Internal Areas Strategies:
From Statistical Methods to Planning Policies

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Abstract. The "National Strategy for Internal Areas", made by the Italian Government for the European Union Partnership Agreement 2014-2020, defines the territory of the Italian internal areas as a set of project-areas, local inter-municipal systems each with its own territorial identity defined by social, economic, geographic, demographic and environmental characteristics. In this sense, we can define "internal" those areas significantly distant from the centers of supply of essential services (education, health, and mobility), rich in environmental and cultural resources with highly diversified natural aspects. The objective of the work is to re-elaborate the existing mapping for the identification of the internal areas, made by the Italian Government, especially taking into account the demographic, economic, morphological profiles and essential services supply, through the use of fuzzy logic. Then, trying to deep explain possible planning strategies and policies for these relevant, sometimes abandoned and extremely diffuse territories.

Keywords: Fuzzy logic · Planning policies · Territorial clusters

1 Introduction

The "National Strategy for the internal areas" interprets the territory of the Italian internal areas as a set of project-areas, or of local systems of intermunicipal, each with its own territorial identity defined by social, economic, geographic, demographic and environmental characteristics. Each project-area, selected through an investigation between Region and State is required to prepare a development strategy for the involved area or "Strategy area".

The identification of the national *Internal Areas* starts from a reading of the polycentric Italian territory, that is a nation characterized by a network of

municipalities or groups of municipalities (centers offer services) around which gravitate areas with different levels of peripheral space (it has to be considered that urban Italy is made by about 8.000 municipalities and the majority of them have no more than 10.000 inhabitants). those areas significantly distant from the centers of supply of essential services (education, health, and mobility) are defined *Internal Areas* and they are rich in important environmental and cultural resources and highly diversified by nature or as a result of centuries of human processes.

The objective of this work is to verify the organization's identification of *Internal Areas* used by the Italian Government through methods of integration of all available data with fuzzy techniques able to identify the degree of belonging to the class of the *Internal Areas* compared to all the data available today and with respect to each of them considered individually.

In fact, the degree of belonging to the *Internal Areas* with respect to each criterion highlights important differences between the same areas already identified by the government and allows us to understand the spatial features on which action is needed to rehabilitate the territories and allow their valorization.

Therefore, a first point emerging from this work is related to the possibility to describe territorial phenomena through a fuzzy integrated model, which starts from the construction of indicators, with a multi-dimensional nature, and then adopt models capable of identifying "goal areas". A second point of research is related to the ability to schedule the *Internal Areas* enhancing their landscape, environmental and economic features rather than trying to change them making more similar to those that currently appear more central and dynamics areas in the globalized economy [1,2]

2   The Italian National Strategy for Internal Areas and Perspectives for European Cohesion Policies

2.1   Italian National Strategy Goals

Italy, like many other European countries, is characterized by the presence of numerous municipalities (there are more than eight thousand) often placed in areas far from major roads (highways, railways, ports and airports) and the main economic flows. It can be said that the country can be described just by these internal areas and large metropolitan cities linked by medium-sized cities in polycentric networks. The internal areas have paid their subordination in terms of depopulation, economic deficit, marginalization in national and European policies. The National Strategy for the Internal areas can contribute to the recovery of the economic and social development of this relevant part of Italy that in these two centuries has not taken advantage of the economic growth, but precisely for this reason has maintained significant environmental and landscape resources that today may become decisive factors of development. It is therefore necessary to develop a new Development Policy "Place-Based" [3] capable of touching every region and macro-region of the country, creating jobs, achieving social inclusion and reducing the costs of abandoning the territory.

As Barca, McCann, P. and Rodríguez-Pose suggest [4,5], since many core urban centres will grow without the need for significant policy interventions, but the question is to whether development goals should be shifted from promoting efficiency in the core to enhancing the potential for growth and development in the periphery. Place-based approaches offer a greater possibility of exploiting unused potential in all regions in a co-ordinated and systematic way.

This strategy provides the basis for implementing the interventions by means of a Framework Programme Agreement (FPA) between the italian state and the italian regions and the tool to communicate clearly to all citizens of the expected results and the actions taken. The document and the share path between the Region and State are required to obtain financial and organizational support (European Community Programmes and National Stability Law) for the National Strategy for the internal areas.

The strategy area is not the usual "list of actions or projects" in which several municipalities or interests "share" funds "intercepted", but the logical framework that guides the choice of actions.

A significant part of the Internal areas has gradually suffered (after World War II) a process marked by marginalization: population decline, sometimes below the critical threshold; reduction in employment and land use; a local supply waning of public and private services; social costs for the entire nation, such as the hydrogeological instability and cultural heritage and landscape degradation. But in this large part of the country there is such a strong development potential that the construction of a national strategy, robust, participatory and continuous in time may free.

This strategy has been initiated in Italy using as an occasion and a lever, the European Choesion Funds available for all regions of the country for seven years 2014-2020, combined with the provision of dedicated resources in stability law. It is a work in progress, through close cooperation with the Regions and a useful discussion with Municipalities and Provinces, aware that for a national strategy should contribute the leadership of open and innovative local communities.

2.2   Internal Areas' Classification Methods

A major part of the Italian territory is characterized by a spatial organization founded on municipalities, very often with a small demographic dimension, which in many cases are capable of providing to residents only a limited accessibility to basic services.

The analysis made has cleared that the only demographic size of the municipality does not seem sufficient to qualify the territories as poles of attraction and has therefore directed the work towards a pole declination as the center which offer specific services.

The character of "services supply center" is reserved exclusively for those municipalities, or aggregates of neighboring municipalities, offering simultaneously all the secondary school supply, hospitals with all the basic venues and Platinum, Gold or Silver railway stations. The main hypothesis is therefore that in the first instance we can identify the nature of Internal Areas on the basis of the "distance" from essential services. Note that Internal Areas, in this view, is not necessarily

synonymous of "weak area". Only by examining the characteristics and dynamics of the demographic structure and socio-economic of the areas identified, we can have a complete reading of the different paths of territorial development.

In Italy there is a very different overview of Internal Areas. In some areas the remarkable capacity of local actors, together with many policy interventions that have occurred since the eighties', has helped to change the inaccessibility in an asset to be valued, triggering interesting development processes, through the involvement of local communities and succeeding to stop the population drainage.

The proposed methodology of the Italian government is substantiated in two main phases:

1) Identification of the poles, in accordance with a offer capacity of some essential services;

2) Classification of other municipalities in 4 groups: peri-urban areas; intermediate areas; peripheral areas and outermost areas, according to the distances from the poles measured in travel times.

The final mapping is therefore mainly influenced by two factors: the criteria by which to select the services supply centers and the choice of the distance thresholds to measure the degree of remoteness of the various areas. Thus classification of municipalities was obtained on the basis of an accessibility indicator calculated in terms of minute trip respect to the nearest pole. Ranges obtained are calculated using the terziles of the distribution of the index of distance in minutes from the next pole, equal to about 20 and 40 minutes. It was then inserted a third band, over 75 minutes (the 95-th percentile), to identify the ultra peripheral regions.

The approach using the dimensional threshold chooses as poles those municipalities that for various reasons, due to market conditions as well as public investments, have followed a process of agglomeration. The approach which has been reached, based on the offer of services, chooses as poles, municipalities with essential services.

According to this approach, based on the offer of services in the following map it has been shown the areas that are *Central* (first 3 categories) or *Internal* (last 3 categories).

(Source: Italian Ministry of Economic Development, Economic and Cohesion Department, http://www.dps.tesoro.it/aree_interne/, visited 16.02.2015)

Starting from this work, this research tries to deep the identification of *Internal Areas* used by the Italian Government through methods of integration of all available data with fuzzy techniques able to identify the degree of belonging to the class of the *Internal Areas* compared to all the data available today and with respect to each of them considered individually, in the case of the Apulia Region (see Figure 2).

In fact, as already said in the introduction, the degree of belonging to the *Internal Areas* with respect to each criterion may suggests important distinctions between the same areas and allows us to understand the spatial features on which action is needed to rehabilitate the territories and allowing their valorization.
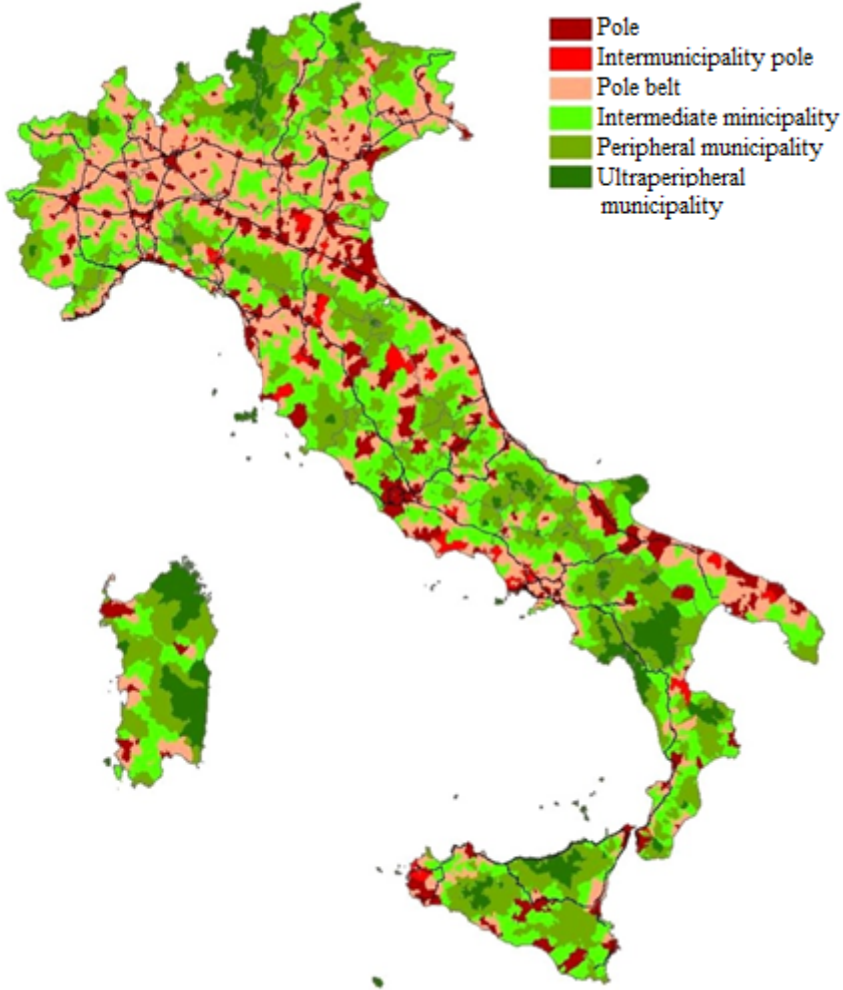
Fig. 1. Maps of Italian municipalities according to the classification in Poles and areas with different degrees of remoteness from the centers of reference

3   The Construction of Indicators to Identify Internal Areas

3.1   Introduction

The starting point for this work derives from the necessity of identifying, on the basis of statistical data, what has been called by the Italian Government geographical *internal zones*, as already defined (cfr. paragraph n.2), characterized by demographic, morphological, economic and structural aspects in the specific case of the Apulia Region. From this follows the importance to define specific indicators, which are able to estimate

the level of membership to the internal areas class, between municipalities. The attempt to apply a fuzzy approach to this question allows for the definition of a measurement of the degree of association to the totality, taking into account typical indicators of demographic, morphological, economics and structural aspects.

The scope of interest and the fields of application of the present work are numerous. The first consists of the possibility of quantifying and localizing the disparity of distribution of the phenomenon and therefore in the identification of phases of policy programming in those areas which may not usually be involved in development processes. Furthermore, it facilitates the possibility of organizing information with the aim of structuring and focusing intervention programs with regards to special and inherent problems, for example, the necessity to improve scholar or medical facilities.

3.2   The Fundamental Dimensions for the Identification of Indicators

According to what emerges of the Partnership Agreement 2014-20 "National Strategy for Internal areas: definition, objectives, instruments and governance" a significant part of the Internal areas suffered, since the fifties of last century, a process of marginalization that, first of all, is manifested through intense phenomena of de-human activity: a) decrease of the population below the critical threshold and aging population; b) decrease of employment c) reduction of the degree of utilization of the territorial capital. Moreover, this process was manifested in the gradual reduction of the quantity and quality of the local public services, private and collective.

The activity of prediction of possible scenarios for the Internal areas may be carried out with reference to a few dimensions. From these dimensions, analyzed for the potential development of the inland areas, it was decided instead to derive criteria for identifying the areas through the construction of the set of indicators.

1) The first dimension to be considered is the demographic aspect, mainly due to the fact that local systems of internal areas have reached a degree of aging that does not ensure a sufficient exchange of population. Many local systems are likely to suffer a demographic collapse in the medium to long term, or at least a reduction in the population of working age classes. There are some signs of demographic recovery, but are still limited and insufficient.

In Internal Areas emerges a negative rate of change of the population and a constant increase in the total population of the share of the older population (aged 65 and over), which has almost doubled between 1971 and 2011. The aging concerns both centers that Internal areas, but especially in the peripheral areas and ultra-peripheral that are recorded the highest percentages.

2) The second dimension concerns the morphological component that is associated with the non-use or improper use of the territorial capital. The settlement system will suffer an inevitable process of decay. Even the hydro-geological instability will increase, with effects of degeneration territorial that will make these territories gradually less hospitable. The demographic changes determined a change in land use and its destination, particularly in the Internal areas, creating an increase of phenomena such as the loss of active protection of the territory and the increased level

of geological risk. As for the Internal areas it is noted particularly strong presence in areas exposed to landslides, a high percentage of forest and agricultural areas.

3) The third component concerns the logic of employment that influence those territorial systems of internal areas that had a limited process of industrialization and outsourcing. In line with the physical characteristics of the internal areas, their economic structure is characterized by a strong specialization in the primary sector. In particular, we note that, while the percentage of municipalities specialized in the first sector in the centers is equal to 43%, it rises to 73% in the case of the municipalities that are located in the Internal areas. However, it is interesting to observe that within the Internal areas the regional realities present some variability: it is observed as in the internal areas of the regions of Southern Italy there is a higher agricultural specialization, compared to those of the Centre-North. Conversely, in the Internal Areas, are found lower than average percentages of specialization in Secondary and Third sector.

4) Last fundamental dimension to be considered for an exploration of individual local systems is the development of the supply of services and infrastructure. The term "pre-development conditions" refers to the production and supply services in the territory that in contemporary society qualify as rights of "citizenship": a) Health b) education c) mobility. Strictly functional and complementary to the efficient administration of services in the internal territories is the widespread dissemination of communication technologies telematics.

4   The Internal Areas of Puglia: A Methodological Comparison

4.1   The Set of Indicators

The objective of this work is to integrate mapping of internal areas with other mappings resulting from the integration of indicators of demographic (declining and aging population); morphological (exposure of the area to landslides or seismic risk); economic (reduction or increase in employment on the basis of economic sectors); supply of services and infrastructure (supply of services in transport, health, education and communication).

The case study concerns the Puglia region and, based on what was mentioned in section 3.2, for each component were constructed Set of statistical indicators:

Set 1: *DEMOGRAPHIC INDICATORS:*

      a) Changes in the population 1971/2011
      b) Share of elderly residents in the territory (2011)

Set 2: *MORPHOLOGICAL INDICATORS:*

      a) Class of population exposed to landslides (2012)
      b) Percentage of total forest area on the surface - in classes (2010)
      c) Percentage variation of utilized agricultural area (1982-2010)

Set 3: *ECONOMIC INDICATORS:*

>a) Population employed in agriculture on total employment (2001)
>b) Percentage of employees in the Manufacturing sector from 1971 to 2001
>c) Percentage of employees in the services sector from 1971 to 2001

Set 4: *INDICATORS OF THE OFFER OF SERVICES AND INFRASTRUCTURE:*

>a) Health - Number of beds in hospitals per 100,000 residents (2011)
>b) Education - Presence of school aggregated into three types: high schools, technical and professional institutes and other types (2011)
>c) Transport - Presence of a train station, at least of type "Silver" (2012)
>d) Digital divide - Proportion of population without broadband fixed network (2012)

4.2   The Fuzzy Approach

The development of *fuzzy theory* stems from the initial work of Zadeh [6] and successively of Dubois and Prade [7] who defined its methodological basis. Fuzzy theory assumes that every unit is associated contemporarily to all identified categories and not univocally to only one, on the basis of ties of differing intensity expressed by the concept of degrees of association. The use of fuzzy methodology in Italy can be traced back to only a few years ago thanks to the work of Cheli and Lemmi [8] who define their method "*Total Fuzzy and Relative*" (TFR) on the basis of the previous contribution from Cerioli and Zani [9].

Supposing the observation of k indicators of poverty for every family, the membership function of *i*-th family to the fuzzy subset of the poor may be defined thus [9]:

$$f(x_{i.}) = \frac{\sum_{j=1}^{k} g(x_{ij}).w_j}{\sum_{j=1}^{k} w_j} \qquad i=1,.....,n \tag{1}$$

For the definition of the function *g(x_{ij})* please refer to other works [10,11,12].

4.3   The Thematic Maps in Apulia Region

Analyzing the situation of Puglia on the basis of the criteria specified in Section. 2, based on the offer of services, emerges as the percentage of municipalities defined as internal areas is equal to 56.2%, with lower percentages of outermost areas (2.3%) and higher intermediate areas (32.2%).
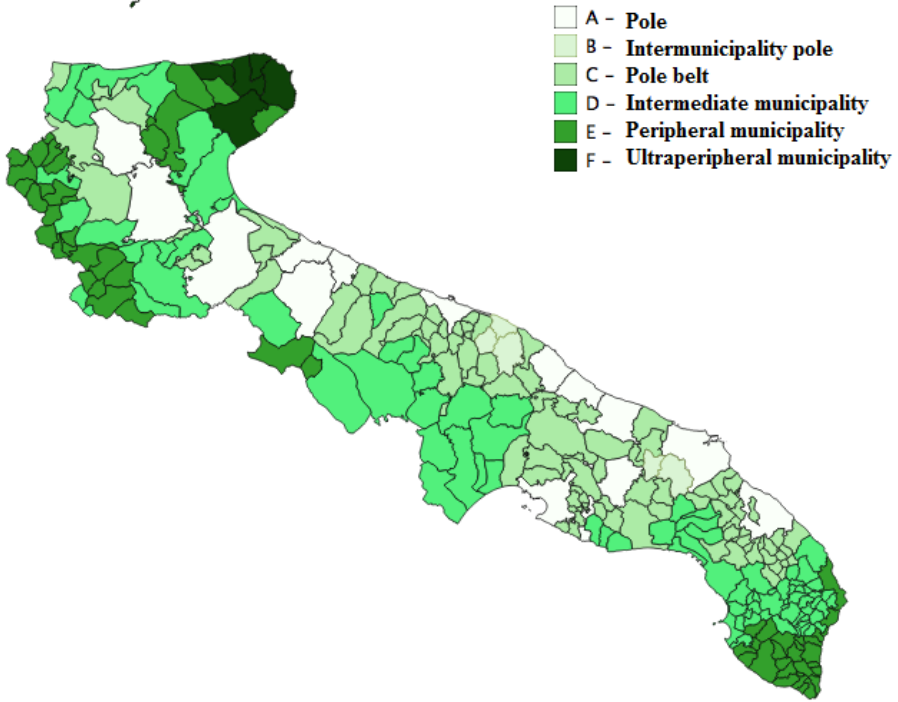
Fig. 2. Geographical classification of the municipalities on the basis of the service offer

Table 1. Percentage of the municipalities on the basis of the service offer

Classificazione	n. comuni	%
A - Polo	14	5.4%
B - Polo intercomunale	5	1.9%
C - Cintura	94	36.4%
D - Intermedio	83	32.2%
E - Periferico	56	21.7%
F - Ultraperiferico	6	2.3%
	258	**100%**

The results obtained with the fuzzy approach can be classified into 6 classes of value ranges, in which, the more the values approximate to unity, the more the ratios show a potential belonging to the set of the Internal Areas. In the following table are presented the number of municipalities that belong to the individual classes analyzed.

Table 2. Number of municipalities by classes of fuzzy values and types of indicators

Fuzzy value	Demographic aspects	%	Morphological aspects	%	Economic aspects	%	Offer of Services	%
0,00- 0,16	36	14,0%	217	84,4%	52	20,2%	89	34,6%
0,16 - 0,33	0	0,0%	5	1,9%	95	37,0%	143	55,6%
0,33 - 0,50	13	5,1%	18	7,0%	0	0,0%	6	2,3%
0,50 - 0,67	31	12,1%	12	4,7%	12	4,7%	2	0,8%
0,67 - 0,83	0	0,0%	3	1,2%	65	25,3%	0	0,0%
0,83 – 1,00	177	68,9%	2	0,8%	33	12,8%	17	6,6%
	257	100,0%	257	100,0%	257	100,0%	257	100,0%

In particular, as regards the application of data relating to *Demographic aspects* emerges as the most of the municipalities (about 69%) belongs to the last class or to one which has greater criticality. This is due to the fact that in many municipalities of Puglia is a reduction of the population and aging (Fig 3).

Instead, as regards the application of the data relating to morphological aspects most municipalities (84.4%) belongs to the first class, that is, the class that has not critical. This factor becomes, therefore, strongly discriminating for the identification of Internal Areas, as the municipalities that have values close to one really are areas with problems related to morphological aspects, such as exposure to landslides or percentage of forest area or surface agricultural (Fig 4).
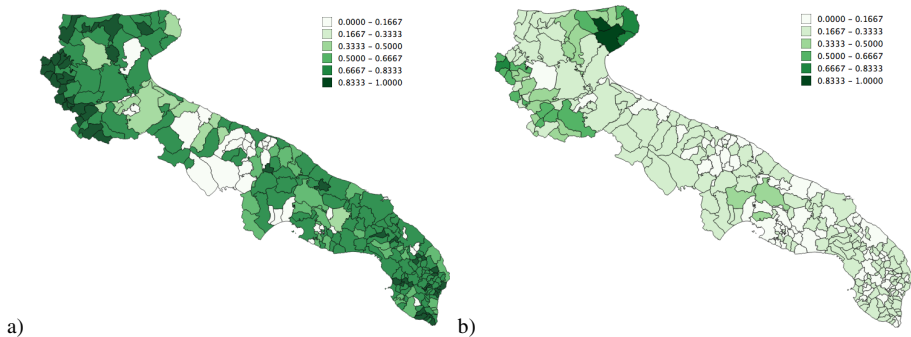

a)   b)

Fig. 3-4. Classification of the municipalities on the basis of fuzzy indicators related to aspects: *a) demographics; b) morphological*. Representations underline the discriminatory effect of the second set of indicators for the identification of possible internal areas.

On the economic aspects should be noted, however, a situation of equal distribution of the municipalities in the different classes. May be, therefore, interesting to the identification of areas inside the municipalities belonging to the last two classes next to 1, which together account for 38.1% of the municipalities of Apulia. In these municipalities emerges prevalence of employed in the agricultural sector rather than in manufacturing or services (Fig 5).

Even more discriminating than the morphological component, is the aspect of services and infrastructure. Indeed, the municipalities in which there is lack of services in the field of health, education and transport are few (6.6%). These municipalities belong to the latter class, next to 1, and then with high probability belong to the municipalities classified as Internal Areas (Fig 6).
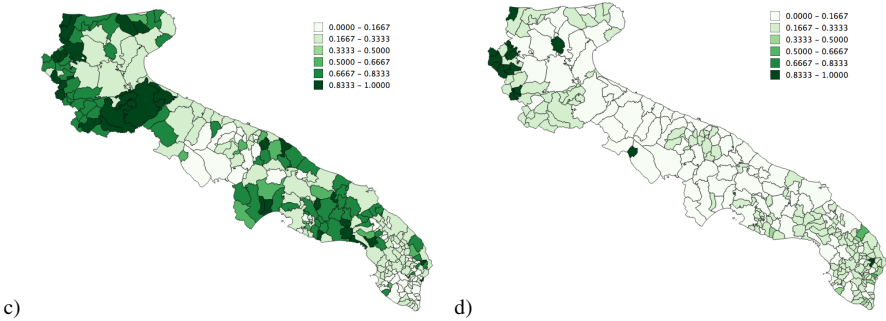

c)   d)

Fig. 5-6. Classification of the municipalities on the basis of fuzzy indicators related to aspects: c) economic; d) supply of services and infrastructure. Also in this case representations show the discriminating effect of the second set of indicators for the detection of possible internal areas.

5   The Intersection of all Sets of Indicators

Going to consider all the indicators set, a differentiated picture emerges where the municipalities belonging to the last three classes are equal to about 15% of the municipalities of Apulia Region and they are characterized by a high degree of belonging to the Internal areas (darker in Fig. 7).

This application takes into account all the components analysed: demographics, geomorphology, economy and range of services and infrastructure.

It 'should be noted that compared to the study carried out by the Ministry (see Figure 2) the areas classified as *Internal Areas*, identified considering all indicators except the distance from the services supply providers, are inferior, and in particular are not belonging to the class of Internal Areas of many municipalities in the South Salento, while confirming the belonging to the same class of Municipalities of Northern Apulia and in particular those of the "Gargano", the mountainous area of the region and the so-called "Monti Dauni", another mountainous area on the border of the region bordering the Campania Region. From this comparison it can be deduced further scale intervention priorities determined by belonging to the class of the Internal Areas even without considering the distance from the services supply centers, signal of a condition of greatest weakness of these two zones with respect to that of the south the region, which is focused by today's most important tourist flows that have increased economic flows and decreased unemployment rates.
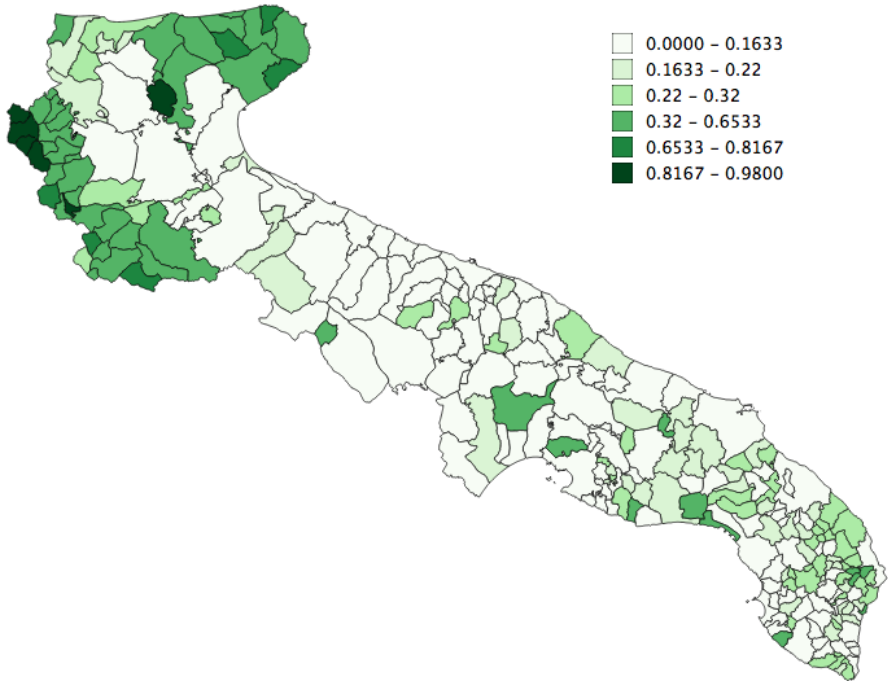
Fig. 7. Classification of the municipalities on the basis of all fuzzy indicators

The representation of the synthesis shown in Figure 7 does not consider the thresholds distance of each municipality from the service provider useful for measuring the degree of remoteness of the different areas, according to the analysis conducted by the Ministry. To understand the weight of this criterion was drafted last application considering these thresholds and, therefore, on the balance of all indicators compared to the distance from the center service provider.

Going to consider also the aspect of the distance from the center you get the classification of the municipalities of the Apulia Region in the representation shown next.

In this case remains strong the membership of the areas located in the North Region to the Internal Areas class, while it seems clearer that there is a further area of inland areas in southern Salento with a greater difference between the towns of this area and the neighboring. Specifically, having inserted, as a fifth criteria, the distance from the centers service supply, seem to have "polarized" some of the situations that have already emerged in the previous analysis, making it more clear the difference between the central areas and internal areas.
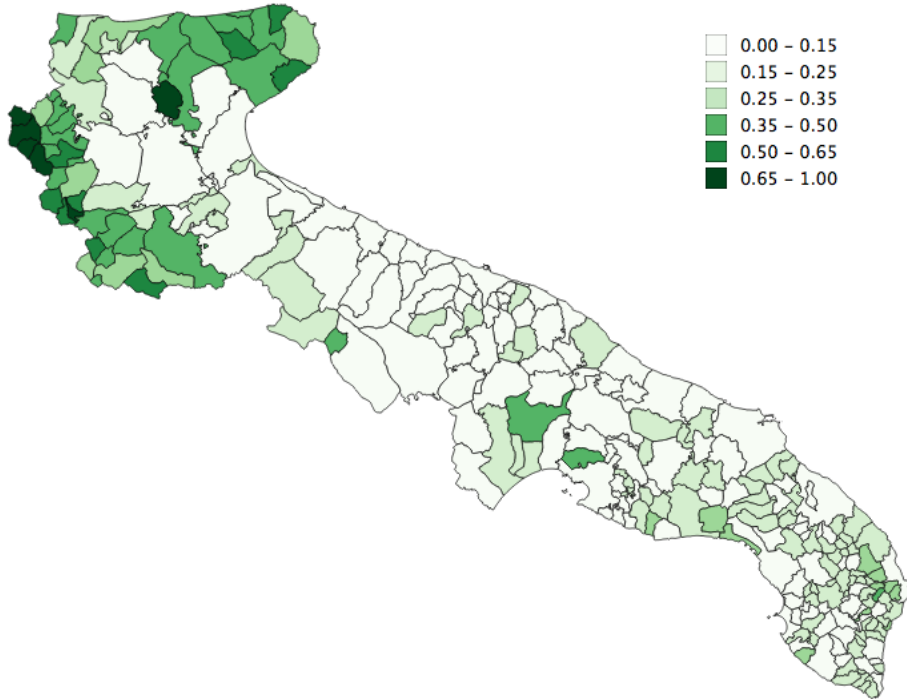
Fig. 8. Classification of the municipalities on the basis of all fuzzy indicators *weighted with the distance from the center*

6   Conclusions

The Internal Areas represent a large part of the country - about three-fifths of the area and just under a quarter of the population - very diverse within itself, far from the great agglomeration centers and service and unstable development trajectories, but endowed with resources lacking the central areas, with demographic problems but also strongly polycentric and with strong potential for attraction.

Intervene in these areas requires creative solutions capable of interpreting the territories, the traditional inhabitants and new, promote development models based on the quality of the sites. The study presented here demonstrates how to investigate the internal areas can not be limited to studying only the distance from the service supply centers, but that it is necessary to investigate all the components of the phenomenon because each area has different criteria discriminating belonging to the class of the internal areas. The case of the Apulia Region shows that, for example, in the post-industrialized nations population dynamics are not elements capable of discriminating the internal areas, as well as for the economic dynamics.

Because in this period of crisis the population may decrease even in the central areas as well as in the internal ones, as well as the growth in the number of

unemployed or employment growth in areas hitherto regarded as traditional agriculture not only distinguishes the areas far from service supply centers but also important development poles, given the growing importance of its sectors such as agriculture and tourism have started to play even in countries such as Italy with a strong manufacturing development that seems to doze off over time in favor of emerging nations where the cost of labor is undoubtedly lower.

On the contrary, the geomorphological stability, unmistakable sign of of the land care and the availability of resources, and even further away from the service poles providers, mark clearly the difference between internal areas and the central event in Puglia. The case study analyzed is not a solution to generalize, because on the contrary it highlights the need to analyze in depth each component of an area to identify the criteria discriminating the degree of membership to the internal areas highlighting the aspects on which more focus the subsequent enhancement policies of these areas long neglected in the usual place-neutral policies.

In fact, as pointed out by Barca, McCann and Rodriguez-Pose [4], many of the previously accepted arguments have been called into question by the impacts of globalization and a new response to these issues has emerged in response to both these global changes and also to non-spatial development approaches. We are not yet able to assess whether the correct approach is the most radical of an happy De-growth (proposed by Latouche) or the more place-based institutional one proposed by scholars as Barca [5] who also played Institutional roles supporting technically and theoretically the work of the European Commission. The most convincing studies conducted in these areas demonstrates with certainty that to redevelop and enhance these territories through plans and programs must deeply understand the peculiarities that distinguish them and interpret them in a new way and able to self-generate a process of endogenous development from below as the same Apulia Region is trying hardly to develop through a new landscape plan that tries to bring out the multiple regional identities [13].

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