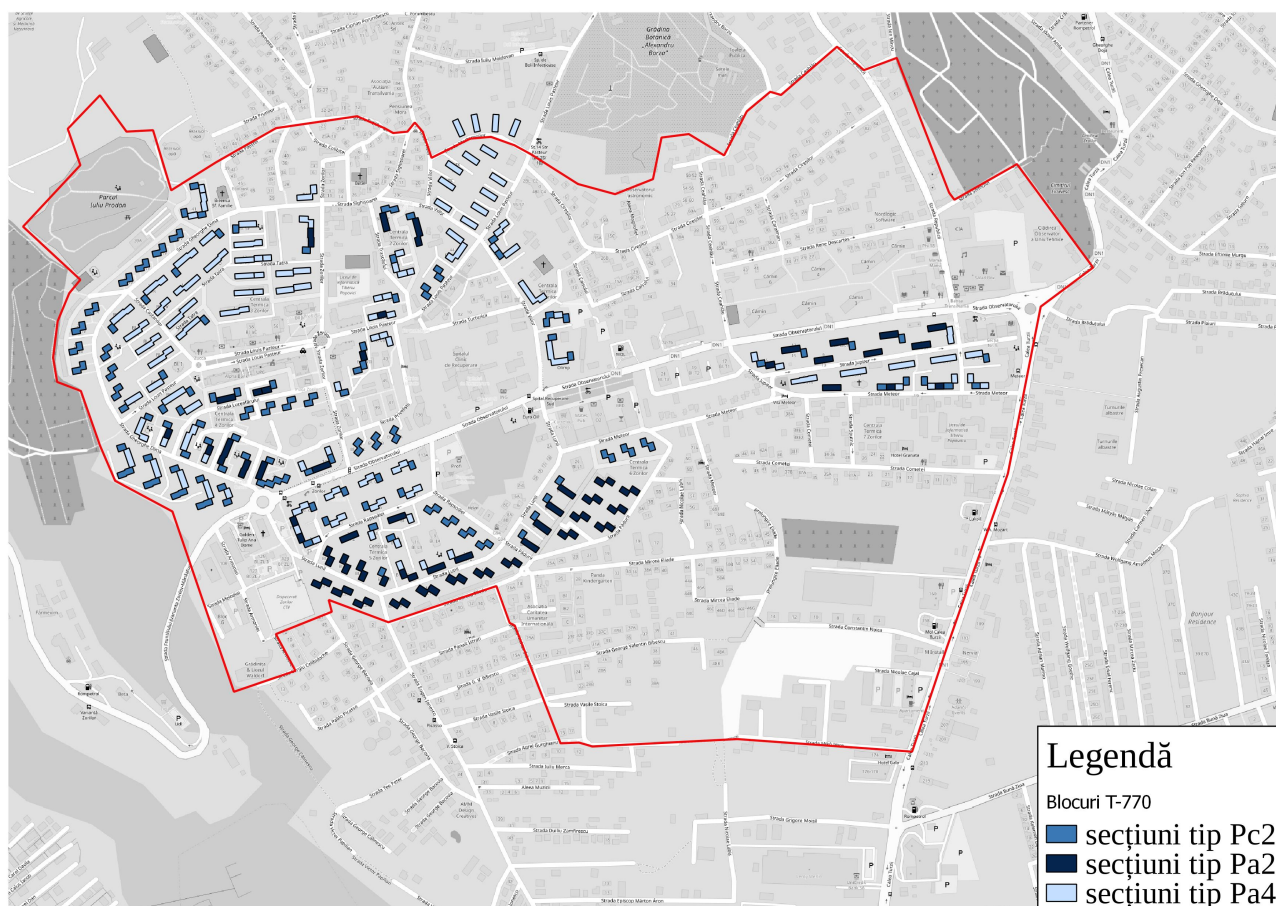

Figure 2: Buildings and building sections by section layouts. Source: the author.

After mapping blocks by section section type (Fig.2), we noticed that most sections with 2-room apartments are located south of Obsevatoului street, while most of the sections with 4-room apartments are located north of this the street. In other words, the Zorilor South 1 and Zorilor South

2 housing complexes, that were developed in the '80s, contain dwellings with a lower level of comfort than the Zorilor North, that was developed in the late 1970s.

The study attempted to illustrate a method by which precise data on a large part of the housing stock could be obtained. Thus, due to the industrialization and standardization of housing construction during the socialist period, there are a large number of dwellings with similar characteristics at national level. Unfortunately, the details of systematization and the catalogs of construction projects are not always available (many of them have disappeared or have been destroyed). To overcome this problem, the study compensated for the absence of information from the socialist period with the help of tools such as *Google Maps*, *Google Street View*, *OpenStreetMap* or *QGIS*. The methods used can be easily replicated to extend the study for all dwellings in T-770 buildings within the city, or to apply it to other cities. The study can also be adapted for the analysis of dwellings located in other types of standardized buildings.

5.3. The Usage of the Housing Stock

The study found that, during the studied period (2002-2011), the average number of persons / dwelling decreased in all of the CNMA settlements. Significant decreases of this indicator occurred in municipalities where there was either a much stronger increase of the housing stock than that of the population (*e.g.* Baciu and Floresti) or significant decreases of the population (*e.g.* Petreştii de Jos).

In order to correct any distortions induced to the *per capita* indicators by the existence of a large share of unoccupied dwellings - situation found by the study for both, secondary centers and peripheral settlements of the metropolitan network - we proposed to replace these indicators by reporting them to the number of occupied dwellings. Thus, we observed significant discrepancies between the *per capita* housing indicators calculated in refference to the total number of dwellings and those calculated in refference to occupied dwellings, discrepancies that change the hierarchical classification of the settlements according to the recorded values.

Concerning the occupancy of dwellings, the study found very large shares of vacant dwellings both, in the secondary centers of CNMA and in its peripheral settlements. However, while in Apahida, Baciu and Floresti the high vacancy rate is most likely due to the large number of dwellings completed in the recent period, in the case of the peripheral communes, the scenario of abandonment of existing dwellings as a consequence of population decline is more plausible.

Through the analysis of the housing occupancy by households, the study has managed to determine the housing needs component generated by the presence of two or more households in

the same dwelling. Thus, as calculated on the basis of a mathematical formula, it would be necessary to allocate more than 5,100 dwelling units to households living in overcrowded dwellings in CNMA in order to reach a ratio of maximum 1 household / dwelling.

In terms of the use of dwellings for lucrative purposes, the study found that, at the CNMA level, a relatively small number of dwellings have rooms that are used for professional or commercial purposes. At the same time, we have noticed that, in absolute terms, most of these dwellings are located in Cluj-Napoca and that, in relative terms, there are more than two times more such dwellings in the urban core of the metropolitan area than in its rural settlements.

6. Conclusions

6.1. Answers to the Research Questions

Whitin this section, the disertation summarizes the answers to the research questions for each of the proposed objectives:

I.   For the first objective:

1)   Is the suburbanization of CNMA typical for Central and Eastern Europe?

The study that dealt with this objective compared the features of Cluj suburbanization to a template of common features as observed by Kiril Stanilov in the case of suburbanization of central and eastern European cities (Stanilov, 2007). Following this comparative analysis, we observed that there is an equal number of common features and distinctive features between the suburbanization of CNMA and those of other cities of Central and Eastern Europe. Thus, within the limits of the study, it can be stated that the Cluj suburbanization does not correspond to the pattern identified by Kiril Stanilov. However, the work does not exclude the possibility that the features identified as distinct fall into patterns that have not yet been identified by existing studies.

2)   What are its distinctive traits?

The characteristics that distinguish the suburbanization of CNMA from the patterns used by the comparative analysis are:

- Condensed Evolution: the suburbanization of CNMA is rather spontaneous, no models being imported as such from the West.

- Suburbanization patterns: the suburbanization of CNMA is characterized by a lower level of urban dispersal than those of Western cities. At the same time, the number of dwellings reported to the area of land occupied by buildings in the municipalities most affected by suburbanization is high - in the case of Floreşti commune recorded values are exceeding those from the urban core of the metropolitan area.

- Lack of administrative separation and segregation: CNMA is constituted on the basis of the voluntary association of distinct administrative entities. Thus, administrative entities have remained completely separate, having their decisional independence limited only partially by constraints embodied whitin integrated development strategies.

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- Social homogeneity: CNMA does not present this trait, as real estate properties are much more affordable in the suburban municipalities than in urban areas. At the same time, due to the suburban development of a pre-existing rural structure, there is a social mix between the initial population and the one arrived through migration.

II. For the second objective:

1) What changes should be made to the differential urbanization model (Geyer and Kontuly, 1993; Geyer, 2002b) in order to use it for the study of demographic changes of a sub-national network of settlements?

   - The first necessary change consists in tackling the scale issue: we proposed an analogous transition from the national urban network analyzed by the original model to the scale of any network of settlements. To this aim, the settlements of the original model were redefined: the *primate city* has become the *center* of the network, the *intermediate cities* have become *secondary centers*, and the *small cities* have become *peripheral settlements*. Trough these name changes are overcomed both, the scale problem and that related to the urban or rural character of the studied settlements.

   - The second necessary change is to redefine the phases and stages of the original model. These redefinitions are imposed both, by the extension of the model so that it can be used in the analysis of urban systems that also include rural settlements and by the existence of a cyclicity in the succession of phases - given by the periodic repeat of a limited number of migratory relations between the nodes of the network.

   - The third change involves taking into account the migration flows between the studied system studied and its exterior. This change is especially necessary when analyzing a system that has two or more cores of equal rank. Thus, the system can be divided into two or more monocentric networks that can be analyzed analogously to the original model of differentiated urbanization. Afterwards, a network of networks can be built in order to study the migratory relationships between these subsystems.

2) How does the modified model apply to the CNMA network of settlements?
   - For the 1992-2002 period, the study notes an orientation of migratory relations within the metropolitan network that is specific to the *polarity reversal phase*, the Apahida, Baciu and Floresti municipalities representing the main attractors of migration within the metropolitan network. At the same time, the system goes

through the *early stage of the secondary centers*, while these settlements are start to consolidate their status trough the demographic growth recorded during this period.

- For the 2003-2007 period, we noted a continuation of the *polarity reversal phase* together with an amplification of the flows from the urban core towards the secondary centers. At the same time, during this period, the urban system enters the *intermediate stage of the secondary centers*.
- For the 2008-2011 period, we noted the beginning of the transition from the *polarity reversal phase* to the *decentralization phase*. The transition between the two phases is also reflected in the beginning of the transition from the *advanced stage of the secondary centers* to the *early stage of the periphery*.

III. For the third objective:

1) Is internal migration a sustainable source of demographic growth for the CNMA?
   - The study found that the main settlements that supported the demographic growth of the CNMA are facing population decline. Therefore, a continuation of metropolitan growth based mainly on arrivals from these settlements is unsustainable in the long run.

2) How can the CNMA tackle the possible risk of draining these sources?
   - The study recommends that, when planning the future development of the metropolitan area, the dependence of population growth on the arrivals from settlements affected by demographic decline should be reduced by identifying new sources (possibly external) or by adopting scenarios of growth slowdown.

IV. For the fourth objective:

1) What are the areas affected by the *youthification* phenomenon (Moos, 2016; Moos et al., 2015)?

   - In the CNMA, the settlements in which the *youthification* was observed are the municipalities of Floresti, Apahida and Baciu. The most prominent manifestation of the phenomenon was observed in municipality of Floresti.
   - In the city of Cluj-Napoca, we noted a tendency of young adults to gather in the neighborhoods in the southern part of the city.

2) What are the traits of young adults that influence their needs and choices in matters of housing?

- The studied characteristics are the age group, participation in a form of education (by age group), civil status and number of children (for female young adults).We noted that the probability of manifestation of the studied characteristics differs depending on the residence of young adults whitin the urban core, in the large periurban municipalities or in the peripheral municipalities of the CNMA.

V. For the fifth objective:

1) What is the structure of the housing stock of the main settlements of the CNMA?
   - The study has analyzed the structure of the housing stock of the city of Cluj-Napoca, of the municipalities of Apahida, Baciu and Floresti, as well those the peripheral municipalities of the CNMA and reached the following conclusions:

     i. The housing stock of the urban core is composed mostly of units located in constructions built between 1961 and 1991 - time period that includes the socialist period of building industrialization. Dwellings with problems related to the lack of public utilities are relatively few. The main building material used for the exterior walls of the dwelling buildings is reinforced concrete (including the reinforced concrete used in the production of large prefabricated panels used during the building industrialization period).

     ii. The housing stock of the municipalities of Apahida, Baciu and Floresti is composed mostly of dwellings located in buildings built during the post-socialist period, especially between 2003 and 2011. Dwellings with problems related to the absence of public utilities are relatively few in Floresti commune, but numerous in the communes Baciu and Apahida, where the main problems are related to the absence of sewerage and water supply. The data on the materials used for the exterior walls of buildings are likely to be erroneous and cannot be used for a detailed analysis of the housing stock.

     iii. The housing stock of the other municipalities of the CNMA is composed, for the most part (over 74%), of units located in buildings built up to 1977. Dwellings that have problems related to the lack of public utilities are relatively numerous, the main problems noted being related to the lack of sewerage and running water. As with in the case of Apahida, Baciu and Floresti, the data on the building materials of the exterior walls of dwelling buildings are likely to be erroneous.

- In terms of dwelling occupancy, the study finds that a significant proportion of the housing stock of the rural settlements of the CNMA is vacant. The largest share of vacant dwellings was noted in Floresti (over 35%).

2) Can the information on standardized housing be used to get a clearer picture of the existing housing stock?

- Because of the industrialization and standardization of housing constructions during the socialist period, there is a large number of dwellings at national level that have similar characteristics.

- The research has succeeded in providing a detailed image of a significant portion of the housing stock of the Zorilor neighborhood through a case study limited to the analysis of T-770 dwelling buildings in this neighborhood. The methods used are easily replicable and can be extended to the entire city.

6.2. Other Observations. Possible Future Research Directions

In addition to the answers to the research questions, the disertation notes a number of observations relevant to the analyzed objectives:

I. For the first objective:

- The fact that suburbanization in the CNMA does not perfectly fit into the patterns identified by Kiril Stanilov for Central and Eastern European cities does not necessarily mean it represents a particular case. Thus, a comparative analysis of several metropolitan areas whitin the country is necessary to determine whether the features identified in the CNMA would fit into a national suburbanization pattern.

II. For the second objective:

- The model proposed for the study of migratory relations between the settlements of an urban network - obtained by adapting the differential urbanization model (Geyer and Kontuly, 1993; Geyer, 2002b) - can be further improved by adding information about the motivation of migration. In this respect, HS Geyer (Geyer, 2002c) identifies the possibility that migrations that have same destination might occur from completely different causes, such as *environmentalism* (migration oriented towards better spatial conditions) and *productivism* (migration oriented towards employment). Thus, in addition to the data on the flow and direction of migration relations,we can add information about the cause or purpose of the migration.

III. For the third objective:

○ As in the case of the previous objective, complementing the analysis of the main flows of internal migration with information on the purpose or reason of migration could provide useful information both in developing the future strategies of the CNMA and those of the settlements from which come most of the new residents..

○ A similar study, encompassing the motivation of migration, could be developed (based on data availability) on residents coming in the CNMA from outside the country.

IV. For the fourth objective:

○ The University Function (Păcurar, 2011) has, due to the high value of its schooling figures, an important impact on the age structure of the population of CNMA. This translates into a relatively high share of the young adult population whitin the total population of the metropolitan area, fact that evidently influences the likelihood of occurence of the *youthification* phenomenon.

○ The image of the *youthification* phenomenon in CNMA can be further detailed by studying the *studentification* phenomenon (cf Smith, 2005; Moos et al., 2017).

V. For the fifth objective:

○ There is a close link between the relative variation of the number of inhabitants and that of the housing stock whitin the settlements of CNMA (Fig.3). Thus, considering the independent variable (X) as the ratio between the number of inhabitants in 2011 and 2002, and the dependent variable (Y) as the ratio of the number of dwellings in 2011 and 2002, we have a correlation coefficient of the two variables R ~ 0.99 and a determination coefficient R2 ~ 0.98. These values translate into the fact that the linear regression equation *Y = 2.12X - 0.928* can explain more than 98% of the variance of the dependent variable. The standard deviation of the data points from the regression line is σ ~ 0.139.
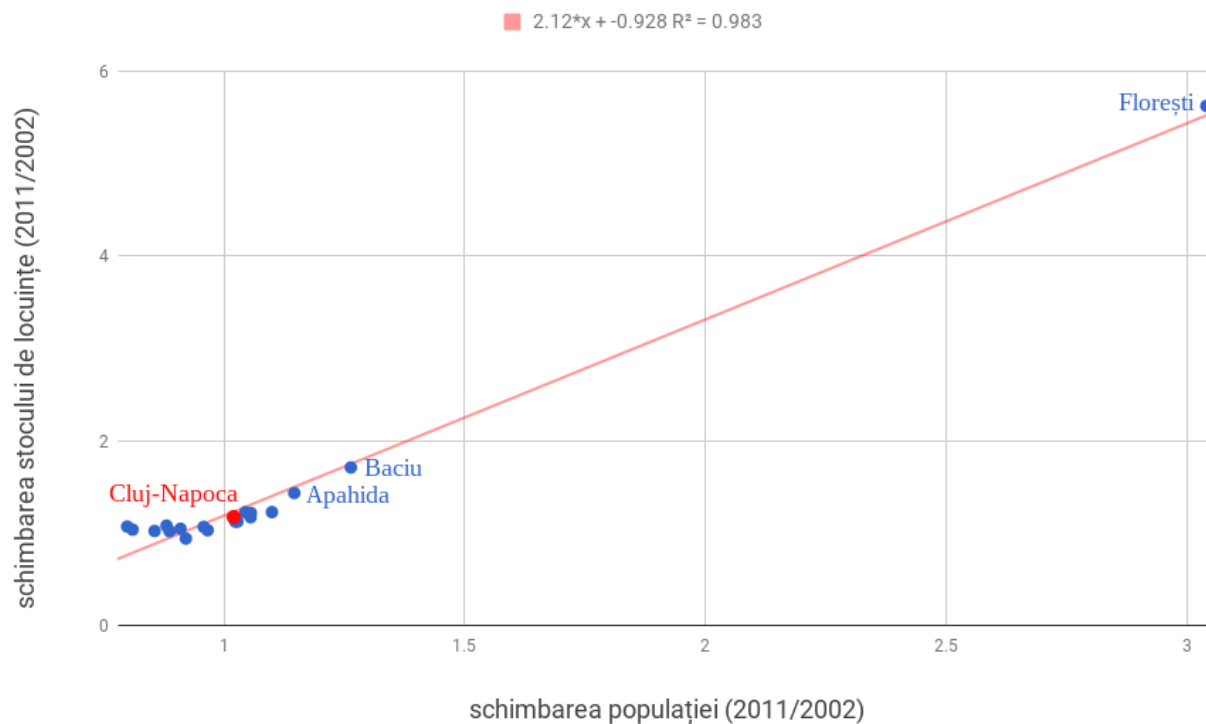
Figure 3: The relationship between population and housing stock changes in CNMA between 2002-2011. Source: the author.

In addition to the possible directions listed above, it is important to note that future research projects could benefit from technological advances, and, with the help of instruments such as scientific workflow systems (Cohen-Boulakia and Leser, 2011; Florescu et al., 2018), to simplify the analysis of spatial problems, data processing and communication between researchers. At the same time, such tools could facilitate checking older research - a mission that is still difficult (see Boettiger, 2014) and which is of little interest to researchers nowadays, that are focused mainly on the delivery of new findings (Starbuck, 2006).

6.3. Possible Directions in Strategy Development

The last part of the conclusions section attempts to make a transition from the analysis of the links between demographic changes and the residential function to planning - activity which is still not given due importance in Romania (Florescu and Mitrea, 2015) - by proposing a set of suggestions regarding the development of the future housing strategies of the metropolitan area. Thus, depending on the geographic scale, we propose:

I.   For the metropolitan network level:
   1. Starting from the analysis of the migratory flows within the network based on the modified model of differentiated urbanization, we can identify the types of settlements

between which the flows of residence relocations record the highest volumes, as well as the nature of these flows depending on the motivation of the migration. For settlements where *centrifugal forces* predominate (Krugmann, 1999) it is necessary to identify and address the causes leading to the departure of residents. Should the complete remediation of these causes not be possible, strategies based on controlled contraction need to be developed. For settlements where *centripetal forces* predominate (Krugmann, 1999), it is necessary to identify the elements that generate these forces in order to control them.

2. It is necessary to periodically analyze the risk of population drain of those settlements outside the metropolitan area that represent important sources of resident arrivals in the CNMA. Should there be a demographic decline whitin these settlements that is strong enough to affect the population growth of the CNMA, it would be necessary either to find alternative sources to feed this growth or to adopt strategies based on scenarios of growth deceleration.

II. For the settlement level:

1. After analyzing the network of settlements, it is necessary to analyze the flows of residence relocation for each of the settlements falling in the main destinations category according to the corresponding phase of the modified differential urbanization model. Resident arrivals may have differing impacts on these settlements, fact that translates into the need for proportionate allocation of the investments needed to develop the residential infrastructure.

2. It is necessary to analyze the causes that cause people's departures from the network's settlements that are recording demographic decline in order to build strategies to tackle the effects of *centrifugal forces* (*see* Krugmann, 1999).

3. The analysis of the size and structure of the housing stock according to the main housing indicators can provide partial information on the number of inadequate dwellings (there are types of inadequacies that can not be identified on the basis of these indicators - *e.g.* the inadequacy of a dwelling for the elderly). Part of this number (the number of homes whose problems can not be remedied) represents one of the components of the local housing need (McDowell, 1979; Garzena and Petsimeris, 1984; DCLG, 2010).

4. The analysis of housing occupancy at each settlement's level brings information not only about another component of housing need (by identifying the number of dwellings occupied by two or more households) (Garzena and Petsimeris, 1984; DCLG, 2010), but also about to the possible existence of an unused surplus (unoccupied dwellings). The

simultaneous existence of housing need and vacant housing is possible because this need is not fully transposed into market demand. Thus, it is necessary to adopt local policies aimed both at reducing the need and reducing the vacancy rate. These policies can consist of both, direct market actions of acquisition of housing by the public administration for social welfare (subsidized housing) and measures aimed to discourage long-term vacancy of dwellings through tax leverage.

III. For the level of area or neighborhood whitin a settlement:

1. The identification of areas or neighborhoods that present certain types of demographic concentration of the population (*e.g. youthification*) is necessary in order to tackle segregation.

2. The identification and mapping of standardized housing constructions built during the socialist period can provide accurate information regarding about two thirds of Cluj-Napoca's housing stock. At the same time, based on this information it is possible to calculate with a higher accuracy some of the housing indicators for the other dwellings. More specifically, knowing the local overall average value of some indicators such as the average number of rooms / dwelling or the average area of the dwellings, as well as the share represented by socialist dwellings within these values, it is possible to calculate the share represented by the other dwellings based on simple arithmetic calculations. In this way, detailed information can be obtained on the housing stock at city or neighborhood level, that can be used in the development of future housing strategies.

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