CENTRE-PERIPHERY DICHOTOMY AND ITS INVESTIGATION BY GIS METHODS

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Abstract
Centre-periphery dichotomy can be regarded as one of the crucial issues in human geography and regional science. The definition of periphery is far from unambiguous due to its relative expression and its content. This is the reason why can significant number of studies be found focusing on the delimitation of central and peripheral areas. The revolution of computer technology and the rapid development of GIS cause the more and more extended usage of these techniques in the human geography as well. These related studies were categorised by their approaches – namely the locational or developmental centre-periphery concepts – and their GIS tools. Application of spatial parameters with extended datasets and complex GIS based calculations mean the most precise and complicated use of GIS and computer tools in the delimitation of peripheral (and central) areas.

Keywords: centre-periphery dichotomy; delimitation methods; GIS; human geography; Hungary; peripheral areas; regional policy; spatial analysis; spatial development; spatial parameters

1. Introduction

The extremely *rapid development of informatics and GIS technologies* are influencing the spatial research of the society as well. The *territorial databases represent a significant growth* in their dimensions and in their quantity as well. GIS applications *opened new dimensions* and orientations *in the human geographical researches*, at the same time some data analysing processes were integrated into the field of GIS methods (Jakobi 2007).

The *delimitation of peripheral areas* can be regarded as one of the most *important research issues* of human geography, regional science and regional policy. GIS applications are connecting to these analyses received important roles in the fields of data mining, data processing and analysing besides the thematic mapping itself.

The objective of this paper is to create a categorisation of the methods appropriate to make territorial delimitations on the basis of (primarily Hungarian) scientific studies.

2. Centre-periphery dichotomy and the types of peripheries

In order to make an overview about the GIS methods that could be applied in the delimitation of peripheral areas, it is *important to have a conceptual fundament.* The *centre-periphery dichotomy* is regarded as a *basic paradigm* in the social sciences but it is not unambiguous as Immanuel Wallerstein spread a tripartite concept in his theory – by the introduction of the definition

of the semi-periphery (Wallerstein 1983). Apart from this approach, the dual definition provides the core concept of this paper.

The centre-periphery pair of concepts can be interpreted in three ways (Nemes Nagy 1996):

- *positional (geographical or locational) centre and periphery*, where the centre means a designated, enhanced place, while the periphery means the marginalized settlements – it is more often coupled with the issue of accessibility (e.g. Tóth 2006; Tóth – Dávid 2010);
- *developmental (economical) centre and periphery*, which can be identified as the economic development and underdevelopment with social consequences as well;
- *authority centre and periphery*, in which the dependence of power and imbalance of interests appear.

The first and second approaches can be simply interpreted from geographical point of view (e.g. Lőcsei – Szalkai 2008) – this is the reason why the examples in the current paper are limited to these studies. In the followings we refer to the concept of developmental peripherality from the listed definitions and the term 'backwardness' is used as synonym.

The examination of the *problem of the peripheral areas* is quite difficult, because the phenomenon may *appear in multiple dimensions* (Csatári et al. 2006). The impoundment of peripheral areas is, therefore, generally taken into consideration together with multiple indicators and different methods to bring the indicators to the same unit. The multidimensional character of peripherality causes the demand for typifying instead of using one category (Halás 2008).

Different approaches can also be found in the international literature about the concept of centre-periphery dichotomy and about *the classification of peripheries*. According to Alan Reynaud (Reynaud 1981) there are at least *two types of centres* (dominant and hypertrophic) and about *four kinds*

of peripheries (dominated, abandoned, integrated and exploited, integrated and annexed). Besides of these some of the areas do not fit into this dichotomy – isolated (isolate) and blind spot (angle mort), these regions can therefore be classified as marginal regions. (Leimgruber 2007). As part of the discussion about geographical marginality four types were proposed: geometric, ecological, economic and social (Leimgruber 1994).

The identification of peripheral areas is not regarded as a simple challenge. Numerous approaches and methods came to light during the last decade even from Hungary. The previously mentioned multidimensional character of backwardness is the most important reason for the extremely broad spectrum of variables describing and explaining this issue. At the same time, different multivariate statistical methodologies are applied to create complex indicators as a kind of essence deriving from several variables. Besides of these, the dynamically transforming content and spatial pattern of peripherality makes the comparative analysis of different delimitation attempts almost impossible (see details about this issue in the cited study – Pénzes 2013).

Geographical features – even physical geographical characteristics – might also be part of different development calculations targeting to delimit peripheral areas. This point is *especially important in the case of less developed countries or those with very limited resources* (e.g. the share of ground surface and underground waters; share of cultivated lands; definite mine reserves or the share of pastures) (Ziari 2007). However, geographical characteristics might appear by indirect way as well (e.g. due to the network of settlements determined by morphological, hydrographical features).

Different *delimitations represent a gradual alteration towards* the revaluation of *environmental and natural features* of territories. The increasing importance of
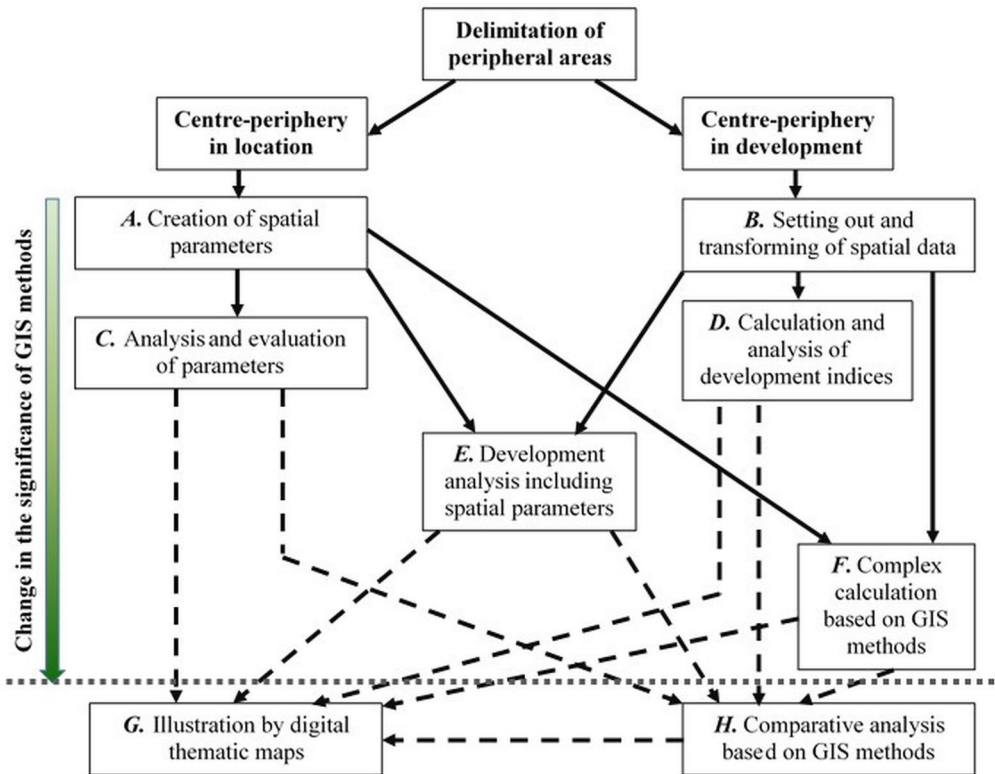
Fig. 1. Relations between the methods of delimitations of peripheral areas and the application of GIS tools (own edition)

sustainable development had a major role in this process. The Stieglitz-Sen-Fitoussi Report (Stieglitz et al. 2009) and the proposed composite indicator called objective well-being method provides an exceptionally complex and sensitive approach thank to its 'holistic' view (Nagy – Koós 2014). This approach tends to strengthen due to appearance of territorial capital concepts as well (e.g. Tóth 2014).

3. GIS methods in the investigation of centre-periphery dichotomy

More possible approaches are available in the investigation of *centre-periphery in geographical location*. Periphery means marginal location from geographical point of view and it suggests the proximity of state border in the case of countries. GIS based findings have already been published about

the theoretical analyses of the delimitation of buffers created from a centroid or from an external border itself (Horváth 2007; Hurbánek 2009). The concept of distance in most cases points beyond the *geographical distance covering the air distances* and it is based on the *time or cost distances* (Szalkai 2001; Dusek – Szalkai 2006; Dusek 2014). The creation of the necessary distance matrices is unthinkable without the support of GIS programmes.

We make *an attempt* with the help of Fig. 1. *to summarize and overview the delimitation methods and GIS technologies targeting to delimit peripheral areas.* The figure contains more complex methodologies from its top to bottom. The horizontal grey dashed line separates those GIS methods appropriate to make general thematic mapping or GIS based comparative analyses (indicated by 'G' and 'H' in the figure). Solid lines indicate

direct relations between the elements, while dashed lines demonstrate the indirect ones.

Brackets with 'A' and 'C' letters refer to the *creation and evaluation of spatial parameters* in which GIS applications have a major role. The increasing role of accessibility put this concept into the spot (inter alia Keeble et al. 1988; Szalkai 2012; Tóth 2013). Accessibility indicators tend to be created as 'realistic' instead theoretically idealistic – latter one can be easily calculated by network analyst tools (Kiss – Mattányi 2005; Bugya et al. 2015), however the previous one is becoming more and more producible thank to mobile applications and big data techniques (Pálóczi – Pénzes 2013). As it was mentioned cost distance appears in spatial analyses as well.

Accessibility indicators became especially important after their built into the complex indices of settlements and sub-regions as part of the Hungarian regional policy. Accessibility and other distance variables were used in different studies (about these see Lőcsei – Szalkai 2008). The usage of spatial parameters during the complex index calculations is demonstrated by the 'E' point in Figure 1.

Network analysis provide additional opportunities to express the territorial centre-periphery features (or marginalization itself) – e.g. for road distance see Tóth 2006. Some attempts were made to use the public transport relations and accessibility for these purposes in Hungary (Pálóczi – Pénzes 2011; Kiss 2012), but this can be the basis of comprehensive analyses (e.g. Kubeš – Kraft 2011).

Traditional centre-periphery delimitations generally utilize extended datasets due to the multidimensional character of territorial development (letter 'B' in Fig. 1). Simple or difficult methods became easily accomplishable as the result of the rapid development of the informatics (letter 'D' in Fig. 1).

The creation of spatial parameters by GIS tools can be applied not only in the case of the practice of regional policy but during the *update of former studies* as well.

In the 'E' bracket refers to those calculations and delimitations containing spatial parameters besides territorial data. Some of the calculations can be part of this group of methods, however these procedures are not regarded as classic delimitations of peripheral areas – for instance spatial moving average, methods based on gravitation or potential models.

According to the current categorisation of methods, *calculations made expressively with GIS softwares* (letter 'F' in Fig. 1) and this demands the greatest GIS value added. Not only the spatial parameters are generated by GIS tools but the processes of calculations are primarily accomplished by them (for instance the calculation of spatial autocorrelation or fuzzy clustering).

Last but not least GIS tools provide the opportunity to *make comparative analyses and evaluation of different delimitations*. Territorial analysis of the potential effects of different delimitation attempts can be made (for example Nagy 2012) – demonstrated by letter 'H' in Fig. 1.

Some of the studies targeted to *compare the locational and the developmental centre-periphery pattern* (e.g. Nemes Nagy 1996; Lőcsei – Szalkai 2008). In fact this approach is demonstrated by the comparison of the figure's letters 'C' and 'D' that *can be illustrated by thematic maps* (letter 'G') or *can be analysed by GIS tools* (letter 'H').

4. Discussion and conclusion

Current paper put the emphasis on the issue of the categorisation of GIS methods on the basis of the delimitation methods of peripheral areas. In order to have an appropriate theoretical background for it, the overview of centre-periphery definitions was necessary to make. The multidimensional character of territorial development resulted in the need for extended datasets and for procedures to create complex indicators. Environmental and physical geographical indicators could also be required in specific

approaches. Their appearance could be traced with the strengthening role of sustainable territorial development.

The possible delimitation methods were categorised by the role of GIS in these procedures. In this approach the locational and developmental centre-periphery dichotomy was separated. The creation of spatial parameters and their building into the steps can be regarded as an important part of the categorisation. It is necessary to emphasize that categorisation created is a subjective opinion that can be discussed, however similar study has not published yet about this issue.

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