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**55th EOQ Congress**

**CONCURRENT SESSIONS**  
**KEMPINSKI HOTEL CORVINUS**

**Wednesday 8:30 – 10:30**  
**Erzsébet tér 7-8, Budapest V.**

**SALON BANDINI/MARZINO**

**Wednesday 11:00 – 12.30**

## 16.1. ACCREDITATION AND SUSTAINABILITY

**Session Chair:** *Thong Ngee Goh, University of Singapore, Singapore*

### 11.40 Management Systems: a Path to Organizational Sustainability

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*Pedro Saraiva, University of Coimbra, Portugal*

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Paulo Sampaio is Researcher and Assistant Professor in the Systems and Production Department at the University of Minho in Portugal; Assistant Professor at the Lusíada University, Portugal; Quality Management Consultant in several companies; Founder Member and President of the Industrial Engineering Alumni Association, University of Minho; President of the General Assembly of the University; Product and Project Manager of the Portuguese Association for Certification. He is member of the American Society for Quality (ASQ). He graduated in Industrial Engineering (2002, 5-year degree) and received his doctorate (PhD) in systems and production engineering from the University of Minho in 2008 entitled "ISO 9000 worldwide phenomenon research: origins, motivations, consequences and perspectives". His research interests include quality management, ISO 9001 certification, ISO 9000 standards and quality management systems.

Paulo participates as a speaker in many quality management international conferences and he is currently author of several publications in the quality management area (books, papers in international and national journals). He is member of the research team of several quality management research projects and also supervises several Master and PhD thesis. In 2006, 2008 and 2009 Paulo has been distinguished with the award of the Best Paper Presented in the Student Technical Paper Competition during the ASQ World Conference. In 2008 his PhD Thesis was distinguished by the Portuguese Association for Quality as the best thesis developed in Quality. In 2009, Paulo has been distinguished as Senior Member of the American Society for Quality.

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# MANAGEMENT SYSTEMS: A PATH TO ORGANIZATIONAL SUSTAINABILITY

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## Abstract

According to the last available ISO survey, in December 2009 there were 1.065.785 issued ISO 9001 certificates, thus reflecting the importance of ISO 9001 certification worldwide, and approximately 223.149 ISO 14001 issued certificates. In the line of my previous publications, this paper presents a further set of statistical analyses conducted over ISO 9000 and ISO 14000 available data, providing some key results, which try to answer important questions regarding quality and environmental management systems certification in several countries. Such results provide an additional important contribution to the study of management systems diffusion/evolution, aimed at providing fact-based insights into, among other, the following issues:

- Which are the countries leading quality and environmental management system certification?
- Which are the countries that present highest growth rates between 2008 and 2009?
- What has been the evolution of ISO 9000 and ISO 14000 certification in the different countries in the past few years?
- What are market future perspectives regarding certification?

**Keywords:** *Management Systems, Certification, Standards.*

## 1. INTRODUCTION

A management system can be defined as a set of interrelated organizational processes which use different resources to achieve the objectives specified by the organization. Management systems therefore relate to planning, carrying out, controlling and improving various activities in an organization, by itself, and with regard to its stakeholders, on how the company is performing both in the short and long term. According to Karapetrovic *et al.* [1], management systems are thus based on the basic principles of systematization and formalization duties.

A management system implementation does not require a certain level of organization performance or the achievement of a predetermined result. Rather, it establishes the need to systematize and formalize a whole series of organizational processes in a set of procedures which are related to different areas of business management. Implementation of a management system means that the organization activities, which that particular standard attempts to regulate, are systematized and formalized. Due to this fact, standards are very often criticized for a tendency towards bureaucratization and excessive rigidity [2], and the variety of intra-organizational silos that they may create, according to each company subsystem.

From a global perspective, the success enjoyed by the dissemination of management systems seems to be closely linked to the dynamics of the globalization process, mainly of multinational companies.

The number of ISO 9001 certified companies is significantly high when compared with the remaining management systems, thus reflecting the huge importance that ISO 9000 certification has assumed for companies across the planet. According to the last ISO Survey [3], in December 2009 there were issued 1.064.785 ISO 9001 certificates in the world. China leads the ISO 9000 top 10 countries, with 257.076 certificates, followed by Italy with 130.066 certified organizations. Regardless of the number of ISO 9000 worldwide certified organizations, it is important to point out that recent analyses show an apparent stabilization over the number of certified companies, thus reflecting a possible market saturation [4, 5].

Concerning the number of companies with environmental certification according to the ISO 14001 standard, by December 2009 there were issued 223.149 certificates. China did present the highest number of ISO 14001 certified organizations (55.316), followed by Japan, with 39.556 issued certificates.

Management systems today cover a broad spectrum of areas within an organization and are aimed at providing confidence to different internal and external stakeholders. Karapetrovic and Willborn [6, 7], Karapetrovic [8] and Sampaio *et al.* [9, 10], among other researchers, address a number of factors that influence decisions on the implementation of a specific standard, ranging from the availability of internationally-accepted models to stakeholders pressures. The three most popular standards are ISO 9001 (quality management systems), ISO 14001 (environmental management systems) and OHSAS 18001 (occupational health and safety management systems). Additionally to these standards, there is an emergent set of other standards that, although having a more reduced number of certified companies, do reflect significant added value for those companies that implement them. In this group of standards one can find namely ISO 22000 (food safety management systems), ISO/TS 16949 (quality management systems – particular requirements for the automotive sector), or ISO 26000 (social responsibility).

After conducting one of the first quantitative statistical modelling efforts to understand and forecast ISO 9001 certification on a country-by-country basis [4], in this article the authors provide some key results, which try to answer the following research issues:

- Which are the countries leading quality (QMS) and environmental (EMS) management system certification?
- Which are the countries that present highest growth rates between 2008 and 2009?
- What has been the evolution since 1993 of ISO 9000 and ISO 14000 certification in different countries?
- What are market future perspectives regarding certification?

## **2. RESEARCH METHODOLOGY**

As mentioned before, the aim of this article is to examine the evolution of quality and environmental management systems certification worldwide, to reinforce not just competitiveness at the organizational level, but also at a broader scale of analysis, in the

development of regions and countries. For that purpose, we have followed a research methodology based on a set of statistical analyses conducted over ISO 9000 and ISO 14000 available data, and adopted the data sources that are described in the forthcoming paragraph.

**2.1 Data sources**

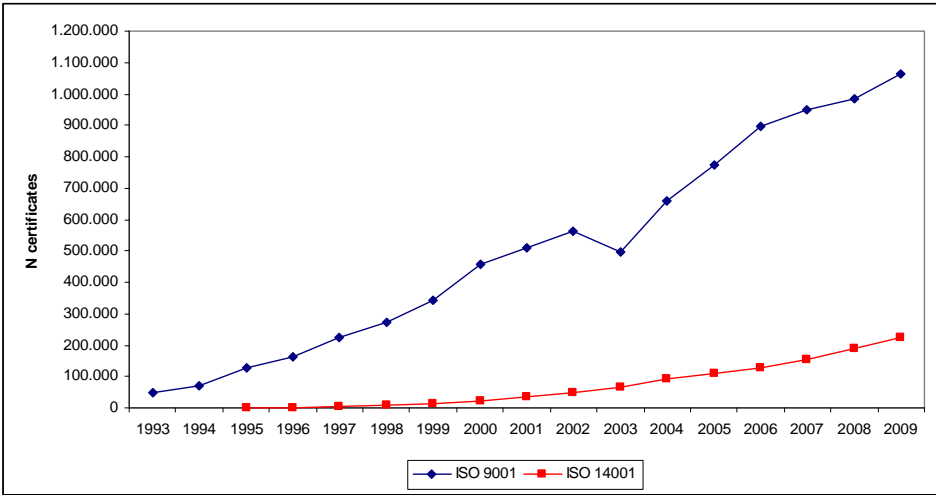
For the purposes of this study we compiled and used data obtained from the following sources:

- World Bank: population data.
- ISO Survey 2009: number of issued certificates.

**3. MANAGEMENT SYSTEMS CERTIFICATION: QUANTITATIVE AND QUALITATIVE ANALYSES**

As is illustrated in Figure 1, the number of ISO 9000 and ISO 14000 issued certificates in the world has been growing steadily from, respectively, 46.571 (December 1993) to 1.064.785 (December 2009) and from 257 (December 1995) to 223.149 (December 2009). Even though growth rates do vary across different countries, on a consolidated basis the overall number for both management systems is still growing fast. This situation is more evident in the last few years for environmental management systems certification.

Figure 1 – QMS and EMS certification evolution in the world



According to Figure 1, we can see that in the time period that ranges from 1993 to 2002 there was a significant growth in QMS certification, followed by a decreasing trend in 2003, and then a further increase since 2004. The reduction of growth rate in 2003 may be related to the ending of the transition period for adoption of the year 2000 versions of the standards (which lasted until December 2003), with some organisations possibly not fulfilling that process. In the past few years there seems to be a stabilization of the worldwide number of ISO 9000 certified companies, around 1.000.000 registrations. Concerning the ISO 14000 certification evolution curve, one can verify that it presents a smooth trajectory. It is continuously increasing since 1995, reaching in 2009 the value of 223.149 certified companies.

In an attempt to apply the Pareto Principle to the contribution of countries to the overall total of ISO 9000 and ISO 14000 certificates in the world (2009 data), we have identified that the ISO 9000 top 30 countries (17%) in terms of issued certificates corresponds to 90% of the worldwide ISO 9000 certificates, and that the ISO 14000 top 30 countries (19%) corresponds to 87% of the total number of 223.149 certificates.

However, just examining the absolute number of certified entities in a particular nation does not account for scale differences amongst countries. Therefore, an interesting quality metric that we have developed is the value of the number of issued certificates per 1000 inhabitants at any given country or region, designated here as ISO 9000 per capita (ISO 9000pc) and ISO 14000 per capita (ISO 14000pc) [4, 5, 11, 12]. To build the ISO per capita scores associated with each country or region, we combined the values mentioned before, which correspond to the number of ISO certificates issued in each country, together with the corresponding population values. When this scaling effect is taken into account, a different ranking, which corresponds now to the top 30 countries according to ISO 9000pc and ISO 14000pc, was obtained (Table 1). In the following analyses we have only considered those countries with 100 and more issued certificates, both for QMS and EMS certification, in order to remove noise from the data set.

Table 1: ISO 9000pc and ISO 14000pc top 30 countries (December 2009)

#	Country	ISO 9000pc (2009)	#	Country	ISO 14001pc (2009)
1	Italy	2.16	1	Sweden	0.45
2	Switzerland	1.50	2	Czech Republic	0.45
3	Czech Republic	1.34	3	Spain	0.36
4	Spain	1.30	4	Romania	0.32
5	Israel	1.03	5	Japan	0.31
6	Malta	1.01	6	Switzerland	0.30
7	United Arab Emirates	0.95	7	Italy	0.24
8	Singapore	0.83	8	Finland	0.21
9	Slovenia	0.83	9	Estonia	0.20
10	Cyprus	0.78	10	Slovenia	0.19
11	Netherlands	0.74	11	United Kingdom	0.18
12	Romania	0.74	12	Denmark	0.17
13	Hungary	0.71	13	Hungary	0.17
14	Bulgaria	0.70	14	Singapore	0.16
15	United Kingdom	0.67	15	Republic of Korea	0.16
16	Slovakia	0.64	16	Norway	0.16
17	Croatia	0.58	17	United Arab Emirates	0.16
18	Germany	0.58	18	Lithuania	0.16
19	Sweden	0.57	19	Slovakia	0.14
20	Hong Kong	0.57	20	Cyprus	0.13
21	Estonia	0.56	21	Hong Kong	0.12
22	Japan	0.54	22	Ireland	0.12
23	Austria	0.51	23	Austria	0.11
24	Luxembourg	0.50	24	Croatia	0.11
25	Republic of Korea	0.48	25	Netherlands	0.08
26	Ireland	0.48	26	France	0.07

#	Country	ISO 9000pc (2009)	#	Country	ISO 14001pc (2009)
27	Portugal	0.48	27	Bulgaria	0.07
28	Greece	0.45	28	Belgium	0.07
29	Finland	0.42	29	Germany	0.07
30	Australia	0.42	30	Israel	0.07

As illustrates Table 1, the ISO 9000pc ranking ranges from 0.42 (Australia) to 2.16 (Italy). Italy leads this ranking with a score of 2.16, followed by Switzerland with 1.50 issued certificates per 1000 inhabitants. Besides Italy and Switzerland, there are four additional countries that do present an ISO 9000pc value higher than 1.00 – Czech Republic, Spain, Israel and Malta. It is important to point out that four out of the ten countries that mostly contribute to the overall number of issued certificates are not in the top 30 ISO 9000pc ranking – China (0.19), Russia (0.37), India (0.03) and USA (0.09).

Regarding environmental management systems certification, the top 30 ranking is lead by Sweden and the Czech Republic, both with a per capita score of 0.45, followed by Spain (0.36), Romania (0.32), Japan (0.31) and Switzerland (0.30). The ISO 14000pc values range from 0.07 (Israel) to 0.45. Two countries that contribute significantly to the worldwide number of ISO 14000 certified companies are not in the top 30 ranking for ISO 14000pc (China – 0.04, USA – 0.02).

Another important conclusion that we were able to find out based on Table 1 is that the majority of the countries are present in both rankings, thus reflecting that the overall number of quality and environmental certified companies in a country are in some way related. Australia, Greece, Luxembourg, Malta and Portugal are only in the ISO 9000pc ranking, and Belgium, Denmark, France, Lithuania and Norway belong only to the EMS one. For these countries we can conclude that the importance of the QMS certification and EMS certification for their economies and companies is somewhat different. The countries from the first group consider quality certification more important than the environmental one, and for the countries of the second group environmental certification is more important than the quality one.

Table 2: ISO 9000 and ISO 14000 growth rates top 30 countries (2008-2009)

ISO 9000 top 30			ISO 14000 top 30		
#	Country	%	#	Country	%
1	Republic of Korea	560.5%	1	Russian	108.8%
2	Albania	260.5%	2	Kazakhstan	105.6%
3	Russia	231.1%	3	Thailand	99.6%
4	Venezuela	98.6%	4	Latvia	79.7%
5	Jordan	96.5%	5	Romania	76.7%
6	Vietnam	84.7%	6	Bulgaria	76.0%
7	Moldova	74.0%	7	Serbia	69.3%
8	Honduras	73.8%	8	Vietnam	66.5%
9	Uzbekistan	58.1%	9	Cyprus	59.2%
10	Algeria	57.2%	10	Israel	49.9%
11	Romania	47.8%	11	Czech Republic	41.2%
12	Paraguay	41.7%	12	China	41.1%
13	Latvia	41.6%	13	Croatia	36.7%

ISO 9000 top 30			ISO 14000 top 30		
#	Country	%	#	Country	%
14	Lebanon	39.4%	14	France	34.3%
15	Czech Republic	39.1%	15	Sri Lanka	33.3%
16	Cuba	36.7%	16	Tunisia	32.4%
17	Lithuania	36.3%	17	Peru	31.3%
18	Ukraine	32.6%	18	Lithuania	29.6%
19	United Arab Emirates	32.6%	19	New Zealand	29.1%
20	Nigeria	31.9%	20	Malaysia	28.5%
21	Saudi Arabia	31.3%	21	Australia	27.3%
22	Serbia	30.7%	22	Singapore	22.9%
23	Kazakhstan	28.3%	23	Turkey	22.3%
24	Tunisia	26.4%	24	Belarus	21.0%
25	Mauritius	25.2%	25	Iran	20.5%
26	Sri Lanka	23.5%	26	Portugal	18.4%
27	Cyprus	22.0%	27	India	15.8%
28	Guatemala	21.8%	28	United Kingdom	15.4%
29	El Salvador	19.8%	29	Norway	15.0%
30	Israel	18.9%	30	Hong Kong	14.3%

Based on Table 2, one can see that there are three countries (Republic of Korea, Albania and Russia) that do present growth rates higher than 100% between 2008 and 2009, thus reflecting the importance that quality management systems certification has had for these economies. It is also important to point out that the countries top 30, with the exception of Russia, is mainly composed by countries theoretically less competitive and economically developed. According to these data, we can possibly speculate that quality, as expressed by ISO 9000 certification, nowadays can represent a means for less competitive countries to affirm and achieve increased competitiveness and perceived quality. On the other hand, those countries that do already have high competitiveness levels may not be so much pushed into ISO 9000 certification and possibly can make use of other management and quality approaches or guidelines. The growth rates range from 18.9% (Israel) to 560.5% (Republic of Korea).

Regarding ISO 14000 certification, Russia does present the highest growth rate, with a score of 108.8%, followed by Kazakhstan with a growth rate of 105.6%. The growth rates top 30 ranking range from 14.3% (Hong Kong) to 108.8% (Russia). Furthermore, when we compare both rankings (ISO 9000 and ISO 14000), one can see that the environmental growth rates are inferior to the ISO 9000 ones, and that the ISO 14000 ranking is composed, in general, by countries more economically developed than the ones that define the QMS ranking.

Based on the previous analyses in the forthcoming paragraphs we also analyzed the relationship between growth rates and the per capita score for each country and standard.

Figure 2 – ISO 9000 growth rates versus per capita indicator

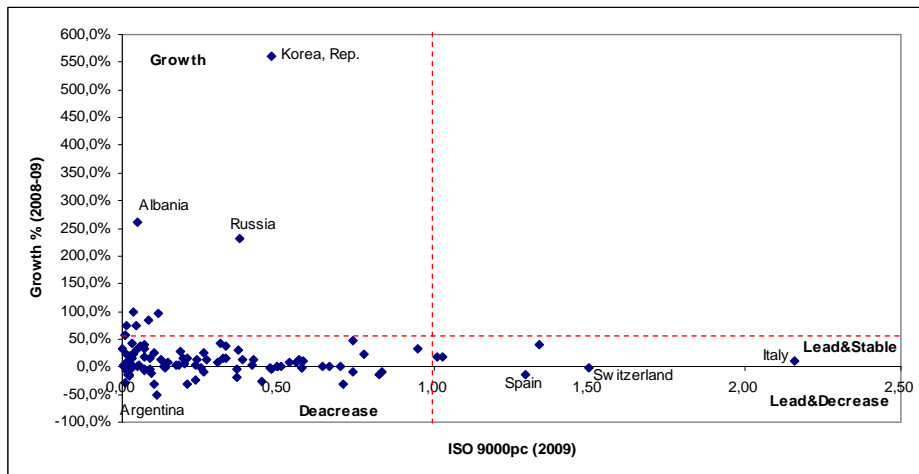
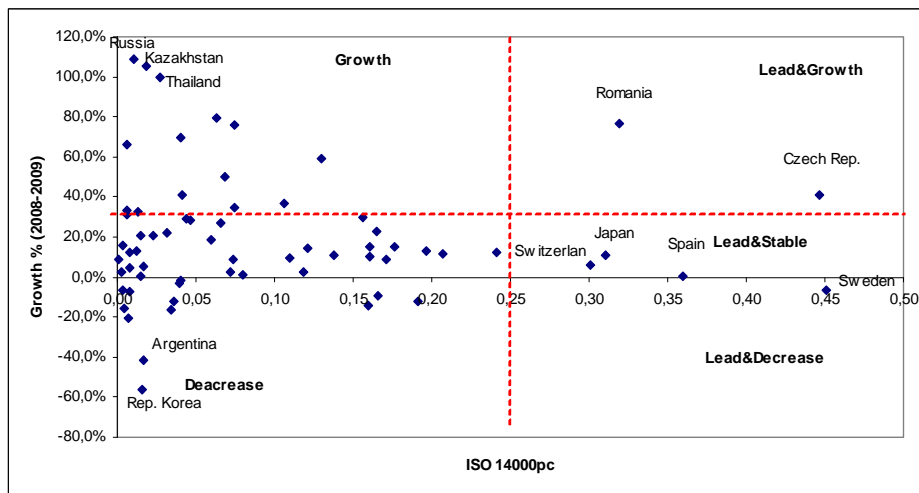


Figure 3 – ISO 14000 growth rates versus per capita indicator



According to Figure 2 there are no countries that do present a high ISO 9000pc score together with a high growth rate – 1<sup>st</sup> quadrant. However we can verify that there is a group of countries that is leading the quality certification movement but that currently do not have significant growth rates (Italy, Switzerland, etc.). In the 2<sup>nd</sup> quadrant there are those countries that do have a high growth rate potential. These countries will probably not reach the market saturation level in the medium term (Republic of Korea, Russia, Albania, etc.). However, Figure 2 illustrates that we should pay attention to those countries that are in the 3<sup>rd</sup> and 4<sup>th</sup> quadrant, respectively, countries where the number of ISO 9000 certified companies is decreasing (Argentina, etc.), and countries where the number of certificates is apparently high but with some decreasing evidence (Spain).

Figure 3 shows that Spain, Japan and Switzerland are leading the environmental movement and that it is not expected that ISO 14000 certification will increase in these countries in the short term. Czech Republic and Romania are also leading but with a tendency to increase the number of certified companies. On the other hand, there are some alarm signals in Sweden. For this country, although the number of certified environmental management systems is still high, the number of registered firms is apparently decreasing. For Republic of Korea and



Argentina and for the remaining countries that are in the 3<sup>rd</sup> quadrant it is evident that the number of ISO 14000 issued certificates is decreasing. In Russia, Kazakhstan and Thailand, despite of the current growth rates, the evolution potential is still significant, when we compare the per capita values of these countries with the ones of those countries that are leading the environmental certification movement. Based on Figure 3 it is apparently evident that the ISO 14000 growth rate in each country decreases with the increase of the per capita indicator.

Figures 4 and 5 illustrate the evolution of the 2009 per capita top 10 countries for, respectively, ISO 9000 and ISO 14000 certification between 2007 and 2009.

Figure 4 – ISO 9000pc top 10 countries evolution (2007-2009)

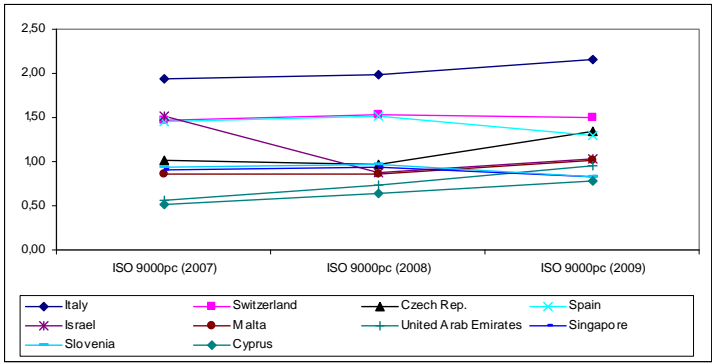
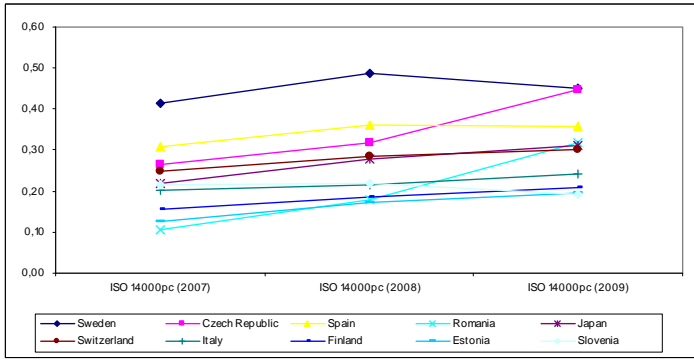


Figure 5 – ISO 14000pc top 10 countries evolution (2007-2009)

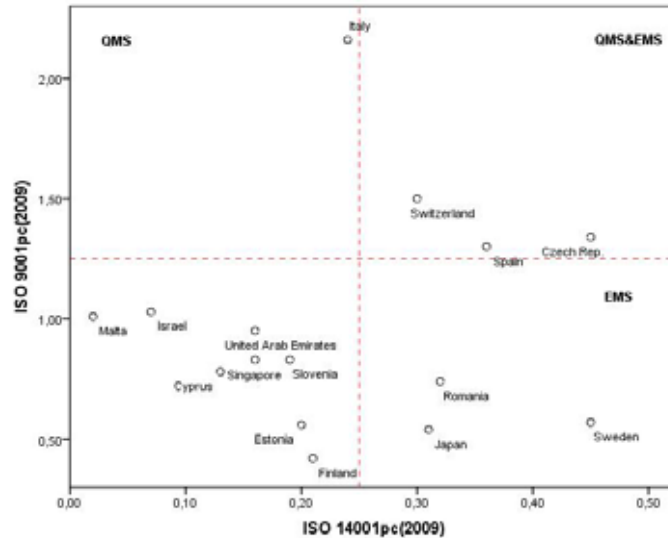


As illustrated in Figure 4, all the ISO 9000pc top 10 countries did present scores higher than 0.5 in 2009. Italy was the only country to reach a score higher than 2.00 certificates. All the remaining countries reached in 2009 values that range from 0.5 to 1.5. Furthermore, with the exception of Israel, we verified for all the countries an increase or maintenance of the ISO 9000pc scores. The number of ISO 9000 certified companies per 1000 inhabitants in the Czech Republic increased significantly between 2008 (0.97) and 2009 (1.34).

According to Figure 5, all the ISO 14000pc top ten countries reached in 2009 scores between 0.20 and 0.50. With the exception of Sweden, all the countries stabilized or increased the ISO 14000pc indicator during 2007-2009. As had been verified for the ISO 9000pc analysis, the Czech Republic did present a significant improvement of the number of ISO 14000 certified companies per 1000 inhabitants between 2008 (0.32) and 2009 (0.45).

In Figure 6 we analyse the relationship between the ISO 9000pc top 10 countries and the ISO 14000pc one, in order to make some inferences about what could be an evolution of the two analyzed management systems in each one of the countries.

Figure 6 – QMS and EMS certification future trends



Based on previous quadrant analysis we were able to identify which one of the management systems predominates in each country, or if both do so, and infer about which could be future trends. Thus, in Switzerland, Spain and the Czech Republic predominate both standards certifications and, based on the analyses presented in this paper, this scenario will be maintained in the future. By the contrary, in Japan, Romania and Sweden the environmental management systems certification is dominant and apparently it will continue in the short and medium term. Concerning Italy, there seems to be a transition stage, from QMS dominance to QMS&EMS dominance, because the number of ISO 9000pc and ISO 14000pc certified companies is continuously increasing in the past few years. Thus, it is expected that Italy will be in the 1<sup>st</sup> quadrant in the forthcoming years.

#### 4. CONCLUSIONS

Given the economic and social relevance of management systems for the worldwide companies, as well as the increasing availability of data related to it, the author believes that more and more fact-based and statistically oriented studies should be conducted in this area. This article tries to point out some interesting and important issues in this regard, which could be used as a starting point to pursue further research in the field.

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