



A worldwide analysis of ISO 9000 standard diffusion

Analysis of ISO
9000 standard
diffusion

Considerations and future development

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Abstract

Purpose – To provide a cross-section of International Standardization Organization (ISO) 9000 quality certification diffusion over time and its impact on industrial systems.

Design/methodology/approach – The starting point of the analysis is “The ISO survey of ISO 9000 and ISO 14001 certificates” document. Available data concur to trace a synthesis of what has happened and what is in process all over the world. Five main aspects are discussed: the correspondence between ISO 9000 standards and total quality management strategy; the effects of ISO 9000 certification on business performance; the ISO 9000 certificates diffusion in the world; the comparison between economical and entrepreneurial structure of different countries and certificates diffusion; the proposal of a prediction model for the diffusion of ISO 9000 certificates.

Findings – The evolution curve of the number of certificates over time in each country presents a “saturation effect.” This behavior has been analyzed by a diffusion forecasting model. The analysis of regional share certificates evolution evidences a sensible increase of Far East countries. The analysis of ISO 9000 certificates’ share by industrial sector highlights a growth for the most sectors; only a few of them show a negative trend in last two years. A relationship between ISO 9000 certificates and socio-economic indicators of a country (human development index, gross national product) has been individuated.

Practical implications – The stunning growth of ISO 9000 certifications all over the world confirms a strong polarization of enterprises’ interest in this practice. Looking at the empirical data, some questions come out about the future. Will the certification market go on? Will certified enterprises continue to be interested to the certification process?

Originality/value – This paper analyzes the worldwide evolution of ISO 9000 certification and suggests a new prediction model for the diffusion of ISO 9000 certificates.

Keywords ISO 9000 series, Quality standards, Quality systems, Quality management

Paper type Research paper

1. Introduction

Since, the early eighties, a proliferation of ideas for enterprises’ management according to Quality principles has been taking place. Quality assurance models (Military Standards Mil, 9859A:1963, 1963; ISO, 9000’s:1987, 1987), first, and total quality management (TQM), lean organization and benchmarking models, afterwards, have constituted a basis for involving and integrating all the factory competencies which can contribute to the competitiveness enhancement.

In such a context, International Standardization Organization (ISO) 9000 certification has acted as a catalyst of the existing tendencies, in order to induce organizations towards a structural model based on the logic of strategic quality management (ISO 9000-1:1994, 1994; ISO 9001:1994, 1994; ISO 9002:1994, 1994; ISO 9003:1994, 1994).



The first attempt to draw a series of guidelines for applying quality principles in industrial sectors dates back to fifties in USA, initially in the military sector, subsequently in the nuclear, pharmaceutical and automotive ones. Originally this was done in order to ensure that products matched technical requirements defined by contracts. Later, these rules have been adopted by British Standard Institution, which broadened the application field to the whole company system by the introduction of BS 5750 Standard.

As from the end of seventies, even though the most developed countries were possessing their own internal standardization bodies, at least for specific sectoral applications, the need of giving a unique and coherent international configuration to the quality assurance standardization structure and to the related activities (certification, accreditation, laboratories, etc.) began to be even more impelling.

The International Standardization Organization (ISO), at first only interested in the regulation of measurement activities in the different industrial sectors, took its cue from these standards, and in 1987 published the first edition of ISO 9000 series. This was fated to become in a few years the leading reference for Quality System Organization all over the world.

The expectation was to facilitate the international commerce and improve the competitiveness of European and North-American companies in an ever more selective market, characterized by a strong penetration of far-eastern products, by harmonizing terms, systems and methodologies. This could only be done by acquiring competitive advantage in terms of customer satisfaction and product reliability (Withers and Ebrahimpour, 2000).

ISO 9000 family standards specify organization requirements for giving a “formal evidence” of the capability to organize resources and processes with respect to regulation, prescriptions and customer requirements. The aim is to ensure stakeholders’ satisfaction (Franceschini, 2002).

ISO 9000 standards represent a benchmark for company management in its whole. They are not focused on the intrinsic product/service quality, but on the related processes, enlarging their action to the entire network of interactions in which the factory is acting. The extension of the application field originates from the awareness that quality is a strategic variable to be planned and managed through the whole network of the value-chain (Romano and Vinelli, 2001).

Nowadays, quality certification is steering towards a new frontier which is represented by the “Vision 2000” project, aimed to the reorganization of the whole quality standard structure. The leading philosophy results from the need of aligning factories’ growth opportunities towards market dynamics in order to redefine their strategies and their industrial/commercial targets.

The past approach of “conformity to requirements” which has largely conditioned the application of 1994 and earlier editions, is now trimmed in order to promote a review of the organizational order, coherent with a “quality-oriented” model. Still preserving its bargaining power and connotation of commercial visibility media in terms of credibility, the certification becomes a tool for integrating factory management, performance and process verification according to a scheme of “continuous improvement” (ISO 9000:2000, 2000).

ISO 9000 standard series represents a special category of “horizontal” standards of general application, aimed to guarantee product quality through an adequate management of resources and processes (quality system management). These

standards define the criteria for quality evaluation and the guidelines for the implementation of related tools and methodologies (ISO 9000:2000, 2000; ISO 9001:2000, 2000; ISO 9004:2000, 2000; ISO 19011:2002, 2002).

Up to the end of December 2002 more than 560,000 certificates had been issued in 159 countries all over the world, still persisting a significant growing rate (about +10 percent on annual average over the end of December 2001) (ISO, 2003). On the other hand, a drastic reduction of growth in the last year (Table I) is evident.

In the present paper, the ISO 9000 quality standard diffusion and its impact on industrial system is analyzed. Particular attention is dedicated to future trends and evolution.

Five main aspects are discussed:

- (1) the correspondence between ISO 9000 standards and TQM strategy;
- (2) the effects of ISO 9000 certification on business performance;
- (3) the ISO 9000 certificates diffusion in the world, with particular attention to actual trends, geographic share, and most involved industrial sectors;
- (4) the comparison among economical and entrepreneurial structure of different countries and certificates diffusion; and
- (5) the proposal of a prediction model for the diffusion of ISO 9000 certificates.

In the rest of the paper, case by case, it will be specified if the analysis refers to the new or the past standard edition.

2. ISO 9000 standards and TQM

The standard reassessment which led to the Vision 2000 project can be interpreted as an effect of a reorientation of factory management principles, induced by the increasing diffusion of TQM philosophy (Laszo, 2000; Conti, 2000).

The similarity to TQM can be easily found in many aspects of the new standards. Basic concepts such as customer centrality and satisfaction, continuous improvement, employees' valorization and involvement, process-organization-results integration, customers-suppliers-competitors connection, which represent the basis of TQM, have been assimilated and emphasized in the new ISO 9000 architecture.

Year	World total	World growth	Number of countries/economies
December 2002	561,747 of which 9001:2000 167,210	51,131	159 of which 9001:2000 134
December 2001	510,616 of which 9001:2000 44,388	101,985	161 of which 9001:2000 98
December 2000	408,631	64,988	157
December 1999	343,643	71,796	150
December 1998	271,847	48,548	141
December 1997	223,299	60,698	126
December 1996	162,701	35,352	113
December 1995	127,349	32,232	96
March 1995	95,117	24,753	88
June 1994	70,364	23,793	75
September 1993	46,571	18,755	60
January 1993	27,816		48

Source: ISO (2003)

Table I.
Worldwide total of ISO
9000 certificates since
1993

Referring to the efficacy of the two models, the scientific literature is disagreeing and there is no common interpretation so far. Many empirical researches reveal in ISO 9000 standard application a potentiality for valorization of TQM (Beattie and Sohal, 1999; Ismail and Hashimi, 1999; Lee and Palmer, 1999), some others interpret the ISO 9000 implementation as the starting point for the construction of a factory model for TQM (Parr, 1999; Kanji, 1998). Recent researches characterize the ISO 9000 standards as a tool for facilitating and implementing the adoption of TQM (Sun *et al.*, 2004), but not as a necessary precondition (Sun, 1999; Brown and van Der Wiele, 1996) or as the signal of a natural migration towards its implementation (Sun, 1999; Wiele *et al.*, 1997). They only give a set of general/generic guidelines, but they do not guarantee that the process is durable, capable and mature in the application of related constructs.

Although the 2000 series of ISO 9000 standards is closer to TQM principles, the cultural gap between the two models still remains large and not easily fillable (Laszo, 2000; Conti, 2000).

3. The effects of the ISO 9000 certification on business performance

Currently, a common point of discussion concerns the effectiveness of ISO 9000 certification on business performance. Many researches tried to find an empirical evidence of the relationship between these two aspects.

A cross-sectional study undertaken on the Australian market showed that the motive for adopting ISO 9000 certification and the maturity of the quality culture are significant factors for determining the benefits derived from ISO 9000 certification (Terziovski *et al.*, 2003). The style of the auditor, on the other hand, does not appear to have a significant and positive effect on the benefits derived from ISO 9000 certification. According to that, the natural conclusion is that certification contributes to business performance when the quality culture in the organization is well developed and the manager's motivation to gain certification is to improve business performance and not to conform to a standard.

Furthermore, many empirical evidences show that ISO 9000 certification is a necessary condition to support competitive and marketing objectives. Attention must be given in assuring that the company and its customers obtain the maximum benefits by the integration of the certification process in the marketing program (Stevenson and Barnes, 2002).

To confirm the influence of ISO 9000 certification on marketing results, a recent study, performed on a set of Spanish companies, analyzed the stock market's reaction to a publicly announced winner of a quality award (Nicolau and Sellers, 2002). Results show that the stock market reacts positively to such a certification. Quality certification can be considered as a useful tool for reducing the information asymmetry between buyers and sellers, as well as a strategic element for the companies to distinguish themselves in the business competition (Nicolau and Sellers, 2002).

4. A cross-section of ISO 9000 certificates diffusion in the world

The starting point of the analysis is "The ISO survey of ISO 9000 and ISO 14001 certificates" document (ISO, 2001, 2002, 2003). Available data concur to trace a synthesis of what has happened and what is in process all over the world. It must be highlighted that the surveys do not claim to be completely exhaustive and the reported data should be considered with care. In some cases undercounting has occurred, elsewhere accredited and

non-accredited certificates are added together without distinction, and the certificates mentioned may either cover single or multiple site certifications (ISO, 2001, 2002, 2003).

A main goal of the present paper is to provide an analysis of the world certification dynamics over time.

4.1 The “saturation effect”

Comparing different nations, the evolution of certification over time is not a “synchronous” phenomenon. In some countries ISO certification has been deeply practiced since standards’ introduction (see, for example, UK, France and Germany), in some others it met with maximum interest only in the last years (China and other eastern countries).

Looking at those countries in which the certification diffusion is a long-standing phenomenon, we see that the number of certificates is close to arrive at a saturation level. This effect is particularly evident for UK, Germany and France (Figure 1). In these countries the “certification market” is coming to saturation. The saturation level represents only a limited fraction of the total number of Corporation Companies (C.C.). The empirical saturation values for UK, Germany and France are, respectively, 9, 8 and 2 percent of C.C. in each country (Franceschini *et al.*, 2004).

Quality certification diffusion began when some companies, with the aim of distinguishing themselves in the business competition, manifested a wish to give

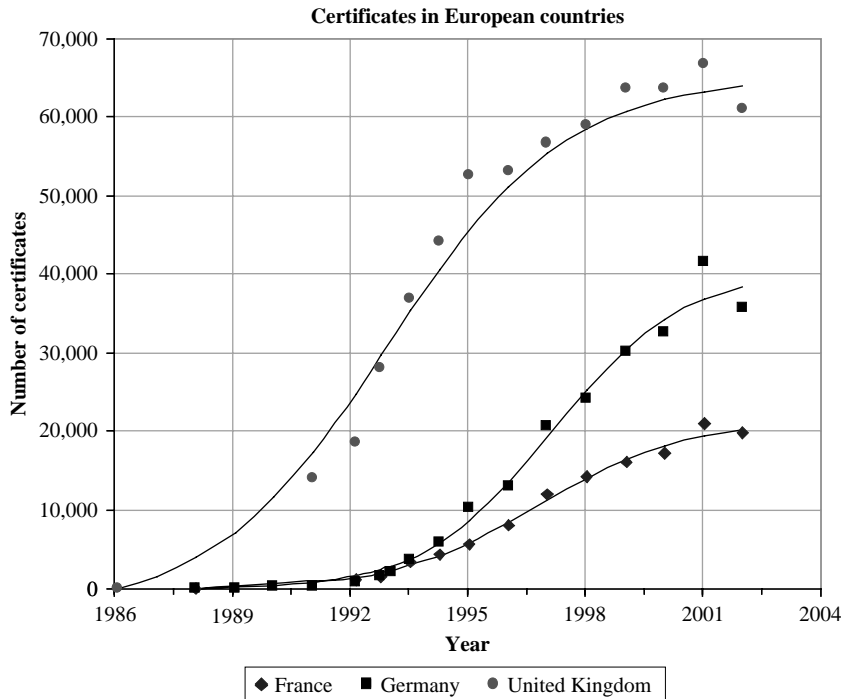


Figure 1.
Time evolution of the number of certificates in some European countries with the highest number of certificates in 2002 (since 1986)

Sources: ISO (2001, 2002, 2003); Comite Française d'Accréditation (2003); TGA Accreditation Body and DQS GmbH (2003); United Kingdom Accreditation Service (2003)

an external and formal evidence of their organizational efforts towards quality practice. Achieving success in a more and more careful market, their number has progressively grown up according to an almost exponential trend. This dissemination was promoted by central governments and by quality national bodies, reducing administrative features and supporting the diffusion of the certification bodies in the countries. As a result of these joint actions, an increasing attention of the enterprises towards the certification was caused: inside of the organization, in order to increase the resource involvement; outside, to give customers the evidence of excellence achievement. But the increasing process does not go on without end. Caught up the interest apex, the driving push slowly begins to attenuate under the effect of some concomitant factors: the reduction of the competitive gap between certified and not certified companies, and the limited number of enterprises potentially interested to certification. So, the growth slowly tends to a gradual saturation (Franceschini *et al.*, 2004).

This “saturation effect” strongly depends on the economic and productive structure of each country. For some European countries, with comparable entrepreneurial structures, the obtained results show that the predicted average saturation level is around 10 percent (number of certificates over the total number of C.C.) (Franceschini *et al.*, 2004). Table II reports the observed values for the top five European countries in 2002.

Date	Percentage of C.C.				
	France	Germany	Italy	Spain	UK
December 1986					0.00 ^a
December 1988	0.00 ^a	0.00 ^a		0.00 ^a	
December 1989		0.00 ^a		0.00 ^a	
December 1990		0.05 ^a	0.00 ^a	0.00 ^a	
December 1991		0.05 ^a		0.01 ^a	2.13 ^a
January 1993	0.11	0.18	0.06	0.02	2.83
September 1993	0.17	0.35	0.25	0.04	4.28
December 1993		0.47 ^a		0.05 ^a	
June 1994	0.36	0.79	0.56	0.07	5.60
December 1994				0.10 ^a	
March 1995	0.45	1.33	0.81	0.12	6.71
December 1995	0.59	2.32	1.25	0.19	8.00
December 1996	0.86	2.94	1.83	0.31	8.08
December 1997	1.26	4.67	2.92	0.54	8.63
December 1998	1.50	5.44	4.15	0.80	8.97
December 1999	1.70	6.82	4.58	1.09	9.40
December 2000	1.82	7.35	6.19	1.58	9.70
December 2001			9.56	1.95	
December 2002					

Note: ^aData refer to ISO surveys, with the exception of the marked ones. These lasts have been collected by each national accreditation body

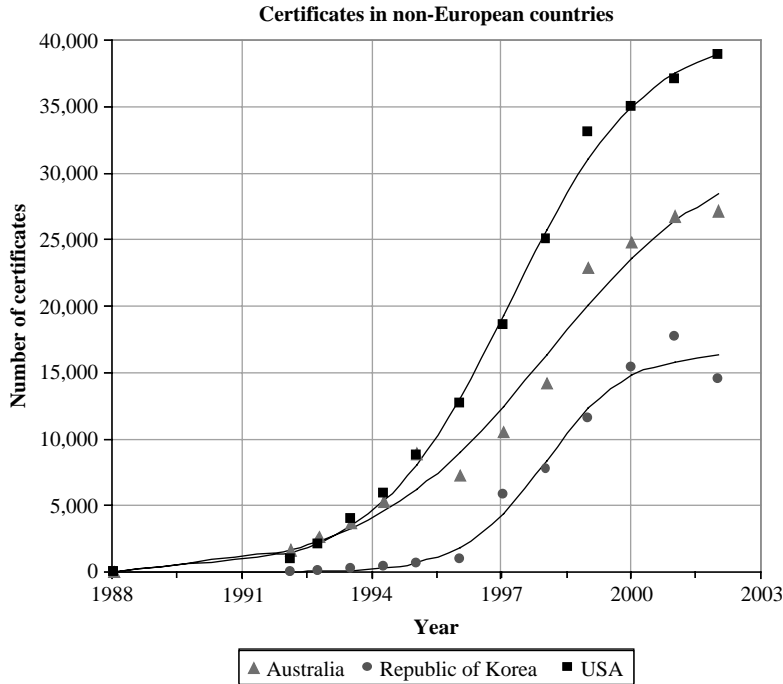
Sources: ISO, 2001, 2002, 2003; Comite Française d’Accréditation, 2003 (France); Ministère de l’Economie de France, 2003 (France); TGA Accreditation Body and DQS GmbH, 2003 (Germany); Deutsche Bundesbank, 2003 (Germany); Statistisches Bundesamt, 2003 (Germany); SINCERT, 2003 (Italy); Italian Ministry of Productive Activities, 2003 (Italy); Entidad Nacional de Acreditación, 2003 (Spain); Instituto Nacional de Estadística, 2003 (Spain); United Kingdom Accreditation Service, 2003 (UK); UK National Statistics, 2003 (UK); Eurostat, 2003)

Table II.
Percentage of certificates over the total number of C.C. for the top five European countries in 2002

The same “saturation effect” can be observed for many other non-European countries (see, for example, Australia, Republic of Korea, and USA in Figure 2).

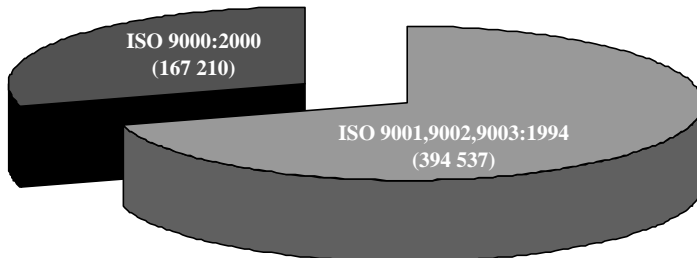
4.2 ISO 9000:2000 certificates’ geographic distribution

The number of ISO 9000:2000 certificates is 29.77 percent of the overall total at the end of 2002 (Figure 3). Considering that within the end of December 2003, the full transition to the new standards is supposed to take place, this percentage does not represent an encouraging result for the Vision 2000 project. Even if considering that this delay can be ascribed to some inertial effect towards change (typical in industrial/social environments), this percentage is too exiguous to give assurance of a complete transition.



Sources: ISO (2001, 2002, 2003)

Figure 2. Time evolution of the number of certificates in some non-European countries with the highest number of certificates in 2002 (since 1988)



Source: ISO (2003)

Figure 3. Portions of ISO 9000:2000 and ISO 9000:1994 certificates at the end of 2002

A further investigation about the causes of this phenomenon is mandatory. Three points of view may be considered:

- (1) organizations consider ISO certification as a flop, hence they decide to not renew the process;
- (2) organizations still consider ISO certification 1994 standard version an effective model for industrial quality management, hence they do not require a transition towards the Vision 2000 model; and
- (3) the transition follows an exponential growth (Figure 4). This behavior can be explained by a “cascade effect” induced by the deadline approaching (December 2003).

4.3 Emerging countries

Analyzing the regional share of certificates in the lapse of time from January 1993 till December 2002, two elements are particularly relevant: a continuous and systematic reduction of European countries’ percentage (compared to the overall number of certificates), and a parallel growth of Far East countries’ percentage (Table III and Figure 5). More details for European and Far East countries are shown in Figure 6.

This phenomenon can be justified by two main causes:

- (1) the maturity of European “quality market” particularly evidenced by the achievement of the so-called “saturation level” in most countries in this area; and
- (2) the appearing of “emerging countries” such as, for example, China (for its large size) and Republic of Korea.

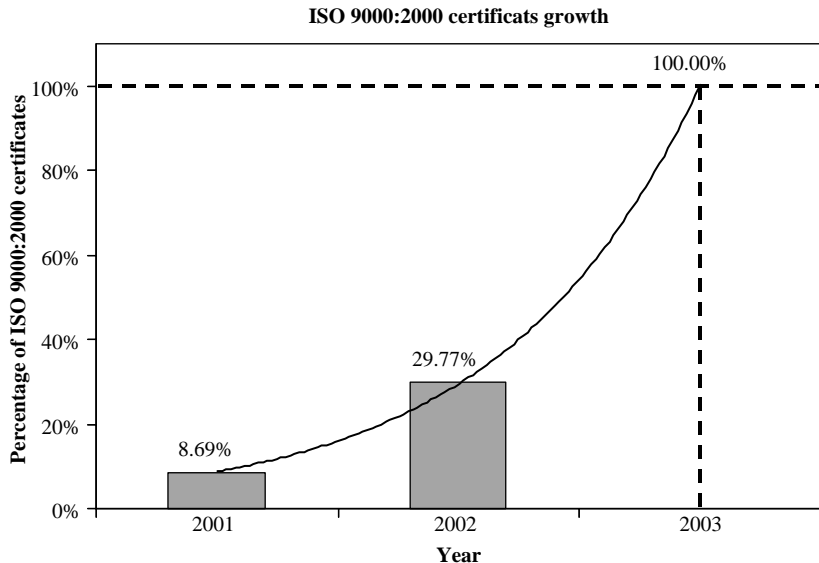


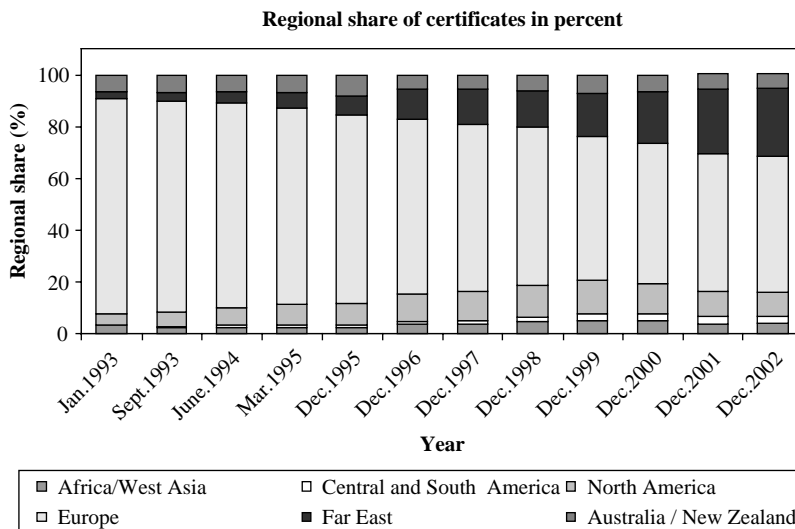
Figure 4.
Growth of ISO 9000:2000 certificates at the end of 2001 and 2002 compared to a hypothetical exponential growth

Source: ISO (2003)

	Total percentage					
	Africa and West Asia	Central and South America	North America	Europe	Far East	Australia and New Zealand
January 1993	3.42	0.10	4.32	83.02	2.46	6.69
September 1993	2.73	0.30	5.61	81.12	3.4	6.84
June 1994	2.64	0.68	6.99	78.73	4.39	6.58
March 1995	2.75	0.77	7.77	75.61	6.29	6.81
December 1995	2.65	0.96	8.15	72.72	7.26	8.27
December 1996	3.79	1.05	10.44	67.58	11.31	5.83
December 1997	3.88	1.34	11.25	64.31	13.42	5.79
December 1998	4.47	1.92	12.34	61.13	13.99	6.16
December 1999	5.04	2.61	13.14	55.36	16.48	7.36
December 2000	4.94	2.64	11.82	53.87	20.05	6.68
December 2001	3.87	2.83	9.97	52.87	24.83	5.65
December 2002	4.19	2.44	9.58	52.16	26.45	5.2

Sources: ISO (2001, 2002, 2003)

Table III.
Percentage values of the regional share of certificates in the world (since 1993)



Sources: ISO (2001, 2002, 2003)

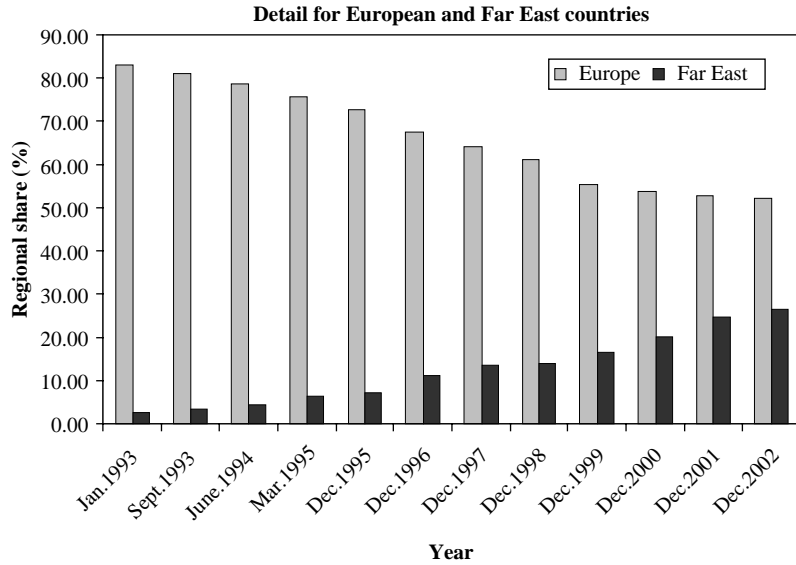
Figure 5.
Time evolution of the regional share of certificates' percentage in the world (since 1993)

4.4 The top ten countries for ISO certificates in 2002

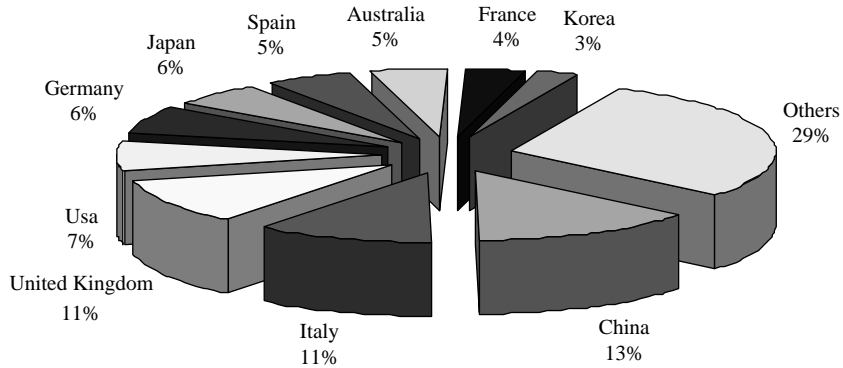
The top ten countries for ISO certificates in 2002 represent more than the 70 percent of the overall certificates in the world (Figure 7). It must be specially highlighted that five of them (France, Germany, Italy, Spain, and UK) are European countries.

The pole position is held by China, which is ever more imposing as emerging country in the global market.

USA position reveals a curious aspect. The adoption of ISO 9000 certifications in USA industry has lagged that of other developed countries due to questions about



Sources: ISO (2001, 2002, 2003)



Source: ISO (2003)

Figure 7.
Share of certificates referring to top ten countries in 2002

whether the benefits of ISO 9000 registration were sufficient to offset costs and sheer complexity (Stevenson and Barnes, 2002). This behavior was also supported by the natural dynamism of USA market, which did not force companies in pursuing ISO 9000 certification as distinguishing element in business competition.

Nine countries of the top ten in 2002 (China, Japan, Italy, Germany, UK, Spain, Australia, France, and USA) are also part of the top ten for ISO 9001:2000 (2000) certificates.

4.5 ISO 9000 certificates' share by industrial sectors

Certificates subdivided by industrial sectors are reported in Table IV (ISO, 2003).

EAC No.	Industrial sector	1998	1999	2000	2001	Of which 9001:2000	2002	Of which 9001:2000
1	Agriculture, fishing	610	678	1,745	1,265	112	2,381	813
2	Mining and quarrying	1,052	1,791	2,028	2,359	131	2,423	607
3	Food products, beverages and tobacco	7,347	8,746	11,440	13,805	1,317	17,038	5,113
4	Textiles and textile products	2,835	3,673	5,178	6,706	593	9,071	3,045
5	Leather and leather products	2,313	2,093	926	1,063	115	1,490	492
6	Wood and wood products	2,218	1,967	2,225	2,791	197	2,910	868
7	Pulp, paper and paper products	1,316	3,279	4,785	4,961	420	5,693	1,227
8	Publishing companies	363	354	445	1,048	68	1,212	190
9	Printing companies	1,998	2,939	3,299	3,191	378	3,630	1,097
10	Manufacture of coke and refined petroleum products	1,009	1,669	1,929	1,927	127	1,620	407
11	Nuclear fuel	279	220	115	96	4	192	108
12	Chemicals, chemical products and fibers	11,803	12,615	14,790	15,505	1,232	19,612	5,481
13	Pharmaceuticals	1,160	1,105	1,451	1,349	137	1,697	496
14	Rubber and plastic products	6,277	13,575	18,036	18,243	1,315	21,517	5,210
15	Non-metallic mineral products	2,328	3,571	4,209	5,363	454	5,753	2,113
16	Concrete, cement, lime, plaster, etc.	4,998	7,107	6,467	7,290	544	8,218	2,312
17	Basic metal and fabricated metal products	28,885	28,972	40,713	41,534	2,912	50,234	13,248
18	Machinery and equipment	20,275	19,827	23,027	29,812	2,146	35,047	9,246
19	Electrical and optical equipment	36,653	40,035	38,148	42,710	3,558	43,839	14,001
20	Shipbuilding	398	4,670	589	881	50	689	188
21	Aerospace	1,052	4,131	924	1,314	58	866	184
22	Other transport equipment	3,040	7,656	9,072	9,573	599	10,561	2,465

(continued)

Table IV.
ISO 9000 certificates
subdivided by industrial
sectors (since 1998)

Table IV.

EAC No.	Industrial sector	1998	1999	2000	2001	Of which 9001:2000	2002	Of which 9001:2000
23	Manufacturing not elsewhere classified	2,106	4,844	5,534	5,680	807	6,914	1,879
24	Recycling	1,001	1,765	932	959	97	966	357
25	Electricity supply	860	932	979	1,349	171	1,503	569
26	Gas supply	390	558	531	664	41	584	171
27	Water supply	505	799	1,242	932	106	874	331
28	Construction	19,768	25,273	32,389	40,948	3,507	51,093	15,752
29	Wholesale and retail trade; repairs of motor vehicles, motorcycles and personal and household goods	16,451	13,803	18,530	22,385	2,275	30,280	8,723
30	Hotels and restaurants	865	1,794	1,187	1,500	204	1,840	670
31	Transport, storage and communication	11,738	11,366	13,181	12,732	1,221	20,356	4,592
32	Financial intermediation, real estate, rental	4,690	3,218	4,367	4,950	773	7,195	2,322
33	Information technology	5,826	6,706	11,067	7,529	1,017	7,777	2,661
34	Engineering services	8,064	9,201	11,451	13,303	1,590	15,089	4,699
35	Other services	13,088	12,150	13,160	15,762	1,886	21,270	5,169
36	Public administration	689	2,086	1,404	1,840	331	1,932	780
37	Education	1,833	3,996	4,282	4,879	580	4,544	1,529
38	Health and social work	1,250	2,871	3,820	4,010	411	5,807	1,723
39	Other social services	2,513	2,005	1,529	2,372	332	3,111	629

Source: ISO (2003)

The top five sectors in 2002 are construction (28), basic metal and fabricated metal products (17), electrical and optical equipment (19), machinery and equipment (18), and wholesale and retail trade; repairs of motor vehicles, motorcycles and personal and household goods (29) (Figure 8).

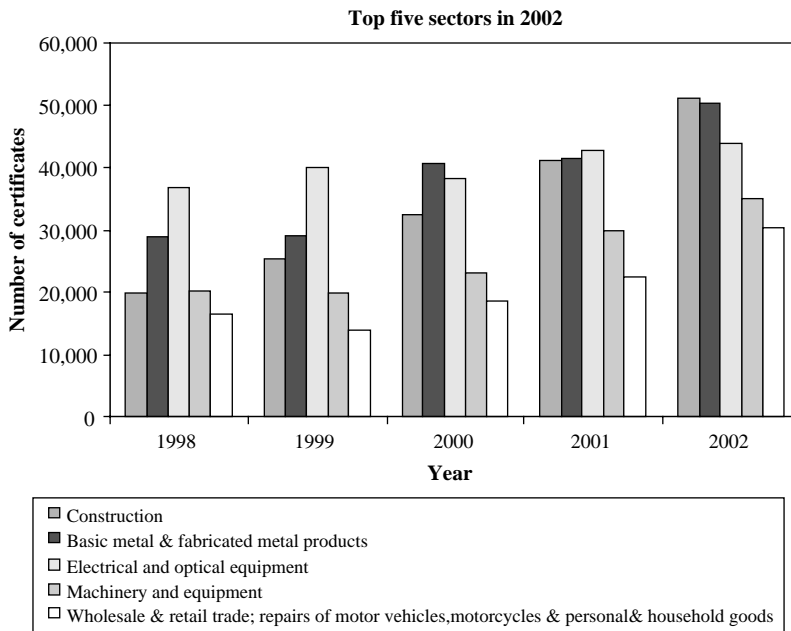
This outcome reveals some particular aspects. The first position, held by the sector construction (28), can be justified by considering a “regulatory/legislation effect.” Many countries impose a ISO 9000 quality certification for participating to public-work contracts. Certificates in this sector manifest a constant growth since 1998.

Till 2001 (except 2000) the first place was held by electrical and optical equipment (19), currently holding third position.

The second position, held by the sector basic metal and fabricated metal products (17), is due to the large influence of automotive industry, which is one of the most involved in quality certification (QS-9000:1998, 1998; ISO/TS 16949:2002, 2002 standards are an evidence of this strong attention).

Looking at Table IV, a series of particular behaviors leaps out. In some cases, the limited number of certificates is due to the small number of companies operating in a specific sector (see, for example, nuclear fuel (11)); in other cases, sectors are still “immature” towards the implementation of a quality system (see, for example, agriculture, fishing (1)).

The common trend for most sectors is a regular growth over years till a saturation level (maturity stage). However, some sectors reveal a reduction of the number of certificates in the last years. This is a questionable aspect. Referring to sectors such as aerospace (21) and shipbuilding (20) the causes can be found in the reduction of the number of companies



Source: ISO (2003)

Figure 8.
Time evolution of the top
five sectors for number of
certificates in 2002

currently operating in these fields. In other cases, the causes must be ascribed to the monopolistic conditions and to the low sensibility to the market competition (manufacture of coke and refined petroleum products (10) and gas supply (26)).

Service sectors show a clear growth in the last two years (see, for example, financial intermediation, real estate, rental (32), engineering services (34) and other services (35)). On the other hand, after an initial booming period, the information technology (33) sector is displaying a moment of stagnation.

5. ISO 9000 certification in developed countries and GNP

A comparison between economical and entrepreneurial structure of different countries can help to better understand the ISO certificates regional share. A natural index for a thorough analysis could be the ratio between ISO 9000 certificates and the total number of potentially “certifiable” companies in each country (Franceschini *et al.*, 2004). Unfortunately this kind of information is not available for all the countries, as a consequence of the different entrepreneurial classification.

Some authors tried to normalize the number of certificates for each country by introducing the so-called “ISO 9000 per capita index” defined as the average number of ISO 9000 certificates per inhabitant (Saraiva and Duarte, 2003). This approach can be, at least, fairly hazardous. There is no direct correlation between the number of companies in a country and the number of its inhabitant.

On the other hand, it is interesting to analyze the relationship between ISO 9000 certification and the economic development of a country. This can be done by considering the number of certificates in a country and the corresponding gross national product (GNP). A one-to-one comparison between the ISO 9000 ranking position and the GNP is reported in Table V.

Eight of top ten countries for ISO 9000 certificates also appear in the first ten positions in GNP ranking (i.e. China, Italy, UK, USA, Germany, Japan, Spain and France). This shows a high correlation between the two sets of indicators.

To better understand the correlation between ISO 9000 certification and socio-economic development of a country, the analysis has been enlarged to the human development index (HDI) (see Table VI). HDI is a composite index that measures the average achievements in a country in three basic dimensions of human development: a

Country	Certificates (2002) (percentage of world total)	GNP (2002) (billions US dollars)	GNP ranking
China	13.49	1,234.157	6
Italy	10.90	1,100.713	7
UK	10.85	1,510.771	4
USA	6.93	10,207.039	1
Germany	6.37	1,876.340	3
Japan	6.05	4,323.919	2
Spain	5.11	596.469	10
Australia	4.83	384.075	14
France	3.54	1,362.077	5
Republic of Korea	2.58	473.050	13

Sources: ISO (2003); World Bank (2003)

Table V.
Comparison between the ISO 9000 ranking position and the GPN for the top ten countries in 2002

long and healthy life, as measured by life expectancy at birth; knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools; and a decent standard of living, as measured by GDP per capita in purchasing power parity (PPP – US dollars) (United Nations Development Program, 2004).

Considering HDI values in Table VI, Italy, UK, USA, Germany, Japan, Spain, Australia, France, and Republic of Korea are considered “high human development” countries. China is still classified as a “medium human development” country (United Nations Development Program, 2004).

6. A forecasting model for the diffusion of ISO 9000 standard certifications

In a previous paper, Franceschini *et al.* (2004) empirically showed that ISO 9000 diffusion process is very close to the behavior of the so-called logistic systems, firstly introduced by the Belgian mathematician Pierre Verhulst (1838) in order to describe phenomena related to bio-population growths. The set of hypothesis considered by the predictive model are the following:

- the model considers only the total number of certified enterprises, paying no attention to their specific dimension and to their commodity sector;
- the “saturation level” is affected by market competition and by economic policies pursued by central governments;
- the diffusion growth is influenced by national incentives, by the presence of local Governments’ encouragement and by the number of certification bodies; and
- there are not events or external interferences (for example, international/national regulatory/legislation changes) that can change the natural evolution of the so-called “certus-population” (i.e. the ISO 9000 standards certified companies, hereinafter called “certus-population”).

Denoting by $N(t)$ the number of ISO 9000 standards certified companies over time, the “modified-logistic-curve” for a “certus-population” is the following (Franceschini *et al.*, 2004):

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

Country	Certificates (2002) (percentage of world total)	HDI (2002)	HDI ranking (2002)
China	13.49	0.745	94
Italy	10.90	0.920	21
UK	10.85	0.936	12
USA	6.93	0.939	8
Germany	6.37	0.925	19
Japan	6.05	0.938	9
Spain	5.11	0.922	20
Australia	4.83	0.946	3
France	3.54	0.932	16
Republic of Korea	2.58	0.888	28

Sources: ISO (2003); United Nations Development Program (2004)

Table VI.
Comparison between the
ISO 9000 ranking
position and the HDI for
the top ten countries in
2002

where the parameters have the following meaning: r_0 is the population growth rate in the absence of intra-specific competition; N_0 is a constant to assure the initial condition $N(0) = 0$;

$N(\infty) = (K - N_0)$ is the certus-population saturation level, that is the total number of companies that will be interested in the certification process.

Analyzing by this model the ISO 9000 top ten countries, a series of considerations take rise. Consider, for example, the case of Germany, which has achieved the saturation plateau (“maturity stage” see Figure 9). The prediction curve has been derived by applying to the empirical data a first-order non-linear regression fit (Seber and Wild, 1989). The estimated average asymptotic value $N(\infty)$ is approximately 40,000 (about 8 percent of C.C.). These results show that the certificates growth has come to the end.

It can be shown that this phenomenon is happening in many other countries, such as, for example, United Kingdom (the first country to introduce the ISO certificates), Australia, France, Republic of Korea, and USA, (see also Figures 1 and 2).

The “modified-logistic-curve” model can be applied to “certus-populations” only until the plateau level is reached. After this point, other mechanisms drive the diffusion and a more appropriate model should be individuated. At the moment many different scenarios can be hypothesized for the evolution after the saturation plateau. Related mechanisms are not clear yet (Figure 9). Some current behaviors let believe that a “reverse mechanism” is taking place (see, for example, UKPPP and Germany curves in Figure 1).

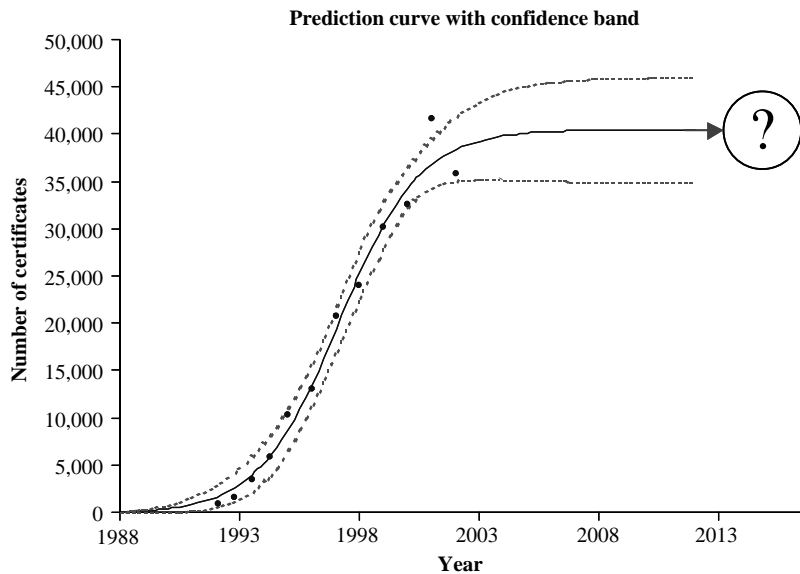


Figure 9.
Forecast of the German ISO 9000 standard certificates elaborated by a modified-logistic-model until 2012

Note: The figure reports the empirical data (circles), the fit curve (thick line), and the forecast confidence interval (95%) (dotted lines)

Source: Franceschini *et al.* (2004)

7. Conclusions

The paper presents a cross-section of the diffusion of ISO 9000 family certification in the world. Many aspects which highlight the peculiarity of this framework have been analyzed. Some main results are hereafter summarized.

By the analysis of the scientific literature a correlation among certification and business performances is not univocally demonstrable. It is still a matter of discussion if the increase of business is due to the management methodology prescribed by quality standards, or if it is only a question of marketing (certification as a way for distinguishing itself in a global market).

If we look at the evolution curve of the number of certificates over time in each country, we can observe a kind of “saturation effect.” This means that after a certain period of fast growth a physiologic break take places. This phenomenon can be explained by interpreting the certification process as a distinction element. When the number of certified organizations reaches a certain limit, certification loses its connotation and becomes less attractive for the remaining companies.

This behavior has been analyzed by a diffusion forecasting model. The “saturation effect” has been verified for those countries which are attaining the so-called “maturity level” (i.e. the level in which no certification growth is registered).

The analysis of regional share certificates evolution evidences a sensible increase of Far East countries.

On the other hand, referring to the new Vision 2000, the results do not seem to be so exciting. Up to the end of 2002, the number of certificates issued for the revised standard (ISO 9001:2000, 2000) seems too exiguous to give assurance of a complete transition by the fixed term.

The analysis of ISO 9000 certificates' share by industrial sector evidences a growth for the most sectors; only a few of them show a negative trend in last two years.

A relationship between ISO 9000 certificates and socio-economic indicators of a country (HDI, GNP) has been considered.

Looking at the obtained results, some questions come out about the future of certification. Will the certification market go on? Will certified enterprises continue to be interested to the certification process?

A possible future scenario will polarize the certification focus from the inside of enterprises (internal quality systems) to the actual beneficiaries of their performances (stakeholders). Some markets are already showing examples in this direction. Many commodity associations are adopting their own “quality standards”. At this point, how can international standardization authorities act for avoiding this new certification “Far-West”?

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