

# COMPARATIVE STUDY REGARDING THE IMPLEMENTATION OF MANAGEMENT SYSTEMS

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**Abstract:** *The paper includes relevant data on the history and evolution of management systems in some European countries. The choice of only a small number of countries took into account the prospect of the number of certifications at European level. The study took into account the differences in the number of certifications between the European Union and followed the evolution of the implementation of standards on management systems over a period of seventeen years, between 2000 and 2017, as well as the global evolution of certifications.*

**Keywords:** Management System, Certifications, ISO 9001, ISO 14001.

## 1. Introduction

Given the context of globalization, more and more organizations are forced to implement management systems in order to remain in the increasingly fierce competitive struggle, in different fields of activity and in different markets [Darabont, 2019].

The aim of this paper is to analyze the evolution of management systems (MS), regarding the implementation and certification according to the requirements of ISO 9001, ISO 14001 standards for some European countries (France, Germany, Greece, Hungary, Italy, Nederland, Norway, Ostrich, Poland, Portugal and Romania), which have a significant number of certified management systems, the evolution of certifications by activity sectors for 2019, for the countries listed above and MS globally for 2018.

The resilience of each organization must be carefully analyzed by the top manager in order to make decisions in a very short time. The reasons for implementing management systems are very different, they differ from

country to country, from one geographical region to another.

Management systems (MS) standards have developed a lot in recent years. For example, in Romania in 2000 there were 1,033 ISO 9001 certifications, increasing to 20,524 in 2015, and in the next 2 years they decreased to 10,204 in 2017 [ISO, 2018].

The organization must design, implement and maintain an MS focused on customer satisfaction and meeting the expectations of all stakeholders. When designing such a well-structured and efficient system, emphasis should be placed on identifying existing or potential problems related to quality, environment, health and safety at work and on implementing the necessary risk assessment and corrective actions but also on the costs involved. implementation [Mironeasa, 2009].

In the context of the current globalization, more and more companies must take into account the resilience of the organization, in order to have a future in a certain market in a certain field of activity. The resilience of the organization must be managed

by top management, in a very short time so as not to lead the company to a total decline, ie bankruptcy.

At European and global level, the figures for the integration of certain standards are very different. The objective of this article is to conduct a comparative study on the level of implementation and certification of management systems in different countries and in certain sectors of activity.

The International Organization for Standardization (ISO) has developed the management standards ISO 9001: 2015, 14001: 2015 and OHSAS 18001, replaced by ISO 45001, which have been accepted internationally in order to create a unitary framework for assessing the level of implementation. of the requirements under which recognitions are made for MS certification. The publication of ISO 9001, 14001 standards in 2015, is an important step in managing quality and environmental issues in an integrated way, optimizing the resources spent by the organization for this field. Their structure on chapters that present the same requirements have allowed companies to integrate some requirements much easier. [Elfianusn, 2018].

With the launch in 2018 of the ISO 45001 standard "Occupational health and safety management systems - Requirements with user guide" [ISO 45001: 18] which respects the same structure on chapters with the other standards, it came to complete a framework common requirements in order to achieve easier integrations with other systems management standards. The standard, through its structure, integrates good practices obtained through the use of previous documents, namely ILO-OSH 2001 "Guidelines for Occupational Safety and Health Management Systems" and OHSAS 18001 "Occupational Health and Safety Management Systems - Requirements" [Darabont, 2019].

## 2. Method used

The complexity of statistical research needs to be continuously improved. The processing of a very large volume of

information has led to the innovation and development of modern calculation tools, such as: Excel Data Analysis; Excel Stat; SPSS Statistics, etc. [Pinti, 2019].

For statistical data processing we used specialized Excel Data Analysis software and ELSTAT program.

Statistical data were obtained from the website of the International Organization for Standardization, which was collected by specialists within the organization [ISO18]. The data include information collected over several years, in the period 2002-2018.

In order to achieve the proposed goal, a first analysis aimed to use the Pearson linear correlation coefficient, given by the relation (1):

$$r = \frac{\sum (x_i - \bar{X})(y_i - \bar{Y})}{\sqrt{(\sum (x_i - \bar{X})^2)(\sum (y_i - \bar{Y})^2)}} \quad (1)$$

The purpose of using Pearson's linear correlation was to determine whether there were differences in the number of certifications of management systems between the European countries for which the analysis was performed.

The analyzed data took into account the following states: France, Germany, Greece, Hungary, Italy, Nederland, Norway, Ostrich, Poland, Portugal and Romania, which have the largest number of MS certifications. These countries were chosen from the perspective of the number of certifications, the comparison being made between the countries with the most certifications and countries that have certifications close to those of Romania. Countries with fewer certifications than Romania were included in another chart in order to have a clearer and more detailed view on the evolution of MS certifications, and to make the comparison easier.

The data, presented in the tables on the ISO website, were entered in the specialized statistical processing software Excel Data Analysis and XLSTAT for generating graphs in order to perform a comparative analysis and correlations. For the interpretation of the

obtained data we used Pearson correlation indices, to observe the type of correlation and to be able to make an analysis of the correlations.

Reference indices are between -1 and +1.

-1 perfectly negative correlation

+1 perfectly positive correlation

0 there is no correlation (random association).

The correlation coefficient is a quantitative value that describes the relationship between two or more variables. It varies between (-1 and +1), where the extreme values assume a perfect relationship between variables while 0 means a total lack of linear relationship. A more appropriate interpretation of the values obtained is made by comparing the result obtained with certain default values in correlation tables according to the number of certifications, the type of link and the desired significance threshold. [Bigo, 2020].

The Pearson type analysis was performed for the data obtained for the certification of MS of quality and MS of environment.

In order to perform a comparative analysis on the annual evolution of the number of certified management systems at European level, we introduced the data in the specialized statistical processing software XLSTAT for graphical representation of trends.

### 3. Results and discussions

#### 3.1 The evolution of ISO 9001 certifications in Europe

In the graphical representation in figure 1 you can see the correlations established using the Pearson coefficient for each country. Based on the results obtained from the analysis, conclusions can be drawn regarding the existing differences between the number of certifications for MS of the existing quality in Romania and other European countries analyzed.

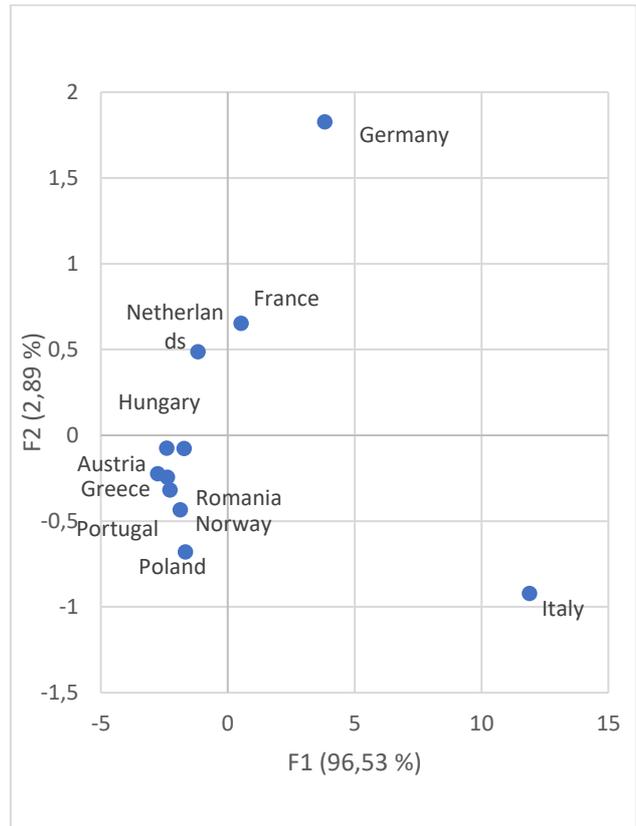
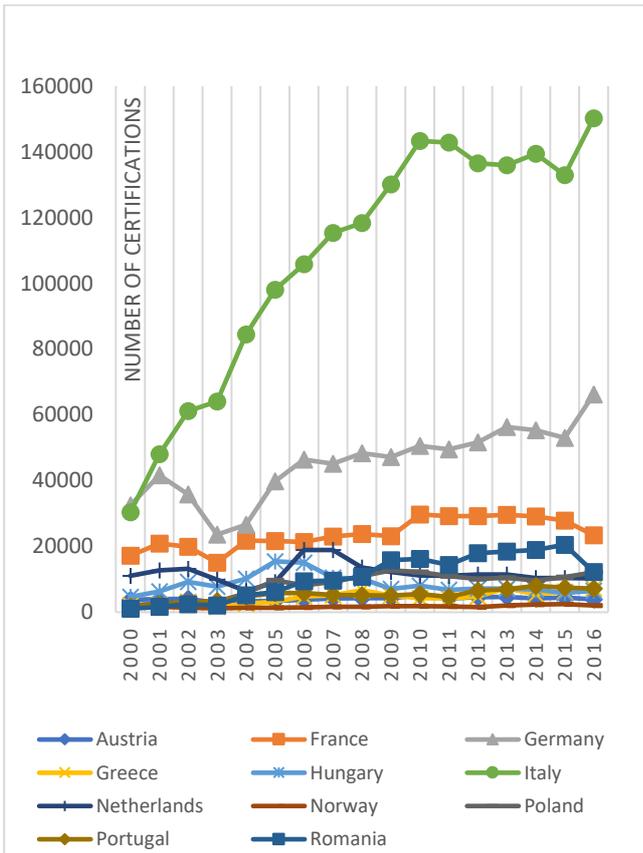


Figure 1. Pearson correlations for ISO.

In order to carry out the evaluation and to carry out a comparative analysis regarding the evolution by years of the number of MS of the quality certified at European level, the data destined for analysis were introduced in the specialized software of statistical processing XLSTAT. The generated graph, figure 2, allows the visualization of the evolutions in order to perform a comparative analysis. Since in two of the states Italy and Germany, as shown in Figure 2, the number of certifications is much higher than in the rest of the European states, for a more detailed representation of developments the data values were classified into categories, the representation was made in two distinct graphs. Thus, a first graph was represented with the countries that have over 20,000 certifications and a second one for the countries that have a number of certifications between 5,000 and 20,000.

Data representations were made for the two types of MS: quality and environment.

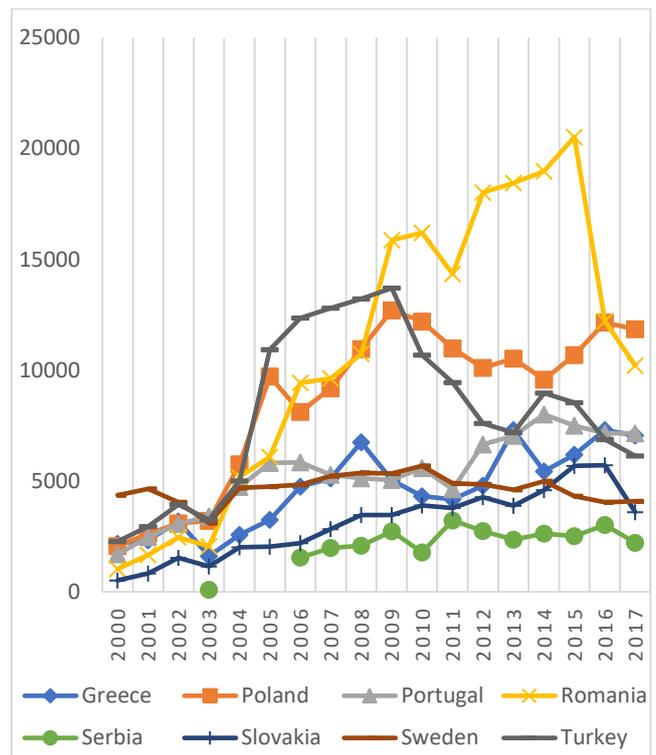


**Figure 2.** Evolution of certifications at European level for the period 2000 - 2016, for countries with over 20,000 certifications [ISO, 2018].

Romania is on the 5th place in the implementation of ISO 9001, at European level. Regarding the comparison with Italy, France and Germany, the difference is very large, compared to Italy for example, it is 731.54%. So, the difference is very big and this aspect requires for the affirmation on the European market that the Romanian companies to implement MS in a more alert movement.

The graph in Figure 3 shows that, among the countries with certifications below 20,000 MS certifications according to ISO 9001, Romania ranks first even occupying the 1st place between 2008 and 2016.

Between 2000 and 2015, almost all countries have a linearly increasing trend, and between 2016 and 2017 the trend is linearly decreasing. Making a ranking according to the number of certifications for MS, it looks like this: Romania is in first place followed by Slovakia, Poland, Portugal, Greece, Sweden, and other countries.



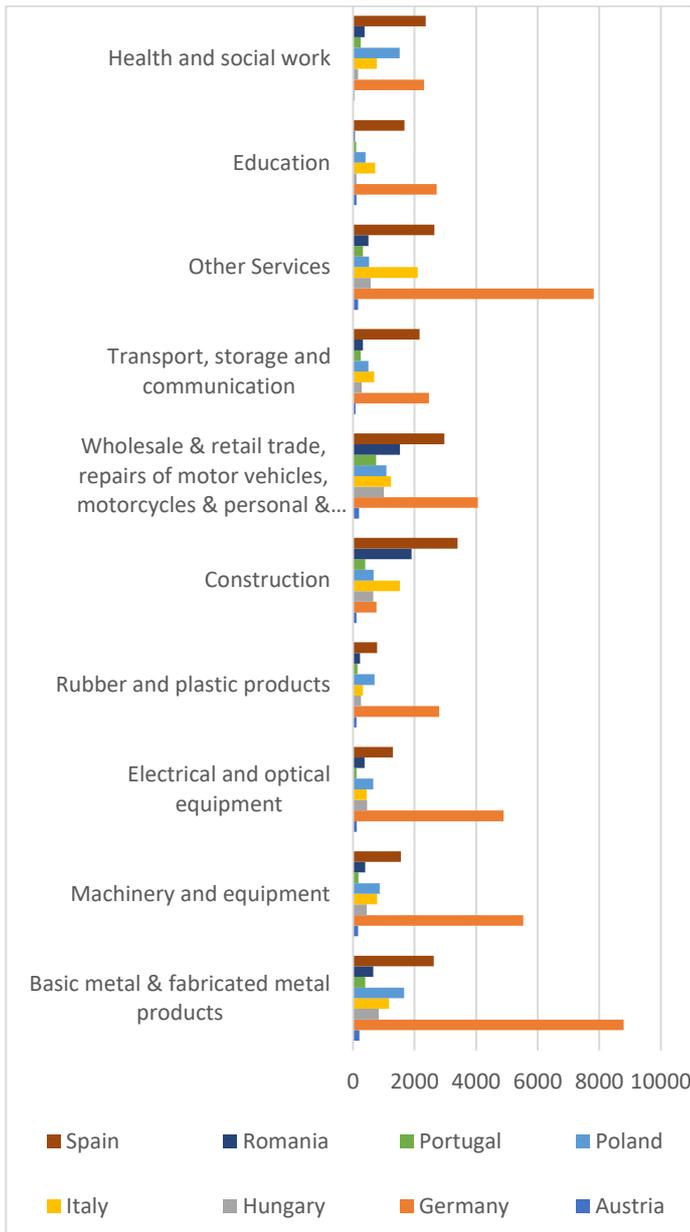
**Figure 3.** Evolution of certifications at European level for the period 2000 - 2017 for countries with certifications below 20,000 certifications [ISO, 2018].

Regarding the distribution of ISO 9001 by activity sectors, a first graph Figure 4, includes the countries with certifications between 1,601 certificates and 9,000 certificates for MS that have implemented the ISO 9001 standard. a number of 1600 certifications.

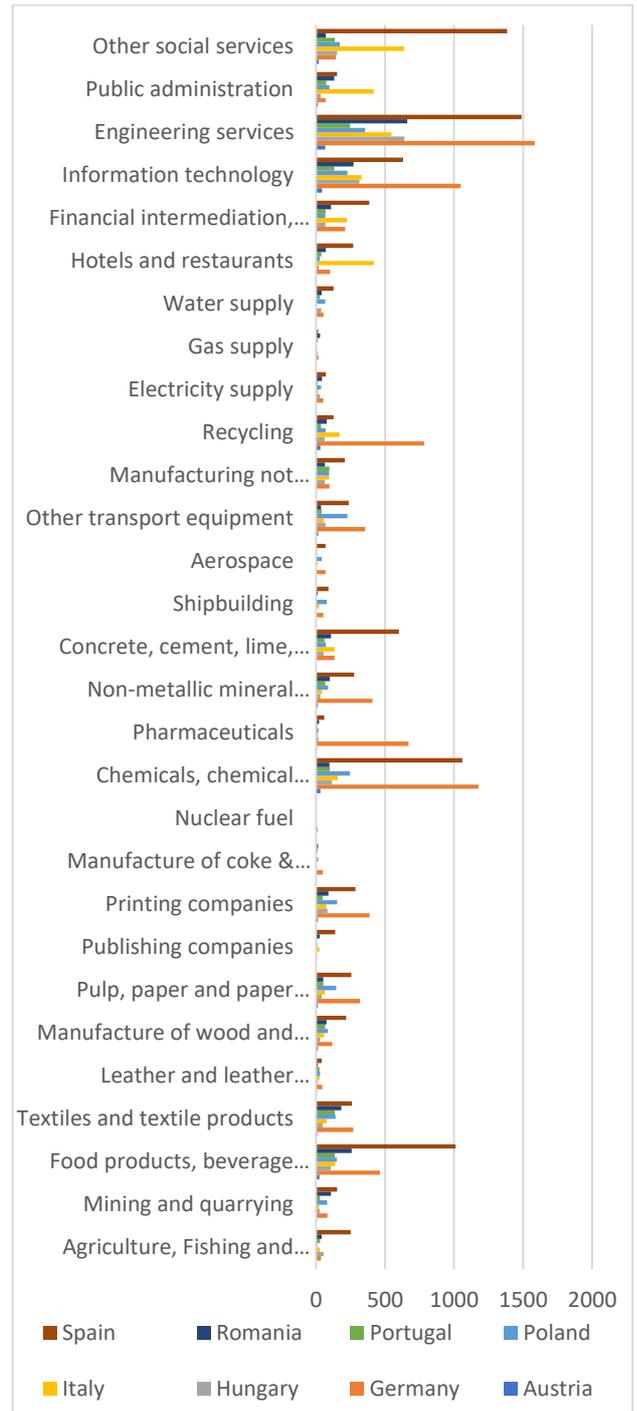
For certifications according to ISO 9001 requirements, ISO Survey holds information for 191 countries worldwide, out of a total of 195 countries around the globe, which means that ISO holds information for 97% of the country.ri [UN 20], [ISO, 2018].

Based on the analyzed data, a ranking was made with no. of ISO 9001 certifications, as follows: Italy with 97,771 certifications, representing 9.42% of the certifications worldwide followed by Germany with 60,480 certifications, representing 5.83%, Spain with 35088 certifications representing 3.38%, Poland with 13,770 certifications, representing 1.32% followed by Romania which is on the 5th place in this ranking with 9,806 certifications,

representing 0.94%, Hungary is on the 6th place with 8,815 certifications, representing 0.85%, Portugal is on the 7th place with 4,732 certifications, representing 0.45% and the last country in this ranking is Austria with 1,981 certifications, representing 0.19% of the total certifications worldwide for MS of quality according to the requirements of the ISO 9001 standard.



**Figure 4.** Distribution by activity sectors for the ISO 9001 Quality Management System, between 1601 - 9000, for 2019 [ISO 2018].



**Figure 5.** Distribution by activity sectors for the ISO 9001 Quality Management System, for 2019, under 1600 certifications [ISO 2018].

The graphical representation in figure 5 shows the distribution of the number of certifications below the value of 1,600, by activity sectors for European countries. Based on this representation, the comparative study for quality MS certifications was performed.

From the data provided, the graphical representation for the "Unknown Sector" which has 102,887 certifications was excluded in order to be able to see and understand the differences between the known sectors.

Most certifications that do not have the specified name and are unknown are found in Italy, 81.84% of the total of 102,887 certifications, followed by Germany with 9.23% and Spain with 3.63%, respectively.

Although Italy has the most ISO 9001 certifications, many certifications are for areas of activity that have not been specified.

The sectors of activity for the manufacture of various materials and other services are on the 2nd place in the ranking in Figure 4. The ranking is continued by the sectors of wholesale and retail trade, repairs of motor vehicles, motorcycles and personal and household goods which is on the podium in ranking in the top 3 places.

Achieving the ranking for the first 9 places in the ranking of sectors of activity we have the following ranking: Sector Unknown - 102,887 certifications - representing 44.26% of the total of 232,443, Basic metal & fabricated metal products - 16,320 certifications - representing 7, 02%, Other Services - 14,631 certifications - representing 6,29%, Wholesale & retail trade, repairs of motor vehicles, motorcycles & personal & household goods - 12,810 certifications, Machinery and equipment - 9,922 certifications, Construction - 9,411 certifications, Electrical and optical equipment - 8,349 certifications, Transportation, storage and communication - 6,741 certifications, Education - 5,905 certifications.

Considering the total number of certifications of the ranking, it is found that there are a number of 186,976 certifications, representing 80.43% of the total of 232,443 certifications for 2019. Out of the total of 32 sectors of activity, the 9 sectors of the ranking represents 28.12% of the total sectors. So the Pareto principle is also true in this case, in which it is known that the 80/20 rule or the law of the few but critical writes Ankunda. The amount of 100% also leads to a beautiful symmetry. For example, if

80% of the effects come from 20% of the causes, then the remaining 20% of the effects come from the other 80% of the causes. This is called the "common ratio", and can be used to measure the degree of imbalance: a common ratio of 96: 4 is very unbalanced, 80:20 is significantly unbalanced (Gini index: 60%), 70:30 is moderate unbalanced (Gini index: 40%), and 55:45 is only slightly unbalanced [Ankunda, 2011].

### 3.2 Evolution of ISO 14001 certifications in Europe

Environmental management, described in the ISO 14001 series, and argued by "Domingues -2016", in its works, provides tools for considering environmental management systems, in addition to offering organizations many economic benefits associated with environmental benefits [Domingues, 2016]. In the graphical representation in figure 6 we can see the correlations established by Pearson's coefficient for each of the analyzed countries. Following the analysis of the ISO 14001 system, conclusions can be drawn regarding the differences between the number of certifications for the environmental management system..

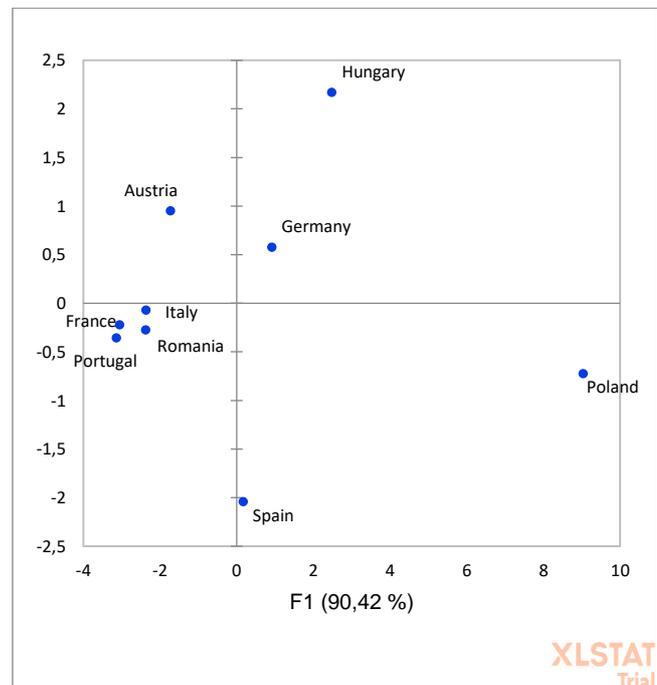
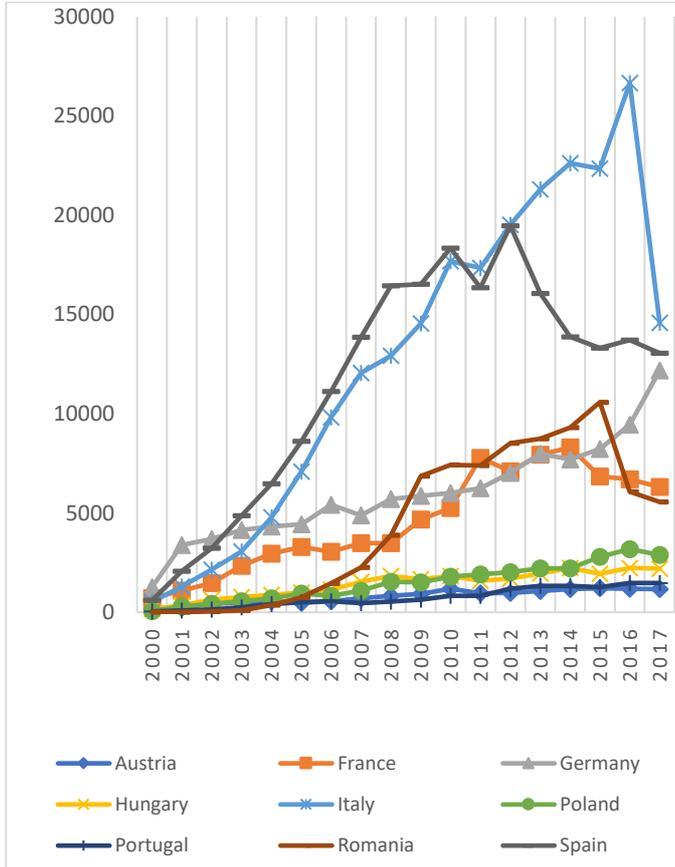


Figure 6. Pearson correlations for ISO 14001 [ISO 2018].

ISO 14001 is the only standard of the environmental management system, which involves, among other requirements, compliance with regulations, waste minimization, reduction of environmental impact and low costs [DP16], [Elfianusn, 2018].



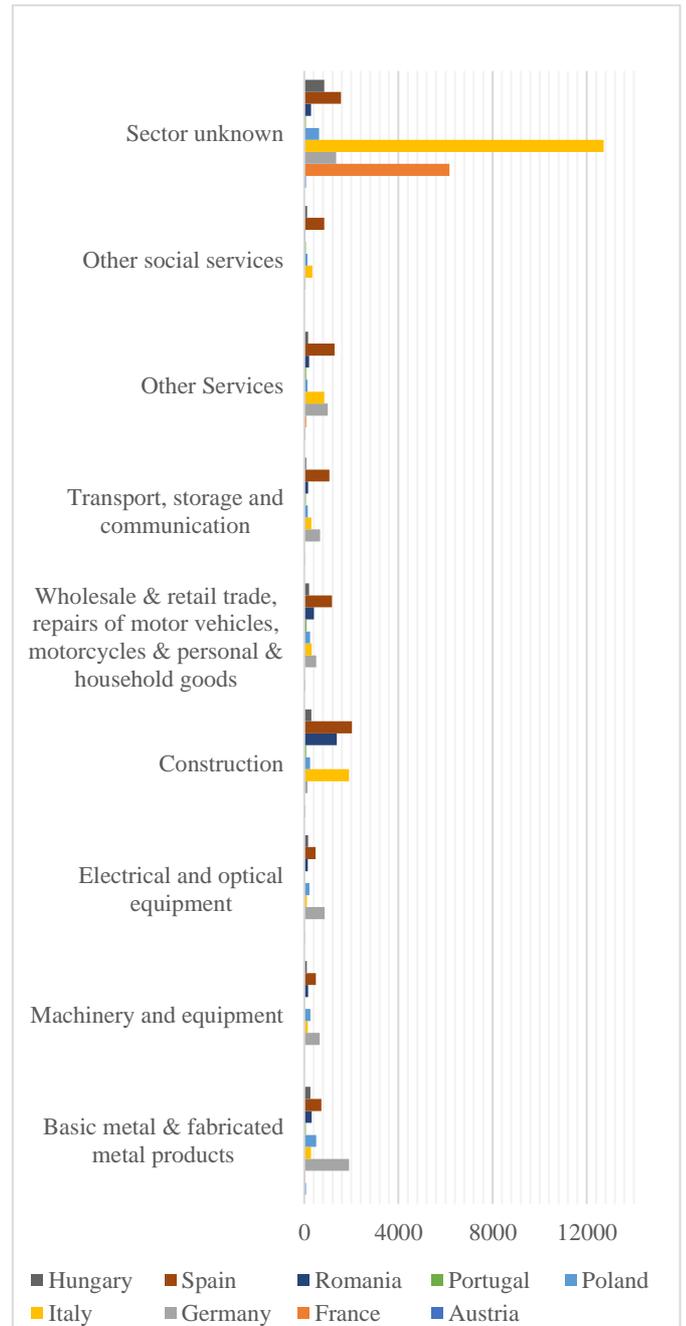
**Figure 7.** Evolution of ISO 14001 certifications at European level for the period 2000 – 2017 [ISO 2018].

Regarding the evolution of the sectors of activity for the Environmental Management System, ISO 14001, as shown in Figure 8, most certifications are in the unknown sector 23699 certificates out of a total of 63,687 (total of the 9 countries) certificates for the year 2019. The results provided by ISO are presented for 175 countries out of a total of 195 countries around the world, this means that ISO has information for 89% of all countries around the world [UN, 2020].

The total certification at the level of the 175 countries is 396,242 certifications. We made a first graph, figure 8 in order to observe the

differences between the first 9 sectors of activity in the 39 sectors.

As there are very big differences in the number of certifications, for a clear view two graphs were drawn (figure 7 for the first 9 sectors of activity, with over 1000 certifications and for the rest of the sectors, less than 1000 certifications a second graph, figure 8 for a more detailed view.



**Figure 8.** Distribution by activity sectors for the Environmental Management System ISO 14001, for the first 9 sectors, for 2019 [ISO 2018].

Percentage of unknown certificates represents 37.21%, they are considered null.

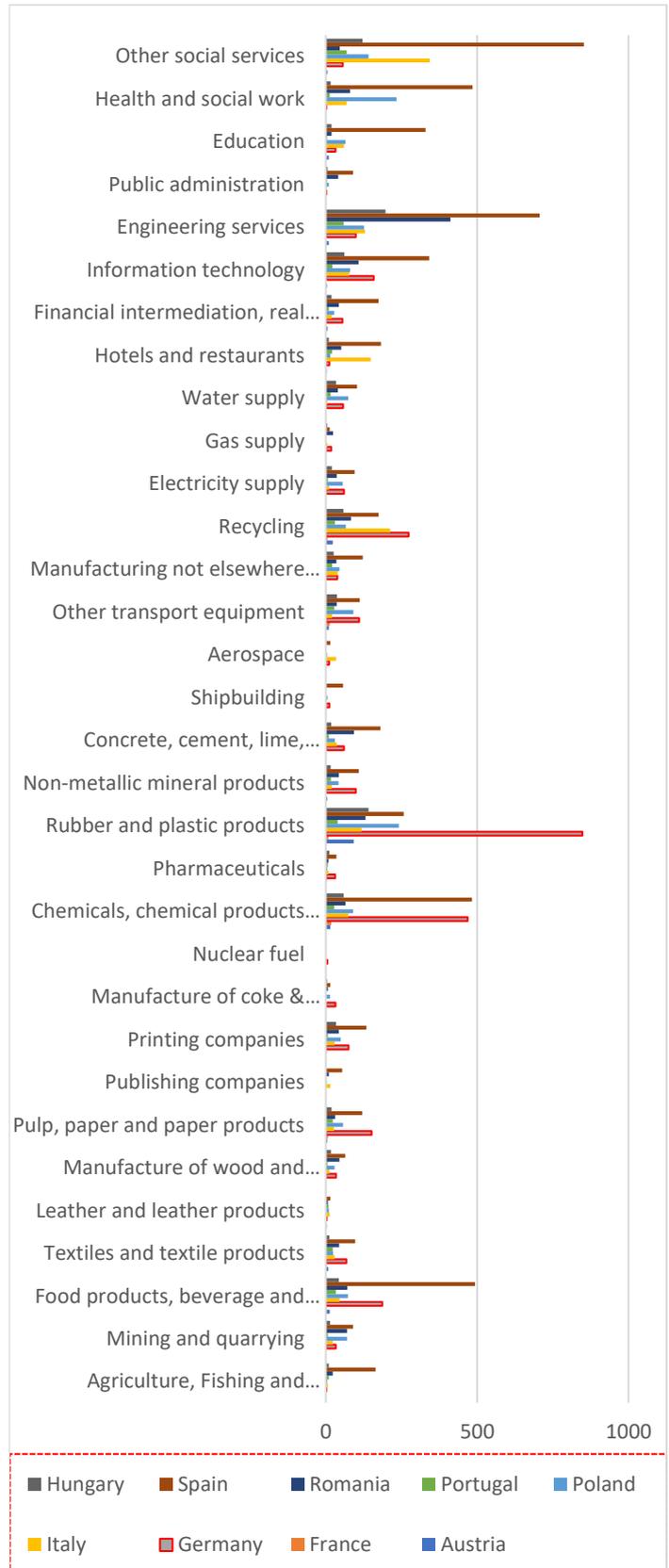
The ranking regarding ISO 14001, for the 9 countries regarding the number of certifications looks like this: Italy has 18,274 certifications representing 28.69%, Spain has 14,993 certifications, representing 23.54%, Germany has 10187 certifications, representing 15.99% , France has 6225 certifications, representing 9.77%, Romania has 4826 certifications, representing 7.57%, Poland has 4,163 certifications, representing 6.53%, Portugal has 1,052 certifications, representing 1.65%, Austria has 583 certifications, representing 0.91%.

In order to obtain a ranking of certifications, the number of certifications in the 9 countries was compared with the total number of certifications in the world, the total being 39,6242 certifications worldwide in the 175 countries out of a total of 195 countries worldwide.

The ranking for the 9 countries is as follows: Italy with 18,274 certifications representing 4.61%, Spain with 14,993 certifications representing 3.81% followed by Germany with 10,189 certifications, representing 2.57%, France with 6,425 certifications, representing 1.62%, Romania ranks 5th out of the 9 countries with 4,826 certifications, representing 1.2%, then Poland with 4,163 certifications, representing 1.05%, Hungary with 3,184 certifications, representing 0.80% , Portugal with 1052 certifications, representing 0.26% and Austria with 583 certifications, representing 0.14% of the total certifications globally.

The percentage of certificates of the 9 countries, reported globally indicates a value of 16.07%.

The following comparison took into account the first 9 sectors that hold 47,389 certificates, representing 74.40% of the total certifications and the other sectors with a number of 16,298 certifications, representing 25.59% of the total of 63,687 certifications, figure 9.



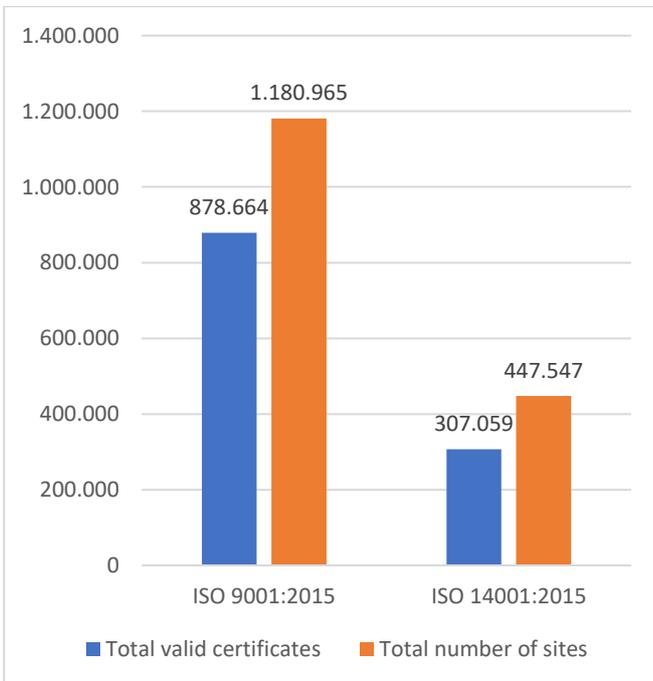
**Figure 9.** Distribution by activity sectors for the Environmental Management System ISO 14001, under 1000 certifications for 2019 [ISO 2018].

### 3.2 The evolution of ISO certifications worldwide for 2018

The data collected by ISO were:

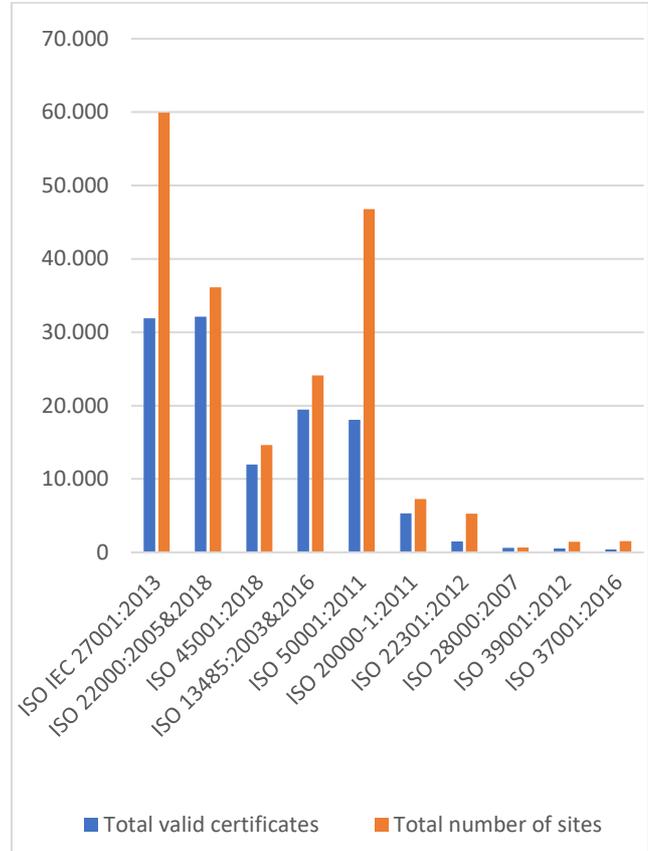
1. Number of certificates valid in the country on 31 December (A valid certificate is one that was issued by a certification body accredited by IAF MLA members in the survey year or in the previous two years that is still valid on 31 December of the survey year )
2. Number of sectors per country covered by certificates according to the classification of the 39 sectors specified by European Accreditation.
3. The number of certifications for each country, covered by their certificates [ISO, 2018].

Because the differences in the number of certifications are very large, we made a first graph, figure 10, with a number of certifications between 307059 certifications and 878664 certifications and another second graph, figure 11, with a number of certifications between 389 of certifications and 31910 certifications.



**Figure 10.** The global ISO certifications of the ISO 9001 and 14001 Management Systems, with a number of certifications including 307059 certifications and 878664 certifications, for 2018 [ISO 2018].

To compile the statistics, ISO used over one million sites, namely 1180965 sites for ISO 9001 and 447547 sites for ISO 14001. In total, ISO used 1827153 sites for all MS.



**Figure 11.** Global ISO certifications of Management Systems with certifications between 389 certifications and 31910 certifications, for 2018 [ISO 2018].

The ISO report contains detailed results for each standard covered by the survey, with country data for the number of certificates and the number of sites and the total number of sectors. [ISO18].

Following the comparison presented above, which were made according to the statistics on the ISO site, statistics made by researchers from the International Organization for Standardization we can see the following:

1. Regarding ISO 14001, and in this case we rank 4-5, which means compared to the other states Italy, Germany, France and Spain that we have very few certifications compared to the countries listed above.

2. According to the data provided by ISO for 2018, for the standards related to MS we can make a ranking with the 7 most implemented standards, figure 10 and 11:

1. ISO 9001:2015 - 878.664 certified;
2. ISO14001:2015 - 307.059 certified;
3. ISO 22000:2005:2018 - 32120 certified;
4. ISO IEC 27001:2013 - 31910. certified;
5. ISO13485:2003&2016 - 19472 certified;
6. ISO 50001:2011 – 18059 certified;
7. ISO 45001:2018 – 11952 certified.

The analysis of trends in certifications for other MS also indicates the need for Romanian companies to align with European and global trends in order to develop in an increasingly competitive market.

#### 4. Conclusions

There is a significant upward trend in the evolution of ISO 9001 for Italy and Germany, and for the other countries a linear model is maintained with a slight increase from year to year. Regarding the sectors of activity (first 5 sectors) for the achieved ranking in Figure 4, they foresee an increase between 5 % and 20% of the number of certifications.

From the data analysis it is observed that there is no correlation between the number of MS certifications for the analyzed countries. In Romania, regarding the certifications with the use of the ISO 9001 standard as a reference, the trend is linearly increasing and in 2016 a decreasing linear trend is observed. Regarding the activity sectors, Romania has a downward trend compared to 2015, when Romania had the most certifications in history. After 2016, the trend becomes linearly decreasing.

In the case of the evolution of ISO 14001 certifications, there is a trend of progressive growth between 2000 and 2014, and starting with 2015 - 2016 the trend is decreasing, the model being linearly decreasing. For the sectors of activity (first 5 sectors) in the ranking in Figure 8, they provide for an increase between 3% and 18% in the number of certifications. The only country that has an upward linear trend throughout the study period 2000 - 2017, is Germany which maintains its upward linear

trend. The trend in Romania since 2004 and 2015 is an increasing one, and since 2015 the trend is linearly decreasing.

Regarding the ranking of Management Systems certifications, there is a maintenance of the increasing trend of ISO 9001, ISO14001, ISO IEC 27001, ISO 22000 and ISO 45001. For the next years, I foresee a significant increase for ISO 45001: 2018, even a doubling or tripling of the number of certificates.

The intuitions regarding the percentage increase for 2019 are:

1. ISO 9001:2015 - an increase with 2 % certified;
2. ISO14001:2015 - an increase with 5% certified;
3. ISO 22000:2005:2018 - an increase with 4 % certified;
4. ISO IEC 27001:2013 - an increase with 10 % certified ;
5. ISO13485:2003&2016 - an increase with 6 % certified;
6. ISO 50001:2011 - an increase with 1 % certified;
7. ISO 45001:2018 – an increase with 200 % certified.

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