

ISO 14001 diffusion: after the successfully pattern of ISO 9001?

Martí Casadesús
Departament d'Organització, Gestió Empresarial i Desenvolupament de Producte
Av. Lluís Santaló, s/n
Universitat de Girona
17071 Girona
Spain
Tel: +34 972 41 82 86
Fax: +34 972 41 83 61
E-mail: marti.casadesus@udg.edu

Frederic Marimon *
Universitat Internacional de Catalunya
Facultad de Ciencias Económicas y Sociales
c/ Inmaculada 22
08017 Barcelona
Spain
Tel: +34 93 254 18 00
Fax: +34 93 254 18 50
E-mail: fmarimon@uic.es

Iñaki Heras
Departamento de Organización de Empresas
E.U.E. Empresariales
Universidad del País Vasco
San Sebastián
Spain
Tel: +34 943 01 83 71
Fax: +34 943 01 83 60
E-mail: oephesai@sc.ehu.es

* Corresponding author

ISO 14001 DIFFUSION: AFTER THE SUCCESSFULLY PATTERN OF ISO 9001?

SUMMARY

El interés de las organizaciones y entes relacionados en la implementación de sistemas de gestión mediambiental (EMS), en especial de la familia de normas ISO 14000 y del reglamento EMAS en Europa, ha crecido de forma espectacular en los últimos años en todo el mundo, si bien, se detecta una cierta saturación en ciertos países. Ello nos lleva a pensar, ¿está ya saturada la implementación de EMS?. El presente artículo analiza el caso de la exitosa norma ISO 14000, a partir de la experiencia previa de los sistemas de gestión estandarizados con más experiencia en todo el mundo: los sistemas de gestión de la calidad (QMS). ¿Seguirán los EMS los mismos pasos que los QMS?. El análisis realizado, mediante *logistics curve that fits quite well* in order to explain the nature of these growths, distingue three general patterns to explain the diffusion of these norms, namely: expansionistic, mature and retrocessive.

Keywords: ISO 14000, Environmental Management Systems, Standardization, Diffusion.

1. INTRODUCTION

During the past few years, there has been a significant growth in the standards issued by agencies specialized in standardization in the economic field. This growth of standardization has been largely due to the marked process of economic globalization and integration that western economies have experienced throughout the last two decades [1].

Standardization could be generically defined as that activity aimed at putting order into repetitive applications that arise in the field of industry, technology, science and the economy [2]. In its beginnings at the start of the 20th century, standardization arose to limit the anti-economic diversity of components, parts and supplies so as to favour their interchangeability, facilitating serial production and the repair and maintenance of products and services. In a global economy without standardization and the fruits of it – regulations, standards and technical specifications – exchanges will be made exceeding difficult. Consequently, standardization fosters international trade thanks to the elimination of obstacles owing to different national practices. Notwithstanding, on many occasions these standards form non-tariff barriers for international business relations as they are not truly global. Thus and has been highlighted by different authors [3,4], while there are fewer and fewer tariff barriers, non-tariff barriers – technical standards and regulations which affect the requirements of products, services and, indirectly, production processes – take on greater importance.

At present, there is a great number of national and international standards attempting to order and systematize –amongst other things– the implementation of business management systems in terms of very different functions and operating activities, such as quality improvement (ISO 9000, TS 16949, QS 9000, EAQF, VDA, etc), occupational hazard prevention (OHSAS 18001), corporate social responsibility (SA 8000, AA 1000 and the ISO 26000 draft standards), R+D activities (the Spanish UNE 166000 EX experimental standard), human resources management (Investors in

People), y por descontado el caso que nos ocupa: environmental impact (ISO 14000 family standards and EMAS). All of these standards which will be included in the set of Management Systems Standards (MSS) are dealt with. However, it must be made clear these MSS are not based on standards which refer to the attainment of a specific objective or result – that is to say, they are not result or performance standards, but rather are standards which establish the need to systematize and formalize a whole series of business procedures related to the different fields of business management in a series of procedures [5].

From a global perspective, the success of disseminating all these management standards would seem to be closely linked to the dynamics themselves of the globalization process of Western economies and the main players in them – multinationals: if standardization originally came about in order to limit the anti-economic diversity of components, parts and supplies in an economic environment in which outsourcing and delocation of business activity prove to be cornerstone strategic elements, it must nowadays promote a certain homogeneity in business management systems in order to favour such processes. Specialists in this field point out that in the absence of a regulating power of a global public nature, the task of designing, implementing and enforcing standards has increasingly tended to be taken on by different regional or global institutions of a non-governmental nature in areas which have traditionally belonged to the field of regulation of public powers [6-8].

All these standards implement very similar methodologies of creation, structuring, implementation and third-party verification processes. Two series of standards issued by the International Organization for Standardization (ISO) stand out amongst these standards, due to their successful dissemination: the ISO 9000 series, related to the implementation of quality systems, and the ISO 14000 series, objetivo de análisis del presente artículo, related to the implementation of environmental management systems.

The ISO 9000 phenomenon has aroused great interest and has been extensively studied in the academic field, mientras que the literature is not as profuse as regards research analyzing ISO 14000 implementation, si bien, pueden encontrarse distintas investigaciones centradas en ello [9-12]. The results of these studies are very diverse, although, in general, it could be stated that external factors, especially the coercive pressure of customers, are of great importance as motivators in the implementation of the standards referred to. As regards the methodology used in all these studies, it must be pointed out that they are generally based on opinions obtained from surveys circulated amongst the environmental & quality managers of companies, and thus reflect an inherent bias.

Recently, a few academic works focusing on the endogenous process of ISO 9000 dissemination itself have been carried out internationally, among which that of Saraiva and Duarte [13] and Franceschini [14] may be highlighted. Now, in the academic literature known to us, only Professors Corbett and Kirsch [15], an extension of the research carried out by Vastag [16], and Marimon *et al.* [17] have analyzed the joint dissemination of ISO 14000 and ISO 9000. These studies are interesting in our opinion, not only due to their descriptive and predictive capacity regarding the dissemination process of these international standards per se as highlighted by the authors, but also because they offer certain empirical evidence with regard to whether there exists an analogy between the dissemination process of these standards and the dissemination of innovations in general.

Now, there is a crucial difference between the studies found and the present. All this research work was done at a time when the number of certificates was growing year by year, with both standards in clear expansion, a situation that is very different from the present one in many countries. In fact and as the ISO itself includes in its latest annual report in which the international dissemination of both standards is analyzed, there has been a certain decertification in the number of certificates in

recent years in several of the countries which had historically been leaders in this area (see [18]), es por ello que nos preguntamos si dicho fenómeno detectado principalmente en los QMS también se producirá en un futuro en los EMS.

The purpose of this article, with its clearly exploratory and pilot content, is to analyze in detail la evolución de las certificaciones ISO 14000 on an international level, con el objetivo de preveer su futura diffusion. Para ello se utilizará el proceso de difución de la exitosa ISO 9000 por ser la única estudiada hasta el momento, y en especial, por su posibilidad de ser claramente un referente en el ámbito de la estandarización. Es muy lógico pensar que los “pasos” seguidos por dicho standard de gestión serán bastantes similares a los que la norma ISO 14000 tomará en los próximos años. De esta forma, quizás sea posible determinar homogenous guidelines exist in the phases of the dissemination process of both certificates– including the decline phase which might be defined as the concept of decertification. In addition se analizará whether it is possible to assess the scope of these decline phases which prove to be of interest for the different agents involved in the implementation of the aforementioned standards. From the exploratory and projective work carried out, some proposals that could be tested in future work are also specified in the final part of this article.

2. CURRENT SITUATION OF THE LEADING EMS STANDARDS

The ISO 14000 family standards establishes a reference model for implementing a company environmental management system, defined as that part of the global management system that describes the organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for preparing, applying, reviewing and maintaining the company’s environmental policy. It contains standards that include guidelines and suggestions for matters such as environmental management, environmental auditing, environmental labeling or lifecycle

assessment. Nonetheless, the only normative standard within this series is the ISO 14001, which provides a list of specifications and requirements that an EMS should meet. It is the only one against which the company can be assessed and certified [19].

The ISO14001 standard is divided into five major sections: (a) environmental policy, which involves making a statement of environmental intentions and principles; (b) planning, which requires the company to specify the processes it uses to identify the environmental problems that must be tackled and define specific objectives and targets; (c) implementation and operation, which involves both defining responsibilities for the system and guaranteeing the identification of training needs, the internal and external knowledge of the system, the control of documents and operations, and the preparedness for and response to emergencies; (d) checking and corrective action, which entails the existence of procedures to monitor operations and to prevent and mitigate any non-compliance with objectives and targets; and, (e) management review, which implies the setting up of processes through which senior managers review the suitability and effectiveness of the system and introduce the appropriate changes. [19].

The ISO 14001 standard was published in September 1996 (although some companies had already been certified in accordance with a previous draft). The main rationale for the creation of ISO 14001 was that its worldwide acceptance should expedite international trade by harmonizing otherwise diffuse environmental management standards and by providing an internationally accepted blueprint for sustainable development, pollution prevention, and compliance assurance [20]. Sin embargo, el proceso de generación del estándar fue long y complicated como es especificado por Haufler [21]. The last review of the standard dates from 2004. A transition period that ends in May 2006 has been established. From that point onwards, the ISO 14001:2004 standard would be the only one acknowledged by the IAF (International Accreditation Forum) member states.

Before analyzing the dissemination of this standard, it would be interesting, from our point of view, to properly clarify an important question that usually causes confusion regarding this standard. ISO 14000, with a structure and formulation that is very similar to the famous quality management standard ISO 9000, is not a standard that measures the environmental impact of the companies that implement it, but rather, establishes the manner of systematizing and formalizing procedures related to the company's environmental impact processes. Consequently, it is likewise not a standard dealing with objectives or results, but rather with procedures. From the point of view of management systems and taking into account that their area of applicability is different, it could be affirmed that one of the main differences existing between this standard and ISO 9000 is due to the fact that ISO 14000 does indeed establish – however tenuously or ambiguously – a reference for the compliance of certain environmental objectives, since it holds that companies must commit themselves to compliance with the elementary environmental standards and regulations in force in each setting.

Por otro lado, en Europa también nos encontramos con el reglamento EMAS. EMAS -Eco-Management and Audit Scheme- establishes the need to comply with said standards and regulations. It is a voluntary initiative designed to improve companies' environmental performance. It was initially established by European Regulation 1836/93, and it was revised in 2001 by the European Regulation 761/2001 (EMAS II). Actually, EMAS requires participating organisations to implement an environmental management system (EMS) that must meet the requirements of the International Standard BS EN ISO 14001. Many organisations progress from ISO 14001 to EMAS and maintain certification/ registration to both.

“Take in Table I”

Como se recoge en el tabla I, de acuerdo a los últimos datos disponibles por la the Environment Directorate General of the European Comission, a finales de 2006 había un total de 3.531 certificados EMAS en vigor en la European Union (EU-27). Una cifra menor a la de los certificados en vigor a finales de los ejercicios 2002 y 2003, y cercana a la existente a finales de 2001 (3.417 certificados), año en el que se crea EMAS II. Si bien la interpretación de estos datos resulta compleja, dado que con la entrada en vigor de EMAS II se estableció la posibilidad de registrar corporaciones, además de sites, parece claro que EMAS registration se ha estabilizado, si es que no se ha reducido con fuerza.

De hecho, en la literatura se comienza a señalar que both internationally and within the European Union EMAS already has lost the race against ISO 14001 long ago [22]. Según los estudios realizados, una de las principales razones por las que las empresas están dejando de lado registrase conforme a EMAS está relacionada con la European limitedness of EMAS [23]. Así las cosas, en este artículo nos centraremos únicamente en el análisis de la difusión del estándar ISO 14001.

Hasta día de hoy, the story of ISO 14001 difussion it's a success story. The latest data offered by ISO [18] indicates that, as of December 2005, there were already 161 countries with ISO 9000-certified companies, and the number of certificates worldwide is at least 776,608. When ISO 14000 was published, 127,349 certificates had already been issued for ISO 9000. Like ISO 9000, ISO 14000 was also disseminated worldwide, although not with the same degree of success for the time being. The latest data available, also dating from December 2005 [18], indicates that 111,162 ISO 14000 certificates have already been issued in a total of 138 countries.

Before proceeding with an analysis of the data obtained, debemos hacer notar que there are other reliable sources of the worldwide ISO14001/EMAS certifications, como por ejemplo la collected by Reinhard Peglau (Federal Environmental Agency in Germany) o las recogidas por Environmental Systems Update (ESU). However, we will take the data provided by ISO, thus they

publish simultaneously the ISO 9000 and ISO 14000 data with the same criteria and using the same sources in every country.

También it should be specified that data supplied by ISO regarding the number of certifications worldwide is used in this research; in particular, the latest data available reports [18,24,25]. It is very important to take into account that this data, must be viewed with some caution, as it may contain some errors or aspects which need to be qualified. Firstly, it should be taken into account that the current version of both standards allows having a single site certification, which would explain a huge reduction if the multinational firms apply this model, although the details provided by ISO [18] do not place importance on this. Secondly, the ISO organization itself acknowledges the fact there are some errors in its data, as this is compiled via organizations from different areas in each specific country in a different way. That is why the reduction in the number of certifications analyzed in this article is not necessarily only due to companies which have stopped being certified, but rather may be due to other reasons which are difficult to contrast in any research work.

Having said this and analyzing the data given by ISO itself in more detail, it is easy to see how the situation is not so optimistic. Making a comparison using the latest data available [18,24,25], and solely bearing in mind the 13 countries with the greatest number of certificates – which reflect more than 70% of all certificates worldwide – we obtain the data reflected in table II. The nature of the analysis which is being tried to be carried out from country to country makes it very difficult to work with a large number of countries, as well as quite possibly being of little relevance. That is why throughout the research, a decision has been made to focus solely on the 13 leading countries in ISO certifications, their behaviour probably being similar to that of the other 148 countries with companies that have implemented both standards - countries which only represent 30% of certificates worldwide.

“Take in Table II”

It is important to point out different aspects in the previous table: on the one hand, there are some countries in a declining process as regards dealing with the number of ISO 9000 certificates (United Kingdom and Australia) compensated on a worldwide scale by the strong growth of China, Italy, Japan and Spain. Thus, although the number of certificates is globally increasing, the situation is worrisome, since various economically significant countries have already started a trend towards decertification. On the other hand, as regards ISO 14000, it is easy to note how such behaviour is not detected. There continues to be a certain growth in the great majority of countries, with the exception of China, where the increase is very high. As is observed in Marimon *et al.* [17], it seems normal that this should be the case, since the implementation of the standard in question has always taken place under the aegis of its famous predecessor.

In order to be able to compare the number of certifications existing in each country, taking into account the relative importance of the economies of those countries, a relevant analysis involves studying the intensity of certification by means of certain rates created for this study. This intensity of certification in ISO 14000 (r_{14}) and ISO 9000 (r_9) are the relationship between the number of certificates and an indicator of the GDP of each country. This indicator is the simple average of the GDP of the four years expressed in 1.00 E+09 current \$US. In this way, r_{14} shows the number of ISO 14000 certifications for each 1.00 E+09 \$US of GDP mean of these four years. Similarly r_9 shows the intensity of ISO 9000. These indexes allow comparisons among countries whose absolute certifications numbers are quite different, but may show a similar behaviour towards these standards. Just as an example, as it will be analyzed forward, these indexes shows that Spain and China are in the same cluster, even though China has almost four times the ISO 9000 certifications

of Spain. Hence, this indicator does not make economic sense; it is used as a deflator constant over the four years to avoid the fluctuations between the \$US and the currency of each country. Without a doubt, it would be even more interesting to calculate this intensity, not in accordance with contribution to GDP, but rather, for example, in accordance with the number of plants or industrial companies in each of the countries; but the real difficulties inherent in being able to avail of appropriate data make it necessary to use the indicator mentioned.

Analyzing the intensity of certification using the aforementioned rates, as noted in table III in the case of the ISO 9000 certification, a significant decertification in some countries analyzed may also be observed, particularly in countries such as Australia, United Kingdom or Netherland. Conversely, the situation is very different in the case of the ISO 14000 standard, in which all the countries analyzed evidence growth in terms of this rate. This growth may even be deemed spectacular in countries such as China, Republic of Korea, Italy, France and Spain, in which this rate has doubled in the last four years.

“Take in Table III”

Faced with this apparent decertification issued in highly relevant countries on a worldwide scale, different questions to explore arise: did the models of dissemination existing in the literature foresee such a decertification? And the most important consideration is, can this decertification show us the trend that the rest of the countries are gradually going to follow?

3. DIFFUSION MODELS

The literature relating to dissemination of the different management tools and systems is very extensive, since this is a research topic that has enjoyed great interest amongst the academics of

different fields (the synthesis reflected in Rogers [26] is particularly interesting). Specifically, there is a very extensive literature on studies dealing with the dissemination of innovative technologies, which can also be applied in some form to management innovations; i.e., to innovations in general, such as Teece [27] does, demonstrating that the models of technological innovation are not limited to tangible products. From these studies, it may be roughly deduced that the accumulative adoption of innovations over time follows an S-shaped or sigmoid curve that reflects the fact that few members of a social system adopt an innovation in practice during its first stages, and that the rate that innovations are adopted rises until the process reaches its saturation point, when the growth rate falls anew. Stoneman [28] affirms that this model usually explains well the phenomena of diffusion in the field of new technologies.

Some studies tackling questions similar to those formulated in this study, however incipient, have already been carried out in specialist academic literature. With regard to the development of the ISO 14000 and ISO 9000 standards, Corbett and Kirsch [15] propose a regression model that explains the number of ISO 14000 certificates in a given country on the basis of its exporting capacity, its degree of commitment to the environment and the number of ISO 9000 certificates issued in that country. However, it must be taken into account that this interesting study is of a static nature: it does not analyze the development of both standards, ISO 14000 and ISO 9000, over time. From the study carried out, these authors conclude that the number of ISO 9000 certificates in a given country is one factor that explains the number of ISO 14000 certificates issued in the same country; however, they neither specify how such a dissemination occurs, nor do they analyze the sectorial factor, which, as they themselves state in the conclusions of their research, would be an interesting analysis.

On the other hand, Franceschini *et al.* [14] have established that the logistic curve explains well the dissemination of ISO 9000. As reflected in mathematical literature, the model of the logistic

curve was applied for the first time by the Belgian mathematician Verhulst during the 19th century in the field of biology, to account for the growth of a species. According to this model, growth rate is at a maximum at the start, when there are very few individuals in the species that scarcely have to compete for limited resources, and it becomes zero once a certain size is reached. This is the size of saturation that the available resources permit. The model responds to the following expression:

$$N = \frac{N_0 K}{(K - N_0)e^{-r_0 t} + N_0}$$

in which N represents the number of certificates, a function of time. N_0 represents the number of certificates at the starting point. K is the maximum level that may be reached: the saturation level. The initial growth rate is determined by r_0 .

On the basis of the aforementioned work, Marimon *et al.* [17] perceive how the logistic model in question is also applicable to the ISO 14000 standard. This research is based on the premise that the increase in the number of certificates for both standards would be proportional to the number of existing certificates at a given time. In addition, the same work observes how the dissemination referred to takes place in a rather similar way with respect to rates of concentration and instability in the different economic sectors that the authors analyze. Thus, they conclude by affirming that both standards have very similar behaviour as regards their dissemination. In fact, Corbett and Kirsch [15] and Vastag [16] had already affirmed that one of the factors that could account for the number of new ISO 14000 certificates in a certain country is precisely the number of ISO 9000 certificates.

Applying the logistic models previously mentioned to current worldwide data, in which countries experiencing a drop in the number of certificates are detected for the first time, figure I is obtained. The data was taken from a report on development published by ISO itself – the most reliable global information that can be availed of – even though ISO warns, in the introduction to these statistics, that ISO 14000 and ISO 9000 certificates are issued by local entities in each country, and thus, there is no “official” database of certified companies. From this, it may be observed how the said model suits the current certification data perfectly, with a fit of more than 99% for r squared in both curves. At present, we would be at 64.6% of the saturation level for ISO 14000 and 84.6% for ISO 9000, which, as Marimon *et al.* [17] point out, has a rather faster growth than ISO 9000. Considering 95% as the possible saturation percentage limit, the forecast according to this model is to arrive at a maximum of 160,000 ISO 14000 certificates and some 870,000 ISO 9000 certificates worldwide.

“Take in Figure I”

Analyzing individually by country, as Marimon *et al.* [17] have done with some countries, it is easy to observe how the aforementioned logistic curves adapt practically 100% to the empirical data compiled.

4. THE ISO 14000 AND ITS DIFFUSION RELATIONSHIP WITH ISO 9000

For the purpose of analyzing the relationship between ISO 14000 and ISO 9000 certifications, it has been decided to continue to work with the “Certification Intensity” indicator previously mentioned. As has already been said, although this may be improved, it at least allows us to work with data that may be better contrasted, since otherwise it would be impossible to compare the

number of certificates in countries with a potential such as China's, as against that of countries of a smaller size.

“Take in Figure II”

The representation of certification intensity rates for both standards on one and the same graph for the 13 countries which have the greatest impact on an international level yields the graph shown as figure II, on which the mean values of both variables have been marked through the use of a horizontal and a vertical line that divide the graph into four quadrants. This figure shows the situation in 2002, the start point of our analysis.

In the above figure, it is clearly observed that the two variables are related, with a Pearson's correlation factor of 0.666 at a significance level of 0.013. In any case, what is most relevant is to point out, as Corbett and Kirsch [15] affirm, that the number of ISO 14000 certificates in a country has a certain relationship with the number of ISO 9000 certificates in that same country, some years after the analysis carried out by these authors. Moreover, it may be perceived that very few countries are found in the upper left quadrant or in the lower right quadrant, implying that the countries that are relevant with regard to one standard and not to the other, are in the minority. In this sense, Japan is possibly the most noteworthy, having a low ISO 9000 certification rate with regard to its ISO 14000 certification rate. Some explanations regarding the reasons for this “delay” may be found in Corbett and Kirsch [29].

A data update using the information from 2003 yields a very similar graph, with slight lower correlation rates. This correlation decreases in 2004 and 2005 (see table IV). This indicates that some countries are coming out of the diagonal in figure II. This is the cases of Japan and Republic

of Korea. They make a great effort in terms of environmental responsibility but they keep at the same level of ISO 9000 intensity through the years.

“Take in Table IV”

At any rate, for the purpose of analyzing the line of development that countries seem to follow with regard to the number of certificates, the 2002 to 2005 graphs have been superimposed so as to make it possible to observe the country “movements” detected. This graph is shown in figure III.

“Take in Figure III”

First of all, analyzing figure III, a certain movement towards the right for some countries is observed which must be understood as an increasing in ISO 9000 certification intensity. It stands out the trends of three countries – China, Italy and Spain– that are registering a strong increase in their ISO 9000 certification intensities over the four years, clearly evidencing a situation of obvious expansion. The figure also shows some movements to the left, indicating a decrease in terms of ISO 9000 intensity (Australia, United Kingdom and The Netherlands). As far as ISO 14000 is concerned, it seems that in general the displacement moves upward, situating us in a period of expansion.

Indeed, analyzing the previous graphs in more detail, we believe it opportune to highlight 3 clearly differentiated behaviours, which we have assigned 3 different names: Expansionist, Mature and Retrocessive.

Expansionist behaviour

This group is made up of countries growing in their ISO 9000 and ISO 14000 certification intensity rates, “moving” toward the upper right-hand quadrant. China, Italy and Spain particularly stand out amongst the countries studied, and, to a lesser degree, Switzerland. These countries are all in a phase of growth as regards both standards, as is shown for instance in figures IV and V. In these figures, it is clearly noted how the logistic model used characterizes the number of certificates for both standards to a very satisfactory extent. This once again confirms that the aforementioned model is valid for representing and forecasting the growth of both standards beyond the forecasts made by Franceschini *et al.* [14] and Marimon *et al.* [17].

“Take in Figure IV”

“Take in Figure V”

Mature behaviour

This group is made up of countries that continue their increasing in ISO 14000 intensity rate, but which otherwise are decreasing as regards the rate referring to ISO 9000. This is the situation of countries that have already reached a certain maximum level of ISO 9000 certificates, whereas this limit has not been exceeded in the case of ISO 14000, very probably, among other reasons, because its real implementation in companies occurred much later. Of the countries analyzed, Republic of Korea and United Kingdom are found in this group, among others. They have reached the saturation rate close to the 95% with regard to the ISO 9000 logistic curve some years ago.

By way of example, the forecast models carried out for both standards in the Republic of Korea and United Kingdom are shown in figures VI and VII. If we focus in terms of ISO 14000

certification, the forecast model is perfectly adjusted to the real data obtained. This proves especially interesting when the Republic of Korea is a country which is predictably just starting out according to the model shown of ISO 14000 certifications. The case of United Kingdom is more complicated to analyse. The data does not fit the logistic curve, although there can be appreciated some similitude with the s-shaped curve. Part of this discrepancy can be explained by the lack of accuracy of the data. ISO declares some problems collecting data in the case of United Kingdom [24, 25].

“Take in Figure VI”

“Take in Figure VIII”

However, what occurs with the ISO 9000 certifications? As is noted in the figures, there is not only a clear drop in the number of certifications, but also the trend would appear to continue, and obviously the logistic curve can not be used any more to forecast ISO 9000 evolution. Clearly, it is very difficult to conduct analyses which are other than purely exploratory, bearing in mind the few years over which this phenomenon has been detected. However, a drop is in fact detected in stabilization in the number of certifications which one might initially expect.

Clearly, the analysis carried out would be of special local interest if it had only been conducted for these two countries. However, after carrying out the same analysis for all the countries involved in this group, the exploratory results obtained are very similar: perfectly foreseeable growth in the number of ISO 14000 certificates of up to 95% saturation of the model, to then start a relatively “chaotic” drop in the number of ISO 9000 certificates once saturation level has been reached “in an orderly fashion.”

It is interesting to note how, at the same moment in time, whereas for one of the standards growth continues in a relatively predictable way, for the one which has already reached the saturation limit, a drop in number has already started. This makes us think – albeit with certain caution – that what is detected is not tiredness in the use of management standards on the part of companies, but rather the assimilating and overcoming of the requirements of each standard. This in turn leads for instance to the non-renewal of certificates. In other words, a standard is implemented and certified, is maintained over time and, once its requirements have been accepted by the organization, they are no longer certified and the company focuses its attention on another standard to be implemented. In our opinion, standards may perhaps increasingly become “use and throw away” products or, at least the certification of these standards, as once the level required is attained, it would seem that the trend will be not to certify them again, which does not mean not continuing to use the standard.

Retrocessive behaviour

This group is made up of those countries in which a clear decertification in both ISO 9000 and ISO 14000 certification rates has been detected. Taking into account the data up until the year 2005 of the countries analyzed, there is no country following this pattern. Australia is the closest to this situation. Clearly, with a single country to analyze, it is very difficult to draw conclusions, even more so when these may be influenced by very specific aspects of each country such as a public administration campaign or funding for a certain type of certification or an error in taking into account data regarding certificates in that country. In any event and as is noted in figure VIII, the conclusions drawn from previous behaviour would seem to be confirmed from a merely exploratory point of view: a very accurate forecast may be made using the logistic curve model in the expansive phases, but once 95% saturation in that model has been reached, behaviour is quite

chaotic, and generally evidences a continued decrease. It is clear that more reliable conjectures cannot be put forward from the little data available – that is, faced with a phenomenon which is still so new.

“Take in Figure VIII”

Any other types of behaviour?

It must be pointed out that it would be possible to define another group of countries: those that have decreased in their rate as regards ISO 14000 certifications, but on the other hand continue to grow as regards ISO 9000. In any case, no country has been found in this situation, which seems reasonable enough, since the expansion of ISO 9000 was carried out with a sufficient head start and with sufficiently more impact than that of ISO 14000. It is logical to think that these types of country have not been detected in the sample, nor will there be a possibility of their detection in analyzing the rest of the population.

Following this exploratory analysis and taking into account the saturation levels of the countries analyzed as well as the different individual historical situations of each country, it seems very logical to think that countries will pass sequentially through three states: from expansionist to mature and from this to retrocessive. In some way, it is possible that the model followed by Australia is the one which most countries are gradually going to follow: continued growth in certain management standards which may be perfectly forecast by means of a logistic curve, whereas others are decreasing from the same moment as they reach their saturation level. It is true that such a conclusion has been reached in a relatively “provocative” manner, but on the other hand, it is impossible to go further in-depth as to results when such decertification only began to be detectable one or two years ago. However, it is also true that this analysis is very interesting in

particular if it is proven that the patterns followed by the leading countries are applicable to the others, even more so at a time when the number of environmental management standards is constantly growing (for instance, ISO 10015 and ISO 10031, recently-approved standards such as ISO 14063 for the environmental communication, and others which are at the draft stage such as ISO 14005 for the implementation of a EMS).

5. CONCLUSIONS

Este artículo no es el primero en el que se detectan comportamientos similares entre la implementación de un EMS según el estándar ISO 14000 y la de un QMS según ISO 9000. De esta forma, some authors [30,31] had already found out that the reasons companies had in getting certified as well as the benefits they obtained with certification coincided for both standards. However, up to now very little analysis has been done to determine whether their dissemination followed the same parameters or not. In particular, some research work proposing dissemination models has been carried out [14,17], but all of them had been carried out at a time when both standards were in a process of expansion.

On another hand, no research has been detected regarding a new effect such as the decrease in the number of certifications which has been detected in recent years. Firstly, it must be taken into account that this decertification concerns, above all, the ISO itself. In this sense, the latest report published by this organization [18] regarding the number of certificates includes a brief description of the possible causes of such decertification, as well as the results of a survey about it; in the aforementioned study, it is pointed out that one of the main reasons for decertification is “Organization failed re-certification audit,” although it must be taken into account that the main reason cited by companies (with 54.2% of answers) is “Other reasons,” whereby major conclusions cannot be drawn from this brief study.

In any case, the worldwide decertification is evident, more so if we take into account the fact that many countries ranked as worldwide economic leaders, such as United Kingdom or Australia, and up to a certain point Germany, are clearly immersed in this process of decertification. Without a room for doubt, the total number of certificates throughout the world is maintained thanks to the impact of the more incipient countries, particularly China, with their low saturation levels in forecast logistic models.

On discovering the first countries evidencing certain decertification in the number of ISO 14000 certificates, así como de ISO 9000 certificates, this article has sought to analyze their pattern. A first approach is found on detecting that this decertification begins once the number of certificates has reached 95% of the degree of saturation shown by the logistic model. Will this be the pattern for all the countries involved? In particular, will it apply to those that are in their first stages of growth? Needless to say, the low number of countries in which such decertification has been detected, and in particular the short period of time during which it has been detected – not more than one or two years – does not make it possible to make too many conjectures.

However, from the analyses carried out, it has been possible to define 3 types of country in terms of an expansion in both standards: the countries evidencing “expansionist” behaviour,” “mature” and “retrocessive” behaviour. In the first case, those countries evidencing a constant growth in the number of certifications according to both standards would be included – growth which may be easily modelled by means of logistic curves. China is the most representative country in this group, where the main reason to implement ISO 14000 standards is seeking entrance in the international market [32,33], and secondly to get environmental and management advantages and benefits similar to those documented for companies that adopted ISO 14000 in industrialized countries. Countries evidencing “mature” behaviour would be those in which the number of ISO 9000 certifications has reached 95% expansion, according to the model used, and a process starts

involving a decrease in certified companies which is difficult to model, whereas the number of certified companies according to the ISO 14000 standard continues to grow. Lastly, in countries evidencing “retrogressive” behaviour, those countries would be included in which the level of certifications decreases in the case of both standards.

In any event, the most interesting thing about the types detected is to note how the impact of one standard has already started to decrease in the same country at the same moment in time as another continues its “predictable” growth. This is closely related to the first hypothesis which we believe is interesting to formulate. That is why, by basing ourselves on the experience gained from our prior research and the practitioner and academic literature available, we consider it appropriate to conclude this exploratory pilot article by announcing a series of work proposals which we deem to be of interest and which one might attempt to contrast in subsequent research.

The first of them, as we have mentioned, is related to the possible loss of appeal of the implementation of MSS, due to the fact that the intrinsic value of the certificates supporting such implementation loses value as the total number of certificates increases. Indeed, we understand that there are by no means few companies - as has been pointed out to us at least in empirical studies carried out [34,35] – which have embarked on the process of implementation and certification of ISO 9000 standards motivated by the competitive advantage and the differentiation of image resulting from having the certificate; well, it would seem obvious that the intrinsic value of the certificate is not constant, but rather that it tends to decrease in an environment in which the fact of possessing the aforementioned certificates does not prove to be a distinguishing factor for companies. Muy posiblemente exactamente lo mismo ocurra con la norma ISO 14000. In our opinion and linked to this fact, it proves interesting to analyze the hypothesis of the competition factor involved for the dissemination of MSS such as ISO 9000 and ISO 14000 of business management general models, also known as models of excellence such as EFQM, Malcom

Baldrige and the Deming model. All this would mean that, as companies steadily implement, take on and certify a certain standard, it will make sense to certify it for a period of time, but gradually this certification will lose its importance, resulting in its being discontinued. Of course, this does not mean that that standard is not used, but rather that it is simply not certified. From then on, the company will focus its attention on other standards or models which it will probably be more interested in certifying, either to show this to its customers and competitors or to ensure their proper implementation.

On the other hand and as authors such as Delmas [20] and Potoski and Prakash [36] have stated, it is clear that the political and regulatory context of each country and, in particular, the prescriptive role of Public Administration plays a fundamental role in extending these MSS: direct or indirect grants for the implementation and certification of these systems may play a major role in the growth of certificates in a specific country, but also in the decertification process (as is the case of Australia, for instance, in which very particular behaviour is detected, probable for these reasons). We understand that this is an issue that should be contrasted in subsequent studies.

Similarly, we consider that it may also prove interesting to carry out an in-depth study on possible losses in terms of certifications owing to a lack of confidence in the system [35] and, in particular, if decertification can be explained due to the fact that there may be a trend in companies which, although they have implemented the system to a substantive extent in their organizations rather than merely symbolically - as many companies do according to some studies [37] - they have no incentive to become certified.

There is yet another point that could be analysed in future works in particular areas of the world. As an instance, since the ISO 14000 standard is now the management system used as the foundation for EMAS certification, it will be very interesting to investigate if the reduction of EMAS

certifications harms the European economy; or if it lessens the ability of companies to continually improvement in the area of environmental management.

As has been stated, we understand that all these reflections and working hypotheses in the broadest sense of the word and which we leave open for study in the future, are of great interest to we researchers who are working in EMS lines of research – a line of research which is gradually making its way into the academic field, as well as being of interest to different agents involved in the EMS dissemination process (e.g. multinational companies, accreditation and certification bodies, consultants, public sector agencies, etc).

6. REFERENCES

1. Mendel PJ. International Standardization and Global Governance: The Spread of Quality and Environmental Management Standards. In: Hoffman, A. and M. Ventresca editors. Organizations, Policy, and the Natural Environment: Institutional and Strategic Perspectives. Stanford University Press, UK, 2001.
2. Dale BG. Managing Quality. Blackwell Publishing, Third edition. U.K, 2002.
3. Krugman P, Obstfeld M. International Economics: Theory and Policy, 6th Edition, Addison-Wesley-Longman, 2003.
4. Blanco HB, Bustos. Normalización y Comercio Sustentable en Sudamérica, RIDES, Santiago de Chile, Chile, 2004.
5. Casadesus M, Heras I, Merino J. Calidad práctica. Una guía para no perderse en el mundo de la calidad, Prentice Hall-Financial Times, Madrid, Spain, 2005.

6. Brunsson N, Jacobsson B. The contemporary expansion of standardization. In: A World of standards. Herausgeber: Brunsson, N., Jacobsson, B. und Associates, Oxford University Press, Oxford, 2000:1-17.
7. Abbott KW, Snidal D. International 'standards' and international governance. *Journal of European Public Policy* 2001;8(3):345-370.
8. Neumayer E, Perkins. Uneven geographies of organizational practice: explaining the cross-national transfer and adoption of ISO 9000. *Economic Geography* 2005;81(3):237-259.
9. Van Der Veldt D. Case studies of ISO 14000: A new business guide for global environmental protection. *Environmental Quality Management* 1997;autumn:1-19.
10. Zabihollah R, Szendi JZ. An examination of the relevance of ISO 14000 environmental standards: a survey of US corporations. *Advances in Environmental Accounting and Management* 2000;1:123-140.
11. Mohammed M. The ISO 14001 EMS implementation process and its implications. A case study of Central Japan. *Econ-Management and Auditing* 2000;25(2):177-188.
12. Nakamura M, Takahashi T, Vertinsky I.. Why Japanese firms choose to certify: A study of managerial responses to environmental issues. *Journal of Environmental Economics and Management* 2001;42(1):23-52.
13. Saraiva PM, Duarte B. ISO 9000: some statistical results for a worldwide phenomenon. *TQM & Business Excellence* 2003;14(10):1169-1178.
14. Franceschini F, Galetto M, Gianni G. A new forecasting model for the diffusion of ISO 9000 standard certifications in European countries. *International Journal of Quality & Reliability Management* 2004;21(1):32-50.
15. Corbett C.J. Kirsch, DA International diffusion of ISO 14000 certification. *Production and Operations Management* 2001;10(3):327-342.

16. Vastag G. Revisiting ISO 14000: A new “Look” at the drivers of certification. Working Paper, Indiana University, 2003.
17. Marimon F, Casadesús M, Heras I. ISO 9000 and ISO 14000 standards: an international diffusion model. *International Journal of Operations and Production Management* 2006;26(2):141-165.
18. ISO The ISO survey of ISO 9000 and ISO 14000 Certifications: ISO. Geneva, <http://www.iso.ch/iso/en/iso9000-14000/pdf/survey2005.pdf>
19. González-Benito, J., González-Benito, O. An analysis of the relationship between environmental motivations and ISO14001 certification. *British Journal of Management* 2005;16(2):133-148.
20. Delmas M. The diffusion of environmental management standards in Europe and in the United States: An institutional perspective, *Policy Sciences* 2002;35(1):91-119.
21. Haufler, V. Negotiating international standards for environmental management systems: the ISO 14000 standards. UN Vision Project on Global Public Policy Networks. New York. 1999.
22. Loew, T., Clausen, J. .Wie weiter mit EMAS? Schlussfolgerungen vor dem Hintergrund einer Längsschnittanalyse 1997 bis 2002. *Diskussion Paper N° 4 Sustainability. Institute 4 Sustainability. Berlin. 2005.*
23. Loew, T. *Environmental Cost Accounting: Classifying and Comparing Selected Approaches*, in: Bennet, M, Rikhardsson, P, Schaltegger, S (eds.) *Environmental Management Accounting - Purpose and Progress* Kluver Academic Publishers. Dordrecht. 2003.
24. ISO The ISO survey of ISO 9000 and ISO 14000 Certifications: 13th cycle, ISO, Geneva, <http://www.iso.ch/iso/en/iso9000-14000/iso9000/survey13thcycle.pdf> 2004.
25. ISO The ISO survey of ISO 9000 and ISO 14000 Certifications: 14th cycle, ISO, Geneva, <http://www.iso.ch/iso/en/iso9000-14000/iso9000/survey14thcycle.pdf> 2005.

26. Rogers EM. Diffusion of innovations, Free Press, New York, USA, 1995.
27. Teece D. The diffusion of an administrative innovation. *Management Science* 1980;26(5):464-470.
28. Stoneman P. *Handbook of the Economics of Innovation and Technological Change*, Blackwell Handbooks in Economics, Oxford, UK. 1995.
29. Corbett CJ, Kirsch DA. ISO 14000: An agnostic's report from the front line. *ISO 9000 + ISO 14000 News* 2000;2:4-17.
30. Pan J. A comparative study on motivation for and experience with ISO 9000 and ISO 14000 certification among Far Eastern countries. *Industrial Management and Data Systems* 2003;103(8):564-578.
31. Poksinska B, Dahlgaard JJ, Eklund JAE. Implementing ISO 14000 in Sweden: motives, benefits and comparisons with ISO 9000. *International Journal of Quality and Reliability Management* 2003;20(5):585-606.
32. Zenga S.X., Tamb C.M., Vivian W.Y. Tamb, Dengb Z.M. Towards implementation of ISO 14001 environmental management systems in selected industries in China. *Journal of Cleaner Production* 2005;13: 645-656.
33. Peng Tan, L. Implementing ISO 14001: is it beneficial for firms in newly industrialized Malaysia? *Journal of Cleaner Production* 2005;13:397-404.
34. Casadesús M, Giménez G, Heras I. Benefits of ISO 9000 implementation in Spanish industry. *European Business Review* 2001;13(6):327-335.
35. Casadesús M, Karapetrovic S. Has ISO 9000 lost some of its lustre? A longitudinal impact study. *International Journal of Operations & Production Management* 2005;25(6):580-596.
36. Potoski M, Prakash A. Regulatory Convergence in Nongovernmental Regimes: Cross-National Adoption of ISO 14001 Certification. *Journal of Politics* 2004,66(3):885-905.

37. Christmann P, Taylor, G. Firm self-regulation through International certifiable standards: Determinants of symbolic versus substantive implementation. First Annual Conference on Institutional Mechanisms for Industry Self-Regulation, Dartmouth University, UK, 2005.

ACKNOWLEDGEMENTS

This article was written as part of a research project titled “The integrated management system (IMS) on Spanish companies” (SEJ2006-00682/ECON) financed by the Ministry of Science and Technology within the aid programme for R+D projects.