

Pattern of diffusion of the UNE 166002 innovation management standard: an exploratory analysis

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Abstract: The purpose of this paper is to analyze the evolution of the diffusion of the UNE 166002 innovation management standard in Spain for first time. Using data provided by most of the accredited organizations, the evolution of the diffusion of the UNE 166002 standard from 2002 to 2011 is studied. The results show that the diffusion of UNE 166002 follows a logistic curve in S shape. The current stage of diffusion it is in the expansion stage (in terms of initial stage, expansion stage, and saturation stage). According the available data at the end of 2011, the market would not be saturated until 2021. The findings of the present study should be of interest to all institutions and organizations involved with this type of certification—including accreditation organizations, certifying bodies, and business consultants specializing in the implementation of the UNE 166002 standards.

Keywords: UNE 166002, innovation management standard, diffusion, Spain

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1.1 Introduction

In a globalized world, there is no doubt that the interest in innovation phenomenon, and innovation management best practices, has increased the last decades as is widely demonstrated, since Shumpeter (1934) first said that innovation boost economical development, that innovation is a key factor for competitiveness (Porter, 1990) and for successful organizations,. Nowadays we enter in a new paradigm, the possibility of standardize innovation management first discussed by Mir and Casadesus (2011) regarding the Spanish innovation management standard UNE 166002 and already discussed if an International innovation management standard should be created.

UNE 166002 was designed in 2002 in the experimental phase and afterwards the official publication was issued in 2006. Some first case studies of implementations and certifications according UNE 166002 standard requirements have been done in Spanish firms for instance in the construction sector, in a manufacturing firm and in a biomedical research group (Pellicer et al. 2008; Mir and Casadesus, 2011 and Romero-Cuevas et al., 2010). In this paper we analyse if the evolution of the diffusion of the UNE 166002 number of certificated firms fits with a logistic curve proposed by Franceschini et al. (2004), and later adapted by many other authors like the recent work of Llach et al. (2011). Because, although there is a first approach of this evolution in a case study (Mir and Casadesus, 2011), there is no paper detected that focus on innovation management standards such the Spanish UNE 166002 pattern diffusion analysis.

Companies and organisations need to know about the decisions that other companies take on this topic. Managers need to know about trends. The phenomenon also triggers the interest of consulting companies specialized in the implementation of standards or in auditing management systems, as well as the interest of national standards institutes and accreditation and certification bodies.

Focusing the study on the diffusion pattern of the UNE 166002 there is an adoption of the methodologies previously developed for the diffusion of the ISO 9001 standard, witch has in fact been

The objective of the paper is, therefore, to analyse, for the first time, the way that UNE 166002 standard spreads in Spain: -is this pattern similar of others previously done at an international level? For instance just like for ISO 9001 and ISO 14001? Spanish standard have its own peculiarities?

1.2 Literature review

The literature review is twofold. On one hand, literature reviews studies on standard diffusion patterns, at a world-wide level, through the most common management standards. On the other hand, literature gathers studies related to innovation management systems, in general, and the UNE 166002 standard, in particular.

Related to standard diffusion patterns, Liu and Li (2010) show an update bibliography review about innovation diffusion, starting with the first steps of Rogers (1983) in this well-established theory of diffusion of innovation. According to Teece (1980), the dissemination of management tools and systems is analogous to the dissemination of innovations in general – in that they both follow an “S-shaped curve” that consists of three distinct phases. These phases were identified by Stoneman (1995) as: ‘initial’, ‘expansion’ and ‘saturation’.

These general ideas on innovation diffusion have been applied to the specific question of the diffusion of the ISO quality management standards around the world. Some studies (Corbett and Kirsch, 2004) have examined the question from the geographical point of view; according to these studies, the different levels of commercial activity that exist across different countries explain the varying number of certifications of quality standards. Other studies (Franceschini et al., 2004; Corbett, 2006) have suggested that the global diffusion of management practices is associated with the role of supply chains in the increasingly globalised world economy.

A somewhat different approach to the question of diffusion of the ISO standards has been taken by other authors (Marimon et al., 2004, 2006, 2009, 2010; Casadesus et al., 2008), who have defined the dissemination curve as a so-called “logistic curve”. The notion of the “logistic curve” was developed by Pierre Verhulst, a nineteenth-century Belgian mathematician who had the initial aim of accounting the growth rate in the population of a given biological species. However, it should be noted that the studies that have analysed the diffusion of quality standards in accordance with this logistic curve (Marimon et al., 2004, 2006, 2009, 2010; Casadesus et al., 2008) have analysed the diffusion across various countries and among different sectors of activity.

Related to innovation management systems, exists a lot of literature on this field but few studies about the concrete Spanish standard UNE 166002 and there are some discussions still not answered in any empirical study, whether UNE 166002 innovation management standard boost innovation capacity of the firms and its business results of a firm or not.

As we commented in the introduction, some first case studies have been made initial contributions to UNE 166002 subject in the recent years of its issue. First implementation evaluations revealed that ICT (Information and Communication Technologies) have an important role to its implementation in an organization (Mir-Mauri and Casadesus-Fa, 2008). In the construction sector Pellicer et al. (2008) developed a model of implementation of this standard, concluding that the UNE 166002 is highly interesting for the construction firms because is a plus to achieve public purchase contracts.

Mir-Mauri and Casadesus-Fa (2011) made contributions in a comparative analysis between this standard and other standards in other countries like the British Standard *BS 7000-1:2008 Innovation management*. Romero-Cuevas et al. (2010) also found that a good solution to improve innovation management and the re-

source optimization by implementing a management system based on the UNE 166002 in a biomedical research centre.

From an historical perspective, Rothwell (1994) has identified five generations of innovation processes and Mir and Casadesus (2011) speculate whether innovation management is at the threshold of a new generation of innovation processes—perhaps even the starting-point of the ‘sixth generation’ of innovation processes. As previously noted, Rothwell (1994) proposed a ‘five-generation’ (5G) framework for the development of innovation. The ‘sixth generation’ (6G) of innovation processes could thus be constituted by the 5G model (Rothwell, 1994), but with the additional feature of now being managed through a standardised management system based on the UNE 166002 standard, or similar subsequent innovation standards.

In September 1992, the European Committee for Standardisation (CEN) created the ‘CEN-STAR committee’, which aimed to draw up European standards for Research, Development and Innovation (R&D&I). Eight years later, in 2000, the Spanish standards authority (AENOR) created its own technical standards committee (AEN/CTN 166), which consisted of relevant professionals in the field of R&D&I. Against this background, the UNE 166000 family of standards was created in 2002 to cover R&D&I management in Spain.

Up to now, the European Committee CEN/TC 389 that was created in 2008 is still working on the standardisation of innovation management at European level (Mir and Casadesus, 2011).

1.3 Methodology, analysis and results

The first stage of our investigation will begin updating the model based on the logistic curve to explain the evolution of UNE 166002 certifications in Spain, and in this case taking the data as the aggregation of certifications from all the activity sectors.

1.3.1. Data set

The data used for this study has been collected visiting the websites and emailing the six accredited firms (AENOR, AIDICO, IVAC, EQA, Bureau Veritas Certification and SGS) by the National Spanish Accreditation Agency (ENAC, 2012).

Most of the certificates have been issued by AENOR, which represents almost 80% of the total of certificates, although lastly this trend has diminish, mainly because of the entrance to the market of three others accredited firms like Bureau Veritas and SGS (since 2006) and AIDICO (since 2009). IVAC has not issued any certificated and EQA did not provide the information and do not have this information on their website either. Next, Table 1 presents the number of certificates by year according the accredited firm.

Table 1. Evolution of the total number of UNE 166002 certificates during the period 2002-2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AENOR	1	3	6	8	35	17	40	82	90	69
Bureau Veritas	0	0	0	0	2	0	2	2	17	25
AIDICO	0	0	0	0	0	0	0	6	4	5
IVAC	0	0	0	0	0	0	0	0	0	0
SGS	0	0	0	0	1	0	3	8	4	13
EQA	*	*	*	*	*	*	*	*	*	*
Total	1	3	6	8	38	17	45	98	115	112
Total (aggregated)	1	4	10	18	56	73	118	216	331	443

Source: Actualized from Mir and Casadesus (2011), compiled from AENOR, AIDICO, IVAC, SGS and Bureau Veritas

*data not provided

The number of firms certified with UNE 166002 has grown steadily each year. Figure 1 confirms this upward trend with the aggregated number of certificates by year as well.

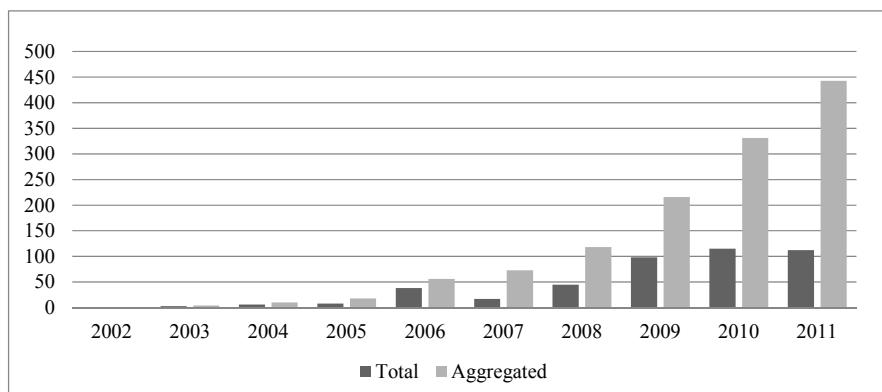


Fig. 1 Evolution of the total number of UNE 166002 certificates during the period 2002-2011

1.3.2. Methodology

The model used to analyse the diffusion of UNE 166002 is that proposed by Franceschini et al. (2004), and later adapted by Marimon et al. (2004, 2006, 2009, 2010 and 2011), Casadesus et al. (2008) and Llach et al. (2011). The model can be expressed as follows:

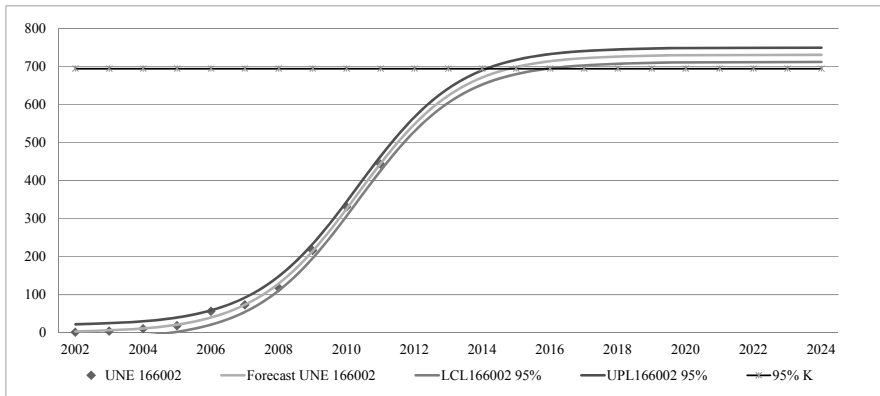
$$N = \frac{N_0 K}{(K - N_0)e^{-r_0 t} + N_0}$$

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 can be reached (the saturation level); and the initial growth rate is determined by r_0 .

1.3.3. Analysis of the diffusion of the UNE 166002

Figure 2 presents the diffusion of UNE 166002 during the period 2002 - 2011. It is apparent that the logistic model provides a good fit for the data on the current number of certifications, with a fit of more than 99% for r squared in the curve. In terms of the current diffusion state ('initial', 'expansion', and 'saturation' levels) nowadays we could consider that the number of certificates is in expansion, according to Stoneman's (1995) taxonomy.



	Sum Sq	DF
Regression	374852,631	3
Residual	443,369	7
Uncorrect ed Total	375296,000	10
(Corrected total)	214006,000	9
R squared	.998	

	Value	LI	UI
N_0	2,992	,965	5,019
K	730,885	525,251	936,519
r_0	,660	,544	,775

LI: Lower limit of the 95% confidence interval.
UI: Upper limit of the 95% confidence interval.

Fig. 2 Logistic curve and forecast of UNE 166002 certifications

1.4 Discussion and conclusions

There has been a wide diffusion of management systems, especially quality and environmental management systems and standards, in recent decades. Academic study of the diffusion of management systems has usually been analysed from a cross-national perspective (see e.g., Franceschini et al., 2004, Corbett, 2006, Marimon et al., 2006, 2009 and 2010, Casadesus et al., 2008). Lastly, even some studies have analysed the diffusion according to activity sectors in the case of the two most diffused standards, ISO9001 (Llach et al., 2011) and ISO 14001 (Marimon et al., 2011).

In the present study, for the first time, as far as the authors know, the diffusion pattern of the UNE 166002 has been analysed in the Spanish scenario. The realization of this study allows extracting some conclusions. Firstly, it is noteworthy the quick increase of the total number of innovation management standard certificates issued in Spain. At the end of 2011, the total number of certified firms was already over 440. Secondly, following the methodology proposed by the literature, the trend of this increase follows a logistic curve in a similar way that ISO 9001 and ISO 14001. Spanish standard have no peculiarities. And finally, according the logistic curve, nowadays, the market is still in expansion because the 443 certificates represent still 60% of the market. Based on the results, the saturation market forecast will not be until the year 2021.

However, the curve should be adjusted every year when new certifications are issued and, therefore, the saturation market forecast will be modified constantly.

The findings of the present study should be of interest to all institutions and organisations involved with this type of certification—including accreditation organisations, certifying bodies, and business consultants specialising in the implementation of the UNE 166002 standards. In addition, these empirical conclusions should be of interest from the strictly academic point of view—particularly for the line of research that analyses the diffusion pattern and adoption of ideas, models, systems, and tools of business management.

Regarding the limitations of this type of analysis of prediction based on mathematical models, the validity of the data is crucial. In the database used in the present study has a weakness: there are a number of UNE 166002 certificates that are missed in this study because there was not access to some databases. In this sense, the mathematical model must be updated annually in order to establish the saturation level of the diffusion that is growing meanwhile more data is collected.

Finally, we discuss whether a similar study could be extrapolated in a logistic curve in a European or International level to forecast the evolution even before the next European or international standard will be created, so more research is needed to find a methodology to adjust the analysis in different geographical scope perhaps relative to GDP, number of business firms, etc. In addition, following previous studies the analysis could be carried out by sectorial activity (Marimon et al., 2011, Llach et al., 2011).

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