

THESIS OF DOCTORAL (Ph.D.) DISSERTATION

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COMPARISON OF AGRICULTURAL ENTREPRENEURIAL
SKILLS LEVELS IN THE COUNTRIES OF THE EUROPEAN
UNION

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1. ANTECEDENTS OF THE RESEARCH, OBJECTIVES

Several publications have dealt with the performance of education and the impact of education on the economic growth (*Hanushek - Kimko (2000)*, *Romer (1990)*, *Benhabib - Spiegel (1994)*) on the basis of quantitative and qualitative factors (*Hanushek, Wössmann (2007)*, *Barro-Lee (2000)*, *Krueger - Kumar (2003)*) since the appearance of the human capital theory (*Becker (1964)*). The analyses examine the different educational fields in general (*Krueger (1997)*, *Lazear (1999)*, *Bassanini - Scarpetta (2001)*). The typical characteristics of single sectors –such as the agricultural education– are not completely revealed in the literature (*McElwee (2005)*).

Entrepreneurial skills can be taught (*Van der Sluis and Van Praag (2007)*). Therefore the teaching of these skills is recommended in all educational fields by the directives for educational development of the European Union (*Európai Bizottság (2006)*). The influence of education on human capital improvement prevails in the field of entrepreneurial skills, as well.

Entrepreneurial skills construct a complex system (*Mikko and Jarkko (2008)*). The connecting skills are defined both in general (*Man, Lau, Chan (2002)*, *Krueger (2005)*, *Schiebel (2002)*) and for most economic sectors (*Wolf, Schoorlemmer (2007)*). Up to the present the measurement and comparison of these skills is not solved. The positive connection between entrepreneurial skills and economic growth is only documented generally (*Carree and Thurik (2005)*).

Personal factors and skills influencing the success of entrepreneurial activities are well defined, either generally (*Man, Lau, Chan (2002), Schiebel (2002), Northouse (2004), Makó, Csizmadia, Illésy (2005)*) or specifically, for the agricultural sector (*Wolf, Schoorlemmer (2007), Mikko and Jarkko (2008)*). Nevertheless, the measurement of required entrepreneurial skills in the agricultural sector is missing both from literature and from international databases. In addition to this, the relationship between agricultural entrepreneurial skills and economic performance is not analysed nor described. Therefore the analysis and explanation of these factors is necessary to explore the opportunities for the increase of competitiveness in the agricultural sector.

The basic aim of the dissertation is to measure the agricultural entrepreneurial skills level in the different Member States. According to this, the first objective of the dissertation is to **prepare the model of agricultural entrepreneurial skills**. The model demonstrates both the required entrepreneurial skills and their system, and their importance in the agricultural sector.

Technological differences in the agricultural activity between the European Union's countries are widely analysed in the literature. As opposed to this, agricultural entrepreneurial skills are not compared in the sources. The second objective of the dissertation is to **develop a database** on the basis of the currently available datasets. The new database will be suitable for measuring the agricultural entrepreneurial skills level.

Based on the above database, the third objective is to **generate a new index**, which enables the comparison of the level of agricultural entrepreneurial

skills in the Member States. With the help of the index, distinct comparison is required for the age group older than 15 years and within the population aged 15-30 years.

The existence and intensity of a **relationship between agricultural entrepreneurial skills and economic performance in the agricultural sector** is not an analysed topic in the literature. Therefore the fourth objective of the dissertation is to examine and define these.

The fifth objective is to arrange the analysed Member States into groups according to the agricultural entrepreneurial skills level and economic performance. The classification is realizable with cluster analysis. On the basis of the clusters common characteristics and differences of countries would be revealed.

2. MATERIAL AND METHODS

On the basis of the literature it is possible to **prepare the model of agricultural entrepreneurial skills**. The steps of modelling are the following:

- Comparison of agricultural entrepreneurial skills defined in the whole of the European Union and in the requirements of the Hungarian agricultural training system.
- Selection of common skills from the two sources and resolving the differences between the two groupings.
- Determining those skills which would be built into the model of agricultural entrepreneurial skills.
- Constructing the model.

It is not possible to analyse the agricultural entrepreneurial skills defined in the model from the current databases. Therefore it was necessary to **create a new database** from the other available international datasets. Two databases were made separately in order to analyse the skills level. One is for the population older than 15 years, and one for the 15-30 years age group. Since the datasets measure the skills in different scales, the standardized values of variables were employed for the examination.

In order to compare the agricultural entrepreneurial skills level of countries, the **agricultural entrepreneurial skills level index (AESLI) was developed** using the theory of *Lorenz (2007)*. Given that the elementary and secondary education of the 15-30 years old population segment puts more emphasis on the skills determined in the model, the values of the indices were separately counted for the two groups.

The tendency in the relationship **between the values of the agricultural entrepreneurial skills level index and the Gross Domestic Product per capita at purchasing power parity (GDP PPS)** (*Kozma and Falusné (2002)*) can be examined by graph and covariance analysis. The strength of the relationship between AESLI and GDP PPS would be measured by correlation analysis. The Pearson correlation analysis is suitable according to *Kerékgyártó, Mundruczó, Sugár (2001)*.

Based on the values of AESLI in the two segments, it is possible to arrange the **Member States into groups** with cluster analysis. Applying the **dividend hierarchical cluster algorithm** the analysed countries can be grouped unambiguously. During the process the distance of one element and one cluster is counted by applying the Between Groups method (*Székelyi-*

Barna (2005)). A **dendrogram** displays the results of the cluster analysis (page 15, *Figure 6.*).

3. RESULTS

3.1. The model of agricultural entrepreneurial skills

The agricultural entrepreneurial skills necessary in the European Union are collected by the program called 'Developing the Entrepreneurial Skills of Farmers' (ESoF). The Országos Képzési Jegyzék 2008. contains the skills which are necessary to develop in the Hungarian agricultural sector. On the basis of the two sources the following skills are built in the **model of agricultural entrepreneurial skills**:

1. Professional skills (plant or animal production skills);
2. Info communication technology skills;
3. Reading skills;
4. Mathematics skills;
5. Communications skills and foreign language skills;
6. Financial and administration skills;
7. Physical skills;
8. Information collection, planning, opportunity perception;
9. Problem solving skills;
10. Skills of analysis and feedback;
11. Skills of logical thinking;
12. Creativity;
13. Result orientation;
14. Learning skills.

The **model of the agricultural entrepreneurial skills** can be seen on the *Figure 1*.

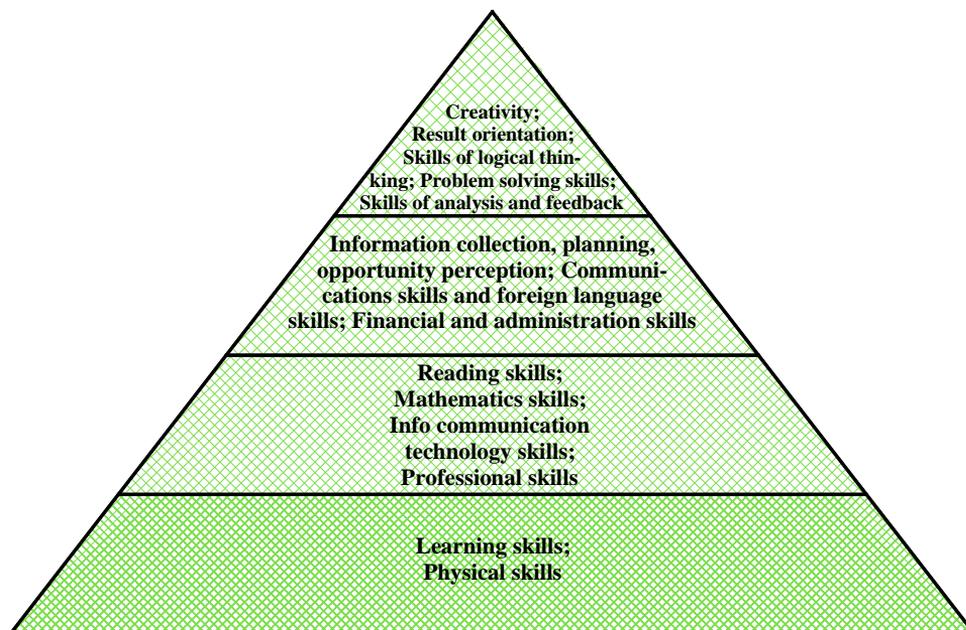


Figure 1. The pyramid model of the agricultural entrepreneurial skills, source: own results

The hierarchical system of the entrepreneurial skills can be demonstrated in a **pyramid model** on the basis of *Argyle (1990)*, since without reaching a minimum required level of the skills on lower stages of the model, the skills on the top cannot be developed in the right way. Therefore the skills on lower stages of the pyramid model are fundamental in the comparison analysis.

3.2. The database developed for measuring the agricultural entrepreneurial skills level

In order to analyse the agricultural entrepreneurial skills level of older than 15 years population a new database was developed. I have chosen the **following variables** from examined sources **into the database**.

- Percentage of individuals who have used a search engine to find information from less than 100 inhabitants/km² populated area.
- Percentage of individuals who have sent an email with attached files, from less than 100 inhabitants/km² populated area.
- Percentage of individuals who have copied or moved a file or folder, from less than 100 inhabitants/km² populated area.
- Percentage of individuals who have connected and installed new devices, from less than 100 inhabitants/km² populated area.
- Percentage of individuals who find important to be informed about European affairs.
- Percentage of individuals who have heard or read about the Common Agriculture and rural development Policy and known precisely what it is.
- Percentage of individuals who have known well at least two data from the inflation rate, the national growth rate and unemployment rate in his/her country.
- Percentage of individuals who have considered buying a product or a service from another Member State via the Internet because it is cheaper or better.
- Percentage of individuals who prefer being self employed.
- Percentage of skilled agricultural and fishery workers, craft and related trades workers who have participated in any learning activities.
- Average scores, Document measurement
- Percentage of individuals who can access financial services.
- Percentage of individuals who prefer paying by credit card over 100 EUR in other Member States.
- Percentage of individuals who find important to make own decision and be free.
- Percentage of individuals who find important to be successful and people admit this.
- Percentage of individuals who find important to think new ideas and be creative.
- Percentage of individuals who have savings for living comfortable late in life.

Variables in the group of 15-30 years-olds:

- Average scores in problem-solving in less than 15000 populated areas.
- Average scores in mathematics in less than 15000 populated areas.

- Average scores in reading in less than 15000 populated areas.
- Percentage of individuals who have used a search engine to find information.
- Percentage of individuals who have sent an email with attached files.
- Percentage of individuals who have created a Web page.
- Percentage of individuals who have copied or moved a file or folder.
- Percentage of individuals who have connected and installed new devices.
- Students aged 15-24 years as % of corresponding age population.
- Average number of foreign languages learned per pupil.
- Percentage of individuals who are very interested or interested in what is going on in politics and current affairs.
- Percentage of individuals who have get most of his/her money from regular job.
- Students enrolled in agriculture and veterinary as % of all students.
- Students aged 25-29 years as % of corresponding age population.
- Percentage of individuals who find important to make own decision and be free.
- Percentage of individuals who find important to think new ideas and be creative.

3.3. The agricultural entrepreneurial skills level index

The counted values of the **agricultural entrepreneurial skills level index (AESLI)** of the whole population are shown in *Figure 2*. The index was calculated by applying the method presented in the 2nd part.

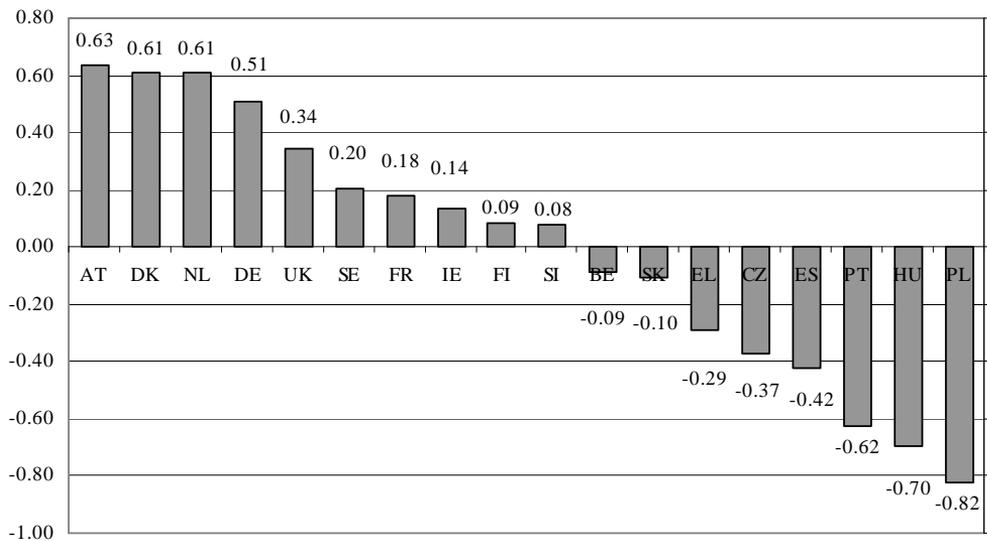


Figure 2. The values of the agricultural entrepreneurial skills level index in the whole population older than 15 year olds, source: own results

The highest values of the index are in Austria, Denmark and Netherlands. The lowest levels of agricultural entrepreneurial skills are in Portugal, Hungary and Poland.

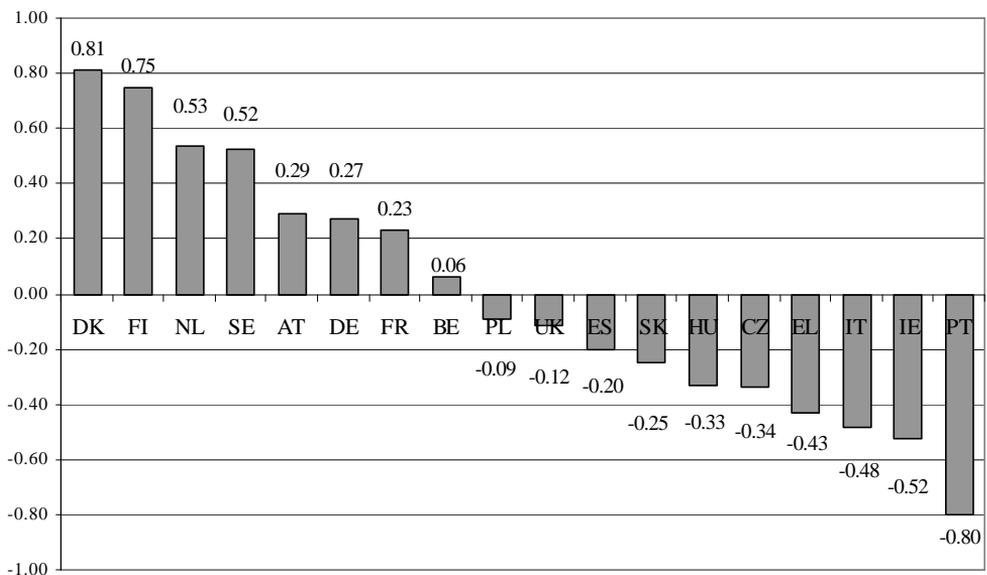


Figure 3. The values of the agricultural entrepreneurial skills level index in the group of 15-30 year olds, source: own results

The values of the agricultural entrepreneurial skills level index for the age group of 15-30 years are displayed on *Figure 3*. On the basis of the diagram, Denmark, Finland and the Netherlands have got the highest skills level. The lowest values of the index are in Italy, Ireland and Portugal. Both Denmark and the Netherlands have high skills levels on the basis of AESLI in both segments. AESLI has higher values for the group of 15-30 years than in the whole population of Hungary.

3.4. Relationship between the agricultural entrepreneurial skills level index and the economic performance

The values of the agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity in the whole population can be seen on the *Figure 4*.

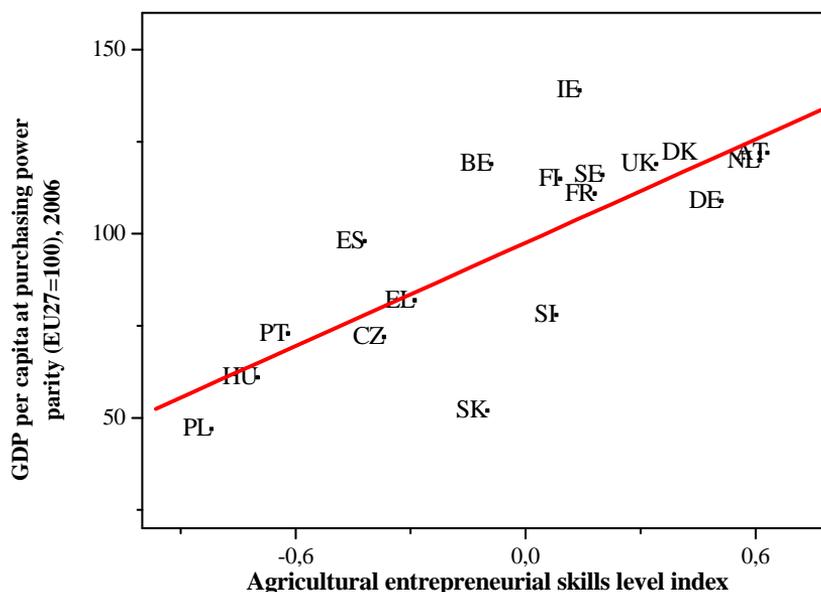


Figure 4. The relationship between the agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity of the whole population, source: own results

Applying the covariance method, a **positive relationship** between the values of agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity can be established. The results of the calculation are summarized in *Table 1*.

Table 1. Covariance analysis on the basis of whole population data, source: own results

	GDP PPS per capita, (EU27=100), 2006	AESLI_total
GDP PPS per capita, (EU27=100), 2006	680.6914	
AESLI_total	9.2842	0.1999

The correlation coefficient between the analysed factors is 0.795 and significant at the 0.01 level. This means a **positive linear correlation and strong stochastic relationship exists**. The results concerning the whole population are displayed in *Table 2*.

Table 2. Correlation analysis on the basis of data concerning the whole population, source: own results

		AESLI_total
GDP PPS per capita, (EU27=100), 2006	Pearson correlation	0.795 ^{**}
	Significant	0.000
	Number of countries	18

^{**} Correlation is significant at the 0.01 level, 1-tailed

In the group of 15-30 years old population a **positive relationship** can also be revealed between the skills level and the GDP PPS. The values of the two factors are presented in *Figure 5*.

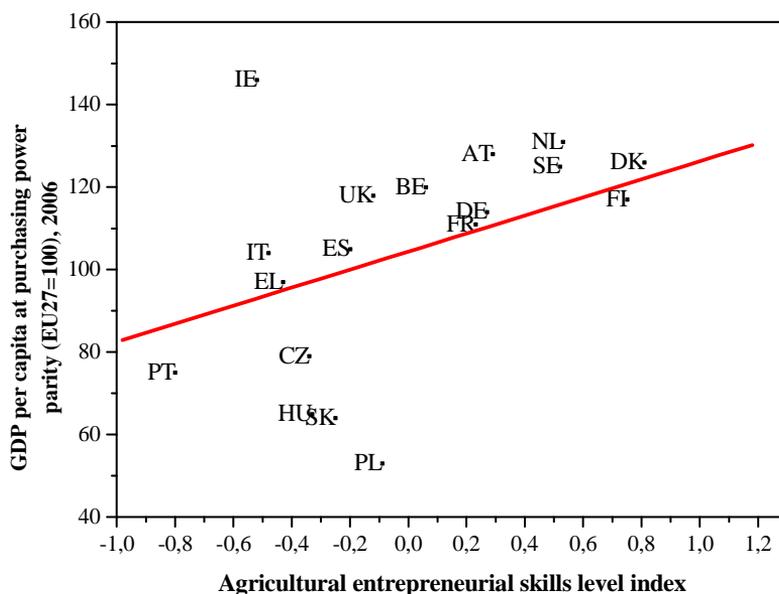


Figure 5. The relationship between the agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity for the group of 15-30 years olds, source: own results

The covariance analysis also shows a positive relationship between the factors in the group of young people. The results of covariance analysis are summarized in *Table 3*.

Table 3. Covariance analysis on the basis of 15-30 years olds data, source: own results

	GDP PPS per capita, (EU27=100), 2006	AESLI_15_30
GDP PPS per capita, (EU27=100), 2006	666.67	
AESLI_15_30	5.7777	0.2046

The results of the correlation analysis (*Table 4.*) in the segment of young people show a **positive linear significant correlation at the 0.05 level and a medium strong stochastic relationship.**

Table 4. Correlation analysis on the basis of the 15-30 years olds data, source: own results

		AESLI_15_30
GDP PPS per capita (EU27=100), 2006	Pearson correlation	0.494*
	Significant	0.019
	Number of countries	18

* Correlation is significant at the 0.05 level, 1-tailed

Summarizing the results, there is a relationship between the entrepreneurial skills level index and the GDP per capita on purchasing power parity in both segments. The tendency of the relationship suggests that higher agricultural entrepreneurial skills level and higher economic performance are common characteristics.

3.5. The groups of European Union's countries on the basis of agricultural entrepreneurial skills level index

The member states of the European Union presented in the examination can be arranged into groups by **hierarchical cluster analysis**. Clusters are composed on the basis of the AESLI and GDP PPS per capita. The dendrogram of the analysis is in *Figure 6*.

* * * * * H I E R A R C H I C A L C L U S T E R A N A L Y S I S * * * * *
 Dendrogram using Average Linkage (Between Groups)

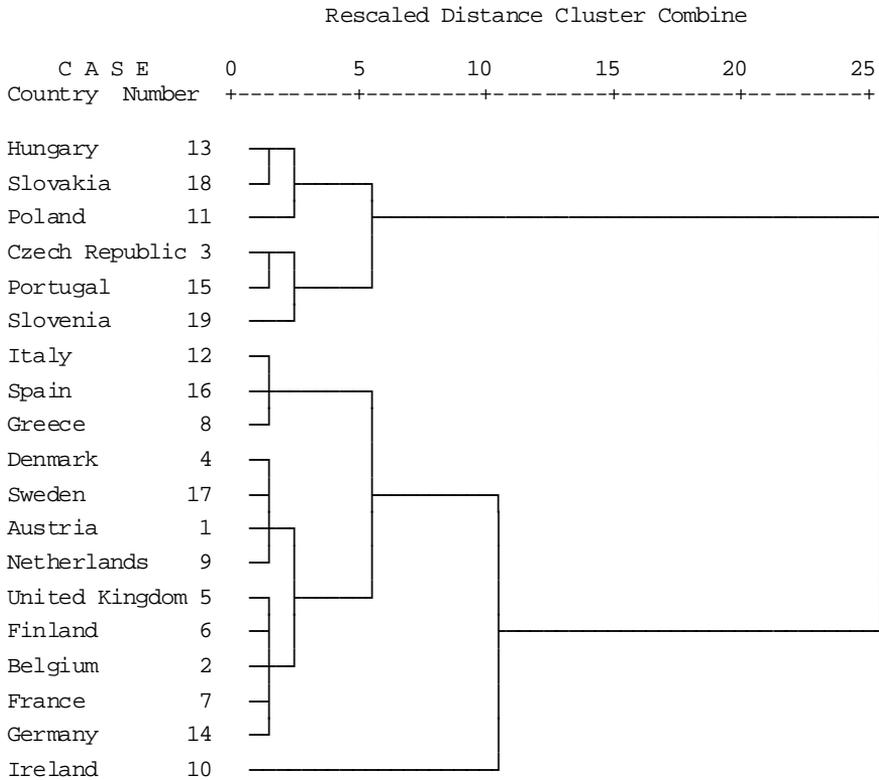


Figure 6. Dendrogram, hierarchical cluster analysis, source: own results

It is worth dividing the examined countries into two clusters, see *Table 5* 94.74% of the countries are in the same cluster when they are arranged in three clusters. In a four-clusters analysis, 78.95 % of the countries are in the same cluster than in the case of the two-clusters examination.

Table 5. Results of the cluster analysis, countries are divided into two clusters, source: own results

Member of cluster			
Country	Cluster	Country	Cluster
Austria	1	Italy	1
Belgium	1	Netherlands	1
Czech Republic	2	Poland	2
Denmark	1	Portugal	2
Finland	1	Slovakia	2
France	1	Slovenia	2
Germany	1	Spain	1
Greece	1	Sweden	1
Hungary	2	United Kingdom	1
Ireland	1		

On the *Figure 7*, the two groups of European countries separated by cluster analysis are displayed.

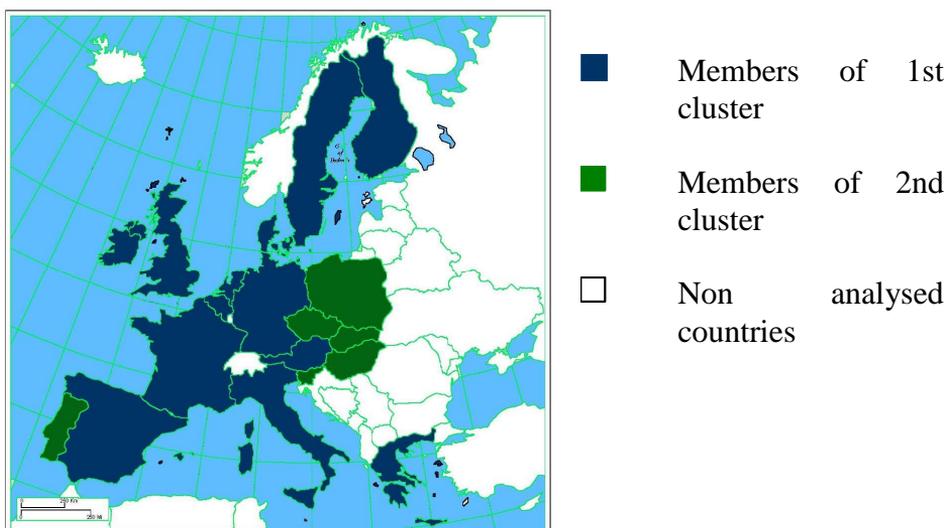


Figure 7. Locations of countries on the basis of cluster analysis, source: own results

The older Member States form the first cluster. The second cluster is built up of countries that joined together to the European Union on the 1st May of 2004, except Portugal. Therefore the **Member States that joined later have disadvantages on the common market on the basis of the agricultural entrepreneurial skills level index.**

4. CONCLUSIONS

According to the objectives drafted in this dissertation the agricultural entrepreneurial skills can be determined and systematized on the basis of the literature, the European Union recommendations and the available data sources. **The pyramid model is suitable for characterizing the agricultural entrepreneurial skills** because these skills have a hierarchical system.

The **new database** was built up from available data sources and the **agricultural entrepreneurial skills level index** was calculated from this database. These are **suitable to measure the entrepreneurial skills level** necessary for **successful activity** in the agricultural sector.

There are differences in the calculated skills level between the more than 15 years old whole population and the segment of 15-30 years old people. The countries have a different sequence in the two segments. Some countries –for example Hungary– have a higher skills level in the group of young people. **The current skills level of the young people shows that entrepreneurial performance in the agricultural sector** can improve in the future in these countries.

The correlation between the agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity is weaker in the segment of young people than in the whole population. The skills level of this segment will palpably affect the economic performance and competitive advantages in the future.

Based on the data of the analysed countries, **there is a relationship between the agricultural entrepreneurial skills level and the economic performance.** One of the several factors influencing the Gross Domestic Product can be the agricultural entrepreneurial skills level. These skills affect economic performance through the whole sector output.

On the basis of the agricultural entrepreneurial skills level index and the GDP per capita on purchasing power parity, there is a significant difference is between the older and the newer Member States of the European Union. **The Member States that joined later have disadvantages in agricultural entrepreneurial skills** which contribute to their disadvantages in their competitiveness.

5. NEW SCIENTIFIC RESULTS

1. I have prepared the model of agricultural entrepreneurial skills taking into consideration the peculiarities of the European Union and Hungary.
2. I have developed a database suitable to measure the agricultural entrepreneurial skills and for the comparison of countries.
3. On the basis of the database, a new index, called agricultural entrepreneurial skills level index, was prepared. It is suitable to measure the necessary entrepreneurial skills in the agricultural sector and explore the differences between the Member States of the European Union.
4. Employed, the created agricultural entrepreneurial skills level index shows that the relationship between the agricultural entrepreneurial skills level and the economic performance is provable in the European Union.

6. RECOMMENDATIONS

Improving the available statistical databases and creating **new databases** is required to analyse the agricultural entrepreneurial skills in more depth and to observe temporal changes. Current data does not enable the following of the processes of development and does not describe all of the entrepreneurial skills.

Despite the European Union's enterprise and rural development policy there are no surveys on entrepreneurial skills and non economical factors in the agricultural sector. **It is necessary to widen the sample of the common EU's surveys** (e.g. Eurobarometer) in order to analyse the population in rural areas. Then a representative sample would measure the entrepreneurial skills of both the rural population and the agricultural workers.

On the basis of the measured current agricultural entrepreneurial skills level it is possible to determine the steps of agricultural entrepreneurial skills development in practical education. According to the data of agricultural entrepreneurial skills level index **different skills development is necessary in Member States** through differentiated training programs. Entrepreneurial skills development trainings should be based on European Union's directives and national specialities in agriculture.

In Hungary, it is proposed to improve the different skills in the model of the agricultural entrepreneurial skills in an earlier life period. Only the professional skills make an exception. Practice oriented training would be desirable for all educational levels for the development of skills.

Furthermore, skills on the two lower levels of the pyramid model should be improved strongly. The young population in the Hungarian rural area has weaker performance in these skills than in the other Member States.

The **Life Long Learning programs** are suitable to improve of the current level of agricultural entrepreneurial skills. The reason for this is the increasing average age of agricultural workers and entrepreneurs and the decreasing rate of young farmers. Therefore it is not likely that the average skills level will increase owing to the higher skills level of young new employers and employees.

7. PUBLICATIONS ON THE SUBJECT OF THE DISSERTATION

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