

BUSINESS STANDARDIZATION IN THE WORLD – STATE OF THE ART

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Abstract: *The purpose of this paper is to conduct an analysis of number of companies with certified standardized management systems (SMS) obtained for standards 9001, 14001, 16949, 13485, 22000, 27000, and ISO50001 across the continents: Central and South America, North America, East Asia and Pacific, Central and South Asia, Europe, and Africa. In 2014 the number of certificates for all SMS amounts 1580679 of which 657280 certificates were issued in Europe, 63430 in Central and South America, 74127 in North America, 708091 in East Asia and Pacific, 63002 in central and South Asia, and 14749 in Africa. Since the number of inhabitants and gross domestic product are important growth predictors together with number of certificates they are combined for further analysis. The European continent is the leader according to the number of certificates per number of inhabitants, whereas East Asia and Pacific is ranked first in the parameter gross domestic product per number of certificates. Regression analysis is used to calculate the predicted number of certificates including all SMS and it gives forecast for the next decade (2024th year).*

Key Words: *Business standardization, Certificate, Continent, Prediction.*

1. INTRODUCTION

ISO is a nongovernmental organization which consists of 162 member countries representing the national standards bodies from the continents all over the world, and its objectives are to issue and develop standards in response to global market demand. It does not provide certification services to the standards, but it works with industry and with accreditation bodies to encourage the application of standards in ways that meet their objectives increasing the profit and reducing the waste and cost [1].

A survey [2] has been conducted in Portugal in order to develop ISO 9001 European scoreboard and ranking European countries based on quality management systems evolution over the past few years. Authors have discovered clusters of countries with different evolution stages of ISO 9001.

In Italy and some European countries that have similar economic structure a detailed analysis of certification diffusion has been done resulted in the suggestion of new model describing the process of certification diffusion and forecasting the certifications growth with the time required to reach the level of saturation [3].

Manual and Duarte [4] have found out a new macroeconomic statistical indicator with the certificates per thousand inhabitants and forecasted the evolution of total number of certificates for the period 2000-2006 through statistical analysis of the number of ISO 9000 certifications on many entities in different countries over the period 1993-2001.

In Serbia research study has been conducted on the growth of number of certificates for seven standardized management systems - ISO 9001, 13485, 14001, 19949, 22000, 27001, and 50001 in the world, the western Balkans countries and Serbia, which

revealed that business standardization has started a step into the new era by adoption of integration between standardization management systems and the release of new QMS/EMS: 2015 models [5].

The aim of this paper is to analyze the number of certificates issued in the world during the period 2007-2014 obtained for seven standards: 9001, 14001, 16949, 13485, 22000, 27000, and 50001 across the continents: Central and South America, North America, East Asia and Pacific, Central and South Asia, Europe, and Africa and forecast future values. The data collected from the international organization for standardization survey shows that 1580679 certificate were found for all the six continents of which the highest amount was in North America 708091, and Europe 657280.

Number of inhabitants and gross domestic product data are collected from the international bank and used as parameters combined together with number of certificates to rank the continents and to be used as an important predictor parameter. Regression analysis was used to calculate the predicted number of certificates including all SMS models for the next decade to give a total forecasting of 2472186 certificates in all continents, of which the highest number was in East Asia and Pacific 1097632 followed by Europe 1049604, whereas the smallest number was in Africa 20528. Coefficient of determination (R square) values was greater than 0.7 in all stages of analysis indicating that the model is statistically significant.

2. STANDARDIZATION MANAGEMENT SYSTEMS IN THE WORLD – STATE OF THE ART

Table 1. illustrates the number of certificates for seven ISO models of standardized management systems and shows that a number of 1 609 294

certificates are issued worldwide in the year 2014 slightly more than in 2013, and it can be seen, too that almost all the ISO management systems standards have moderate growth demonstrated by the latest edition of the survey to confirm the same trends as were observed over the last two years.

Table 1. Review of certificates number in the world for 2012, 2013 and 2014

Standard of MS	Number of Certificates 2013 ¹ /2014 ²	Number of certificates 2012	Evolution	Evolution in %	% of Total
ISO 9001	1126460/1138155	1096987	29473/11695	2.68%/1.0%	72.14%/70.72%
ISO 14001	301622/324148	284654	16968/22526	6.0%/7.46%	19.3%/20.14%
ISO 500001	4826/6778	2236	2590/1952	115.8%/40.4%	0.3%/0.42%
ISO/IEC 27001	22349/23972	19620	2729/1623	14%/7.3%	1.43%/1.48%
ISO 22000	26847/30500	23278	3569/3653	15.3%/13.6%	1.72%/1.89%
ISO/TS 16949	53723/57950	50071	3652/4227	7.3%/7.8%	3.4%/3.6%
ISO 13485	25655/27791	22317	3338/2136	14.9%/8.3%	1.64%/1.72%
ISO 22301	0/1757	0	0	0	0
Total	1561482/1609294	1499163	62319/47812	4.1%/3.0%	100%

Despite the apparent stabilization of the global market three standardized management systems showed more sustained growth although less impressive than in previous years. ISO 50001 for energy management contributed by 40% of total growth rate and Germany was the leader again sharing by 50% the total certificates (6778). ISO 22000 for food management gave continued reliable performance with 14% growth rate whereas ISO 16949 for automotive industry had indication for reasonable economic recovery with growth rate of 8%. ISO 9000 quality management and ISO 14001 environmental management with 1% and 7% respectively are gradually reaching stability. Finally new standard ISO 22301 for business continuity came into the work which aimed to protect the organizations against disruption in times of crises, although shared with small number of certificates [6].

By reviewing the implementation of ISO certification in the world based on countries, industries, and SMS models it gives us good indicator of the global economy developments, together with praeto approach applied to the contribution of ISO to the overall total of SMS certificates in the world. Among the total number of 1609294 certificates in six continents approximately 72% of the certificates with ISO 9001, 19% with ISO 14001, and 7% with other SMS models [6].

According to the analysis of continents it is easy to notice that East Asia and Pacific is ranked first with 708091 certificates in the world with all SMS models followed by Europe 657280 certificates, while Africa comes into the last position with 14749 certificates.

2.1 Standard ISO 9001

Certificates under this standard contribute to improve the quality of delivery with a growth rate of 1% of the market compared with 2% and 3% in the previous two years. The regional tendencies of ISO 9001 uptake were as follows: (i) North America showed 4% growth in which several new certification bodies participated by Mexico, (ii) an encouraging progress was made in East Asia and Pacific with 1.9% performed extremely well in Australia, despite the lack of number of certificates in Vietnam and Philippines. (iii) a negative progress with -4.2% growth was exhibited by South America attributed to a significant drop in the number of certification bodies that reported fewer certificates in Brazil and (iv) Slow growth rate with 0.2% in Europe because large number of contributors from countries like Germany, Greece, and Netherland does not participate this year [6].

2.2 Standard ISO 14001

After a regression of environmental management last year, it picked up with 7% growth this year driven by East Asia and North America by new certification bodies entering the survey and increase in the number of certificates in pre-existing contributors. In Australia the increase of growth was due to reporting of more certificates than before whereas in Turkey, and Czech Republic it was due to inclusion of previously unreported certificates, however the highest growth was 13023 in China [6].

2.3 Standard ISO 50001

For the third year energy management standard performed well with an annual progress of 40% and 6778 certificates issued, where the largest share of the market 80% was from Europe, furthermore Germany was the champion of this growth due to country's legislation in energy followed by UK. [6].

2.4 Standard ISO 27001

This standard provides requirements for information security management systems, it had a slight decline with 7% opposite to what was expected in previous years. Japan historically was in the top of charts although UK had an important growth with 340 certificates [6].

2.5 Standard ISO 22000

This standard provides requirements for the management of food security issue, it decreased slightly with 14% growth rate compared with 20%, 15% increase in previous years, because the largest number of certificates plummeted in Greece despite the spectacular growth 70% in America and remarkable progression in Australia [6].

2.6 Standard ISO 16949

Suppliers in the automotive industry are obliged to apply the standard of quality management systems for automotive. Confirming the trend that was clear in the last two years this standard had performance of 8% growth compared with 5% and 7% in 2012, 2013 respectively. Regarding to the car manufacturers China was the leader followed at a distance by USA.

2.7 Standard ISO 13485

This standard provides requirements for quality management in the production of medical devices. There is a sown turn in this standard with 8% growth rate compared with 12% and 15% in last survey, although china shows remarkable growth in this area,

it does not compete with the top five countries dominating the market in absolute term. Europe claims 60% of the total number of certificates issued because of strict regulations that necessitate certification to the standard in some countries [6].

2.8 Standard ISO 22301

This standard will provide the requirements for business continuity management, although it's apparent to the market was timid, it showed a performance with 1700 certificates where 30% of these certificates shared by India followed by UK, and Japan. It's expected to have wide potential user base in the future due to acceleration of organizations that face the disaster [6].

3. QUANTITATIVE ANALYSIS

According to data shown in Table 2 It can be seen that East Asia and Pacific is a leader regarding the total number of certificates of all SMS, and with a small difference Europe is in the second place, North America comes in the third place followed by Central and South America, and Central and South Asia in the forth and fifth places respectively, and the last position was for Africa. If we analyse the number of lost certificates for seven SMS it can be seen that for Quality management standard the highest amount was East Asia and Pacific with 48087 lost certificates, followed by Europe with amount of 27821 lost certificates, Central and South America is ranked third with a number of 2632 lost certificates, while Central and South Asia is ranked forth, North America is fifth, and Africa comes in the last position. Similarly for the environmental management standard East Asia and Pacific, and Europe occupy the first and second places with amount of 10769, and 5766 lost certificates respectively, also for the other SMS models except the standard ISO 50001 which has got only one lost certificate in Europe and East Asia and Pacific.

Table 2. Quantitative review of certificates number for continents in 2014

SMS	Europe ⁶ / ₆ ⁵	Central and South America	North America	East Asia and Pacific	Central and South Asia	Africa
ISO 9001	483710/1 ³ (27821) ²	50256 (2632)	50533 (1318)	476027 (48087)	45365 (1958)	10308 (359)
ISO 14001	123849/2 ³ (5766)	10143 (271)	10139 (224)	166441 (10769)	7192 (248)	2565 (69)
ISO 16949	11848/2 ³ (90)	1621 (11)	5928 (65)	32728 (1139)	4618 (92)	480 (32)
ISO 13485	12983/1 ³ (541)	316 (13)	6026 (76)	6637 (949)	902 (47)	167 (2)
ISO 22000	10654/2 ³ (615)	754 (11)	580 (12)	14257 (1614)	2373 (80)	1130 (27)
ISO 27001	8710/2 ³ (432)	277 (1)	836 (2)	11303 (1263)	2253 (54)	81 (1)
ISO 50001	5526/1 ³ (1)	63	85	698 (1)	299	18
Total	657280	63430	74127	708091	63002	14749
Evolution	0.01%	-0.03%	0.06%	0.05%	0.04%	0.05%

A detailed analysis of Table 2 allows us to draw the following conclusions: (i) according to the number of certificates for all SMS, Europe is ranked second out of six continents preceded by East Asia and Pacific in the (iii) by estimating the evolution it is obvious that North America is ranked first with 0.06% although it has less amount of issued certificates than other continents, because of increase in the number of issued certificates compared with pervious year, whereas East Asia and Pacific, and Africa are ranked

World, and it is first in the standards ISO 9001, ISO13485, and ISO 50001, (ii) regarding the number of lost certificates Europe is also in the second place preceded by East Asia and Pacific in all SMS and second with 0.05%, Central and South Asia is in third place with 0.04%, and Europe comes fourth in the list with 0.01%, lastly Central and South America has negative evolution with -0.03%, due to the reduction in the number of issued certificates compared to the previous year.

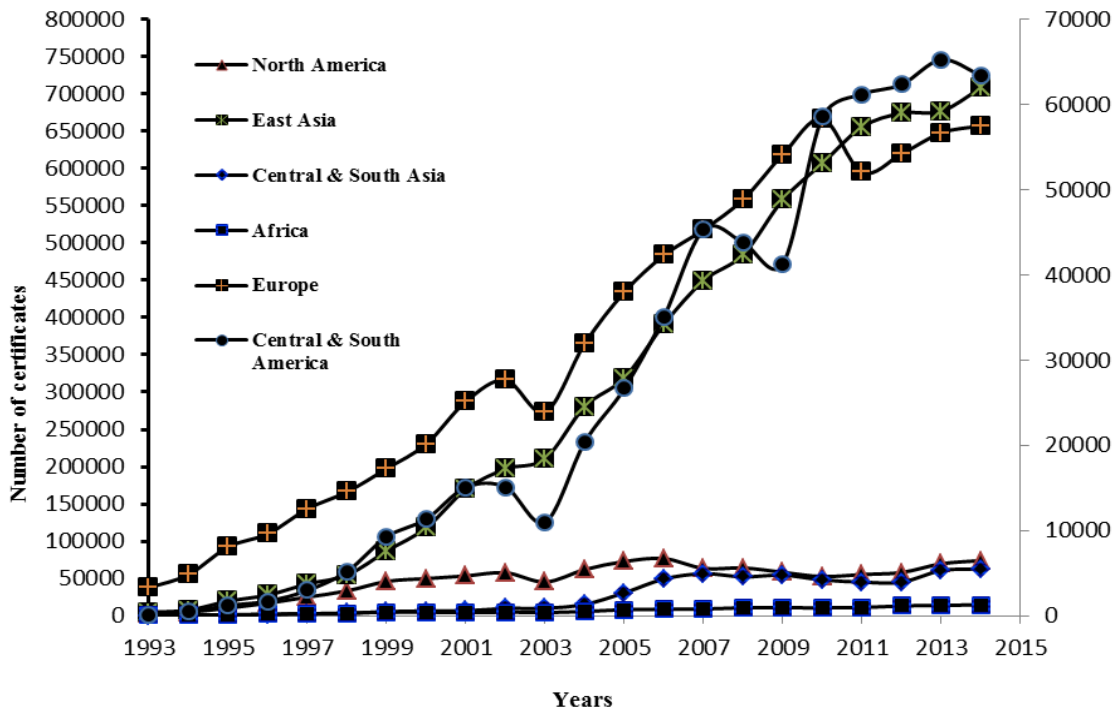


Fig 1. Developing trend of world continents in number of ISOs certificates from 1993-2014

Figure 1 illustrates the number of certificates for all seven SMS models plotted against years. It's obvious that the global growth of certificates is not homogenous across the continents; East Asia and Europe have almost steady growth, and Central and South America shows fluctuating growth, while the other continents have a slight increase in growth rate.

Regression analysis is applied using SPSS to calculate the predicted number of certificates including all SMS. Model summary – Table 3 is one of the results of SPSS provides the R, R square, and adjusted R square values. In our simple bivariate case Europe as an example, the value of R is equal to 0.985 represents a high degree of correlation between the number of certificates and years. The R square value 0.97 indicates how much of the total variation in the dependent variable (number of certificates) can be explained by independent variable (years). The value of adjusted R square is 0.969 indicating that the linear regression explains 96.9% of the variance in the data.

According to the value of sig F change in model summary which is less than 0.05, the regression model statistically significantly predicts the out come variables. With F change value of 650.947 and 20 degrees of freedom the test is highly significant, so it

can be assumed that there is a linear relationship between the variables in our model.

Model coefficients – Table 4 provided us with the coefficients of prediction equation which was linear equation regression used to give forecast for the next decade (2024 year). It was estimated to be 100106 certificates in Central and South America, 108094 in North America, and 1097632 in East Asia and Pacific, 96222 in Central and South Asia, 1049604 in Europe, and 20528 in Africa in 2024 year.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.985 ^a	.970	.969	38832.356	.970	650.947	1	20	.000

Table 4. Model Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B			
	B	Std. Error	Beta			Lower Bound	Upper Bound		
1	(Constant)	-15819.247	17139.337						
	Year	33294.484	1304.967	.985	25.514	.000	-51571.277	19932.783	36016.597

Table 5. Qualitative review number of certificates for all SMS for 2014

Parameter	Europe ¹	Central and South America	North America	East Asia and Pacific	Central and South Asia	Africa
NC ²	657321	63432	74131	708029	63002	14804
Range	2	4	3	1	5	6
NI ³	833.8	500.5	480	2238.6	1788.6	1141
NC/NI ⁴	788.34	126.73	154.43	316.28	35.22	12.97
Range	1	4	3	2	5	6
GDP ^a	22,846.20	4,866.60	20,499	20,925.40	2,856.40	2,458.20
GDP/NC ⁵	0.034	0.076	0.27	0.029	0.045	0.17
Range	2	4	6	1	3	5
GDP ^a /NI ³ /NC ²	0.000042	0.000153	0.00058	0.000013	0.000025	0.000145
RANGE	3	5	6	1	2	4

Note: ¹Continent; ²Number of certificates; ³Number of inhabitants; ⁴Per 000000 inhabitants; ⁵Per 000000 euros; ^ain billion euros

4. QUALITATIVE ANALYSIS

Table 5 shows the qualitative analysis of the number of certificates in the six continents with all SMS models which was carried out by following parameters: (i) the number of certificates per 1000000 inhabitants, (ii) the number of certificates that take part in the 1000000 Euros of GDP making and (iii) the number of certificates that take part in 1000000 euro of GDP together with number of certificates per 1000000 inhabitants.

By analyzing the table, we can conclude that according to the first parameter a leader in the region is Europe with a value of 788.34, followed by East Asia and Pacific with 316.28, whereas North America and Central and South America to some extent close

to each other come in the third and fourth place respectively, Central and South Asia is ranked fifth, and Africa comes in the last position with a value of 12.97. For the second parameter East Asia and Pacific comes first, followed by Europe, and so on. In the third parameter East Asia and Pacific is ranked again first, whereas Central and South Asia second, and Europe is ranked third followed by other continents.

More detailed qualitative analysis has been done for each standard in all continents. Table 6 illustrates ISO 9001 standard as an example in which Europe comes in first place followed by East Asia and Pacific concerning the first parameter, whereas in the second parameter East Asia and Pacific is first, followed by Europe, and regarding the third parameter Europe is

ranked third preceded by East Asia and Pacific and Central and South Asia.

The rest of other SMS analyses concerning the three parameters show that Europe is ranked first regarding the first parameter in all SMS except ISO

16949 where it is ranked second. As for parameter two it comes between first and third place alternating the positions with East Asia and Pacific and Central and South Asia, while it is ranked between first and fourth with regard to third parameter.

Table 6. Qualitative review number of certificates for ISO 9001 for 2014 in

Parameter	Europe ¹	Central and South America	North America	East Asia and Pacific	Central and South Asia	Africa
NC ²	483710	50256	50533	476027	45365	10308
Range	1	5	3	2	4	6
NI ³	833.8	500.5	480	2238.6	1788.6	1141
NC/NI ⁴	580.12	100.41	105.27	212.64	25.36	9.03
Range	1	4	3	2	5	6
GDP ^a	22,846.20	4,866.60	20,499	20,925.40	2,856.40	2,458.20
GDP/NC ⁵	0.047	0.096	0.4	0.043	0.062	0.23
Range	2	4	6	1	3	5
GDP ^a /NI ³ /NC ²	0.000057	0.00019	0.00085	0.00002	0.000035	0.00021
Range	3	4	6	1	2	5

3. CONCLUSION

By applying statistical analysis to the number of certificates issued across the six mentioned continents, the main results can be summarized as follows:

- In this paper categorizing and ranking the continents were based on the evolution (growth rate of certificates) including most SMS over the past few years.
- There is an increased adoption of standardized management systems worldwide which lead to an increase in certification growth during the time.
- This survey proposes new statistical indicator associated with the number of standardized management systems certificates issued per billions of inhabitants and per billions of GDP were computed.
- There seems that there is a maximum saturation point regarding how many certificates per inhabitant is likely to reach.
- Results of the qualitative analysis showed that Europe was always ranked first followed by East Asia and Pacific.
- A good way of identifying continents economic level that are more mature in this analysis is to concentrate on those who are leading the way regarding SMS.
- Regression analysis is used to calculate the predicted number of certificates including all SMS and it gives forecast for the next decade (2024th year).
- The benefits derived from certified organizations in the world are: achieving better team spirit, having fewer staff conflicts, reducing wastage,

increasing efficiency, improving sales, and getting less customer complaints.

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**ISO CERTIFICATIONS DIFFUSION IN EUROPEAN COUNTRIES 2007-2014
AND FORECASTING FOR 2022-STATE OF THE ART**

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Abstract. *Since 1987, when first certification issuing, ISO has been considered as the leader of development of business standardization process and number of certifications speedy grows in all over the planet. In this article, quantitative analysis, we displays the diffusion of ISO certifications in European countries among the recording data for seven common models of ISO (ISO 9001, 13485, 14001, 16949, 22000, 27001, 50001) in the European countries in the past eight years 2007-2014. Italy leads European countries with 26% from total number of certificates, and ISO 9001 ISO 9001 comprises 78% from the total number of certificate in this period. Forecast of new certifications growth, number of certifications will issue in the future for all ISO models (after eight years) increasable and will not reach the saturation level in general. In qualitative analysis, we use statistical analysis of collected data to provide the effect of the number of certificates on the economic development for each country (relationship between number of certificates, number of inhabitant, and gross domestic product GDP).*

Key words: *International Key Words: business Standardization, common models of ISO, European countries.*

1. INTRODUCTION

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies was established in 1946 in Geneva, Austria, and has been seated there ever since [1]. Nowadays, it is Consisting of 165 member countries, both developed and developing, from all over the planet, (August 2015) [1]. More than 19000 international standards have published since 1947 covering all aspects of technology and business [2]. Developing of the ISO standards are carrying out through by a hierarchy of technical committees and subcommittees (currently more than 700) and their associated working groups (currently more than 2200) [3]. ISO 90001, ISO 14001, and ISO 27001 are among ISOs most well-known and recognized quality management standards applied all around the world, and recently, they constitute the conceptual framework for business process standardization [2]. Since 1987, when the first certification of ISO has issued there is enormous diffusion of certificates through the entire world (1609294 certificates in 2014 only) [4]. According to the vast prevalence, a lot of studies have been done to find out the reasons of this spread and determine the impact of ISO practices on organization performance. Generally, there are a various reasons which push an enterprise to certify, both internal and external [5]. Some studies keep exogenous reason first to motivate a company for seeking the certification (benefits, ability to preserve

or improve the share of the market). Also, it is asserted that for exporting companies, the certification is a requirement for them to have direct access to other markets supporting [6]. Other studies prove that endogenous reasons are the significant to push a company for seeking certification [6]. Studies about the impact of ISO certificates on organizational performance are varied even the majority of them prove a positive relationship between implementations of ISO and organizational improvement [7]. The diffusion of ISO certifications started mostly in Europe companies, and then they pressed their supplier from other parts of world to seek ISO certification [8]. The effect of quality on business performance is based on manufacturing and market, by improvement of internal process quality results in better operational performance. And improvement of products or services quality will influence customer and improve business performance [7]. However, the variation of reasons for seeking certification and the impact of ISO practices on organization performance, the diffusion of number of certification vastly grows (ISO surveys numbers) and there are no indicators for Saturation level by (statistical analysis result) in this paper in next few year. . ISO 9001(Quality management system) gets the highest number of certification for the past time in Europe and al the world with a enormous difference with the other models of the ISO[9], and by the statistical analysis result ,ISO9001 will continue grow with the same way in the next few years (up to the year 2022). .

Table1. The top 7 European countries in the number of certificates 2007-2014[9]

ISO/ YEAR	ISO	2007	2008	2009	2010	2011	2012	2013	2014
France	9001	22981	23837	23065	29713	29215	29198	29598	29122
	13485	709	709	788	865	1035	945	1046	1059
	14001	3476	3482	4678	5251	7771	7094	7940	8306
	16949	1165	1183	1096	1033	1059	1039	1021	1006
	22000	36	122	126	399	460	421	535	632
	27001	9	14	15	31	46	66	94	161