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## ***Defining rural: a functional and accessibility approach applied in Castilla-La Mancha (Spain)***

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### **Abstract**

This article reflects on the modern definition of rural spaces, trying to go beyond the mere distinction from the urban areas to develop a more integrated approach with functional elements. In the global context, where the cities and the urban areas became practically the only paradigm, the rural areas show a great range of geographical situations in relation to them. With an empirical perspective, a method grounded on statistical analysis and spatial accessibility is proposed to understand the different configurations of rural areas in relation to the main urban networks, defining profiles and interpreting their trends. This method is applied in Castilla-La Mancha, a region of Spain where the notion of territorial cohesion as a policy goal of the European Union is worth to explore within this framework. Results show that at least three types of rural situations are drawn from the statistical indicators used and the accessibility analysis, depicting quite different diagnosis for the municipalities involved on each group. This proposal is a starting point for further analysis, where comparison between regions or larger areas might be included; also, a more detailed statistical data could improve the performance of the methodology.

**Keywords:** Rurality. Rural accessibility. European Union. Spain.

### **Definindo rural: uma abordagem funcional e de acessibilidade aplicada em Castilla-La Mancha (Espanha)**

### **Resumo**

Este artigo reflete sobre a definição contemporânea de espaços rurais, tentando ir além da mera distinção das áreas urbanas para desenvolver uma abordagem mais integrada com elementos funcionais. No contexto global, onde as cidades e as áreas urbanas se tornaram praticamente o único paradigma, as áreas rurais mostram uma grande variedade de situações geográficas em relação a elas. Com uma perspectiva empírica, propõe-se um método baseado em análise estatística e acessibilidade espacial para entender as diferentes configurações das áreas rurais em relação às principais redes urbanas, definindo perfis e interpretando suas tendências. Este método é aplicado em Castilla-La Mancha, uma região da Espanha onde vale a pena explorar a noção de coesão territorial como objetivo político da União Europeia. Os resultados mostram que pelo menos três tipos de situações rurais

são extraídos dos indicadores estatísticos utilizados e da análise de acessibilidade, apresentando diagnósticos bastante diferentes para os municípios envolvidos em cada grupo. Esta proposta é um ponto de partida para uma análise mais aprofundada, onde a comparação entre regiões ou áreas maiores pode ser incluída; além disso, dados estatísticos mais detalhados poderiam melhorar o desempenho da metodologia.

**Palavras-chave:** Ruralidade. Acessibilidade rural. União Europeia. Espanha.

## **Definiendo lo rural: un enfoque funcional y de accesibilidad aplicado en Castilla-La Mancha (España)**

### **Resumen**

Este artículo reflexiona sobre la definición contemporánea de espacios rurales, tratando de ir más allá de la mera distinción de las áreas urbanas para desarrollar un enfoque más integrado con elementos funcionales. En el contexto global, donde las ciudades y las áreas urbanas se convirtieron prácticamente en el único paradigma, las áreas rurales muestran una gran variedad de situaciones geográficas en relación con ellas. Con una perspectiva empírica, se propone un método basado en el análisis estadístico y la accesibilidad espacial para comprender las diferentes configuraciones de las áreas rurales en relación con las principales redes urbanas, definiendo perfiles e interpretando sus tendencias. Este método se aplica en Castilla-La Mancha, una región de España donde la noción de cohesión territorial como un objetivo de política de la Unión Europea vale la pena explorar dentro de este marco. Los resultados muestran que al menos tres tipos de situaciones rurales se extraen de los indicadores estadísticos utilizados y del análisis de accesibilidad, que representan diagnósticos bastante diferentes para los municipios involucrados en cada grupo. Esta propuesta es un punto de partida para un análisis más detallado, donde la comparación entre regiones o áreas más grandes podría incluirse; Además, una información estadística más detallada podría mejorar el rendimiento de la metodología.

**Palabras clave:** Ruralidad. Accesibilidad rural. Unión Europea, España.

## **1 INTRODUCTION**

What is rural? How can we define rurality? Under these very simple questions lies a great complexity. Not only because any academic concept requires its proper development, and such opens a wide field of approaches and interpretations; but also, because the spatial organization of our communities is in the ground of our own way to develop the society. Behind the concept of rural it is a basic distinction between the character of settlements, a way to define how the human society takes advantage of the territory. As many other concepts rural is grounded on a dichotomy with urban, where the former places are mainly characterized for being the opposite to the urbanization concept.

A general agreement on such distinction is the sense of concentration, where is much in one place is scarce in the other. People, buildings, services, infrastructures and society factors tend to be concentrated in urban areas, while in rural areas there is a lack of density which at this time it is diagnosed as a deficit in a broad sense and connected with the notion of cohesion (PILLET et al., 2013). The XXth Century has been called the “century of the cities” and if we can define globalization in a simplistic way is that is strongly rooted on the metropolitan growth and interconnection. At our time, territorial cohesion is related to the

capacity of connection of the places to the main drivers of globalization: markets, economies, knowledge, innovation, etc.

Another element to raise here is the importance of context. In the theorization of globalization we tend to generalize the context where it is crucial to understand the character of territories. Urban and rural acquires different characteristics according to the spatial context we look at, despite that their duality can be taken as such as long as their complementary relationship.

Cohesion became a main drive of the European policy since late 90's and early 2000 (MOLLE, 2007) and from an operational perspective, it includes three spatial components: efficiency, quality and identity (ESPON, 2006). The two first have a clear dependence on the infrastructures; to the spatial efficiency it is required the existence of infrastructures helping the connection and accessibility, contributing to the competitiveness of the territory. Moreover, in qualitative terms the presence of equipment and facilities for services makes a clear difference in the cohesion level of some territories respect others.

This text proposes to deepen in the first aspect; the spatial efficiency, through the concept of accessibility to help to characterize different areas within the urban-rural duality in the Western-European context, in a Spanish interior region; Castilla-La Mancha.

To that aim we start from the idea of a certain deficit in the acknowledgment of the rural dynamics and their connection with the urban systems. These last areas are the actual leaders of the spatial planning and the rural spaces depend largely on specific policies aware of the identity and dynamics of the contemporary rurality (OCDE, 2005) which overcomes the basic opposition towards *the urban*.

The aim of this work is to apply an empirical approach to the definition of rurality combining two elements: functionality and accessibility. The first encapsulates the inherent characteristics of the rural areas, while the later classifies them according to the potential of access. Both are related and is becoming frequent to find them in the scientific literature. The idea is going beyond pointing out what is rural and what is not and explore the different possibilities to the characterization and classification, with complementary approaches and draw some conclusions.

Our interest falls in the attention to these aspects, together with the lack of specific analysis in this regard. Spatial accessibility is a broad area of interest in the transport research field decades ago, with many different approaches and orientations. A similar case is the rural functionality, which acquired attention in Europe in the early 80s in the XXth Century, when the Economic European Community turned its interest into the future of the rural areas. Both topics have been treated together for obvious reasons, in the global era pushed the urban and metropolitan paradigm to a new limit where concentration, connection and networks left the rural communities aside in most cases, and where they are included, they change their traditional identity.

This text proposes an operative procedure defining the level of accessibility of rural areas on one hand and, in the other, introduces the possibility to understand the trends and features of these areas. The starting point is the definition of rurality through functional elements (demography, economy and geography), including the accessibility and connection combined to reach a

methodology allowing to delimitate, identify and characterize the different rural areas nowadays.

The second part of the article set the theoretical framework around the concept of rurality together with the functional view and the spatial accessibility analysis. The third epigraph shows the empirical framework and the analysis procedure followed by the application in the study case (Castilla-La Mancha, Spain) in the fourth section. The paper concludes with some final remarks and conclusions.

## 2 Rurality: function and dynamics

### 2.1 Traditional approaches to the concept of rural

In the scientific literature we can find two main approaches defining rural areas. We called structural approach to those definitions which draw upon constitutive elements configuring the rural areas; which usually agree on some features such as spaces weakly inhabited tending to dispersion and with dynamics opposite to the urban areas. The complexity of the spatial systems and the economic processes introduce the second approach, with a functional perspective and more specific elements about the contexts and the *rurality* (UNITED NATIONS, 2002). The reality shows that the range of situations that could be considered as rural does not advise to adopt a single and uniform criterion to define them; but otherwise, better to adjust to each local character on which it can be established the key elements of rurality upon with. The Organization for Economic and Cooperation and Development (OECD) set a density threshold below 150 inhabitants per square kilometre to define rural, and at the same time, it points out that this figure should be qualified in the case of areas in the influence of a main city (OECD, 1994); hence, this is a simple indicator rooted on the structural approach (population density) and, at the same time, it introduces some interpretation of functional aspects related to the relative location of the rural area.

Added to this, rural means dispersion, and it is normally understood as the opposite to urban concentration, leading to definitions grounded on spatial density as we just saw on the OECD definition few lines ago. In the European context, the Eurostat<sup>1</sup> defines rural with a density index set in 100 inhabitants per square kilometre, with no further criterion. This threshold is the same taken by the Spanish Law on Sustainable Development and Rural Areas<sup>2</sup> which also developed a subsequent distinction on rural characters according to different configurations (low density areas but with big municipalities or quite small municipalities).

These approaches have been combined with qualitative perspectives which introduces social and/or cultural aspects, speaking of a rural life-style, opposed to the urban life-style. They highlight, therefore, in the reductionism of the definition by opposition instead of the qualification. However, the quantitative thresholds are useful for administrative reasons and they still contribute a capacity for delimitation. But from them it is becoming more complex to go further on functional implications.

<sup>1</sup> European Union's statistics agency.

<sup>2</sup> Law 45/2007, December 13th, for the sustainable development and rural areas. Consolidated tex, last modification: October 21th 2009.



Within this functional aspect, the rural areas are linked to agricultural activities, although it is becoming less frequent to find academic works exclusively focusing on the agricultural perspective when defining the rural character, at least in developed and industrialized territories, where these activities have been completed, even substituted, by leisure and recreation activities. These processes have been facilitated by the increase in personal mobility (LÓPEZ-i-GELATS, 2009) and the closeness to urban areas that wanted from the rural a consumption of its attributed values (nature, open fields, slower life-style, etc.).

Like in other geographical concepts, when developing a definition appears several appreciations of a diverse reality. In the Western Europe context, the distinction among spaces admit the interpretation of a gradient in which we can add elements considered urban and/or rural. Thus, together with the definition it is attached to the understanding of the processes characterizing the territory.

According to CLOKE (2006) the concept of rurality shows difficulties to effectively combine functional aspects, spatial dynamism and the change of factors in the territory. Specifically, to grasp the social change, also important and relevant in rural areas, but less treated in the literature, especially if we compare with change and urban processes. Here a frequent problem arises, the proposal of a definition by opposition, starting from an urban vision and its dynamics, transferred to other realities. This built a duality between urban and rural, where the rural is necessarily what is not urban. This, being true, does not mean that this approach precisely defines and characterizes the rural areas.

A more accurate analysis reveals that beyond the rural-urban distinction lies a necessary correlation between its processes, with relevance in the spatial integration (ISSERMAN, 2005, p. 466). Starting from the statistical definitions, the set of population thresholds solves the primary need to place where starts the rural and where the urban, and, in some cases, establish intermediate categories. In Spain, a municipality is called city when reaching 10.000 inhabitants and the rural goes up to 2.000 inhabitants, being intermediate those places between both figures.

## 2.2 Adding the context, the urban-rural connection

As a consequence of the abovementioned, the seek of multifunctionality of the rural areas strengthen the need for connection and insertion in the territory; the access to the different economic circuits avoiding exclusion. In a more specific way, ESTÉBANEZ (1988) pointed out the urban influence in the rural environment in relation to two impacts or general principles of the urban influence in rural areas: the **gradient** principle and the **differentiation** principle. The first focuses on distance and transport routes as agents of diffusion for the urban processes, which do not disappear within the city limits and have an impact on the surrounding territory. The second considers the rural heterogeneity and multifunctionality, more intense and likely to appear when closer to the urban areas, profiling rural areas.

Remoteness is a key concept detecting and defining rural areas, for several reasons, but essentially because the different level of connection to the spatial system results in different processes with functional impact. Some studies propose the hypothesis that the accessibility is strongly attached with rurality through the

availability of goods and services (BARNETT et al., 2000; MORRISSEY et al., 2008), because “to reach” and “to attract” opportunities and activities may introduce great differences among territories (FARRINGTON and FARRINGTON, 2005). In this sense, in the light of public policies, it is important to have effective diagnosis and characterizations that overcome the vision that the rural is simply the opposite of the urban (ISSERMAN, 2005), mainly because nowadays, the global world is strongly grounded on the metropolitan system, and rural areas are either backwards, overexploited or just shadowed; and the specific situation matters to acknowledge and understand the territory.

Since decades ago appeared new concepts associated to the new rurality, such as “metropolitan rurality” which calls to territories with rural tradition close to metropolitan centres (AGUDELO, 2012). The proximity to urban dynamics affects on their character and configuration, as it is evident; the spatial accessibility will be a key variable to understand the connection in the urban system.

When dealing with remoteness and accessibility we are thinking over the territorial cohesion in the end. In this point, the context and the scale are crucial to focus the interpretation of the accessibility and its role configuring the rural areas. For instance, BALLAS et al. (2003) realize a work in the UE’s NUTS 3<sup>3</sup> framework as scale. In Spain, the province of Ciudad Real (one of the five in Castilla-La Mancha, south Madrid and north Andalucía) show a good accessibility result, something that could be discussed in a different scale and/or resolution of the analysis. The scale defines the scope of the interpretation and the accuracy defining spatial situations. OSSES et al. (2006) establish a direct relationship between population density and distance to the nearest city, determining the rural character of each municipality related to these two variables acknowledging that them are able to add a rurality gradient. In other words, in a similar spatial context, the proximity to urban locations modifies substantially the rural functionality.

From a wide perspective, the integration is not simply a matter of physical distance, but the capacity of connection to the dynamics of the territory, which depend on the competitiveness in the key elements of our society, mainly the different markets. In other words, the accessibility expresses not only the physical distance, but also the economic and social gap (FARRINGTON y FARRINGTON, 2005). Combining these approaches with the traditional ones may open interesting lines of research and analysis in the field of Rural Geography.

### 3 Methodology, applying an integrated approach

The most used criterion to define rural has been based on univariate measures such as the size of the municipality, density or the access to basic services (i.e. water, energy, communications, etc.). Opposite to this, was more frequent finding works based on multivariate analysis trying to grasp the different dimensions of the rural world (PRIETO-LARA y OCAÑA-RIOLA, 2009).

To this article it is proposed a multivariant methodological framework in three steps, adding successively different aspects adding elements of interest to the

<sup>3</sup> NUTS is the acronym for Nomenclature of Units for Territorial Statistics in the European Union, being the number the level of these units: 1 for the State Members of the EU; 2 the first territorial division of the states (i.e. regions) and 3 the second division (i.e. provinces).

concept of rurality. The first step includes indicators used frequently in the rural analysis, such as demographics, density and functional aspects related with the economic activities. The second step of the analysis introduces the accessibility as a component useful for the rural classification. At last, the third step combines the two previous results jointly to define clusters of rural municipalities according to the different results achieved.

### 3.1 Step one: principal components analysis

The principal components analysis is the more frequent statistical method used in multivariant approaches defining rurality (PRIETO-LARA y OCAÑA-RIOLA, 2009). Actually, it is a methodology linked with the factorial analysis, combining the advantage of joining different variables from different sources and natures which, previously normalized, could be reduced in less dimensions, making the interpretation easier. These dimensions are called principle components and have, among other properties, the explanatory capacity of the starting variables (ROGERSON, 2006).

Similar applications can be found in studies to quite diverse territories as Spain (OCAÑA-RIOLA y SÁNCHEZ-CANTALEJO, 2006), China (LI et al., 2015) or the aforementioned reference by BALLAS et al. (2003) which adds a European perspective and develops this technique together with a cluster of results with the aim of classify different rural profiles in Europe; it resolves 15 types of rural spaces in the European Union, analysed by 25 variables reduced in 11 explicative factors.

The methodological advantages are evident if the data available is accurate and precise. Nevertheless, it is necessary to state again that scale matters, because in samples with individuals of heterogeneous characteristics the results in multivariate analysis can be broad, reducing few dimensions with respect to the starting variables; meanwhile in samples with individuals more homogeneous, this technic is capable to highlight the key differences considerably reducing the number of variables. Therefore, at big scales with many cases ranged widely we will barely achieve an optimum reduction and the method might not have a strong contribution.

From the cited studies, the bigger the scale the more number of variables required to reach satisfactory results and greater the number of groups classified, having as a result a wide classification. In our study case, the objective is to apply the analysis of principle components to a set of census statistical indicators which represent different aspects of rurality (Table 1).

The selection of variables wants to cover aspects commonly related with rurality: population, aging, dispersion, built environment level and labour profile. We built a sample of 879 municipalities, initially selected from the Spanish statistical rural threshold (less than 10.000 inhabitants), including those named rural (<2.000 inh.) and intermediate (between 2.000 and 10.000).



**Table 1. Variables of the analysis of principle components**

	N	Unidad	Fuente	Min	Max	Average	S.D.
<b>Population</b>	879	Inhabitants	Municipal Census 2017	3	9811	1023,7	1569,57
<b>Density of population</b>	879	Inhabitants/Sq <sup>2</sup>		0,00	5,76	0,2	0,42
<b>Variation of population</b>	879	100-Index (2001-2015)		0,00	312,82	113,4	37,61
<b>Average age</b>	879	Age		32,05	71,19	51,5	7,68
<b>Built environment density</b>	879	% of built Sq <sup>2</sup> of the whole	Corine	0,00	71,90	17,0	9,91
<b>Unemployment</b>	879	% unemployed population	National Census 2011	0	100	30,7	12,92
<b>Agrarian labour</b>	877	% employees in first sector		0	100	29,6	20,61
<b>Services labour</b>	877	% employees in third sector		0	100	48,6	19,34

Source: INE<sup>4</sup>, Corine Land Cover. Own elaboration.

It stands out the low average density of population, in consonance with the previous evaluation of this kind of areas. The density of built environment makes a noticeable contrast in the sample, because we find figures up to 70% even though the average is certain low (17%). The rest of the variables show a great variation; the demographic evolution points out cases of outstanding growth, although usually related with low populated municipalities, very sensitive to modest changes in the numbers of inhabitants, both in positive or negative.

The average value of age is very significant, ranging from 32 to 71 years old and showing a wide interval which sets the average in a high number, above 51 years old. These results aim to the progressive aging of these areas, one of the most credited, studied and worrying processes in the rural spaces in the European Union.

The labour data shows an irreal gap between 0% and 100% because whether the lack of actual data in some places, whether the demographic weakness that allows to reach the full employment rate to some municipality. Once these cases were identified it was clarified they are just a small number of municipalities in the sample, and they do not affect the statistical description of the whole. The average shows a high unemployment rate, like the regional ones, but slightly higher. We include the employment in the first and third economic sectors (agriculture and services), to get the contrast in the labour profiles. It is proven a higher percentage in agricultural activities but not dominant, at the same time, the services have a higher value, but way bellow the numbers of the urban areas.

### 3.2 Step two: rural accessibility

We start from the road configuration to get the accessibility calculation. With the road network defined and implemented in a GIS an origin-destination layer between the municipalities in the sample is calculated. The distance is considered as the travel time connection using private car, because this is the most used transport mode in the rural areas because of the limited or non-existence of alternative means (i.e. railway) or the growing inefficiency of collective choices by road (buses). The time travel calculation has been weighted by the top speed limit according to each

<sup>4</sup> INE: Spanish Statistics Institute

road by its hierarchy and the results were extracted by the same GIS tool.

From this road network we can elaborate an indicator exploring the urban connection of the sample, by choosing the first five cities close to each rural municipality and calculate an index derive from this result. It is a contour measure, included within the simpler accessibility measures because they take the friction between two points as the only rational to define the friction of distance (CURTIS y SCHEURER, 2010); in our case expressed in time units (minutes). The final formulation is based on OSSES et al. (2006) and set the proximity to the closest urban area, but in our case, we decided to get a subsample of five urban areas for each rural municipality to define the urban connection in a wider geographical scope. The formula used is as it follows:

$$AC_i = \sum_{j=1}^{n=5} \frac{RM_j}{T_{ij} \cdot \sum_{j=1}^{n=5} RM_j}$$

The accessibility of the municipality  $i$  ( $AC_i$ ) is the sum of the different  $ij$  pairs between the rural municipality  $i$  and each one of the closest five cities  $j$  to it. In the numerator we set the economic accessible potential to  $i$  measured by the average income by inhabitant in  $j$  ( $RM_j$ ) divided by the friction of the distance (access time from  $i$  to  $j$ ,  $T_{ij}$ ) multiplied by the economic potential of the  $j$  set (the sum of the average incomes of the five closest cities to  $i$ ).

The result of this indicator gives the combination of the friction of distance in time travel connection, using as access facilitator the attraction offered by the economic potential urban, expressed according to the available income data (FEDEA, 2016). It is worth to note the use of the urban income as element of attraction and not the amount of population, thus adding the proximity to economically dynamic spaces. That is, proximity to urban areas is valued according to the income they generate, offering to the rural areas a better or worse potential for connection in their dynamics based on that distance. It is also convenient to stress the dependence on the availability on the data sources and the difficulty that may appear because using income data instead of population data.

### 3.3 Step three: classification and rural characterization

The outcome of the previous steps can be factorized and used in a cluster statistical method, looking for similarities within the sample and achieve homogeneous groups in relation to each individual result (ROGERSON, 2006: 266).

The base of grouping by k-means focuses on the iteration of values around the variables with more statistical consistency, building the first cluster and, from this point, stating the mean measures of the rest groups by affinity of results. In summary, this method stresses the most numerous group according to the alignment of its variables, detecting the rest from it.

The statistical software SPSS offers different tools and solutions, opting in our case for the non-hierarchical analysis of the variables involved. The result will be a group of the input factors by proximity. These factors will come from the factor analysis of the indicators coming from the first step and the accessibility transformed as a normalized factor. The combination of these groups will give back the central values for each factor that allows to understand that the municipalities

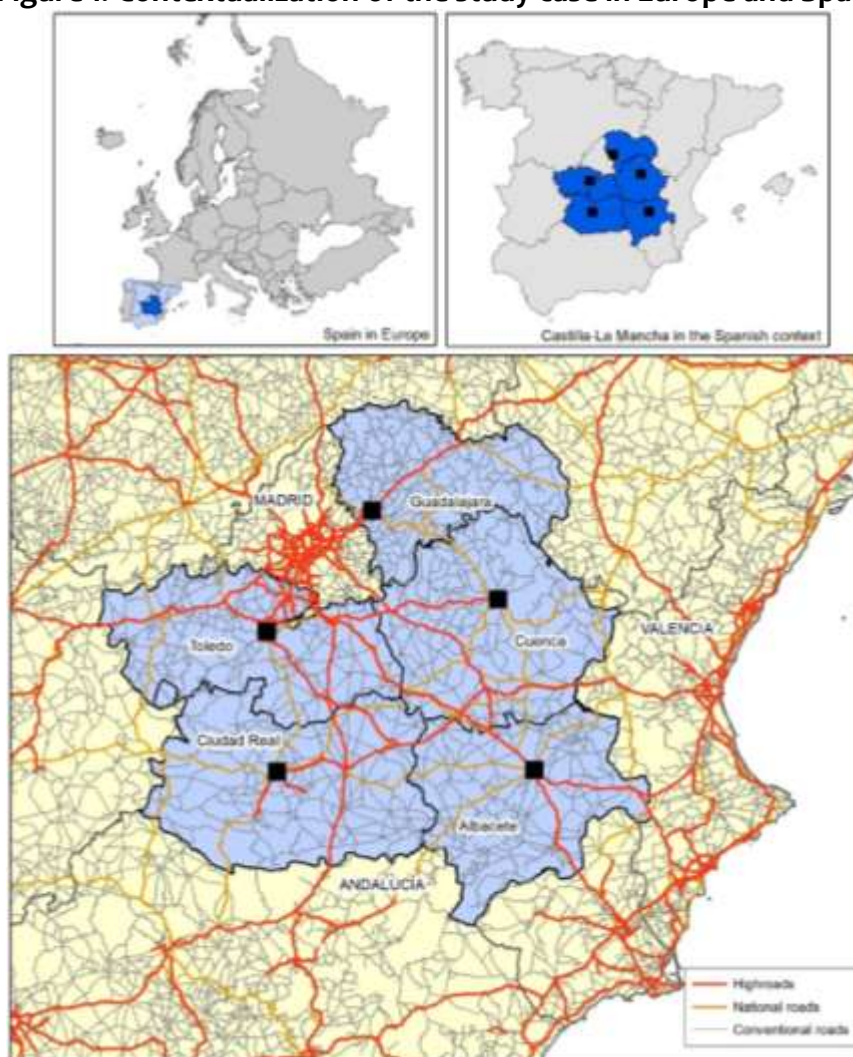
within each cluster present a statistical similarity in those factors and, therefore, similar characteristics based in the two previous steps.

#### 4 Case-study: Castilla-La Mancha (Spain)

Castilla-La Mancha is an autonomous region of Spain, located in the centre plain of the country, in the middle south more specifically (see Figure 1). Being south Madrid, it is known for its agricultural base and the rural predominance of its settlement.

From the functional perspective, several academic analyses have been carried out in this region, applying the precepts of the European Spatial Development Perspective-ESPD (EC, 1999) and revealed the need to adapt the theoretical policy documents to the reality of the territory (PILLET et al., 2010), because in a sparsely populated region as this the concept of functional urban area (FUA) defined in the ESPD become blurry but essential to keep the objective of territorial cohesion (PILLET et al., 2014), because is in these rural areas where this aim acquires relevance.

**Figure 1. Contextualization of the study case in Europe and Spain**



Source: CNIG. Own elaboration.

Aiming to be synthetic in the results, this section is divided in two parts. The first includes the separate results for demographic variables and the accessibility, the first two steps of the analysis. Both bring interesting analytical elements about characterization of rural spaces in the region and allow to extract important conclusions to the second part of results, which focuses in the classification of municipalities.

#### 4.1 Principle component analysis and accessibility

Table 2 contains the outcome of the reduction of dimensions from the original variables. We obtain two factors, with optimum correlations between variables and high factor loadings with convenient signs for each case, except for the unemployment variable, that does not obtain enough significance for any factor ( $< 0,4$ ) and it is finally discarded for this reason.

The variables contributing to each factor have been coloured in grey, and the factors have been named accordingly to the character of the indicators taking part: the first factor stands for population and demographic composition, while the second holds the labour values. In the latter it is of particular interest that the two variables involved contribute in a high proportion (above 0,8) and with opposite signs, meaning that both are inversely correlated among the sample.

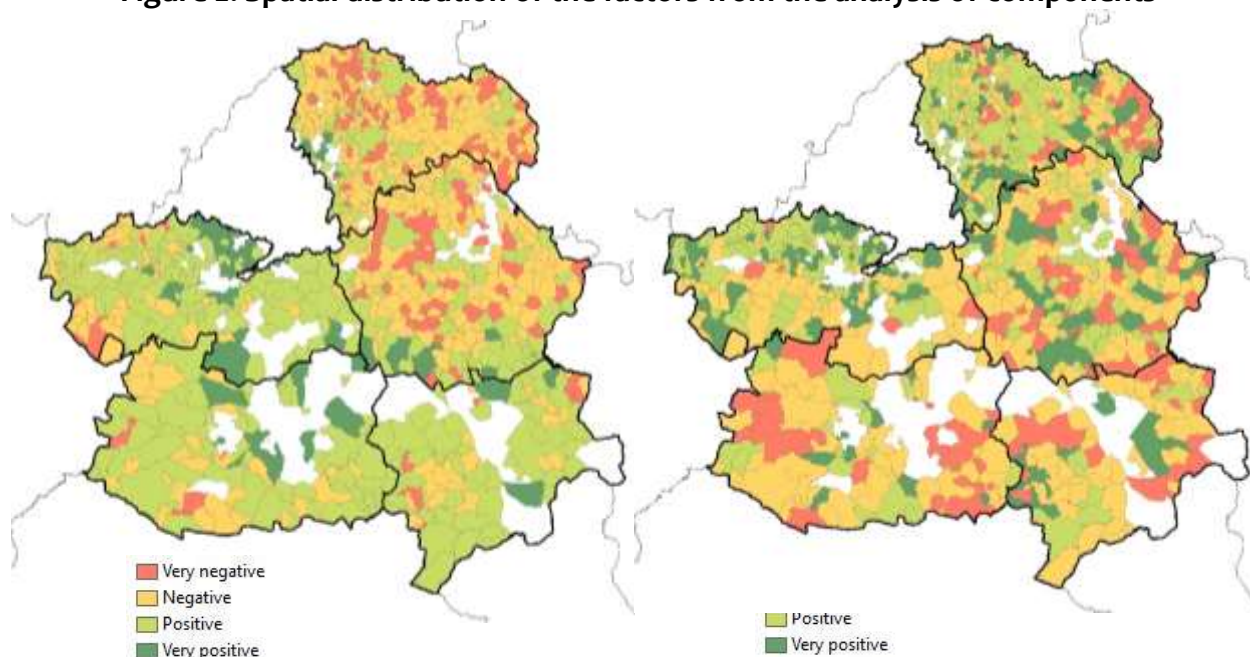
**Table 2. Factor loadings of the factorial analysis**

	Component	
	1: Population and demographic trend	2: Labour configuration
<b>Population</b>	,839	-,066
<b>Population density</b>	,736	-,169
<b>Variation of population</b>	-,719	,185
<b>Age (average)</b>	-,863	,148
<b>Urban density</b>	,486	,367
<b>Unemployment</b>	,359	-,014
<b>Agrarian labour</b>	-,324	,835
<b>Services labour</b>	,056	-,891

Source: INE, Corine Land Cover. Own elaboration.

With an interpretative aim we draw the maps on figure 2 showing in a synthetic way the values of each factor in four intervals. The preliminary distribution is showing the municipalities in disadvantage from the population perspective and the labour structure.



**Figure 2. Spatial distribution of the factors from the analysis of components**

Factor 1: Population and demographic trend

Factor 2: Labour configuration

Source: INE, Corine Land Cover. Own elaboration.

The accessibility results are shown in the Table 3. The average is in 30 minutes from the closest city (50 km.) within a range of 69 minutes (120 km.). The average dispersion is slightly above 15 minutes (26 km.) which leaves a probability range from 15 to 45 minutes of connection by road of the most cases in the sample.

**Table 3. Summary of the urban connectivity analysis**

Ranking (urban connection)	Distance (Km.)				Travel time (min.)			
	Max.	Min.	Average	T.D.	Max.	Min.	Average	T.D.
1	122	2	46	26	70,6	1,5	28,1	16,0
2	164	6	62	30	88,8	3,3	37,1	18,5
3	226	7	73	36	132,6	4,6	43,6	21,4
4	224	14	80	38	133,0	7,9	47,2	22,2
5	237	18	87	40	139,1	10,4	50,9	23,4

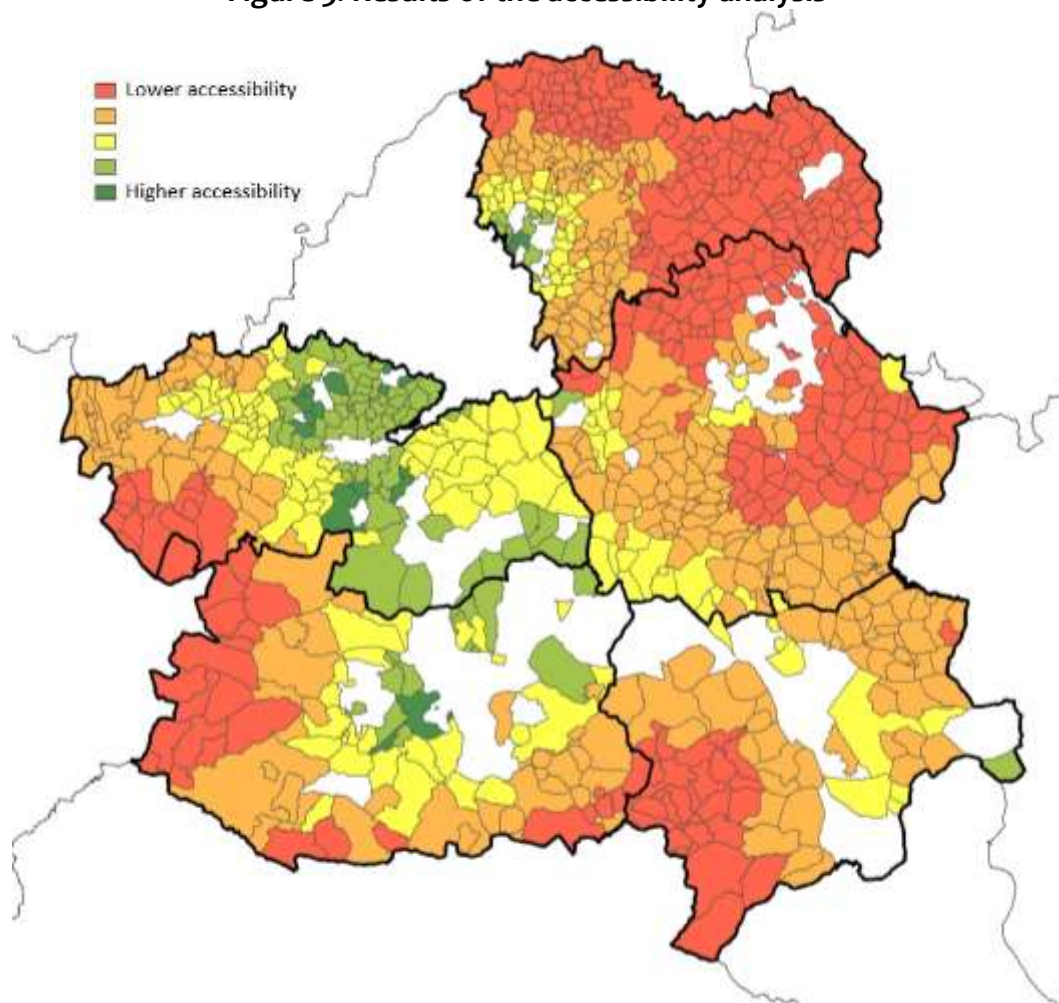
Source: CNIG. Own elaboration.

The figure 3 cartographically synthesizes the accessibility values calculated following the procedure on section 3.2. It points out the municipalities with a better balance between urban travel time access and the economic potential of them (average level of income), defining an area of maximum accessibility in the corridors connecting Guadalajara and Toledo with Madrid (regional corridors in the influence of the metropolitan area of Madrid), and secondly in the connection area between the regional cities of Toledo, Ciudad Real and Albacete (to follow this interpretation,



see Figure 1). The periphery in the East and West show very low potential access values, demonstrating a lack of connection in these areas.

**Figure 3. Results of the accessibility analysis**



Source: CNIG. Own elaboration.

There are singular cases of relevance that cannot be developed in this work, such as single situations of good accessibility among municipalities with very bad results (in the provinces of Cuenca and Guadalajara mostly), this is the result of good connections and insertion with dynamic areas outside the region (Valencia, in the East of the country).

The interpretation of the factorial components allows to advance in the differentiation of situations that affect rural areas, which is a useful element to design development policy strategies. To establish synergies and improve the territorial cooperation, the strategies should promote urban-rural links and create groups and organizations of producers as the rural development regulation<sup>5</sup> establishes through the FEADER<sup>6</sup> EU's funds. In short distribution chains, those with one or none intermediary agents between producers and consumers, it is important

<sup>5</sup> FEADER: Agricole European Funds for Rural Development.

<sup>6</sup> Regulation (UE) n° 1305/2013 COUNCIL AND EUROPEAN PARLIAMENT of 17th December of 2013 related to the rural development by the FEADER, substituting the Regulation (CE) n° 1698/2005 of the Council.

to push forward the specific challenges that the small companies and agricultural holdings face with specific support in innovation and research.

Likewise, there is a growth in requirements for specific criteria to develop effective mechanisms to identify and optimize projects and initiatives that try to improve the production chains, mostly in the final steps, close to the markets, in order to increase the value of the agricultural products. (i.e. JCCM, 2015, p. 487). Integrated analysis like the one presented here, are also useful to apply in rural tourism, adding objective criteria as a basis for action, because the accessibility is a relevant factor to the development of this activity if close to potential demand areas as are the cities (FERNÁNDEZ-ARROYO and MARTÍNEZ, 2017).

#### 4.2 Classification of rural municipalities in Castilla-La Mancha (Spain)

The factorial analysis result and the data from the accessibility calculations normalized were introduced in the k-means cluster analysis, on which we look for grouping results for  $2 \leq g \leq 5$ , that is to say solutions between two and five clusters. Seen the different statistical solutions, the cluster in  $g=3$  groups offer the optimum interpretation, combining synthesis and explanatory capacity. The statistical centres of the clusters are shown in Table 4, pointing out the general features of each group.

Group 1, the most numerous, is clustered around negative values in the three factors, demonstrating a negative demographic configuration (population weakness and dispersion), a more agrarian labour profile<sup>7</sup> and a negative comparative accessibility. The distribution of this group is mostly in peripheral areas, more frequent in Guadalajara and Cuenca provinces, followed by Toledo and in less quantity the meridional provinces.

**Table 5. Statistical centres for clusters  $g=3$**

	<b>Group 1: Stagnant structure and connection problems</b>	<b>Group 2: Stagnant structure and good connective opportunities</b>	<b>Group 3: Dynamic structure and optimal connection</b>
<b>Factor 1: Population and demographic trend</b>	-0,58	0,73	2,1
<b>Factor 2: Labour structure</b>	0,09	-0,21	-0,6
<b>Factor 3: Accessibility</b>	0,62	1,14	2,77

Source: INE, Corine Land Cover. Own elaboration.

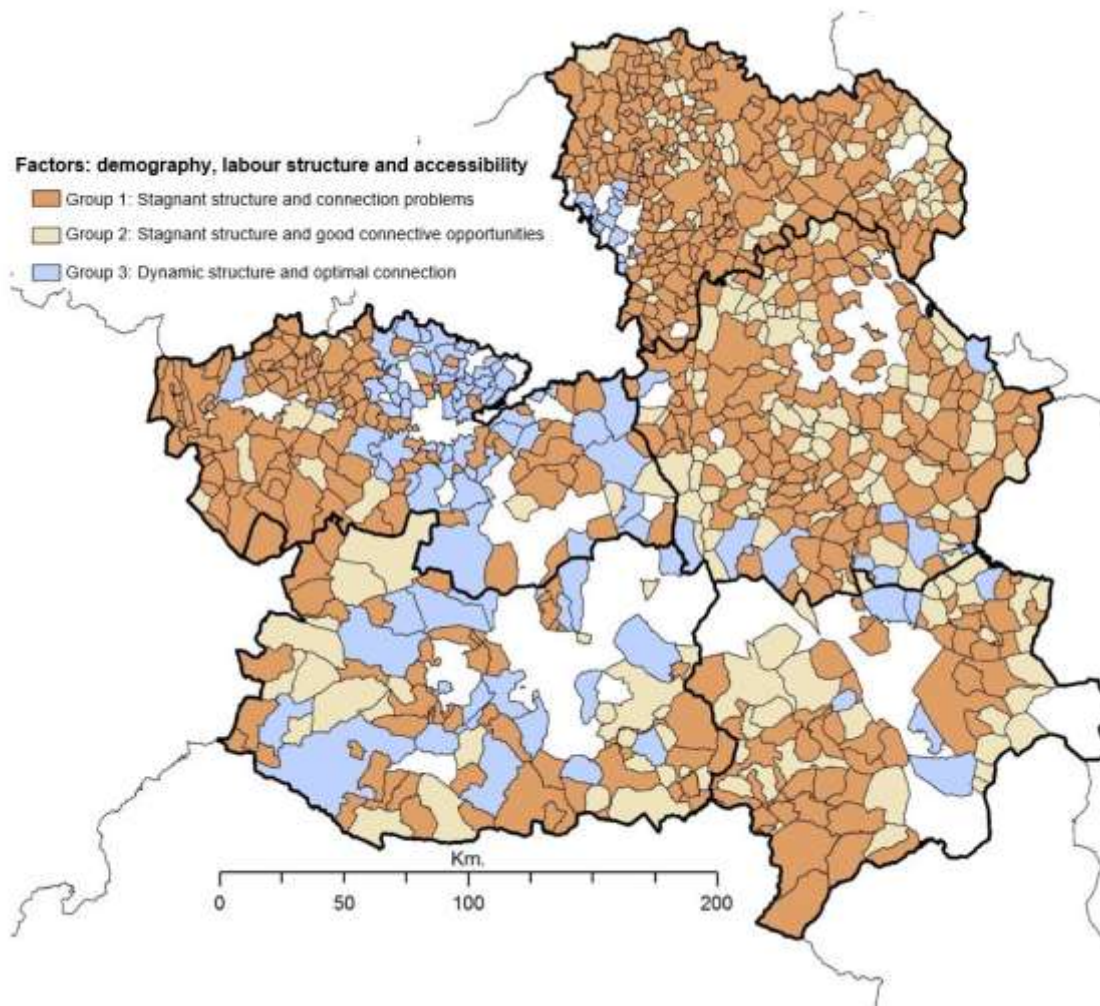
Group 2 keeps similar values in the means of the two first factors but achieves a better result for connection and the labour factor has an opposite sign, drawing a slight tertiary profile. They are municipalities close to urban areas that start to take part in their dynamics because of their proximity.

<sup>7</sup> We remember that positive values lead to an agrarian profile, and negative a services one, as Table 2 have shown.

Lastly, Group 3 marks a good demographic trend, with a tertiary profile and higher accessibility values, above from the rest. They are located in the corridors connecting with Madrid and the axis connecting with Andalucía (south) and the regional connections between Toledo-Ciudad Real and Ciudad Real-Albacete.

Figure 3 shows the geographical distribution of these groups and the characterization obtained by this method. The result, acknowledging the spatial fragmentation derived from this kind of statistical clustering, goes forward in the understanding of the factors that affect the integration and spatial cohesion, benefiting or harming to different agents in their effort to adapt to the current markets. These efforts are not sufficient, as the recent diagnosis highlighted for the 2014-2020 policy period in the region, because many producers have production and operational costs make it difficult their competence skills against bigger companies. The synthesis presented allows to move forward in the recognition of the variables and their interaction, opening a way that may be useful in other areas attached with the rural industries and manufacturers.

**Figure 3. Statistical clustering of rural municipalities**



Source: INE, Corine Land Cover. Own elaboration.



The active rural program in Castilla-La Mancha set a specific policy measure with the intention of improving the competitiveness of producers of the primary sector by reducing their need of intermediate agents (JCCM, 2015, p. 641-624). In this regard, the methodology used in this work allows to define and delimitate the areas of interest and the different profiles of the rural areas, combining the level of connection and productive elements, helping with the decision-making process. The general absence of more specific and objective studies helping the evaluation and selection of strategies and actions pushes us to move towards selection methods keeping the coherence with the general objectives of economic and social cohesion.

#### 4 Conclusions

This work reflects about the urban-rural connection and rural weaknesses in Spain under an empirical framework, which could be also taken as a reflection from the Western Europe rural areas. The focus has been placed in the definition and characterization, putting together demographic and functional variables in one side, and completing them with the access level to the urban economic potential. This integrated approach offers a number of possibilities and solutions both at the academic and policy levels.

It gives the possibility to combine the spatial analysis of the rural areas and the applied studies of accessibility. There is a field to explore such combination, which can be expanded and completed, achieving interesting results from different views. In the friction between both approaches we can find elements for interpretation and application, not only from the theoretical perspective, but also for planning and development programs in rural areas.

The results show the relation between rural patterns and the level of spatial connection, a relationship that may be explored in later works. In this one we presented the starting proposal of a set of indicators together with a simple formulation of potential accessibility in economic terms. The interpretation opens a way of clustering and group rural areas, in the study case focused in the region of Castilla-La Mancha, but easily applied to others.

The main challenge will be the data and the variables available, together with the scope of the statistical analysis. In this example we decided to offer a NUT-3 level analysis, recognising that in this scope we find a good fit between size of the sample and coherence in terms of spatial configuration and policy competences. This approach could be easily transferred to other spatial frameworks and will be also interesting comparing how the method behaves.

It is also possible that a empirical work with more specific variables, like the labour specialization or other economic indicators, would lead to a better performance. Equally, an accessibility formulation focused on the rural remoteness and the urban connection, with more accurate information regarding economic attraction, could run more accurate results about the different capacity of rural connection.

One option is to combine the statistical clustering techniques with the spatial analysis, connecting the factorial and accessibility results with spatial autocorrelation methods which could get a more topological classification within a given sample. We believe that this study opens a way to explore this and other

possibilities, also regarding the scale, that could easily expand to achieve a more general interpretation of the rural areas in a national scope.

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