

ISO 9001 Certification Benefits: A Principal Component Analysis

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This research addresses the benefits of ISO 9001 to understand the reasons behind its worldwide adoption. By applying principal component analysis to the results of a survey encompassing 526 valid responses (24.4% response rate), a more business-oriented scale than the traditional internal/external type of motivation with three main categories of benefits is proposed: operational improvement benefit (regarded as the most relevant), profitability and, market. The internal benefits related to the operational improvement are the benefits most felt by organizations, highlighting the contribution of ISO 9001 to improve learning processes and knowledge generation. Concerning the organization size, medium-sized organizations attribute greater importance to the market and competitiveness. However, there are no statistical differences in the reporting of benefits felt in operational improvement and profitability. In relation to the year of certification, organizations certified before the year 2000 report higher market benefits when compared to those certified later. The investigation of ISO 9001 within Industry 4.0 and digital processes are suggested for future research.

Keywords: ISO 9001, quality management systems, certification, benefits, contextual factors, principal component analysis.

1. INTRODUCTION

ISO 9001 International Standard (IS) sets out the criteria for a Quality Management System (QMS) supported by a process model and the PDCA (Plan-Do-Check-Act) cycle to achieve desired outcomes and customer satisfaction. The first ISO 9001 International Standard was edited in 1987 and reviewed in 1994, emphasizing preventive and mandatory documentation requirements to clarify the standard text further. The next ISO 9001 edition was released in 2000, adopting the process approach and subject to a mild revision in 2008 to make the requirements clear. In 2015, the most recent version of ISO 9001 was published emphasizing the need of companies to evaluate the stakeholders that influence the organization, focusing on business and process approach, with more flexibility and less emphasis on documentation (Fonseca [15]; Fonseca & Domingues [17]; Astrini, [1]; Wilson & Campbell [46]; Fonseca et al. [18]).

A common characteristic of QMS Standard, such as ISO 9001, is that the implementation of their requirements can be audited and certified by an independent external entity (called the CB - certification body), to assess if it complies with the applicable IS requirements and achieves the intended results (Fonseca et al. [19]). The implementation and certification of ISO 9001 Quality Management Systems International Standards [28] achieved high international recognition, with approximately 1 million certified organizations world-

wide [29] and ISO 9001 research is a top theme in Quality related research [10].

Although the research in the benefits of ISO 9001 Management Systems Certification (MSC) indicates a positive relationship between ISO 9001 certification and organizational performance and results (Fonseca et al. [19]), there are some inconsistencies, and several studies have found a neutral or even negative relationship. Furthermore, some authors consider that the organization size is a contingency factor for ISO 9001 benefits. Researchers such as Gustafsson et al. [25] and Klute-Wenig and Refflinghaus [30] consider that since SME's have less relevant resources than larger organizations, they have more difficulties benefiting from ISO 9001. Conversely, Terziovski, Power and Sohal [44] and Castillo-Peces et al. [11] posit that since SMEs have a lower starting point and are more flexible and open to change, they can achieve more benefits with ISO 9001 adoption. Hence, the organization size may influence the benefits of ISO 9001 adoption.

Fonseca and Domingues [20] report that there are divergent research results concerning the influence of the number of years of the certification on the benefits of ISO 9001 certification. Hence, this is another valid research topic.

This study aims to characterize and identify the benefits of ISO 9001 QMS certification amongst Portuguese organizations with a more business-oriented scale than the traditional internal/external motivation type. A considerable stream of research addresses the mechanisms to promote continuous improvement in Quality Management Systems (Putnik and Ávila [37]). In the present Industry 4.0 (I4.0) and digital transformation era, Quality Management (including ISO 9001 certification) can be combined with technology to promote sustainable organizational success. The Quality 4.0 (Q

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4.0) approach can support the technological digital transformation driver with a business and organizational dimension. Q4.0 address both the adoption of quality methods and tools within the I4.0 paradigm and the application of Q4.0 to support I4.0 and promote sustainable results (Fonseca et al. [22]). While product and process quality are required for I4.0 success, intelligent sensors, automation, and big data can support Statistical Process Control (SPC), Six Sigma or Total Quality Management (TQM). Hence, the opportunity to study ISO 9001 certification motivations within a more actual context.

The remaining of the paper is organized in the following way. Chapter 2 presents the Literature Review, followed by the Methodology (Chapter 3). The research results analysis is made in chapter 4, and the conclusions are presented in the final chapter (5).

2. LITERATURE REVIEW

There is a considerable stream of research that posit ISO 9001 adoption and certification generates positive organizational results (Bernardo, et al. [4]; Boiral and Amara [5]; Martínez-Costa and Martínez-Lorente [31]; Martínez-Costa, et al. [33]; Poksinska and Dahlgaard [35]; Psomas [36]; Tari, Molina-Azorin and Heras [41], Fonseca, et al. [19], Fonseca and Domingues [20]. ISO 9001 certification foster the adoption of continual improvement [21], teamwork and quality tools, contributing to operational performance and sustainable results [6] and minimizing operational/technical risk across different processes or departments [39].

Some academics, such as Calvo et al. [8]; Martínez-Costa, Martínez-Lorente and Choi [32]; Terziovski and Power [44]; Wahid and Corner [45], highlight the relevance of positive internal results such as organizational and operational improvements due to ISO 9001 certification.

Conversely, other researchers emphasize positive external results, e.g., a better brand image, improved customer relationships; a more favourable market position of the company; access to markets; financial benefits, strengthening of relationships in distribution channels and improve logistics (Benner and Veloso [3]; Corbett, Montes, and Kirsch [12]; Dick, Heras and Casadesús [14]; Martínez-Costa and Martínez-Lorente [31]; Sharma [38]; Terlaak and King [42]; Zimon, Gajewska and Bednárová [48]; Fonseca et al. [19]).

However, there are inconsistencies in the ISO 9001/ Performance Research (Fonseca et al. [19]). These inconsistencies in the ISO might be explained by concerns over reliability and lack of validation of measures, sampling, and biases errors (e.g., Quality Managers might be more optimistic than CEOs) and the absence of control variables (e.g., the organization size) (Fonseca et al. [19]). Furthermore, situational contingencies that can influence the ISO 9001/ Performance relationship, e.g., investing in improving quality positively impacts intangibles that might lead to superior organizational and financial performance levels. Some benefits can also be realized in the short term (e.g., compliance with customer requirements) while others only in the long term (e.g., company image and reputation).

Some quality initiatives are more long-term oriented measured by qualitative non-financial indicators (e.g., customer satisfaction, quality of products or services, etc.). Additionally, organizational culture and top executive support strongly influence the outcomes of quality initiatives [6], and the contextual approach promoted in ISO 9001:2015 needs to be considered, e.g., when addressing the organizational culture and related management practices match the specific country context [7].

In contrast, financial indicators are usually short term oriented. In conclusion, additional research is recommended to help clear these outstanding issues, namely the effect of organizational size on ISO 9001 certification benefits.

3. METHODOLOGY

This study aims to characterize and identify the benefits of ISO 9001 QMS certification by proposing the following research questions:

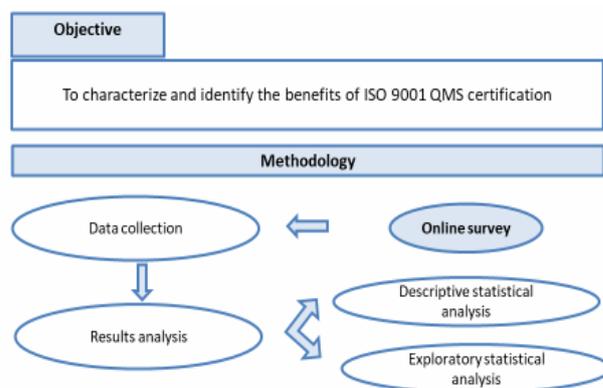


Figure 1. Research methodology

- RQ1: What are the benefits of ISO 9001 certification?
- RQ2: Do the benefits differ by organization size?
- RQ3: Do the benefits differ by the year of certification?

The data were collected from an email survey applied to a sample of 2156 Portuguese organizations certified in ISO 9001 in July 2015 [9]. The research methodology is presented in figure 1, and the authorization to use this data was granted in 2020.

4. RESULTS

The survey yielded 526 valid responses (24.4%), which is in line with similar research (Zaramdini et al. [47] - 23,2%; Costa et al. [13] - 25.2%). The survey results analysis suggests that it matches, i.e., adequately represents the population since the distribution by size is consistent with the population (see figure 2). The data were analysed using statistical software (SPSS 20.0). (see figure 2).

The principal component analysis was applied to analyse the main components and select the components that explain most of the total variation, reducing the size of the data (Varimax rotation, eigenvalue criteria >1), in line with Martins et al. [34].

KMO (Kaiser-Meyer-Olkin) = 0.847 shows a high correlation, and factorial analysis can be interpreted. The factor reduction application leads to the distribution

of the results in three main components – 1. Operational improvement (OP IMP); 2. Market (MKT); and 3. Profitability (PROF) - according to the results presented in Table 1 (Hair et al. [26]).

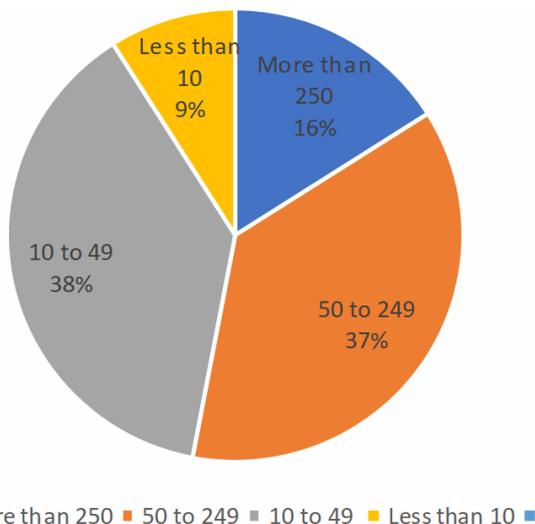


Figure 2. Sample characterization

Three components of ISO 9001 certification explain 87.087% of the total variance:

- Operational improvement (OP IMP, component 1), comprehending five items: Clear People responsibilities; Improvement of quality-consciousness; Improved internal communication; Standardization of processes and procedures; and Improved customer communication.
- Market (MKT, component 2), comprehending four items: Increased market share, Expansion to international markets, Increased competitiveness, and Less customer audits.
- Profitability (PROF, component 3) includes three items: Less internal costs, Increased profitability, and Improved efficiency and effectiveness.

The analyses of the factors mean (see table 2) indicate that the organization gives more importance to Operational improvement and profitability and less to market expansion and competitiveness.

Performing t-tests for paired samples (Table 2) allows to verify that the differences are significant (factors 1,2 $t = -30.659$ $p < .000$; factors 1,3 $t = 20.976$, $p < .000$; factors 3,2 $t = 16.512$, $p < .000$).

The highest correlation is between benefits felt at the level of Profitability and Operational Improvement ($r = .55$, $p < .01$), which means that improving standardization of work procedures and quality awareness is related to increased productivity and profitability.

Table 1. ISO 9001 Benefits

ISO 9001 benefits	OP IMP – comp. 1	MKT - comp. 2	PROF - comp. 3
Clear People responsibilities	.814	.004	.196
Improvement of quality-	.809	.027	.177

consciousness			
Improved internal communication	.755	.092	.322
Standardization of processes and procedures	.752	.007	.038
Improved customer communication	.651	.278	.309
Increased market share	.168	.834	.117
Expansion to international markets	-.070	.807	.002
Increased competitiveness	.228	.745	.258
Less customer audits	-.029	.622	.225
Less internal costs	.146	.177	.859
Increased profitability	.274	.270	.809
Improved efficiency and effectiveness	.372	.126	.747
% factor variance	26.642	20.797	19.647
% total variance	87.087		
KMO: .847; Barlett p.000;			
Cronbach Alpha (internal consistency)	0.85	0.77	0.85

Table 2. ISO 9001 benefits statistics

	Mean	Standard Deviation	OP IMP	PROF
Operational Improvement	3.94a	0.64	.	
Profitability	3.31b	0.80	.55**	
Market	2.64c	0.90	.24**	.41**

Remark: Different letter indicate statistical different values. ** $p < 0.1$

Regarding the organization size, an analysis of variance was carried out (one-way anova), the results of which are shown in Table 3. Micro organizations have less than 10 employees, small between 10 and 49, medium between 50 and 249, and big more than 250.

There are significant differences in the perception of market benefits ($F(3,525) = 2.989$, $p < .05$), with medium-sized organizations attributing greater importance to issues related to the market and competitiveness as a benefit for the certification (Mean = 2.77, Std Dev

= 0.86), unlike micro-sized organizations (Mean = 2.39, Std Dev = 0.77), which are the ones that attribute the least value to this benefit.

There are no differences in the reporting of benefits felt in terms of operational improvement ($F(3,525) = 1.015$, n.s.) and profitability ($F(3,525) = 0,826$, n.s.) as a function of the dimension of the organization.

Table 3. ISO 9001 Benefits as a function of organizational dimension

Benefit	Org.size	N	Mean	Std Dev	F
OP IMP	Micro	50	3.88	0.72	$F(3,525)=1.015$, n.s.
	Small	200	3.90	0.69	
	Medium	195	3,96	0.59	
	Big	81	4.03	0.60	
	Total	526	3.94	0.64	
MKT	Micro	50	2.39a	0.77	$F(3,525)=2.989$, $p<.05$
	Small	200	2.6	0.92	
	Medium	195	2.77b	0.86	
	Big	81	2.57	0.99	
	Total	526	2.64	0.90	
PROF	Micro	50	3.15	0.83	$F(,525)=0.826$, n.s.
	Small	200	3.30	0.88	
	Medium	195	3.33	0.73	
	Big	81	3.35	0.71	
	Total	526	3.31	0.80	

Note: Different letters indicate statistically different values.

The importance attributed to the three factors of benefits was compared by the certified organizations until 1999, between 2000 and 2008 and after 2009, through the performing one-way analysis of variance (one-way anova), similarly to that was done for the motivations and organizational dimensions.

There are significant differences in the importance given to benefits related to the market ($F(2,525)=5.655$, $p<.000$), with certified organizations until 1999 attaching greater importance to this factor ($M=2.85$, $SD=0.84$) than organizations certified after 2009 ($M=2.50$, $DP=0.90$). There are no differences in the benefits experienced in terms of operational improvement ($F(2,525)=.495$, n.s.) and the profitability ($F(2,525)=.256$, n.s.) depending on the years in which the organizations have obtained certification. The overall results are presented in Table 4.

Table 4. ISO 9001 Benefits as a function of the year of certification

Benefit	Year of certification	N	Mean	Std Dev	F
OP IMP	≤ 1999	102	3.89	0.60	$F(2,525)=0.495$, n.s.
	2000-2008	214	3.97	0.65	
	≥ 2009	210	3.94	0.66	
	Total	526	3.94	0.64	
MKT	≤ 1999	102	2.85b	0.84	$F(2,525)=5.655$, $p<.000$
	2000-2008	214	2.68	0.91	
	≥ 2009	210	2.50a	0.90	
	Total	526	2.64	0.90	
PROF	≤ 1999	102	3.30	0.81	$F(2,525)=0.256$, n.s.
	2000-2008	214	3.33	0.80	
	≥ 2009	210	3.28	0.79	
	Total	526	3.31	0.80	

Note: Different letters indicate statistically different values.

5. CONCLUSIONS

The ISO 9001 certification benefits variables were reduced to three main categories by the exploratory factor analysis, characterizing the benefits of ISO 9001 QMS certification with a novel and valid scale:

- Operational improvement (improvements in the definition of employees' responsibilities and obligations, improved quality awareness, improved internal communication, improved definition and standardization of work procedures, improvement of the relationship and communication with the client).
- Market (improvement of market share, expansion to international markets, increased competitiveness, and reduced customer audits).
- And profitability (reducing internal costs, increasing profitability, and increasing productivity and/or efficiency).

Concerning RQ1, "What are the benefits of ISO 9001 certification", this research results emphasize that the certified organizations that responded to the questionnaire identified the operational improvement benefit as the most relevant, followed by the profitability and, finally, the market. It is concluded that the internal benefits related to the operational improvement are the benefits most felt by organizations, the main ones being the employees. These findings indicate that the significant organizational benefits align with the organizations' motivations to adopt and certify ISO 9001, as found by Fonseca, Cardoso & Nóvoa [23].

In relation to RQ2, "Do the benefits differ by organization size", medium-sized organizations are attributing more significant importance to the market and competitiveness as a benefit for the certification. However, there are no differences in the reporting of benefits regarding operational improvement and profitability (as a function of the organization's dimension).

Regarding RQ3, "Do the benefits differ by the year of certification?" the organizations certified until 1999 are the ones that reported the higher market benefits when compared to others certified later. This conclusion might indicate that the increase of the number of ISO 9001 certifications led to a decrease of the corresponding market differentiation value and a stronger emphasis on the operational improvement and profitability benefits, as highlighted by the overall mean results presented in table 4.

Overall, these results are in line with Terlaak [43] that posits ISO 9001 contributes to the cohesiveness and standardization of the organization processes and subsequently quality achievements, and with Heras-Saizarbitoria & Boiral [27] that emphasized the motivation to aim for maximum customer satisfaction, global recognition, and improved performance.

This research contributes to the ISO 9001 body of knowledge with an updated business-oriented benefit scale. It highlights the benefits of ISO 9001 certification, which is a motivating factor for organizations to adopt and pursue ISO 9001 certification. Policymakers, Standardization and Certification Bodies and Consultants, can also adjust their strategies with the infor-

mation provided by this research. Moreover, it can assist ISO stakeholders in their endeavours to possibly start a new revision cycle for ISO 9001.

However, significant megatrends shape the present world (such as the digital transformation, sustainability, the fight to climate change, or the emphasis on creativity and innovation) and the volatile and ever-changing environment (e.g., the COVID.19 pandemic). These megatrends present significant challenges and opportunities for enduring success, as organizations need to manage performance and prepare for the transformations. The RBV theory (Barney [2]) suggests that an organization's resources are essential to superior firm performance, competitive advantage, and strategic success. The contribution of ISO 9001 internal benefits related to the organization's learning processes and knowledge generation should be highlighted.

Quality Management (QM) models and Industry 4.0 share a common objective: improving organizational performance (Gunasekaran et al. [24]). However, some specific aspects of Industry 4.0 need to be carefully addressed within ISO 9001, as Industry 4.0 makes some types of skills obsolete and others (e.g., digital) more relevant. Hence, a suggestion for future research addressing the ISO 9001 within the adoption of Industry 4.0 and digital processes is proposed.

Concerning the limitation of this study, the investigation suffers from the potential bias of the survey methodology, the limitation of the Portuguese sample, and a five-year confidentiality period required to release this data. Nevertheless, measures were taken to minimize potential bias, and the sample size (526 valid responses) is considerably larger than in previous research.

Researchers have emphasized that organizational culture and geographical location can influence how quality management systems, standards, methods, and tools, are adopted by specific organizations (Brkić et al., [7], Fonseca and Ferro [16]). Since this study was carried out amongst Portuguese organizations, the investigation should be replicated in other countries and with more recent data, to validate the research results further.

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**ПРЕДНОСТИ ИСО 9001 СЕРТИФИКАЦИЈЕ:
АНАЛИЗА ГЛАВНИХ КОМПОНЕНТИ**

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Ово истраживање се бави предностима ИСО 9001 да би се разумели разлози његовог усвајања широм света. Применом анализе главних компоненти на резултате анкете која је обухватила 526 валидних одговора (стопа одговора 24,4%), предложена је лествица која је више пословно оријентисана од традиционалног интерног/екстерног типа мотивације са три главне категорије користи: корист од оперативног побољшања (сматра се најрелевантнијим), профитабилност и тржиште. Унутрашње користи у вези са оперативним побољшањем су предности које организације највише осећају, истичући допринос ИСО 9001 побољшању процеса учења и стварању знања. Што се тиче величине организације, организације средње величине придају већи значај тржишту и конкурентности. Међутим, не постоје статистичке разлике у извештајима о користима које се осећају у побољшању пословања и профитабилности. У односу на годину сертификације, организације сертифициване пре 2000. године пријављују веће тржишне користи у поређењу са онима које су касније сертифициване. Предвиђено је истраживање ИСО 9001 у оквиру Индустрије 4.0 и дигиталних процеса за будућа истраживања.