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Exploring Similarities/Dissimilarities In The Agricultural System Among Mediterranean European Union Regions

Rosa Maria Fanelli, PhD and MSc
Assistant Professor in Economics and management of firms and agri-food system Department of Economics Università degli Studi del Molise Via F. De Sanctis, snc 86100 Campobasso Italy
Tel. 0874.404401
**Corresponding Author: Rosa Maria Fanelli*

ABSTRACT:- An analysis of the main characteristics of the different agricultural systems in Mediterranean European Union regions is very important for the implementation (ex-ante) and the evaluation (ex-post) of the actions of the Common Agricultural Policy (CAP).
The purpose of this paper is to identify, with the application of a multivariate statistical analysis (Factor Analysis and Hierarchical Cluster Analysis), the "similarities" and the "dissimilarities" between 82 Mediterranean European regions. The analysis for this study was carried out by taking into account a specific set of 51 indicators: 11 environmental indicators and 40 socio-economic and structural indicators.
A more accurate classification of Mediterranean regions in "homogeneous" territorial agricultural systems is essential to improve the comparability of regions for the development programs of the CAP. Above all, it is important in a period when new agricultural policies (2014-2020) have decentralized more the responsibilities to the regions that, in agreement with local actors, must take into consideration the specific needs of each "homogenous" territory. For this purpose, new and different classifications of the Mediterranean territories can provide important indications for policy making and can increase the farmer's knowledge. However, the results clearly show that some groups of European regions such as *the extensive agricultural system and* the *medium livestock agricultural system*, which have a weaker agricultural structure than the average of the 82 European regions considered in this study, have more needs for the restructuring of their agricultural system than others (e.g. *the profitable agricultural system* and *the professional agricultural system*). Equity is an important factor to ensure that public support goes to the holding that need it. About 80% of support goes to 20% of farmers, who most of the time do not need it, as they are the biggest and wealthiest landowner.
However, the results confirm that policy design might not consider the Mediterranean agriculture as a whole, but it should take into account environmental and structural specificities of the holdings, as well as the different training level of farm managers.

***Key words*:** Agricultural Systems, Factor analysis, Hierarchical Cluster Analysis, Mediterranean European Regions, Regional Development Programs.

JEL Classification: C38, P25, R11, R12

I. INTRODUCTION

Individual European regions are very different in terms of environmental, economic, social and structural factors. These diversities determine the level of agricultural system development (Ciutacu, *et al*, 2015). However, agricultural systems are put under pressure to change as a result of a range of globally and locally driven variables (Van Ittersum *et al*., 2008). An important step made by the European Commission was the introduction in 2003 of new policies for the development of agricultural systems and a subsequent impact assessment (EC, 2005). In order for these policies to be effective and to improve integrated assessment, it is very important for the European Commission have more clear definitions of the peculiarities, which determine the differences between regional areas (NUTS 2) of all European Union countries (Harris, 2002; Parson, 1995).
Several authors (Bednarikova, 2015; Cairol *et al*., 2008; Huylenbroeck and Durand, 2003; Janssen *et al*., 2009; Morse *et al*., 2001; Potter, 2004; Qiu *et al*., 2007; Rigby *et al*., 2001; Scott and Storper, 2003) have researched

different aspects of agricultural development. Other authors (D'Amico *et al*., 2013; Hay, 2002; Rossing *et al*., 2007; Verburg *et al*., 2010; Fanelli, 2018) have highlighted that the specific traits of each region represent a common tool upon which to focus political instruments and to support the analysis of the impact of agricultural policies.

However, in the literature, there are several studies on territorial agricultural systems based on the multivariate method. These studies - which aim to synthesize relevant data, highlight change or define the status of a certain aspect - include different indicators at the national, regional, and local level (Andersen *et al*., 2007; Cannata *et al*., 1998; Deller *et al*., 2001; Dent *et al*., 1995; Fanelli, 2006, 2007; Fjellstad, 2001; Gallopin, 1997; Hazeu *et al*., 2009; Hossain *et al*., 2015; Madu; 2007; Manly, 2004; Metzger *et al*., 2005; Molden *et al*., 1998; Tabachnick and Fidell, 2005; Pierangeli *et al*., 2008).

In line with these approaches, the identification of a new and different classification of Mediterranean agricultural systems is the main objective of this study. It focuses on the analysis of agricultural features in 82 NUTS 2 regional areas. Multivariate statistical analysis is used to compare Mediterranean regions. In the first step, descriptive statistics (min, max, mean, standard deviation, skewness and kurtosis) was used to identify the "similarities" and "dissimilarities" between the agricultural systems of the Mediterranean regions. In the second step, a Factor Analysis (FA) methodology was used to identify the main factors that differ within agricultural systems in the Mediterranean regions, taking into account a specific set of 51 environmental (11) and socio-structural (40) indicators (Table 1). These indicators have been derived from FADN (Farm Accountancy Data Network), an important informative source for understanding the impact of the measures taken under the CAP on different types of agricultural holdings (EC, 2016). Following this, by applying Hierarchical Cluster Analysis (CLA) on the FA results, it is possible to classify the NUTS 2 regions into "homogenous" groups in order to provide some recommendations for the monitoring of the Common Agricultural Policy (CAP).

However, since 1990, the CAP has led to a new structure in agriculture reflecting the changing socio-economic, environmental and political circumstances affecting EU agriculture, and changes in the agricultural, food and forestry sectors as well as in rural areas. The general objectives of the CAP are broken down into specific objectives, some of which are common to Pillars I (direct payments and market measures) and II (rural development), whereas others are linked either to Pillar I or to Pillar II specifically. In pillar 1, direct payments have become subordinated to the respect of cross-compliance to environmental requirements and standards of good agricultural and environmental practices. In pillar 2, the rural development policy has put emphasis on the preservation of rural environment and land management.

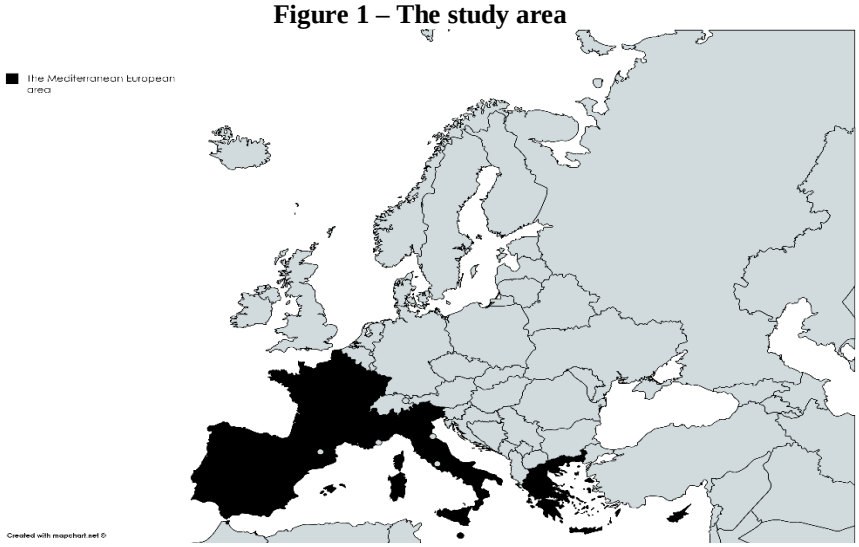
The reform of the CAP for 2014–2020 aims to promote greater competitiveness, efficient use of public goods, food security, preservation of the environment and specific action against climate change, social and territorial equilibrium, and a more inclusive rural development. In order to develop a competitive EU agriculture, there is a need for structural change. The key factors that can help farm businesses to respond to this need are investing in physical infrastructure that can enhance productivity and human capital, improving the skills and knowledge of employees and managers, stimulating innovation and the use of technology, and favoring genuine competition to stimulate enterprise. These elements request behavioral changes that could be stimulated through public policy. Many elements of the CAP reform proposals are going in that direction (D'Oultremont, 2011; Swinnen, 2000).

According to these objectives, this paper hopes to contribute to the debate concerning a more balanced Mediterranean agriculture, at territorial and structural levels. The paper is divided into four paragraphs. After the introduction, the second paragraph presents some characteristics of Mediterranean European regions. The third paragraph reports the methodological basis of the analysis, with a description of the data used and the multivariate method applied. The fourth paragraph shows the research results, and the last paragraph presents the conclusions based on the results and highlights some implications for the Common Agricultural Policy (CAP).

1. The study area

The biogeographical region of Mediterranean area includes the Mediterranean Sea and seven Member States of European Union, either partially (France, Portugal, Italy, Spain) or completely (Greece, Malta, Cyprus) Figure 1. France is the most populous country in the region, with 66.9 million people. Italy, which is harshly divided between the highly prosperous economic north and the very poor agricultural south, have about 60.6 million people, according to the 2017 Population Data Sheet. Spain has the next highest population with approximately 46.56 million people and the largest country in land area of Southern Europe. Greece and Portugal have 10.75 million and 10.32 million people, respectively. The lesser nations of Malta and Cyprus have substantially smaller populations 436.947 and 1.17 million people respectively.

Figure 1 – The study area



Agriculture in the economies of these countries continues to play a key role. However, in these countries, respectively, about 32% of farms are concentrated, 41% of the utilized agricultural area and 34% of the employed in the European Union's agricultural sector (Table 1).

Table 1 - The mainly characteristics of the agricultural sector in the Mediterranean Area

Countries	Holdings (n°)	UAA (ha)	Physical size (ha)	Employment
Greece	709500	4856780	6,85	3610700
Spain	965000	23300220	24,15	17866000
France	472210	27739430	58,74	26423700
Italy	1010330	12098890	11,98	22464800
Cyprus	35380	109330	3,09	358200
Malta	9360	10880	1,16	185900
Portugal	264420	3641590	13,77	4548700
Mediterranean Area	3466200	71757120	20,70	75458000
European Union	10841000	174613900	16,11	220845400
Medit. Area/EU	32.0	41.1		34.2

Source: my processing of information from the FADN database

Relatively to the agricultural land use: arable land represents 38% of the European one, the permanent grassland and meadow the 39% and the permanent crops the 85%. The last one mainly consist of olives, citrus fruits, grapes, wheat, figs, and water-storing plants and cacti that grow very well in the Mediterranean climate (De Blij, 2002). Southern Italy, Southern and North-western Spain and most of Greece and Portugal, especially the coastal lowlands, are all agriculturally based areas. This area comprising differenced agricultural systems - from highly intensive vegetable productions to extensive cereals farms.

Table 2 - The agricultural land use in the Mediterranean area

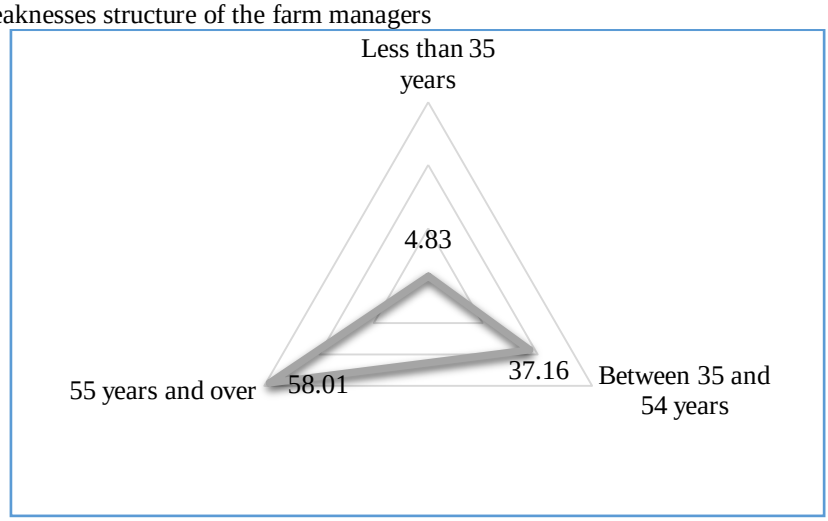
Countries	Arable land (ha)	Permanent grassland and meadow (ha)	Permanent crops (ha)
Greece	1816800	750660	929080
Spain	11294620	8377390	4042360
France	18466200	8418880	1024470
Italy	6728360	3434070	2032310
Cyprus	80120	2140	27320
Malta	8570	0	1260

Portugal	1100860	1784600	708760
Mediterranean Area	39495530	22767740	8765560
European Union	104225290	57945450	10302250
Medit. Area/EU	37.9	39.3	85.1

Source: my processing of information from the FADN database

Mediterranean regions are characterised by similar biophysical, climatic and structural conditions and in particular by a relatively high proportion of poor soils and severe structural weaknesses, which imply the persistence of a relatively high proportion of economically marginal, or semi-subsistence, farmers. However, the 58% of the farm managers have 55 years and over, the 37% an age between 35 and 54 years and only the 5% less than 35 years (Graph 1).

Graph 1 - The weaknesses structure of the farm managers



Source: my processing of information from the FADN database

The region of Southern Europe has been very slow to develop economically. The areas around the major cities are usually highly industrialized, but the majority of remaining land in all of these countries in still agricultural. The two major exceptions to this are the areas of Northern Italy, near Milan, and Northeast Spain, in the Catalan region that surrounds Barcelona. Italy has the most industrialized economy in Southern Europe. The unfavourable natural and structural conditions are reflected in the high proportion of land with natural handicaps (e.g. rural regions). 45% of the regions belonging to these seven countries are intermediate regions, 40% are rural regions and only 15% are urban regions.

Table 3 - The Mediterranean Regions' classification (extension in Km^2)

Country	Rural regions	Intermediate regions	Urban regions	Total
Greece	87198	37355	7496	132049
Spain	85561	302381	118002	505944
France	340825	241884	50103	632812
Italy	72545	72545	65202	210292
Cyprus	0	0	0	0
Malta	0	0	315	315
Portugal	72828	72828	5858	151514
Mediterranean Area	658957	726993	246976	1632926
%	40.35	44.52	15.12	100.00
European Union	1970079	1980789	512280	4463148
Medit. Area/EU	33.45	36.70	48.21	36.59

Source: my processing of information from the FADN database

II. DATA SOURCE AND METHOD

Multivariate analysis was carried out using the Stata 12 statistical programmer. Using this software, a comparative analysis of the environmental and socio-economic and structural characteristics of the 82 Mediterranean regions belongs to seven countries of EU (Cyprus, France, Greece, Italy Malta, Portugal and Spain) with different agricultural systems, was carried out. The set of 12 environmental and socio-economic and structural indicators considered are shown in Table 4.

Table 4 - Regional indicators considered Environmental indicators

Indicators	Groups of indicators	Unit of measure	Year
Land cover			
E1	Agricultural area	% of total area	2012
E2	Natural grassland	% of total area	2012
E3	Forest area	% of total area	2012
E4	Transitional woodland-shrub	% of total area	2012
E5	Natural area	% of total area	2012
E6	Artificial area	% of total area	2012
E7	Other area (includes sea and inland water)	% of total area	2012
UAA under Natura 2000			
E8	Agricultural area	% of UAA	2014
E9	Agricultural area (including natural grassland)	% of UAA	2014
Forest area under Natura 2000			
E10	Forest area	% of forest area	2014
E11	Forest area (including transitional woodland-shrub)	% of forest area	2014

Socio-economic and structural indicators of agricultural sector

Indicators	Groups of indicators	Unit of measure	Year
Employment by economic activity			
SEC1	Agriculture	% of total	2015
SEC2	Food industry	% of total	2015
SEC3	Tourism	% of total	2015
Agricultural holdings			
SEC4	Holdings with livestock	% of total	2013
SEC5	Physical size	ha UAA/holding	2013
SEC6	Economic size	EUR of SO/holding	2013
SEC7	Labour size	Persons/holding	2013
SEC8	Labour size	AWU/holding	2013
SEC9	Less than 2.000 EUR	% of total	2010
SEC10	From 2.000 to 3.999 EUR	% of total	2010
SEC11	From 4.000 to 7.999 EUR	% of total	2010
SEC12	From 8.000 to 14.999 EUR	% of total	2010
SEC13	From 15.000 to 24.999 EUR	% of total	2010
SEC14	From 25.000 to 49.999 EUR	% of total	2010
SEC15	From 50.000 to 99.999 EUR	% of total	2010
SEC16	From 100.000 to 249.999 EUR	% of total	2010
SEC17	From 250.000 to 499.999 EUR	% of total	2010
SEC18	500.000 EUR or over	% of total	2010
Agricultural area			
SEC19	Agricultural area	Total UAA (Utilised agricultural area in farms)	2013
SEC20	Arable land	% of total UAA	2013
SEC21	Permanent grassland and meadow	% of total UAA	2013
SEC22	Permanent crops	% of total UAA	2013

Area under organic farming			
SEC23	Total area under organic farming	% of total UAA	2015
SEC24	Fully converted to organic farming	% of total area under organic farming	2015
SEC25	Under conversion to organic farming	% of total area under organic farming	2015
Irrigated land			
SEC26	Irrigated land	% of total UAA	2013
Livestock units			
SEC27	Livestock units	LSU of the holdings with livestock	2013
Farm labour force			
SEC28	Males	% of total	2013
SEC29	Females	% of total	2013
SEC30	Sole holders working on the farm	% of regular labour force	2013
SEC31	Members of sole holders' family working on the farm	% of regular labour force	2013
SEC32	Family labour force (sole holders + family members)	% of regular labour force	2013
SEC33	Non-family labour force	% of regular labour force	2013
Age structure of farm managers			
SEC34	Less than 35 years	% of total managers	2013
SEC35	Between 35 and 54 years	% of total managers	2013
SEC36	55 years and over	% of total managers	2013
SEC37	Less than 35 years / 55 years and over	Number of young managers by 100 elderly managers	2013
Agricultural training of farm managers			
SEC38	Practical experience only	% of total	2013
SEC39	Basic training	% of total	2013
SEC40	Full agricultural training	% of total	2013

Source: my processing of information from the FADN database

Data processing was performed in two successive phases: a Factor analysis and a Hieratical Cluster Analysis. The latter phase made use of Ward's method of measuring squared Euclidean distance. This method is distinct from all others since it uses an analysis of variance approach to evaluate the distances between clusters. In short, this method attempts to minimize the Sum of Squares (SS) of any two (hypothetical) clusters that can be formed at each step. We can refer to WARD (1963) for details concerning this method. In general, this method is regarded as very efficient; however, it tends to create clusters of a small size. Ward (1963) proposed a clustering procedure seeking to form the partitions Pn, Pn – 1, ..., P1 in a manner that minimizes the loss associated with each grouping, and to quantify that loss in a form that is readily interpretable. At each step in the analysis, the union of every possible cluster pair is considered and the two clusters whose fusion results in the minimum increase in the "information loss" are combined. The information loss is defined by Ward in terms of an error sum-of-squares criterion. As a result of this analysis, regions were aggregated with a hierarchical method and complete binding.

III. RESULTS AND DISCUSSION

4.1 The descriptive statistics

With the first analysis, the measure of the similarity/dissimilarity was conducted on the basis of the results of the descriptive statistics. However, the descriptive statistics shown in Table 5 reflect some huge asymmetries between the Mediterranean regions. The most remarkable ones are number of holdings with livestock units (a 9370:9374270 ratios between the lowest and the highest presence) and total of utilised agricultural area in farms (5430:1.33e+07). As for economic dimensions, the differences in holdings with economic size of 500.000 Eur or over (0:15), or in holding with economic size from 250.000 to 499.999 EUR (0:26) are also significant. In area under organic farming, area under conversion shows a dispersion of 0:68, irrigated area a dispersion of 0:74. This is also the ratio found by looking at the managers with full agricultural training (0:35). Finally, it should be noted that some of the indicators show excess kurtosis or skewness and, therefore, do not follow normal distributions, a fact that was taken into account when choosing the techniques to be used in the following paragraphs.

Table 5 - Descriptive statistics of the Mediterranean Regions Indicators

Code	Description	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis	Year
e1	Agricultural area	8	86	46.99	17.93	0.9652	0.7606	2012
e2	Natural grassland	0	21	4.85	5.07	0.0000	0.0231	2012
e3	Forest area	1	62	24.45	12.17	0.0614	0.3526	2012
e4	Transitional woodland-shrub	0	23	5.19	4.8	0.0000	0.0026	2012
e5	Natural area	0	58	12.01	11.77	0.0001	0.0225	2012
e6	Artificial area	1	29	5.56	5.19	0.0000	0.0000	2012
e7	Other area (includes sea and inland water)	0	4	1.12	0.88	0.0067	0.2075	2012
e8	Agricultural area	1	33	9.59	6.43	0.0001	0.0409	2014
e9	Agricultural area (including natural grassland)	1	34	13.00	7.52	0.0017	0.3061	2014
e10	Forest area	5	85	32.99	18.66	0.9008	0.0001	2014
e11	Forest area (including transitional woodland-shrub)	6	83	32.06	16.77	0.9519	0.0444	2014
sec1	Agriculture	0	31	6.44	6.49	0.8060	0.1828	2015
sec2	Food industry	1	7	2.88	1.42	0.0000	0.0000	2015
sec3	Tourism	2	21	7.09	4.04	0.0001	0.0014	2015
sec4	Holdings with livestock	3	396	63.47	47.00	0.0148	0.6124	2013
sec5	Physical size	0	120	29.09	28.19	0.0000	0.3489	2013
sec6	Economic size	3303	303765	61110.91	60775.79	0.0000	0.0027	2013
sec7	Labour size	2	3	2.07	0.24	0.0000	0.0000	2013
sec8	Labour size	0	2	1.22	0.47	0.0000	0.0000	2013
sec9	Less than 2.000 EUR	0	67	19.51	14.90	0.6083	0.0024	2010
sec10	From 2.000 to 3.999 EUR	1	26	12.96	6.78	0.0030	0.5869	2010
sec11	From 4.000 to 7.999 EUR	3	25	13.50	5.54	0.0000	0.0603	2010
sec12	From 8.000 to 14.999 EUR	2	19	11.08	4.09	0.0000	0.0061	2010
sec13	From 15.000 to 24.999 EUR	1	24	7.61	3.45	0.0000	0.0000	2010
sec14	From 25.000 to 49.999 EUR	1	27	9.55	4.60	0.0000	0.0000	2010
sec15	From 50.000 to 99.999 EUR	0	27	9.09	6.25	0.0000	0.0011	2010
sec16	From 100.000 to 249.999 EUR	0	41	10.16	11.20	0.0000	0.0000	2010
sec17	From 250.000 to 499.999 EUR	0	26	4.13	6.11	0.4491	0.0215	2010
sec18	500.000 EUR or over	0	15	1.60	2.44	0.4122	0.0267	2010
sec19	Agricultural area	5430	1.33e+07	1193168	1715031	0.5377	0.1917	2013
sec20	Arable land	0	97	46.94	25.25	0.0714	0.0563	2013
sec21	Permanent grassland and meadow	2	105	38.05	24.42	0.0021	0.3463	2013
sec22	Permanent crops	0	65	15.07	15.52	0.0021	0.3496	2013
sec23	Total area under organic farming	0	18	4.11	4.01	0.0013	0.1342	2015
sec24	Fully converted to organic farming	32	100	91.07	9.77	0.8672	0.1954	2015
sec25	Under conversion to organic farming	0	68	8.88	9.79	0.4677	0.0650	2015
sec26	Irrigated land	0	74	14.59	15.07	0.0000	0.0021	2013
sec27	Livestock units	9370	6602050	808452.9	1154408	0.1164	0.0000	2013
sec28	Males	52	83	65.63	7.23	0.0017	0.0127	2013
sec29	Females	17	48	34.48	7.26	0.0001	0.5145	2013
sec30	Sole holders working on the farm	25	65	46.16	9.07	0.5843	0.2107	2013
sec31	Members of sole holders'	6	64	33.51	13.42	0.0750	0.0684	2013

	family working on the farm							
sec32	Family labour force (sole holders + family members)	31	100	79.65	19.00	0.0013	0.4461	2013
sec33	Non-family labour force	1	69	20.45	18.98	0.0013	0.4491	2013
sec34	Less than 35 years	2	15	5.52	2.64	0.0027	0.1267	2013
sec35	Between 35 and 54 years	14	59	39.21	9.73	0.0878	0.0806	2013
sec36	55 years and over	32	84	55.47	11.95	0.0017	0.0073	2013
sec37	Less than 35 years / 55 years and over	2	47	11.46	8.53	0.0000	0.0019	2013
sec38	Practical experience only	0	99	56.67	36.07	0.1205	0.0000	2013
sec39	Basic training	1	96	35.09	34.02	0.0020	0.0037	2013
sec40	Full agricultural training	0	35	8.34	10.17	0.0000	0.4127	2013

Source: my processing of information from FADN database

4.2 The Factor Analysis (FA)

The first step in the FA, the decision on the number of factors to retain, was based on the eigenvalue criterion (Kaiser, 1959). Therefore, the first eleven factors, with eigenvalues greater than 1, were retained (Table 6). The Ludlow (1999) criterion points to the same direction since there is a clear variance diminution after the fifth factor. Moreover, this 11-factor solution explains about 87 percent of the total variance of the original indicators, a good match according to Hair et al. (1998). The 11-factor structure also gave the best interpretative solution when compared with three, four and six varimax rotated factor structures. This is a relevant criterion since "in practice the researcher is interested in the interpretability and operational significance of the factor solutions" (Lattin et al., 2003).

Table 6 - Total variance and percentage of individual factors

Factor	Eingevalue	% Variance	Cumulative % variance
Factor1	17.47	35.94	35.94
Factor2	5.28	10.85	46.80
Factor3	4.19	8.63	55.42
Factor4	3.13	6.45	61.87
Factor5	2.61	5.37	67.24
Factor6	2.19	4.50	71.75
Factor7	1.94	3.98	75.73
Factor8	1.52	3.13	78.86
Factor9	1.48	3.05	81.91
Factor10	1.29	2.66	84.57
Factor11	1.01	2.08	86.65
Factor12	0.80	1.64	88.29
Factor13	0.75	1.54	89.83
Factor14	0.66	1.35	91.18
Factor15	0.62	1.27	92.45
Factor16	0.58	1.20	93.64
Factor17	0.53	1.09	94.74
Factor18	0.42	0.86	95.6
Factor19	0.34	0.70	96.3
Factor20	0.31	0.63	96.93
Factor21	0.28	0.58	97.5
Factor22	0.23	0.47	97.97
Factor23	0.19	0.4	98.37
Factor24	0.18	0.36	98.73
Factor25	0.15	0.31	99.04
Factor26	0.14	0.30	99.34
Factor27	0.09	0.19	99.53
Factor28	0.09	0.18	99.7

Factor29	0.08	0.17	99.87
Factor30	0.07	0.14	100,00
Factor31	0.05	0.11	100,00
Factor32	0.04	0.07	100,00
Factor33	0.02	0.04	100,00
Factor34	0.02	0.03	100,00
Factor35	0.01	0.01	100,00
Factor36	0,00	0,00	100,00
Factor37	0,00	0,00	100,00

Source: my processing of information from the FADN database

The derived rotated 11-factor structure is shown in Table 7, with the omission of factor loadings that are smaller in absolute value than 0.45 (Fanelli and Di Nocera, 2018).

Concerning the interpretation of the factors, Table 4 shows that the first three factors are essentially related to five categories of indicators - land cover, employment by economic activity, agricultural holdings, agricultural area and farm labour force.

Factor 1 (35.9% of the explained variance) identifies the *structure of agricultural holdings*. As fact this factor is positively related to the high presence of holdings with only family labour force (+0.93) and members of sole holders' family (+0.84), the low economic size from 2.000 to 3.999 Eur (+0.85), the high percentage of farm managers with 55 years and over (+0.81). These farms are mainly operating in the permanent crops area (+0.59) and in the tourism sector (+0.55) with mainly female labour force (+0.57). Furthermore, age structure and agricultural training of farm manager's indicators help to better characterize the factor and to understand the relationship between the agricultural system and the social and economic contest in which is acts. However, the negative correlations with the percentage of non-family labour force (-0.93), the farm managers with full agricultural training (-0.91), the number of young managers (-0.80), the medium and high economic size of holdings (from 50.000 to 500.000 eur or over), and with the percentage of arable land (-0.49) on the total of the utilised agricultural area in farms help to localize this agricultural system in some more developed Mediterranean regions. That means that from positive to negative value of the first factor, we pass from *Family-Run Agricultural System*, where the agricultural holdings are relatively more relevant in the permanent crops, but weakest in terms of economic size, to *Professional Agricultural System*, characterized by a higher rate of medium and large economic holdings managed by young farm managers. On one hand, regions with high positive score on this factor belongs mainly to Greece (Anatoliki Makedonia, Thraki, Kriti, Iperios, Thessalia) and to Portugal (Algarve, Norte, Região Autónoma dos Açores). On the other hand, regions with high negative score on the same factor belongs mainly to France (Bretagne, Picardie, Pays de la Loire, Nord Pas de Calais, Bourgogne, Champagne Ardenne, Centre)**.**

Factor 2 (11% of the explained variance), *Agricultural System with a basic training of the farm managers*, expresses high percentage of farm managers with basic training, and consequently low percentage of farm managers with practical experience only. Therefore, regions with a high score on this factor (Valle d'Aosta, Piemonte, Marche, Provincia Autonoma di Trento, Toscana, Abruzzo, Umbria) show a positive correlation with the presence of holdings with livestock on the total of holdings (+0.65) and a negative correlation with a percentage of agricultural area under Natura 2000 (-0.47). However, the holdings that belong to this group have a medium economic size (from 8.000 to 24.999 Eur).

Factor 3 (8.6% of the total variance), *Extensive Agricultural System***,** associated with high number of holdings with medium and large economic size (from 15.000 to 99.999 EUR), this factor is also related positively (+0.61) to the percentage of permanent grassland and meadow. The regions that show a value of this indicator greater than or equal to 70 percent belongs mainly to Greece (Ionia Nisia, Sterea Ellada, Peloponnisos) to Spain (Principado de Asturias, Cantabria) and to Italy (Provincia Autonoma di Bolzano, Piemonte).

Factor 4, *Forest System Area Under Natura 2000***,** represents about 6.5% of total variance. Here, positive value of the factor is related to areas where forest represents a significant share of land cover (Canairas, Puglia, Comunidad de Madrid, Andalusia, Comunidad Valenciana, Kriti).

Factor 5, *Agricultural system at labour force intensity*, this factor explained 5.8% of the total variance and is influenced by the greater dimensions of holdings in terms of persons. Only four regions (Canarias, Bozen, Malta and Centro) show a dimension of labour size equal to 3 persons for holding.

Factor 6 explained 4.5% of the total variance and represents the *Organic Agricultural System*. Regions with high score on this factor (Norte, Cantabria, Lombardia, Emilia Romagna, Marche, Algarve) show a fully conversion (100%) to organic farming of the total area under organic farming.

Factor 7, *Agricultural area system***.** This factor explained about 4% of the total variance and is positively correlated to the total utilized agricultural area in farms. Regions with high scores on this factor are Região

Autónoma da Madeira (PT), Castilla y Lèon (ES), Castilla la Mancha (ES), Midi Pyrénées (FR), Calabria (IT), Emilia Romagna (IT), Lombardia (IT), Lisboa (PT), Malta.

Factor 8, *Food industry system*, represents 3% of total variance. Here, positive value of the factor (+0.58) is related to regions (Bretagne, La Rioja, Ipeiros, Sterea Ellada) the percentage of employment in the food industry.

Factor 10, *Agricultural system Under Natura 2000*. This factor shows a positive correlation with the highest share of agricultural land (including natural grasslands) under the Natura 2000 scheme (regions of Greece, Spain and Portugal).

Table 7 - Matrix of rotated factors

Variable		Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor 10	Communalities
e1		-0.49		-0.49		-0.52					-1.67
e2		0.48									1.30
e3											0.14
e4		0.51									1.13
e5		0.49									1.37
e6											0.00
e7											0.24
e8			-0.47								0.04
e9		0.50								0.49	1.03
e10		0.50			0.59						0.67
e11		0.50			0.61						0.70
sec1		0.47									0.63
sec2									0.58		-0.44
sec3		0.55									1.32
sec4			0.65								0.48
sec5											-1.44
sec6											-0.19
sec7						0.49					1.72
sec8		-0.72									-0.15
sec9		0.69	-0.48								-0.14
sec10		0.85									0.49
sec11		0.80									0.74
sec12		0.58	0.47								1.24
sec13			0.48	0.67							1.62
sec14				0.77							0.72
sec15		-0.69		0.49							-0.46
sec16		-0.97									-1.10
sec17		-0.88									-0.67
sec18		-0.68									0.33
sec19								0.48			0.51
sec20		-0.55									-0.8
sec21				0.61							0.51
sec22		0.59									0.43
sec23											0.62
sec24							0.72				1.23
sec25							-0.72				-1.22
sec26											0.73
sec27									0.48		1.00
sec28		-0.57									-1.19
sec29		0.57									1.21
sec30		0.70									0.27
sec31		0.84									1.45
sec32		0.93									1.15

sec33		-0.93									-1.16
sec34		-0.75									-0.41
sec35		-0.79									-0.26
sec36		0.81									0.33
sec37		-0.80									-0.61
sec38			-0.86								-0.73
sec39			0.91								1.07
sec40		-0.91	-0.01								-0.98

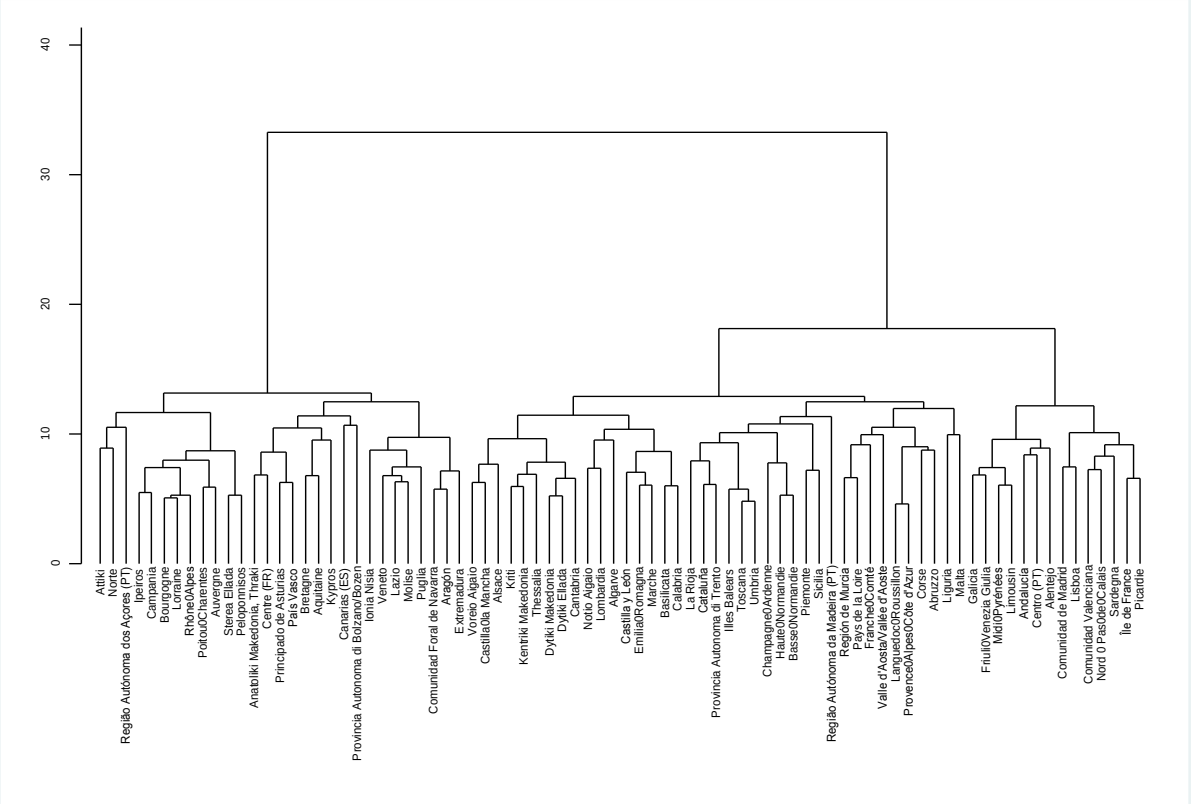
Source: my processing of information from the FADN database

4.3 The Hieratical Cluster Analysis (HCA)

After FA, the Hieratical Cluster Analysis was conducted to calculate a score per factor with the aim of aggregating the 82 Mediterranean European regions into "homogeneity" clusters.

The objective of this step was to analyses the agglomeration schedules and dendrograms in order to establish the number of clusters to choose. A dendogram is a two-dimension diagram that illustrates the fusions made at each successive stage of the process. The observations (in this case, the regions) are listed on the horizontal axis and the vertical axis represents the successive steps. The best interpretative cluster solution can be illustrated by the dendrogram shown in figure 1, corresponding to Ward's method and squared Euclidean distances (other authors emphasize the performance of this method (Everitt, 1993; Everitt and Dunn, 2001; Punj and Stewart, 1983; Millingan, 1980).

Figure 2 - Dendrogram from Ward's method



Cluster 1: The permanent crops system

The first group includes 12 regions of Southern Europe and is mainly characterized by factor 1 and factor 8 (with positive sign) Figure 2. Therefore, the agricultural area of this regions is mainly occupied by permanent crops (about 20%). Regions of this group belong to four Mediterranean Union countries (France, Greece, Portugal and Italy), but the cluster mainly reflects the France and the Greece agriculture, representing 42% and 33% of the regions included. Besides the permanent crops, the land is interesting by natural development of forest formations (the share of transitional woodland-shred 6.5% is higher than the Mediterranean European regions average). The regions with the highest incidence are Norte (PT), Iperios, Sterea

Illade and Peloponninos belonging to Greece. The share of 17% of the irrigated utilised agricultural area in farms is higher than others five groups and then the Mediterranean regions average. The agriculture of this group is characterized by a large percentage (about 13%) of area under conversion to organic farming. In this group can also observed the employment function of the food industry is slightly more relevant.

Table 8 - Characteristics of cluster 1

Mean	e4	sec2	sec22	sec25	sec26
Mean Cluster 1	**6.50**	**3.33**	**19.67**	**12.08**	**17.00**
Mean Cluster 2	3.24	2.88	13.76	7.29	13.12
Mean Cluster 3	6.12	3.06	19.00	5.76	16.82
Mean Cluster 4	3.25	2.83	9.50	10.58	11.17
Mean Cluster 5	6.30	2.6	14.10	6.50	16.90
Mean Cluster 6	5.21	2.5	13.43	12.07	12.86
Mean 82 regions	5.07	2.87	15.06	8.79	14.59

Cluster 2: The extensive agricultural system

The second group concentrates around 21% of the Mediterranean European regions considered and is mainly characterized by factor 3 (with positive sign). Therefore, the agriculture of this group is more extensive, with a high percentage (about 44%) of permanent grassland and meadow. Region of this group mostly belong to Spain (35%) and Italy (29%). Three regions (Centre, Bretagne and Aquitaine) belong to France, 2 (Anatoliki Makedonia Thraki and Ionia Nisia) to Greece and Kypros. Besides the extensive agriculture, this agricultural system is characterized by the presence of large forest area (including transitional woodland-shrub) under Natura 2000 (the share of about 39% is higher than the Mediterranean European regions average).

Table 9 - Characteristics of cluster 2

Mean	e11	sec21
Mean Cluster 1	24.67	37.83
Mean Cluster 2	**38.59**	**43.76**
Mean Cluster 3	37.29	37.47
Mean Cluster 4	29.67	34.17
Mean Cluster 5	29.4	40.8
Mean Cluster 6	28.07	33.36
Mean 82 regions	32.12	37.98

Cluster 3: The medium livestock agricultural system

Also in the third group, as in the second group, 21% of the Mediterranean regions considered are concentrated. These regions belong for 41% to Greece, 29% to Italy, about 18% to Spain and the remaining 12% to France (Alsace) and Portugal (Algarve). These regions on average have the highest incidence of the forest area under Natura 2000 (more than 40%), the utilized agricultural area under Natura 2000 (more than 12%) and the other area (includes sea and inland water) on the land cover (about 1.5%). The average workforce, compared to other groups, are mainly in the agricultural sector (about 10%) and in the tourism sector (more than 9%). In this group of regions, on average (about 75%), the largest number of holdings with livestock is concentrated and with lower physical size and economic size Eur values (respectively slightly more than 15 ha, more than 65 thousand euro for holdings) compared to the other 5 groups obtained. Moreover, these regions show on average a higher fully converted to organic farming (more than 94%) compared to the other 5 homogeneous areas obtained and a higher presence of family workers and females labor force (respectively 91 and 38%) in the farms with the lowest on average presence of farm managers (about 3%) with a full agricultural training.

Table 10 - Characteristics of cluster 3

Region	e2	e7	e8	e10	sec1	sec3	sec4	sec9	sec10	sec11	sec12	sec24	sec27	sec29	sec30	sec31	sec32
Mean Cluster 1	4.25	1.00	9.25	24.67	9.42	5.67	57.83	19.67	14.25	14.17	10.33	87.75	209611.67	35.5	47.17	32.42	79.58
Mean Cluster 2	4.59	1.06	9.76	39.82	6.06	8.12	61.12	19.88	13.24	13.76	11.88	92.71	194197.65	35.59	46.35	34.71	80.71
Mean Cluster 3	**7.24**	**1.47**	**12.35**	**40.06**	**9.71**	**9.12**	**75.88**	**24.35**	**16.94**	**15.76**	**12.24**	**94.12**	**291896.47**	**37.82**	**50.35**	**40.00**	**90.59**
Mean Cluster 4	3.75	1.00	5.33	30.33	4.17	7.08	69.17	21.33	11.50	12.67	10.33	89.42	178732.5	33.17	46.00	33.42	79.50
Mean Cluster 5	6.00	1.00	9.60	29.10	3.80	5.70	65.00	8.70	8.50	11.80	10.80	93.6	159758	30.50	43.7	25.90	69.30
Mean Cluster 6	2.86	1.07	9.93	28.29	4.21	5.57	50.14	19.21	11.14	11.79	10.21	87.86	282844.29	32.14	41.86	30.64	72.64
Mean 82 regions	4.85	1.10	9.54	33.03	6.39	7.07	63.40	19.49	12.91	13.46	11.05	91.17	808452.93	34.48	46.11	33.45	79.57

Cluster 4: Agricultural system run by old farm managers

The fourth cluster includes 12 of the 82 Mediterranean European regions considered. Five regions (that represent about the 42% on the total of this group) belong to Italy (Piemonte, Provincia Autonoma di Trento, Sicilia, Toscana and Umbria). Other European regions from Spain (La Rioja, Cataluña and Illes Balears), France (Champagne Ardenne, Haute Normandie and Basse Normandie) and Portugal (Região Autónoma da Madeira) are present in this group. Overall, the forest area in these countries occupies a high average percentage of land cover (29%) compared to the other 5 groups identified. On average 56% of the agricultural area is arable land value, on average the highest percentage of farm managers with 55 years and over (59%) and with basic training.

Table 11 - Characteristics of cluster 4

Region	e3	sec20	sec36	sec39
Mean Cluster 1	23.00	42.33	53.33	22.00
Mean Cluster 2	24.59	44.65	55.76	38.53
Mean Cluster 3	21.24	41.71	59.06	32.00
Mean Cluster 4	**29.33**	**56.42**	**59.17**	**49.92**
Mean Cluster 5	27.30	44.90	46.5	48.70
Mean Cluster 6	23.21	53.36	55.86	23.43
Mean 82 regions	24.46	46.90	55.38	35.06

Cluster 5: The profitable agricultural system

The fifth group is the smallest one and includes ten Mediterranean regions. This is the agricultural system of France (Corse, Franche Comté, Languedoc Roussillon, Pays de la Loire, Provence Alpes Côte d'Azur) and of Italy (Valle d'Aosta, Liguria, Abruzzo). Others two regions are Región de Murcia (ES) and Malta. The holdings that operate in this regions have the greatest average value of economic size (112,570 Eur of SO/holding) and of labour size (2.20 persons/holding) compared to the average value other groups and to the average value of the 82 Mediterranean regions. However, this group highlight the average value of the utilised agricultural area in farms (more than four million hectares) compared to the other five group. This agricultural system is based on youngest structure of farm managers (more than 46% have an average age between 35 and 54 years and more than 7% less than 35 years) and on male labour force (the share of holdings with male labour force about 70% is higher than Mediterranean European regions). Moreover, the farm labour force shows the highest average percentage of non-family labour force (about 31%).

Table 12 - Characteristics of cluster 5

Region	e5	e9	sec7	sec8	sec6	sec14	sec15	sec16	sec17
Mean Cluster 1	11.67	11.75	2.00	1.33	53983.08	8.58	10.17	11.42	4.00
Mean Cluster 2	13.88	12.35	2.12	1.18	53779.65	9.88	8.35	8.59	3.29
Mean Cluster 3	13.59	16.00	2.00	1.06	29266.82	9.24	6.41	4.29	1.47
Mean Cluster 4	8.92	9.83	2.00	1.00	65924.00	9.33	7.75	11.50	4.58
Mean Cluster 5	**14.8**	**16.70**	**2.20**	**1.60**	**112572.10**	**12.00**	**13.40**	**15.5**	**7.10**
Mean Cluster 6	8.79	11.29	2.07	1.29	73907.07	8.79	10.36	13.14	6.00
Mean 82 regions	11.99	13.03	1.95	1.04	61110.91	9.54	9.01	10.14	4.08
Region	sec18	sec19	sec23	sec28	sec33	sec34	sec35	sec37	
Mean Cluster 1	0.83	148768.33	3.42	64.58	20.42	6.42	40.33	14.58	
Mean Cluster 2	1.53	199300.59	4.53	64.53	19.41	4.88	39.65	9.53	
Mean Cluster 3	0.47	267845.88	2.88	62.35	9.53	4.82	36.41	8.41	
Mean Cluster 4	1.92	237736.67	4.50	66.83	20.50	5.33	35.58	10.25	
Mean Cluster 5	**3.6**	**424184.00**	**6.90**	**69.70**	**30.80**	**7.30**	**46.50**	**17.70**	
Mean Cluster 6	2.00	298022.86	3.36	67.93	27.57	5.29	39.00	11.43	
Mean 82 regions	1.59	1193168.17	4.07	65.52	20.43	5.44	39.17	11.46	

Cluster 6: The professional agricultural system

The sixth and the last group includes 14 regions, 17% of the Mediterranean regions considered and is characterized mainly by factor 1 (with a negative sign).

Regions of this group belong to four Mediterranean European countries (36% France, 29% Spain, 21% Portugal and 14% Italy). The high presence of French regions represents, in the main part, an agricultural system based on large presence of agricultural area (the share of 51% is highest than Mediterranean European regions) and on holdings with a high physical size (average value for holding of 41 ha of utilized agricultural area). The Mediterranean regions of this group are characterized by a highest average percentage of the farm managers with full agricultural training (about 12%).

Table 13 - Characteristics of cluster 6

Region	e1	sec5	sec40
Mean Cluster 1	48.17	35.17	9.50
Mean Cluster 2	48.12	25.29	8.53
Mean Cluster 3	46.12	15.35	2.76
Mean Cluster 4	48.25	28.75	8.00
Mean Cluster 5	38.00	35.4	11.60
Mean Cluster 6	**51.00**	**40.93**	**11.86**
Mean 82 regions	47.01	29.05	8.31

IV. CONCLUSIONS

The objective of this paper has been to offer a new and different interpretation of the character of the territories of the Mediterranean Union regions and its agricultural systems. The methodology was based on multivariate analysis, which led to the identification of basic statistical information. By using a rectangular matrix measuring 82 by 51, where the Mediterranean regions of the EU (82) were represented in the rows and the variable statistics (51) indicative of the six "homogenous" agricultural areas were represented in the columns. Initially, with the descriptive statistics, the differences and the similarities of each European region were measured with respect to each variable. This analysis highlighted the existence of large disparities between the 82 Mediterranean European regions considered in relation to holdings with large economic size (500,000 Eur and over and from 250,000 to 499,999 Eur), to utilised agricultural area in farms, to livestock units, to the farms with full agricultural training. In contrast, there were some similarities regarding the percentage of holdings with male's farm labour force, the intensity of the labour force (persons/holdings), the percentage of land used for organic farming. Following this, an analysis of the territorial similarities of the Mediterranean European regions was carried out by examining the principle factors brought to light by the statistical analysis. This allowed the identification of the eleven most important factors and agricultural phenomena's. The first factor, which accounted for 36% of total variance, led to the pinpointing of two different phenomena: the family-run agricultural system and the professional agricultural system. The former system is characteristic of Mediterranean regions in the East of Europe which are significant in terms of the number of holdings but less so in terms of earnings and the professional training of agricultural contactors. The latter system, however, is characteristic of regions in the North of Europe. Here the professional skills of the agricultural contractors allow for the cultivation of crops with a greater contributory value (such as organic products). Finally, the cluster analysis led to the regrouping of the 82 European regions in the following territorial agricultural systems: "the permanent crops system"; "the extensive agricultural system"; "the medium livestock agricultural system", "the agricultural system run by old farm managers", "the profitable agricultural system" and "the professional agricultural system".

The lower/higher physical and economic dimension, family and professional agricultural activity, the intensity of the labour (Persons/holding, AWU/holding) and some farmer managers characteristics represent relevant differentiation features among the clusters that can be basically related to the average size, in terms of economic and labour size, as well as to farmer mangers age structure and training level. The physical size, the economic size and the typologies of agricultural activity (permanent crops, organic farming), in one hand, have a significant effect on holding profitability in terms of income: *Natura 2000 system* (cluster 3), *profitable agricultural system* (cluster 4) and the *professional agricultural system* (cluster 6) are characterized by larger farms. In other hand, in *the permanent crops system* (cluster 1) the high presence of small farms is related to the lower level of income per holding. In other context (*the extensive agricultural system*) the lower farm profitability is related to presence of the poor agricultural structure (cluster 2). At the end, the *agricultural system run by old farm managers* presents many aspects of self-sufficient economy.

These results confirm that policy design does not have to consider European agriculture as a whole, but it should take into account the productive and structural particularities, as well as the different socio-economic contexts in which agricultural systems operate. This will allow policy-makers and those involved in local government to have enhanced and more effective tools, as required by the new CAP for the 2014-2020 operational period, for a more exact and better monitoring of the policies for agricultural development.

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