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## Identifying Clusters of Regions in the European South, based on their Economic, Social and Environmental Characteristics

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# IDENTIFYING CLUSTERS OF REGIONS IN THE EUROPEAN SOUTH, BASED ON THEIR ECONOMIC, SOCIAL AND ENVIRONMENTAL CHARACTERISTICS

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## Abstract

Regional development has been in the centre of interest among both academics but also decision makers in the central and local governments of many European countries. Identifying the key problems that regions face and considering how these findings could be effectively used as a basis for planning their development process are essential in order to improve the conditions in the European Union regions. For a long period of time a country's or a region's development has been synonymous with its economic growth. Over the last years, however, economies and societies have been undergoing dramatic changes. These changes have led to the concept of sustainable development, which refers to the ability of our societies to meet the needs of the present without sacrificing the ability of future generations to meet their own needs. Measuring sustainable development means going beyond a purely economic description of human activities; requires integration of economic, social and environmental concerns. New techniques are required in order to benchmark performance, highlight leaders and laggards on various aspects of development and facilitate efforts to identify best practices. Furthermore, new tools have to be designed so as to make sustainability decision-making more objective, systematic and rigorous. The growth or decline of a country or region depends on its power to pull and retain both business and the right blend of people to run them. Working in this context, we have so far defined a variable which is called the Image of a region and quantifies this pulling power. The region's Image is a function of a multitude of factors physical, economic, social and environmental, some common for all potential movers and some specific for particular groups of them and expresses its present state of development and future prospects. The paper examines a number of south European countries and focuses on their NUTS 2 level regions. Its objective is to:

- Estimate the Basic Image values of those regions.
- Group those regions into different clusters on the basis of the values of the various factors used to define their respective Basic Images.
- Present and discuss the results.

**Keywords:** Regional Development, Region's Image, Cluster Analysis, European Regions

**JEL Classification:** C02, C65, Q01, R58

## **1. Introduction**

The present paper presents the concept of a region's Image, a composite measure of the region's overall trend towards sustainable development, which encompasses two dimensions: economic and social and suggests ways for its measurement.

Image, as defined in Angelis and Dimaki (2011), has two distinct characteristics:

- It allows for possible discontinuities in the development of a region
- It uses methods and techniques, which can tackle discontinuities

However, before we go on to outline and finally use the notion of a region's Image, we should present a number of key points concerning

- The functions of a region
- The process of business and residential location

### **1.1. The functions of a region: Key Points**

In Angelis and Dimaki (2011) the nature of the functions of a region as a socioeconomic unit has been discussed in details. The key points of this discussion are summarized below:

- Every region performs a number of functions: economic, social and environmental (Kotler et al., 1999; Boschma and Lambooy, 1999).
- The relative importance of each of those functions has not remained constant over time.
- Initially the economic function was the dominant one. Gradually the social function gained in importance. Recently the environmental function emerged as the third pole of development.

Furthermore, the region's functions are not always compatible; on the contrary the idea of a conflict between the economic function on one hand and the social and environmental functions on the other is widespread in literature (Llewellyn, 1996; Lovering, 2001; Bristow, 2005).

### **1.2. The process of business and residential location: Key Points**

The process of business and residential location has been presented in detail in Angelis and Dimaki (2011). The major key points are summarized below:

- The development of a region depends on its power to attract business activities and the right blend of people to run them (Malecki, 2004; Bristow, 2005).
- Regarding the location of business units, although traditional factors, such as accessibility, land availability, labour, capital and infrastructure remain important, a number of factors representing more subjective characteristics, as well as a number of environmental factors, have also appeared.
- Regarding the location of people, although job availability/quality and job/pay prospects still remain important, a number of other factors like quality of life, housing options and quality, educational services and health services have also appeared (Bristow, 2010; Burgess, 1982).
- There seem to be a set of “attraction” factors, common for both business and employees. Those factors include economic stability, economic viability, accessibility, land availability, infrastructure, housing, health and education facilities.
- The choice of location by the prospective movers (business and employees) appears to be a two-stage process, whereby the final choice is made from a small group of possible locations, all of which satisfy a set of basic criteria (Malecki, 2004).

## **2. The concept of a region's Image**

As it has been mentioned already in the introduction, the growth or decline of a region depends on its power to "pull" and retain both business activities and the right blend of people to run them; this pulling power depends on what we call the Image of the region. The term Image is currently used in a variety of contexts. Image is a sum of beliefs, ideas and impressions. It is the total impression an entity makes on the minds of people and exerts a powerful influence on the way people perceive things and react to them (Dowling, 1998; Dichter, 1985). Marketing literature suggests that image is important in this process and identifies different types, including projected and received place images (Kotler et al., 1993). Projected place images can be conceived as the ideas and impressions of a place that are available for people's consideration. This type of images reaches the potential mover by an image transmission or diffusion process through various channels of communication, which themselves can alter the character of the message. The received place images are formed from the interaction

between these projected messages and the movers' own needs, motivations, prior knowledge, experience, preferences, and other personal characteristics. In this way potential movers create their own unique representations or mental constructs, resulting in their own personal images of place (Ashworth and Voogd, 1990; Gartner, 1993; Bramwell and Rawding, 1996).

In this paper, Image is defined in a slightly different way, as a function of objectively measured factors, which influence the movement of both business units and people. It is clear that a region's Image, based on objectively measured factors, may be improved through marketing and promotion activities. Nevertheless, it is believed that the impact of those activities on the region's Image is temporary and limited and the only lasting effect is the objective improvement of the various attributes of this Image. Competition among places involves the improvement in the attributes that make it possible to attract and keep investment and migrants – that is, to become 'sticky places' (Markusen, 1996; Malecki, 2004).

Different people hold quite different Images of the same place. Because a region may be related to a number of potential movers' groups that have a different type of interaction with it, each of these groups is likely to have a different Image of the particular region. Hence, a region does not have an Image, but multiple Images (Dowling, 1998). Based on the above, it can be argued that, at each point in time, the region "sends out" its Image and, depending on its impact on the people (both employers and employees), the region may be considered attractive or non attractive. One may also argue that since people "receiving" the Image of the region belong to various distinct groups (i.e. employers, unskilled workers, skilled workers etc.) and are sensitive to different factors; the impact of the region's Image on the members of each particular group will be different (Kotler et al., 1999; Bryson & Daniels, 2007).

Whilst this argument is plausible, the evidence presented in section 1.2 suggests that all groups of potential movers react similarly to a basic set of factors; more precisely, a set of minimum standards, largely common to all groups, must be satisfied if the region is to be considered as a potential choice by any of them. Every community must provide some basic standards of services to attract and retain people, business and visitors. Admittedly, no uniform standards exist. Hence, every region, in order to be/remain attractive, should determine the standards pertaining each time and try to meet them (Kotler et al., 1999; Schneider & White, 2004).

To reconcile these two views we refine the concept of a region's Image by introducing the following two concepts: the Basic Image and the Specific Image.

- The Basic Image of a given region measures the degree to which the region satisfies a set of basic criteria, common for all movers. A region satisfying those criteria is considered by all potential movers as worth a closer examination and as a potential final choice.
- The Specific Image of a given region, as perceived by a particular group of potential movers, measures the degree to which movers belonging to that particular group consider the region as their best final choice. This Specific Image, however, although a function of specific factors appealing mainly to members of that group, is primarily a function of the region's Basic Image.

The remainder of this paper will focus on a region's Basic Image, a summary measure of its current state of development and future prospects as perceived by all potential movers. A physically realizable measure for the Basic Image is difficult to find. What may be measured more easily, are the changes of a region's population and industrial stock during a time period. However, those measurable changes may be generally considered as the delayed and smoothed consequence of prior changes in the Basic Image. Hence, the study of the mechanisms governing the shaping and the changes of a region's Basic Image is a task of imperative importance.

On the basis of all the above the Basic Image of a region may be defined as a function of a number of variables which may be divided into two sets according to whether they express the economic or the social /environmental function of the region.

The factors of the first set (e.g. Accessibility to Centers of Influence, Land Availability, Financial Conditions) provide a measure of the region's economic development prospects. This measure is referred to as the *Economic Indicator of region i* ( $IND_i^1$ ). Similarly, the factors of the second set (e.g. Housing Conditions, Environmental Conditions, Social Conditions) provide a measure of a region's social profile. This measure is referred to as the *Social Indicator of region i* ( $IND_i^2$ ). Hence,  $Basic\ Image = \varphi(IND_i^1, IND_i^2)$ . At this point it should be mentioned that the growth of a region may be expressed both in absolute or relative terms. In the latter and most interesting case the development pattern of a given region is compared to that of a hypothetical region, which is referred to as the "typical" region and expresses, as far

as possible, an average of the main regions of a similar type to that under study. In this paper we shall be looking at the relative development patterns of a region. Hence, all the factors affecting its Basic Image should be expressed in relative terms as compared to the corresponding values of the “typical” region.

We have so far defined a region’s Basic Image as a function of two indicators. In order to get a first feeling of the shape of its graph we start by stating the following simple observations describing the way in which the two indicators operate.

- i. The higher the Economic Indicator of a region the more Attractive its Basic Image.
- ii. The higher the Social Indicator of a region the more Attractive its Basic Image.
- iii. If the Economic Indicator of a region is continuously increasing but, at the same time, its Social Indicator is continuously decreasing, the Basic Image of the region may be either attractive or non attractive and sudden changes in its state may be expected.

Observation (iii) is the most interesting because it implies that the graph we want to draw may be discontinuous. In Angelis and Dimaki (2011), it has been argued that the process of shaping a region’s Basic Image has all the properties characterizing phenomena which may be modeled in terms of Catastrophe Theory, the general mathematical theory of discontinuous and divergent behaviour for continuous underlying forces. It is also reminded that the Basic Image of a region has been defined as a function of two potentially conflicting indicators. Therefore, according to Catastrophe Theory, the appropriate elementary catastrophe for its description is the Cusp Catastrophe Model (Thom, 1975; Zeeman, 1973; Gilmore, 1993; Poston and Stewart, 1996). More specifically, the value  $x_i, i = 1, 2, \dots, n$ , of the  $i^{\text{th}}$  region’s Basic Image, at each point in time, is given as a solution of the equation:

$$x_i^3 - Bx_i - A = 0 \tag{1}$$

with,

$$\begin{cases} A = m(IND_i^1 - IND_0^1) + (IND_i^2 - IND_0^2) \\ B = (IND_i^1 - IND_0^1) - m(IND_i^2 - IND_0^2) \end{cases} \text{ if } m \leq 1 \quad \text{and}$$

$$\begin{cases} A = m(IND_i^1 - IND_0^1) + (1/m)(IND_i^2 - IND_0^2) \\ B = (1/m)(IND_i^1 - IND_0^1) - (IND_i^2 - IND_0^2) \end{cases} \text{ if } m > 1$$

Equation (1) is referred to as the **Basic Image Equation** and  $IND_i^1$  and  $IND_i^2$  express the values of the Economic and the Social Indicator for the  $i^{th}$  region, while  $IND_0^1$ ,  $IND_0^2$ , express the values of those two Indicators for the “typical” region. The variable  $m$  expresses the relative weights attached to each one of the two indicators in defining the Basic Image. The values of all Indicators lie in the interval  $[0,1]$ , whereas the resulting from the model respective values of the Basic Image lie in the interval  $[-1,1]$  (Angelis & Dimaki, 2011). The value of the “typical” region's Basic Image is 0. Hence, positive Basic Image indicates an attractive region that may be considered as a potential final choice by the various groups of prospective movers. For the purposes of this work, each of those Indicators is expressed as the geometric mean of several Sub indicators, as shown in relations (2) and (3).

$$IND_i^1 = \sqrt[p]{\prod_{j=1}^p SBI_{ij}^1}, i = 1, 2, \dots, n, p = 2, 3, \dots \quad (2)$$

$$IND_i^2 = \sqrt[q]{\prod_{j=1}^q SBI_{ij}^2}, i = 1, 2, \dots, n, q = 2, 3, \dots \quad (3)$$

where  $SBI_{ij}^1$  denotes the  $j^{th}$  Sub indicator of region  $i = 1, 2, \dots, n$ , which is related to the Economic Indicator  $IND_i^1$  and  $SBI_{ij}^2$  denotes the  $j^{th}$  Sub indicator of region  $i = 1, 2, \dots, n$ , which is related to the Social Indicator  $IND_i^2$ .

The values of  $p$  and  $q$  depend on the data availability. The collected raw data, appropriately transformed so as to fulfill the model's requirements (Angelis & Dimaki, 2011), are used for the calculation of the various Sub indicators. Details on the values used for the purposes of this work will be given in the next section.

### 3. Application of the proposed model

The methodology presented in the previous sections, has been used for the estimation of the Basic Image values of the NUTS 2 level regions of four South European



countries namely Spain, Italy, Greece and Portugal, for the year 2012. Those countries have in total 60 regions distributed among them as shown in Table 1.

**Table 1: Number of regions per country**

Countries	# of regions
Spain	19
Italy	21
Greece	13
Portugal	7
<b>TOTAL</b>	<b>60</b>

The required data have been drawn from the official site of Eurostat. However, in certain cases data availability for all four countries was limited and this determined to a large extent the quantification of the two Indicators. The sub indicators used in each case and the derivation, based on relations (2) and (3), of the Economic and the Social Indicators are summarized in Tables 2 and 3 respectively. In the case under study  $n = 60$ ,  $p = 3$ ,  $q = 4$ .

As it has already been pointed out our aim is to calculate those regions' Basic Images and thus provide an overall estimate of their status. However, this task may be placed within a wider framework consisting of the following three steps:

- Classification of those regions on the basis of their economic characteristics
- Classification of those regions on the basis of their social characteristics
- Overall classification of those regions on the basis of their Basic Image

**Table 2: Formation of the Economic Indicator of region  $i$**

$IND_i^1 = \sqrt[3]{\prod_{j=1}^3 SbI_{ij}^1}, i = 1, 2, \dots, 60$	
where	
$IND_i^1$ :	The Economic Indicator of region $i = 1, 2, \dots, 60$
$SbI_{i1}^1$ :	The Financial Conditions Sub indicator of region $i$ . The transformed data used are based on the GDP per inhabitant.
$SbI_{i2}^1$ :	The Research & Development Sub indicator of region $i$ . The transformed data used are based on the R & D expenditure as % of GDP.
$SbI_{i3}^1$ :	The Accessibility Sub indicator of region $i$ . The transformed data used are based on the distance from the large influence centers and modes of transport available (land, sea, air)

**Table 3: Formation of the Social Indicator of region  $i$**

$IND_i^2 = \sqrt[4]{\prod_{j=1}^4 SbI_{ij}^2}, i = 1, 2, \dots, 60$	
where	
$IND_i^2$ :	The Social Indicator of region $i = 1, 2, \dots, 60$
$SbI_{i1}^2$ :	The Housing Sub indicator of region $i$ . The transformed data used are based on the health personnel (per 100k inhabitants)
$SbI_{i2}^2$ :	The Education Sub indicator of region $i$ . The transformed data used are based on the population with upper secondary or tertiary education attainment
$SbI_{i3}^2$ :	The Poverty Sub indicator of region $i$ . The transformed data used are based on people at risk of poverty or social exclusion
$SbI_{i4}^2$ :	The Environmental Sub indicator of region $i$ . The transformed data used are based on the environmental protection expenditure as % of GDP.

For the first two steps, a cluster analysis has been used consisting of the following three stages:

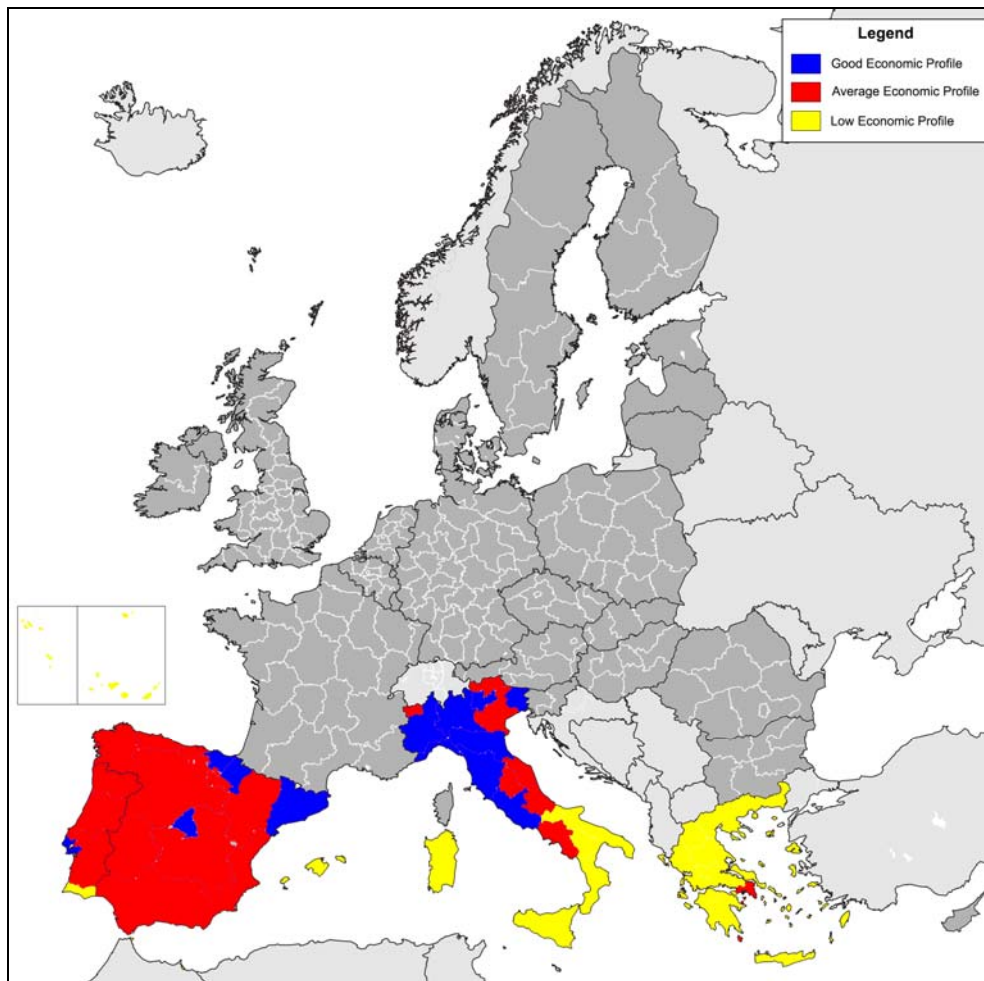
- i. The Hierarchical Clustering method was used in order to determine, through a dendrogram, the number of emerging clusters.
- ii. After defining the number of clusters the K-means method was used, in order to determine the regions belonging to each cluster.
- iii. The means of selected regional characteristics were compared in order to identify differences between clusters.

The use of this wider framework gives both a partial view based on the regions' economic and social characteristics respectively, but also an overall view based on the interaction of the regions' both economic and social characteristics as expressed through their Basic Images.

### 3.1 Identifying the Economic profile of the South European Regions

Applying the Cluster Analysis procedure outlined briefly in the previous section, we conclude that on the basis of their economic characteristics the regions may be classified into three clusters as shown in Figure 1.

**Figure 1: Map of the European South.  
Clustering based on the regions' Economic Characteristics**



In order to identify the differences between the three clusters, the following hypotheses were tested

$H_0$ : There is no difference in the means of the economic characteristics of the regions belonging to clusters 1, 2, 3.

$H_1$ : There is difference in the means of the economic characteristics of the regions belonging to clusters 1, 2, 3.

The summary report is given in Table 4.

**Table 4: Summary Report of the Clustering based on the Economic Characteristics of the South European Regions**

<b>Cluster</b>		<b>Financial Conditions Sub indicator</b>	<b>Research &amp; Development Sub indicator</b>	<b>Accessibility Sub indicator</b>
1	Mean	<b>1.1985</b>	<b>1.4077</b>	<b>1.2269</b>
	N	13	13	13
	Std. Deviation	.06878	.14934	.12466
2	Mean	<b>1.0095</b>	<b>1.0227</b>	<b>1.1564</b>
	N	22	22	22
	Std. Deviation	.16188	.14065	.11745
3	Mean	<b>.8836</b>	<b>.7512</b>	<b>.7520</b>
	N	25	25	25
	Std. Deviation	.07210	.13860	.15033
<b>Total</b>	Mean	<b>.9980</b>	<b>.9930</b>	<b>1.0032</b>
	N	60	60	60
	Std. Deviation	.16387	.28703	.25254

From the summary report and the error bars of the Cluster Analysis the following conclusions may be drawn:

- Cluster 1 contains 13 regions (i.e. 21.7 %). These are regions with very good economic profile, as the mean values of all variables, expressing this profile, are considerably higher than the respective total mean population values. Furthermore, the variability of those variables' values is low in the case of Financial Conditions and Accessibility Sub Indicators, but high in the case of Research & Development Sub Indicator.
- Cluster 2 contains 22 regions (i.e. 36.7 %). These are regions with average economic profile, as the mean values of all variables expressing this profile, are only marginally higher than the respective total mean population values. Furthermore, the variability of those variables' values is low in the case of in the case of Research & Development Sub Indicator, but high in the case of Financial Conditions and Accessibility Sub Indicators.
- Cluster 3 contains the remaining 25 regions (i.e. 41.6 %). These are regions with poor economic profile, as the mean values of all variables expressing this profile, are lower than the respective total mean population values. Furthermore, the variability of those variables' values is low in the case of

Financial Conditions Sub Indicator and high in the case of Accessibility and Research & Development Sub Indicators.

As we can see, this classification shows the clear superiority of Cluster 1 over the Clusters 2 and 3 and the superiority of Cluster 2 over the Cluster 3.

The cross tabulation (by country) leads to Table 5.

**Table 5: Regions per Country.**  
**Clustering based on the regions' Economic Characteristics**

Clusters	Regions per Country				Total
	Spain	Italy	Greece	Portugal	
<b>1</b>	4	8	--	1	<b>13</b>
<b>2</b>	11	7	1	3	<b>22</b>
<b>3</b>	4	6	12	3	<b>25</b>
<b>Total</b>	<b>19</b>	<b>21</b>	<b>13</b>	<b>7</b>	<b>60</b>

As we can see from Table 5 and Figure 1, the Clusters 1 and 2 (i.e. the clusters of regions with average and high economic profile), contain 35 regions or 58% of the total number of regions in all four countries.

Furthermore, looking at Table 5 from the point of view of each particular country, we can say that:

- Most of the regions of Spain (78.9 %) and Italy (71.05 %) belong to this group.
- Over half of the regions of Portugal (57.1%) belong to this group
- Only one (7.7 %) of the regions of Greece belong to this group
- No island regions, in any of the countries, belong to this group

Moreover, looking at Figure 1 from the point of view of the regions' location, we can say that:

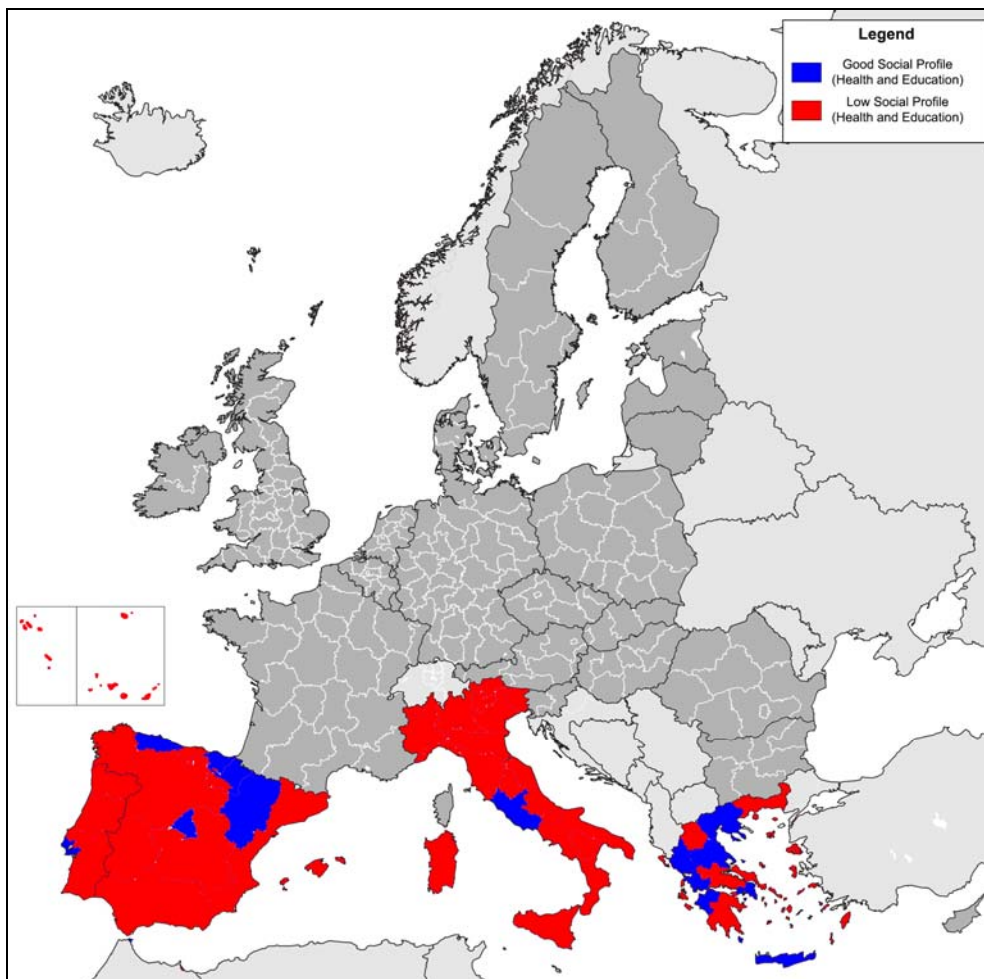
- In the case of Spain and Italy most of the regions with high economic profile are located around the respective capitals, but also in the northern part of the respective countries
- In the case of Portugal and Greece the regions belonging to that group are located around the respective capitals.

### 3.2 Identifying the Social profile of the South European Regions

Following a procedure analogous to that of section 3.1 we conclude that on the basis of their social characteristics the regions may be classified into two clusters. In order to identify the differences between the two clusters, the relevant hypotheses were tested. The basic conclusions may be summarized as follows:

- Cluster 1 contains 23 regions (i.e. 36.7 %). These are regions with higher than average Health and Education Sub Indicators, but lower than average Poverty and Environmental Sub Indicators.
- Cluster 2 contains 38 regions (i.e. 63.3 %). These are regions with higher than average Poverty and Environmental Sub Indicators, but lower than average Health and Education Sub Indicators.

**Figure 2: Map of the European South.  
Clustering based on the regions' Health and Education Characteristics**



As we can see, this classification does not show any clear superiority of one cluster over the other. To clarify this situation, the clustering procedure was executed twice on the basis of the:

- Health and Education characteristics
- Poverty and Environmental characteristics

On the basis of their Health and Education characteristics the regions are classified into two clusters as shown in Figure 2.

The summary report is given in Table 6.

**Table 6: Summary Report of the Clustering based on the Health and Education Characteristics of the South European Regions**

<b>Cluster</b>		<b>Health Sub indicator</b>	<b>Education Sub indicator</b>
1	Mean	<b>.9250</b>	<b>.9793</b>
	N	46	46
	Std. Deviation	.08697	.09756
2	Mean	<b>1.2257</b>	<b>1.0707</b>
	N	14	14
	Std. Deviation	.16066	.09025
<b>Total</b>	Mean	<b>.9952</b>	<b>1.0007</b>
	N	60	60
	Std. Deviation	.16705	.10282

From the summary report and the error bars of the Cluster Analysis the following conclusions may be drawn:

- Cluster 1 contains 46 regions (i.e. 76.7%). These are regions with lower than average Health and Education Sub Indicators. Furthermore, the variability of those variables is very low in the case of both Health and Education Sub Indicators.
- Cluster 2 contains 14 regions (i.e. 23.3%). These are regions with higher than average Health and Education Sub Indicators. Furthermore, the variability of those variables is low in the case of Education but higher in the case of Health Sub Indicator.

The cross tabulation (by country) leads to Table 7.

**Table 7: Regions per Country.**  
**Clustering based on the regions' Health and Education Characteristics**

Clusters	Regions per Country				Total
	Spain	Italy	Greece	Portugal	
<b>1</b>	13	20	7	6	<b>46</b>
<b>2</b>	6	1	6	1	<b>14</b>
<b>Total</b>	<b>19</b>	<b>21</b>	<b>13</b>	<b>7</b>	<b>60</b>

Similarly, as we can see from me Table 7 and Figure 2 the Cluster 2 (i.e. the cluster of regions with better than average health and education sub indicators), contains 14 regions or 23.3 % of the total number of regions in all four countries.

Furthermore, looking at Table 7 from the point of view of each particular country, we can say that:

- Almost half of the regions of Greece (46.2 %) and many of the regions of Spain (31.6 %) belong to this cluster.
- Few of the regions of Portugal (14.3 %) and only one of the regions of Italy (4.8%) belong to this cluster.
- No island regions (apart from Crete in Greece) belong to this cluster.

Moreover, looking at Figure 2 from the point of view of the regions' location, we can say that:

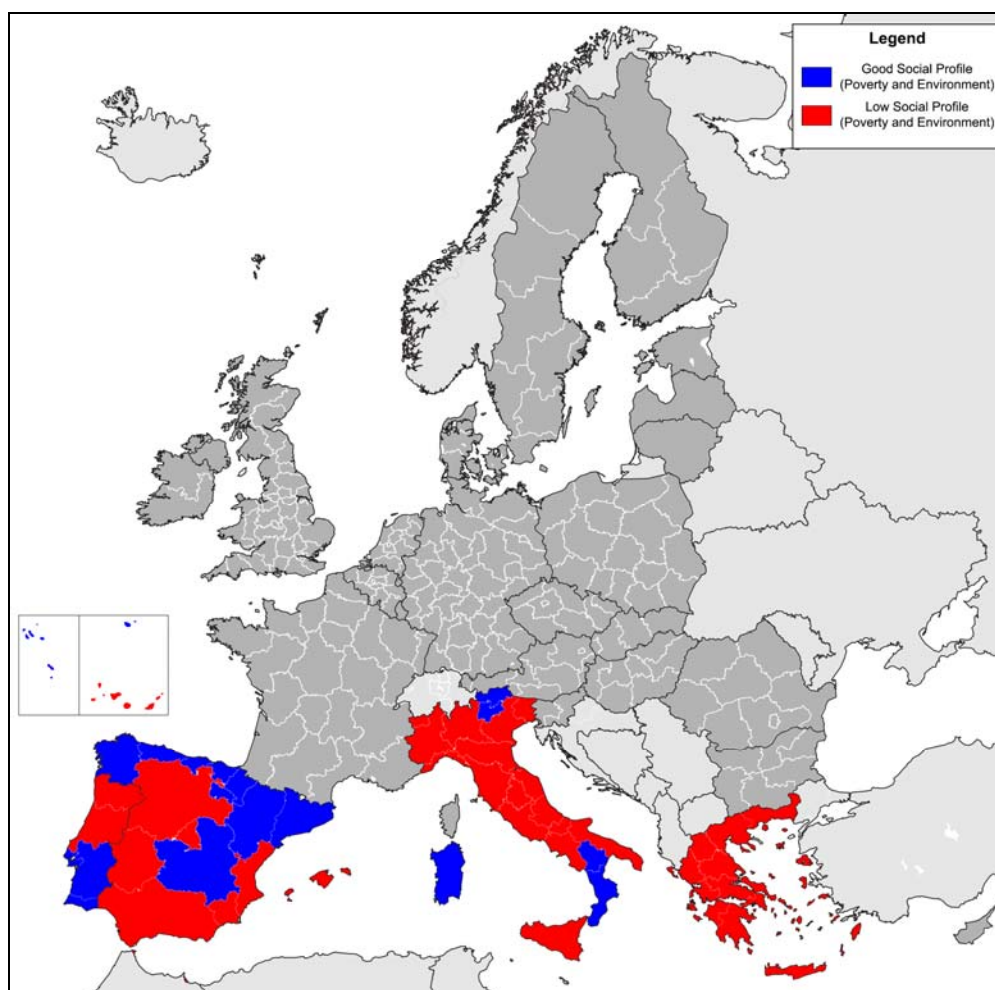
- In all four countries the regions around the respective capitals belong to this cluster.
- Apart from the capital regions, all other regions belonging to this cluster are located in the northern and more industrialized part of the respective countries.

These are expected findings as economically developed, industrialised and urban areas assemble a large number of better educated people and provide better education and health facilities to their inhabitants.

On the basis of their Poverty and Environmental characteristics the regions are classified into two clusters as shown in Figure 3.



**Figure 3: Map of the European South.**  
**Clustering based on the regions' Poverty and Environmental Characteristics**



The summary report is given in Table 8.

**Table 8: Summary Report of the Clustering based on the Poverty and Environmental Characteristics of the South European Regions**

Cluster		Poverty Sub indicator	Environmental Sub indicator
1	Mean	.9835	.7460
	N	40	40
	Std. Deviation	.07550	.13466
2	Mean	1.0370	1.3575
	N	20	20
	Std. Deviation	.07491	.28228
Total	Mean	1.0013	.9498
	N	60	60
	Std. Deviation	.07888	.34950

From the summary report and the error bars of the Cluster Analysis the following conclusions may be drawn:

- Cluster 1 contains 40 regions (i.e. 66.7%). Those are regions with lower the average Poverty and Environmental Sub Indicators. Furthermore, the variability of those variables is very low in the case of both Poverty and Environmental Sub Indicators.
- Cluster 2 contains 20 regions (i.e. 33.3%). Those are regions with higher the average Poverty and Environmental Sub Indicators. Furthermore, the variability of those variables is low in the case of Poverty, but very high in the case of Environmental Sub Indicator.

The cross tabulation (by country) leads to Table 9.

**Table 9: Regions per Country.**  
**Clustering based on the regions' Poverty and Environmental Conditions Characteristics**

<b>Clusters</b>	<b>Regions per Country</b>				<b>Total</b>
	<b>Spain</b>	<b>Italy</b>	<b>Greece</b>	<b>Portugal</b>	
<b>1</b>	10	15	13	2	<b>40</b>
<b>2</b>	9	6	--	5	<b>20</b>
<b>Total</b>	<b>19</b>	<b>21</b>	<b>13</b>	<b>7</b>	<b>60</b>

Finally, as we can see from Table 9 and Figure 3 the Cluster 2 (i.e. the cluster of regions with better than average poverty and environmental sub indicators), contains 20 regions (i.e. 33.3 %) of the total number of regions in all four countries.

Furthermore, looking at Table 9 from the point of view of each particular country, we can say that:

- Most of the regions of Portugal (71.4 %) belong to this Cluster.
- Almost half of the regions of Spain (47.4 %) and many of the regions of Italy (28.6 %) belong to this Cluster.
- No Greek regions belong to this Cluster.

Moreover, looking at Figure 3 from the point of view of the regions' location, we can say that:

- In all four countries the regions around the respective capitals, do not belong to this Cluster.
- Most of the regions of this Cluster are located in the southern part of the countries.

These are expected findings as rural areas:

- Are less industrialised and have higher the average environmental indicators
- Consist of smaller and to a larger extent self sustainable communities with less poverty and social exclusion

As we can see from Table 10 there are only 5 regions in all countries with better than average values in all four social sub indicators.

**Table 10: Regions per Country.  
with better than average values in all four social sub indicators**

	Countries				Total
	Spain	Italy	Greece	Portugal	
<b># of Regions</b>	4	--	--	1	<b>5</b>

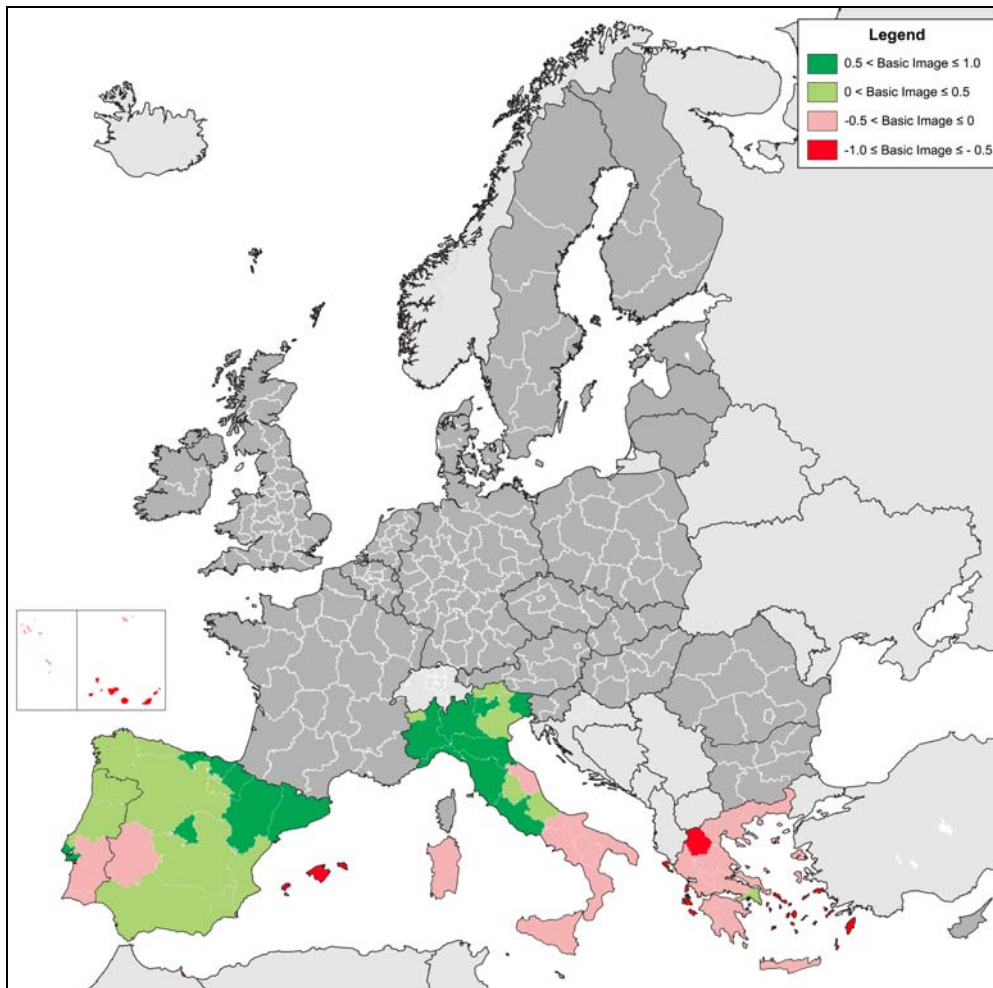
### 3.3 Overall classification of the South European Regions

Having completed the classification of the South European regions on the basis of their economic and social characteristics we now proceed, using the proposed model, with the estimation of their Basic Images which, as already mentioned, provide an overall classification of the regions under study.

**Table 11: Regions per Country.  
Overall Classification of the South European Regions**

The Basic Image lies in the interval:	Regions per Country				Total
	Spain	Italy	Greece	Portugal	
<b>[-1.0 , -0.5)</b>	3	--	3	--	<b>6</b>
<b>[-0.5 , 0)</b>	2	8	9	4	<b>23</b>
<b>[0 , 0.5)</b>	7	5	1	2	<b>15</b>
<b>[0.5 , 1.0]</b>	7	8	--	1	<b>16</b>
<b>Total</b>	<b>19</b>	<b>21</b>	<b>13</b>	<b>7</b>	<b>60</b>

**Figure 4: Map of the European South.  
Overall Classification of the South European Regions**



As we can see from Table 11 and Figure 4, 31 regions (i.e. 51.67%) of the total number of regions have positive Basic Image.

Furthermore, looking at Table 9 from the point of view of each particular country, we can say that positive Basic Image have:

- 14 (i.e. 73.7%) of the regions of Spain,
- 13 (i.e. 61.9%) of the regions of Italy,
- 3 (i.e. 42.9%) of the regions of Portugal,
- 1 (i.e. 7.7%) of the regions of Greece.

Also, no island regions have positive Basic Image.

Comparing the findings of Figure 1 to those of Figure 4 we can see that they have remarkable similarities. Most of the regions with high economic indicators coincide with the regions with positive Basic Image.

This is an expected finding. As we have seen, very few of the areas show high values for all social sub indicators. Some of them (industrialized, urban regions) have better than average values for health and education sub indicators while the rest (mostly rural regions) have better than average values for environmental and poverty sub indicators. As a result, the decisive factor in every case or in other words, the factor which determines the sign and the value of the regions' Basic Image, is the economic indicator.

Our model seems to underestimate the Basic Image values for all island regions. This is due to the fact that it takes into account a regions' geographical discontinuity which is encompassed into its economic indicator. A second run of the model with relaxed economic indicator, taking into account only the distance of the regions from the main influence centers and not their geographical discontinuity, improves the Basic Image values of island regions, but not to a considerable effect. This happens because most of the islands in the four countries under study are located far from large influence centers and this reduces the value of their economic indicator and hence, the value of their Basic Image. However, most of the island regions focus on the attraction of business activities for which unfavorable location is not necessarily handicapped. Tourism is such an activity, for which distance, isolation and geographical discontinuity may not be a problem, but on the contrary, in certain cases a strong comparative advantage. Hence, the current model must be modified for the case of island regions.

#### **4. Conclusions**

Sustainable development refers to the ability of our societies to meet the needs of the present without sacrificing the ability of future generations to meet their own needs. Measuring sustainable development means going beyond a purely economic description of human activities; requires integration of economic, social and environmental concerns. New techniques are required in order to benchmark performance, highlight leaders and laggards on various aspects of regional

development and facilitate efforts to identify best practices. New tools have to be designed so as to make sustainability decision-making more objective, systematic and rigorous.

The first part of this paper, introduced the concept of a regions' Basic Image, i.e. a variable expressing a region's attractiveness and overall progress towards sustainable development. Furthermore, it presented a methodology for the estimation of a region's Basic Image.

The second part used this methodology for the estimation of the Basic Image values of the NUTS 2 regions of four south European countries, namely Spain, Italy, Greece and Portugal for the year 2012. This estimation was placed within a wider framework, consisting of the following three steps:

- i. Classification of those regions on the basis of their economic characteristics
- ii. Classification of those regions on the basis of their social characteristics
- iii. Estimation of the regions' Basic Image

The application gave very interesting results regarding the economic and social characteristics, but also, the Basic Image values, of the various regions within each country but also across the four countries. The results have been presented and discussed and a number of conclusions have been drawn. One of the main conclusions is that this model underestimates the Basic Image values of island regions. Hence, an area of further research will be to modify the model, along the lines already suggested, so as to give a better estimation of island regions' Basic Image.

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## APPENDIX

The information presented on the Tables 12-15 was used for the construction of the respective Maps (Figures 1-4)

**Table 12: Clustering based on the Economic Characteristics of the South European Regions**

CLUSTER 1		CLUSTER 2		CLUSTER 3	
Region	Country	Region	Country	Region	Country
País Vasco	ES	La Rioja	ES	Illes Balears	ES
Comunidad de Madrid	ES	Comunidad Valenciana	ES	Canarias	ES
Comunidad Foral de Navarra	ES	Aragón	ES	Ciudad Autónoma de Ceuta	ES
Cataluña	ES	Cantabria	ES	Ciudad Autónoma de Melilla	ES
Emilia-Romagna	IT	Castilla y León	ES	Basilicata	IT
Piemonte	IT	Andalucía	ES	Puglia	IT
Liguria	IT	Principado de Asturias	ES	Molise	IT
Lazio	IT	Región de Murcia	ES	Sardegna	IT
Lombardia	IT	Castilla-la Mancha	ES	Sicilia	IT
Toscana	IT	Galicia	ES	Calabria	IT
Provincia Autonoma di Trento	IT	Extremadura	ES	Dytiki Ellada	GR
Friuli-Venezia Giulia	IT	Veneto	IT	Stereia Ellada	GR
Lisboa	PT	Provincia Autonoma di Bolzano/Bozen	IT	Ipeiros	GR
		Abruzzo	IT	Peloponnisos	GR
		Marche	IT	Kentriki Makedonia	GR
		Umbria	IT	Kriti	GR
		Valle d'Aosta/Vallée d'Aoste	IT	Thessalia	GR
		Campania	IT	Dytiki Makedonia	GR
		Attiki	GR	Anatoliki Makedonia, Thraki	GR
		Centro	PT	Notio Aigaio	GR
		Norte	PT	Voreio Aigaio	GR
		Alentejo	PT	Ionia Nisia	GR
				Algarve	PT
				Região Autónoma da Madeira	PT
				Região Autónoma dos Açores	PT

**Table 13: Clustering based on Health and Education Characteristics  
of the South European Regions**

CLUSTER 1		CLUSTER 2	
Region	Country	Region	Country
Andalucía	ES	Aragón	ES
Canarias	ES	Ciudad Autónoma de Ceuta (ES)	ES
Cantabria	ES	Comunidad de Madrid	ES
Castilla y León	ES	Comunidad Foral de Navarra	ES
Castilla-la Mancha	ES	País Vasco	ES
Cataluña	ES	Principado de Asturias	ES
Ciudad Autónoma de Melilla	ES	Lazio	IT
Comunidad Valenciana	ES	Attiki	GR
Extremadura	ES	Dytiki Ellada	GR
Galicia	ES	Ipeiros	GR
Illes Balears	ES	Kentriki Makedonia	GR
La Rioja	ES	Kriti	GR
Región de Murcia	ES	Thessalia	GR
Abruzzo	IT	Lisboa	PT
Basilicata	IT		
Calabria	IT		
Campania	IT		
Emilia-Romagna	IT		
Friuli-Venezia Giulia	IT		
Liguria	IT		
Lombardia	IT		
Marche	IT		
Molise	IT		
Piemonte	IT		
Provincia Autonoma di Bolzano/Bozen	IT		
Provincia Autonoma di Trento	IT		
Puglia	IT		
Sardegna	IT		
Sicilia	IT		
Toscana	IT		
Umbria	IT		
Valle d'Aosta/Vallée d'Aoste	IT		
Veneto	IT		
Anatoliki Makedonia, Thraki	GR		
Dytiki Makedonia	GR		
Ionia Nisia	GR		
Notio Aigaio	GR		
Peloponnisos	GR		
Stereia Ellada	GR		
Voreio Aigaio	GR		
Alentejo	PT		
Algarve	PT		
Centro (PT)	PT		
Norte	PT		
Região Autónoma da Madeira (PT)	PT		
Região Autónoma dos Açores (PT)	PT		

**Table 14: Clustering based on Poverty and Environmental Characteristics  
of the South European Regions**

CLUSTER 1		CLUSTER 2	
Region	Country	Region	Country
Andalucía	ES	Aragón	ES
Canarias (ES)	ES	Cantabria	ES
Castilla y León	ES	Castilla-la Mancha	ES
Ciudad Autónoma de Ceuta (ES)	ES	Cataluña	ES
Ciudad Autónoma de Melilla (ES)	ES	Comunidad Foral de Navarra	ES
Comunidad de Madrid	ES	Galicia	ES
Comunidad Valenciana	ES	La Rioja	ES
Extremadura	ES	País Vasco	ES
Illes Balears	ES	Principado de Asturias	ES
Región de Murcia	ES	Basilicata	IT
Abruzzo	IT	Calabria	IT
Campania	IT	Provincia Autonoma di Bolzano/Bozen	IT
Emilia-Romagna	IT	Provincia Autonoma di Trento	IT
Friuli-Venezia Giulia	IT	Sardegna	IT
Lazio	IT	Valle d'Aosta/Vallée d'Aoste	IT
Liguria	IT	Alentejo	PT
Lombardia	IT	Algarve	PT
Marche	IT	Lisboa	PT
Molise	IT	Região Autónoma da Madeira (PT)	PT
Piemonte	IT	Região Autónoma dos Açores (PT)	PT
Puglia	IT		
Sicilia	IT		
Toscana	IT		
Umbria	IT		
Veneto	IT		
Anatoliki Makedonia, Thraki	GR		
Attiki	GR		
Dytiki Ellada	GR		
Dytiki Makedonia	GR		
Ionia Nisia	GR		
Ipeiros	GR		
Kentriki Makedonia	GR		
Kriti	GR		
Notio Aigaio	GR		
Peloponnisos	GR		
Stereia Ellada	GR		
Thessalia	GR		
Voreio Aigaio	GR		
Centro (PT)	PT		
Norte	PT		

**Table 15: Overall Classification of the South European Regions**

THE BASIC IMAGE LIES IN THE INTERVAL:							
[-1.0 , -0.5)		[-0.5 , 0)		[0 , 0.5)		[0.5 , 1.0]	
Region	Country	Region	Country	Region	Country	Region	Country
Notio Aigaio	GR	Basilicata	IT	Veneto	IT	País Vasco	ES
Dytiki Makedonia	GR	Sardegna	IT	Provincia Autonoma di Bolzano/Bozen	IT	Comunidad de Madrid	ES
Ionia Nisia	GR	Algarve	PT	Principado de Asturias	ES	Comunidad Foral de Navarra	ES
Illes Balears	ES	Marche	IT	Comunidad Valenciana	ES	Emilia-Romagna	IT
Canarias (ES)	ES	Região Autónoma da Madeira	PT	Castilla y León	ES	Cataluña	ES
Ciudad Autónoma de Melilla (ES)	ES	Campania	IT	Valle d'Aosta/Vallée d'Aoste	IT	Lisboa	PT
		Kentriki Makedonia	GR	Centro	PT	Lazio	IT
		Calabria	IT	Attiki	EL	Liguria	IT
		Kriti	GR	Norte	PT	Piemonte	IT
		Ipeiros	GR	Andalucía	ES	Provincia Autonoma di Trento	IT
		Molise	IT	Castilla-la Mancha	ES	Lombardia	IT
		Dytiki Ellada	GR	Galicia	ES	Toscana	IT
		Região Autónoma dos Açores	PT	Región de Murcia	ES	Friuli-Venezia Giulia	IT
		Extremadura	ES	Umbria	IT	Cantabria	ES
		Alentejo	PT	Abruzzo	IT	Aragón	ES
		Thessalia	GR			La Rioja	ES
		Peloponnisos	GR				
		Sicilia	IT				
		Puglia	IT				
		Anatoliki Makedonia, Thraki	GR				
		Voreio Aigaio	GR				
		Stereia Ellada	GR				
		Ciudad Autónoma de Ceuta	ES				