ISO 9001 Performance:
A Holistic and Mixed-Method Analysis

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Abstract

Purpose *– The aim of this paper is to analyse the impact of the ISO 9001 Standard on organizational performance from a holistic theoretical perspective, using a mixed-method analysis. More specifically, the qualitative study considers the impact of the adoption of ISO 9001 on the general performance of certified companies. The quantitative study analysed the effect of ISO 9001 on productivity, business value and increase on sales.*

Design/methodology/approach *– A holistic and integrative theoretical approach was adopted, bringing together aspects of the Contingency Theory, the Institutional Theory and the Resources-Based View (RBV). This theoretical perspective was used in a broad empirical study, using a mixed-method analysis combining the use of qualitative and quantitative methods. The study focused on Portuguese companies from different sectors of activity.*

Findings *– The qualitative study confirmed that ISO 9001 was a demand from the market thus conferring a competitive advantage to organizations and it was also clear that without ISO 9001 these would not enter the market. From the quantitative perspective, data obtained indicate a correlation between ISO 9001 and the size of the organizations. Nevertheless, the analysis also showed that some relationships between ISO 9001 and improved performance were not significant and mostly it seems they depend on the sector of activity considered.*

Research limitations/implications *– This study is limited to the consideration of just two sectors of activity and a single geographical location. Therefore, the results cannot be generalized. In the case of the qualitative study, the respondent's self-reporting bias should be considered. Some extension of the scope of analysis to other sectors and an international sample would be advisable in order to compare results. Another limitation may be the possible selection bias introduced when organizations decide to take part or not.*

Practical implications *– The practical implications of this study relate to conclusions about top management involvement and about the fulfillment of ISO 9001 procedures. These are elements that organizations should consider from this study. These practical implications are in line with other similar studies.*

Originality/value *– This paper is a relevant contribution to the state of the art through the use of the holistic theoretical perspective and the mixed-method approach.*

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1. Introduction

As refers to the Quality Management (QM) paradigm, ISO 9001 is arguably the most influential contribution to date (Sampaio *et al.,* 2009, 2014; Salgado *et al.,* 2015). The scholarly literature has considered ISO 9001 as a very important tool for achieving a set of benefits in organizations, benefits that have been measured in terms of operational, economic and financial performance, an issue that has been widely debated in the literature. Overall the results are mixed. In a majority of studies a positive relationship is found between the adoption of ISO 9001 and a company's performance, but the findings are not conclusive (Sampaio *et al.,* 2012; Heras-Saizarbitoria and Boiral, 2013).

Focusing on the most recent research about the benefits and the performance of ISO 9001, Santos *et al.* (2013) showed that for a sample of companies collected from the northern region of Portugal their main benefits were: the improvement of quality, the improvement of the company image, the marketing advantage, the empowerment of workers and a general cost reduction. In Australia, Huo *et al.* (2014) studied the effect of ISO on flow management (product and logistics) and distinguished three levels of implementation of the standard (basic, advanced and supportive) as enablers and the business and operational performance as the outcome. The results showed that: advanced implementation is positively related to both product and process management, supportive implementation is only related to process flow management and basic implementation has no significant effect on either product or process flow management. Sitki-Ilkay and Aslan (2012) in their study carried out in 255 SME's in Turkey found no statistically significant difference in terms of performance between certified and non-certified companies. Psomas *et al.* (2013) in their empirical study using 100 certified service companies in Greece, found that the adoption of ISO 9001 contributed significantly to the performance of the companies. The product/service quality and business and operational performance of the service companies were directly and significantly influenced by ISO 9001. They also found that companies' business performance was directly influenced by the operational performance. In their recent research study carried out in 140 Greek manufacturing companies Psomas and Kafetzopoulos (2014) demonstrated that ISO 9001 certified manufacturing companies significantly outperform non-certified companies, in terms of product quality, customer satisfaction, operational, market and economic performance. In summary, the majority of the most recent studies find a positive relationship between ISO 9000 and performance, but findings continue to be inconclusive.

Among the theoretical frameworks that have been most frequently used to analyse the adoption of ISO 9001, the Resource-Based View (RBW), the Contingency Theory, and the Institutional Theory stand out in the literature (Somsuk, 2010). However, those theories have not been used together as an integrated theoretical framework for empirical studies. As Somsuk (2010) suggested, since each theory alone is insufficient to explain the complexities of the adoption by firms of QM practices such as ISO 9001, it might be advantageous to integrate the organizational theories in order to understand complex QM phenomena. Similarly, Heras-Saizarbitoria and Boiral (2013) stressed, in their literature review, that most studies about the impact of ISO 9001 have been conducted using a very similar quantitative methodology (i.e. surveys based on questionnaires) and have not used other, qualitative methods. Thus, in order to contribute to fill this gap in the literature, the purpose of this paper is to analyse the impact of ISO 9001 on management and, furthermore, its association with the organization performance, using a holistic theoretical approach based on a mixed-method of analysis that combine the use of quantitative and qualitative methods. More specifically, a qualitative study was designed and made first, followed by a quantitative study intended to confirm (or not) the first.

This paper is organized as follows. After this introduction, the second section describes the holistic theoretical framework adopted. The third section addresses the methodological approach and research questions. The fourth section presents the data collection. The fifth section presents the main results of the research, and finally, in the sixth section, the main conclusions are presented.

2. Theoretical framework

Many theories can explain some aspects of organizations in the specific market environment. The holistic theoretical framework used for this study integrates three of them: Contingency Theory, the Institutional Theory and the Resources-Based View (RBV).

Contingency Theory argues that there is no ideal or optimal way to manage. This means that there are many aspects of a good management. Wiio and Golhaber (1993) relate contingency as to the leadership management, while Fiedler (1992) posits that it is connected to the human resources. Vroom (1988) selects employees' motivation and involvement, whereas Smith (1984) states that the standards of behavior must be translated into power. Somsuk (2010) summarizes all these ideas and refers to Contingency Theory as being a combination of ideas about the organization, its environment and adjustments of its different subsystems. There is no single or simple reason that explains the success of a company and that can be replicated in another to get the same results. This may be because in each organization there is a specific institutional perspective, one that consists of norms, rules, regulations, procedures and routines that belong to its structure (Scott 1995). Companies using these artifacts frequently seek for legitimacy through processes of isomorphism, which may be enhanced by benchmarking (O'Connor *et al*. 2004).

Isomorphism is coercive when it is enforced by a third party (state, trade unions, clients or suppliers), but it is normative isomorphism when it relates to standards to be met across the professional classes (Levitt and Nass 1989; Chua and Petty 1999; Lowrey 2005; Leiter 2005).

In addition to these two theories, RBV suggests that organizations use specialized resources (Wernerfelt 1984) based either on knowledge or on power (Hamel and Prahalad 1994). Somsuk (2010) subdivided knowledge into explicit knowledge – information – and tacit knowledge – expertise. Teece et al. (1994) and Dirickx and Cool (1989) argue that a dynamic capacity for change is crucial for the success of organizations. The business strategy of any organization depends on resources and skills (Oliver 1997) and on its ability to maintain routine production (Wernerfelt 1984).

The purpose of this paper is to use these three theories together to extend the state of the art as to the analysis of the impact of ISO 9001 on performance from a holistic perspective, following in the footsteps of Haversjo (2000), Heras *et al*. (2002), Corbett *et al*. (2005), Dick *et al*. (2008), Sampaio (2008), Santos *et al* (2013) and Psomas and Antony (2013).

3. Methodological approach and research questions

In this study a mixed methods approach was used, combining qualitative and quantitative methods (Cameron and Molina-Azorin, 2011). More specifically, a sequential study was designed, where first qualitative research is performed, followed by a quantitative research. It was considered appropriate to develop an initial qualitative stage because of the inconclusive and sometimes contradictory results found in the literature analysing the relationships between ISO 9001 and performance. According to Molina-Azorín *et al.* (2012) mixed methods, such as those used in this study, may help to improve research outcomes and address challenges identified by earlier studies. Similarly, Fetters *et al.* (2013) suggested that this approach was the best way of measuring how qualitative and quantitative findings cohere.

The aim of the exploratory qualitative stage was to establish, together with the literature review that was carried out, a number of more specific propositions (namely, hypotheses) which are then tested in the quantitative stage, through a multivariate, correlation analysis and an econometric model (quantitative analysis). The qualitative study started from some initial contacts with the entrepreneurial world. These organizations were open to the academic world and allowed the use of their information. All data collected for this research was treated and sent back so that its use could be allowed by the respective top management.

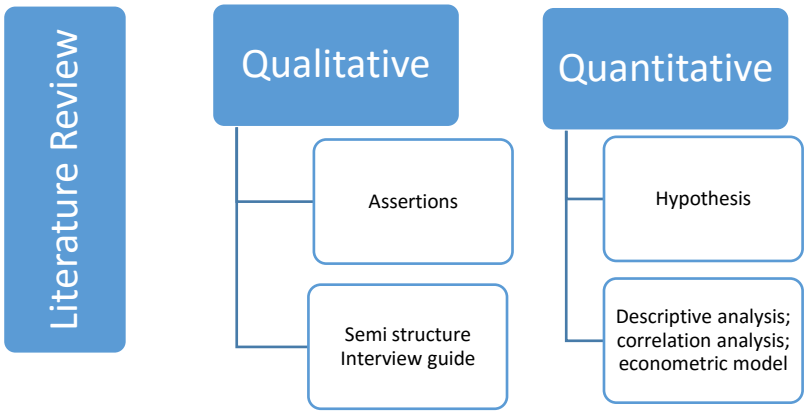


Figure 1 Flowchart of the adopted research path

For the exploratory qualitative stage, a semi-structured script was developed, based on a set of assertions or propositions evidenced by the literature review that was carried out. These assertions, structured around three major themes, were obtained from the literature as follows:

- *Organization and quality* a1-a2: organizations with a lean structure (Kanter 1989) are more likely to implement a quality management system. Dale (1999) argues that these are the ones that have implemented procedures and Wiio and Golhaber (1993) state that this is something very institutional. So, it seems that ISO 9001 certification helps organizations to have a better defined structure – **a1** (Schein, 1992). Kotter and Heskett (1992) and Lindby *et al.* (1999) suggest that organizations culturally more open are better hosts for quality. It looks like that, after being ISO 9001 certified, there is a reinforcement of the quality culture - **a2**.
- *ISO 9001 implementtion process* a3-a5: top management ought to involve employees of the organization (Kaplan and Norton 1992), who should have both a prior knowledge about quality and a keen ability for change (Dillard and Tinker, 1996). It is well known that quality process effects result in expenditures, and perhaps they should be considered as an intangible assets (Kaplan and Norton 2001; Heskett *et al.* 1994) to be better managed. But after such an effort best management practices may emerge - **a3**. Quality certified organizations may show a more motivated human structure and a continuous improvement mindset is a natural event - **a4**. After all from this quality process the organizations need a greater customer loyalty (Crosby 1979; Feigenbaum 1991; Naveh and Erez, 2004) - **a5**.
- *The effects of ISO 9001 implementation* a6-a10: some authors argue that to keep in the market (Oakland and Tanner, 2007) as a customer demand (Zairi and Sinclair 1996) ISO 9001 is a competitive advantage (Porter 1987; Senge et al., 1994; Basu and Wright 1997; Stern and Shiely 2001) - **a6**. However, quality must come from the top - **a7.** These are non-financial effects as to ISO implementation**.** As to the immediate financial effects one should register that expenditure on quality should

be handled very carefully (Yang 2008, Shirley *et al*., 1997) - **a8** and it may be said that good quality management practices may create conditions for a good management performance - **a9.** So in a mediate horizon, after fulfilling all these steps showing the involvement of the top of the hierarchy (Zairi and Sinclair 1996; Weldeghiorgis 2004; Kaplan and Norton 1992; Walsh 2006) this process may contribute to a good financial result of the organization - **a10**.

These previously mentioned assertions are summarized in Table 1.

Table 1 Issues of content and related assertions

ISSUES	*ASSERTIONS*
Organisation and quality	a1 - the structure of ISO 9001 certified organizations may be more enhanced a2 - ISO 9001 may contribute to a culture reinforcement
ISO 9001 implementation process	a3 - after ISO 9001certification, organizations may develop better management practices a4 - with quality certification, organizations may register a more motivated human structure a5 - with ISO 9001, quality there is a greater customer loyalty
The effects of ISO 9001 implementation	Non-financial a6 - a large part of quality certifications is driven by the market a7 - the focus of quality must come from top management
The effects of ISO 9001 implementation	Financial *(Immediate)* a8 - costs related to quality may be significant a9 - good practices of management may create conditions for a good management performance *(Mediate)* a10 - a good management performance can lead to a good financial result

As referred in the theoretical approach of this study, three different management theories - institutional, contingency and Resources Based View (RBV) - were considered as a theoretical umbrella for the analysis of the mentioned assertions (see Figure 1):

- *Institutional and/or contingency theory* (a1-a2)*:* the organizational structure is connected to the cultural nature of the organization what may be considered of an institutional or of a contingent nature.
- *Institutional theory/RBV* (a3-a5): after ISO 9001 certification, organizations can develop better management practices and have a more motivated human structure ascertained with the mission of the organization. This will result in greater customer loyalty. Their placement is of an institutional or of a resources-based perspective.
- *Resources View/RBV* (a6 - a10): quality certification is driven by the market but its start should come from the top of the organization management. It is

a process that develops costs but quality practices may create conditions for a good management performance. It depends on the source and application of the resources (RBV). So it seems that the financial effects are a consequence of this process.

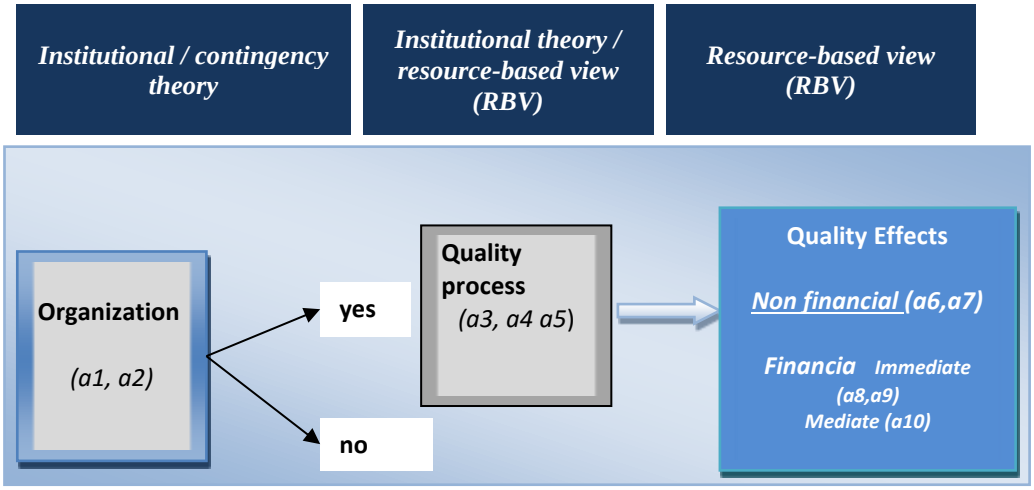


Figure 2 Theoretical approach and embedding of the assertions

For the qualitative study two specific companies were selected (see the next section for more detail). In these companies interviews were developed according to a guide (in two versions for quality certified and not quality certified companies) prepared according to the logical sequence of subjects formatted in ISO 9001 structure and based on the Model of Analysis. Its topics contents were the result of the framework of the assertions (a1-a9) that concern operational performance and the last assertion (a10) concerns economic performance. Therefore, it is essential to address ISO key points, identified as 4.5.6.7.8. and related assertions (see Table 2):

Table 2 ISO 9001 contents and related assertions

Quality Management System (4)	QMS	a1; a5
Management Commitment (5)	MC	a2; a3; a7
Resource Management (6)	RM	a4; a8
Product Realisation (7)	P/S	a6
Measurement, analysis and improvement (8)	MAI	a9; a10

Finally, taking into account the literature review and the propositions and evidences of the exploratory qualitative study, the hypotheses for the quantitative study were defined. These hypotheses analysed the effect of ISO 9001 on Gross Added Value as a proxy of the operational performance and the sales of the companies as a proxy of economic performance (see Table 3). More specifically, the relevant hypotheses of analysis established whether the adoption of ISO 9001 can

contribute to higher productivity and increased business value defined in terms of GAV (Gross Added Value; Hypothesis 1) and whether the increase on sales occurred in certified organizations can be associated to ISO 9001 (Hypothesis 2; see Table 3).

Table 3 Hypotheses and model of analysis for the quantitative perspective

Hypotheses	Model
H1 - ISO 9001, through its implementation, can contribute to higher productivity and increased business value defined in terms of GAV (Gross Added Value)	*AE1: GAV = Function (ISO certification, control variables)*
H2 - The increase on sales occurred in certified organizations can be associated to ISO 9001	*AE2: Sales = Function (ISO certification, control variables)*

4. Data

As to the selection of the companies both for the qualitative and for the quantitative analysis, the financial elements of ISO 9001 certified companies were got from the Portuguese website of stock exchange companies CMVM (accessed on February 25, 2010). This method of analysis, using the stock exchange information was chosen because it was free, on line and presenting information along the last ten years including the management report, the corporate governance report and the profit and loss account.

The qualitative study was focused on six companies, four with ISO 9001 and the other two without ISO 9001 certification. For ISO 9001 quality certified companies the profiles were the following ones:

- *Company 1* and *Company 2:* From the food and retail sector, reached a global value of 12,247,000 Euros, where Company 1 contributes with an income of 6,894,000 Euros, representing 56% of that value, and Company 2 contributes with 5,353,000 Euros, representing the remaining 44%.
- *Company 3* and *Company 4:* From the construction sector, recorded a global value of 7,524,000 Euros in 2008, Company 3, with a turnover of 1,868,000 Euros, represents about 25% and Company 4, with 835,000,000 Euros, register about 11%.

For the companies without ISO 9001 the profiles were the following:

- *Company 5* and *Company 6:* From the media industry, in 2008 all the firms totalled 1,439,000 Euros, where Company 5 records 270,000 Euros income and represents 19% of that amount, and Company 6, with 122,000 Euros, represents 8%.

Regarding this qualitative field-work interviews were carried out from June to October 2010; their duration was 60 to 90 minutes. Interviewed people were either representatives of organisations' top management and or professionals responsible

for Quality Management. Interviews were recorded when possible and then transcribed into text in their entirety. When the interviews were not recorded, detailed field notes were taken, including as many verbatim quotes as possible and afterwards these notes were reviewed and transcribed in a very short period of time, as recommended in the literature (Yin, 2009). The qualitative field-work was confined to this set of interviews because it became clear as the fieldwork progressed that increasingly fewer additional ideas were being gathered, thus giving rise to theoretical saturation. The qualitative data was analyzed with a systematic iterative process of interpretation and categorization, aimed at achieving the convergence of evidences, as suggested in the literature (Yin, 2009).

For the quantitative study, data relating to the companies of the construction and the food sector was obtained from "Exame Magazine" (nowadays Expresso Publishing), which compiles financial indicators for the 500 Biggest and Best Business (this was published in 2009). Information included national companies from which the following parts were taken: Global sales (internal and external), results - operating and net staff costs, Assets, Gross Added Value - GAV, personnel attached. The information was gathered per sector of analysis. Within these sectors of activity, for the period from 2002 to 2009, companies having (or not) ISO 9001 quality certification were identified.

Data was obtained during the period from 2002 to 2009 [2], and referred to the sectors of Construction and Agricultural - food (agro-food) industry in which representations from both agro industry and food distribution are present. Together, these sectors form a representative critical mass of the food area. This sector shows a high level of certification, reaching 52% in 2002 and 71% in 2009. The construction sector shows a significant growth in recent years, representing about 85% in 2009, a value well above the average ones recorded in Europe.

5. Results

5.1 Qualitative perspective

The results achieved through the interviews (to about 10 people) to the top management board and quality management managers belonging to the six companies (construction, food and media) were compared with the initial research assertions and enabled interesting findings, as Table 4 summarizes.

Table 4 Findings from the qualitative analysis

Initial research assertions	Findings
Characteristics and reasons that explain the choice of ISO 9001 quality in the organizations	The market and the size of the organization, as well as culture, are good and steady reasons

Initial research assertions	Findings
Income and expenses associated to the quality process	Usually, the accounting department of companies can identify them, but they are not used as a management tool
The register of costs related to quality certification as an intangible asset	No interviewee considered this as somehow important for management
Effects of ISO 9001 implementation on management	If organizations do not possess an ISO 9001, they will not be in market, so, no competitiveness for them
Quality management performance	Usually, the policy and objectives of quality help the management through the establishment of good practices

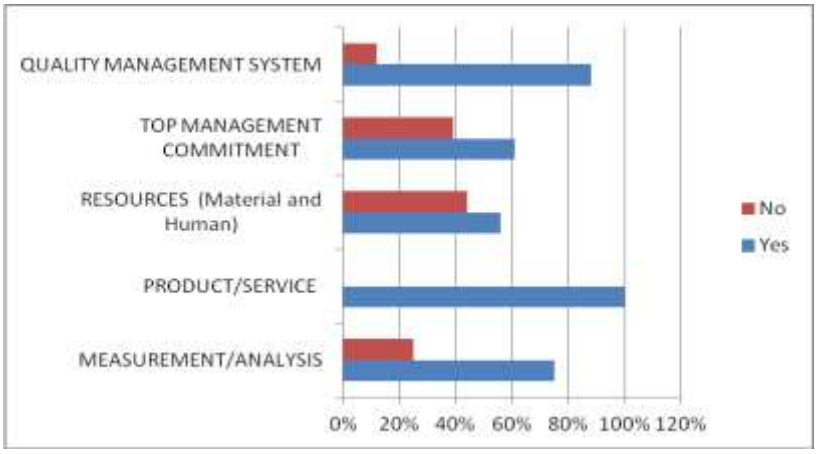
The cross case analysis of results got from the interviews were inserted in the theoretical scope according to the defined criterion. The resources theory (RBV) is the more relevant: Knowledge based (Hamel and Prahalad 1990) and dynamic capability models (Teece *et al.* 1994; Dirickx and Cool 1989). As to the institutional theory – mainly on the mimetic perspective, opinions confirm that the control tools existing in the organization are mostly associated to the quality process (Levitt and Nass 1989; Chua and Petty 1999; Lowrey 2005; Leiter 2005) meaning that anything to be well managed should be measured (Shellhorn, 2007). This way although one can say that ISO 9001 itself has a kind of an institutional figure the rules and procedures may be changed unexpectedly due to events like the contingency of the market.

It was ascertained that the main reasons that explain the adoption of ISO 9001 were linked to the size of the organization and to the market, as well as to its organizational culture. Regarding the effects of ISO 9001 adoption, it was evidenced that the certification was a real *must* for the companies: certified organizations underlined that if they did not have ISO 9001 certification, they would not be in the market, so, this would be a very relevant handicap for their competitiveness. Likewise, it was evidenced that the policy and objectives of quality linked to the adoption of ISO 9001 help the management through the establishment of good practices.

It was interesting to note, from the interviews' data analysis, that not-certified ISO 9001 companies were those advocating more strongly the connection about quality and performance. This issue was evidenced perhaps because they did not start such a process and did not know the problems they must face for the implementation of ISO 9001. Terziovski *et al.* (2003) would say that there is no benefit on it but these organizations that know little about ISO 9001 implementation say that for sure quality must be linked to performance. On the other hand for ISO

9001 certified companies, the explanation of their choice was *ad contrario*, as they refer that a non quality certification would become a competitive disadvantage.

Graph 1. Interviewees' opinion as to the main issues and respective questions (companies with ISO 9001)



5.2 Quantitative perspective

As regards the quantitative analysis, OLS (Ordinary Least Squares Method) multivariate analysis and an econometric model were achieved in order to reinforce the results from the qualitative perspective. Firstly, along the descriptive analysis whose results are described in table 5, some main conclusions can be taken. After being ISO 9001 quality certified, companies exhibit better average financial indicators mainly as to the food sector.

Table 5 Descriptive analysis (construction)

CONSTRUCTION	Mean Value	ISO 9001 certified	Non-certified
SALES – m.e.	130.7	136.7	123.0
ASSETS - m.e.	148.2	160.8	131.8
GAV	27.1	27.5	26.9
PRODUCTIVITY	41.9	44.4	39.9

Table 6 Descriptive analysis (agro food)

AGRO-FOOD	Mean Value	ISO 9001 certified	Non-certified
SALES – m.e.	123.2	157.1	63.7
ASSETS- m.e.	98.6	119.5	61.9
GAV	23.6	31.9	8.9
PRODUCTIVITY	59.1	65.4	48.0

This may have a good reason of explanation if we consider that the food industry is too much close and dependent on the consumer's perception (table 6) and quality must be therein embedded while in the construction sector (table 5) it is somehow further from the consumer.

In order to estimate the impact of certification on the performance of organizations, a model was defined based on a regression of Gross Added Value (as a proxy of operational performance) and Sales (as a proxy of economic performance) and the results can be seen in tables 7 and 8.

Table 7. Correlation (Pearson) for the construction sector

		Sales	Corr Res	GVA	Liq Res	ISO 9001	Active	Produtiv
Sales	Pearson Correlation	1	,145	,800	,056	,044	,754	,072
	Sig. (2-tailed)		,025	,000	,387	,495	,000	,268
	N	241	241	241	241	241	241	241
Oper. Profits	Pearson Correlation	,145	1	,066	,923	-,024	,049	,084
	Sig. (2-tailed)	,025		,308	,000	,716	,447	,194
	N	241	241	241	241	241	241	241
GAV	Pearson Correlation	,800	,066	1	,003	-,008	,654	,420
	Sig. (2-tailed)	,000	,308		,959	,900	,000	,000
	N	241	241	241	241	241	241	241
Net profit	Pearson Correlation	,056	,923	,003	1	-,041	-,034	,061
	Sig. (2-tailed)	,387	,000	,959		,526	,603	,345
	N	241	241	241	241	241	241	241
ISO 9001	Pearson Correlation	,044	-,024	-,008	-,041	1	,065	-,088
	Sig. (2-tailed)	,495	,716	,900	,526		,318	,173
	N	241	241	241	241	463	241	241
Asset	Pearson Correlation	,754	,049	,654	-,034	,065	1	,009
	Sig. (2-tailed)	,000	,447	,000	,603	,318		,887
	N	241	241	241	241	241	241	241
Productiv	Pearson Correlation	,072	,084	,420	,061	-,088	,009	1
	Sig. (2-tailed)	,268	,194	,000	,345	,173	,887	
	N	241	241	241	241	241	241	241

As to construction sector (Table 7) assessing the degree of Pearson correlation-based measure, we can say that there is a strong positive correlation seen between GAV and Sales and between Sales and Assets, with coefficients above 0.7. As to the food sector (table 8) assessing the degree of correlation based on this coefficient this measure also indicates the existence of a strong positive correlation between GAV and Sales and between Sales and Assets in this sector.

Table 8. Correlation (Pearson) for the food industry

		Sales	Corr Res	GVA	Liq Res	ISO 9001	Active	Produtiv
Sales	Pearson Correlation	1	,685	,861	,693	,849	,328	,207
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,009
	Sum of Squares and Cross-products	2,939E18	1,703E17	6,065E17	2,347E17	1,876E18	3,392E9	2,853E14
	Covariance	1,884E16	1,091E15	3,888E15	1,505E15	1,203E16	2,174E7	1,829E12
	N	157	157	157	157	157	157	157
Net profits	Pearson Correlation	,685	1	,891	,986	,750	,225	,383
	Sig. (2-tailed)	,000		,000	,000	,000	,005	,000
	Sum of Squares and Cross-products	1,703E17	2,103E16	5,312E16	2,823E16	1,403E17	1,969E8	4,454E13
	Covariance	1,091E15	1,348E14	3,405E14	1,809E14	8,992E14	1262089,191	2,855E11
	N	157	157	157	157	157	157	157
GAV	Pearson Correlation	,861	,891	1	,899	,833	,337	,312
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,000
	Sum of Squares and Cross-products	6,065E17	5,312E16	1,691E17	7,296E16	4,414E17	8,350E8	1,030E14
	Covariance	3,888E15	3,405E14	1,084E15	4,677E14	2,830E15	5352454,888	6,603E11
	N	157	157	157	157	157	157	157
Curr profits	Pearson Correlation	,693	,986	,899	1	,717	,234	,373
	Sig. (2-tailed)	,000	,000	,000		,000	,003	,000
	Sum of Squares and Cross-products	2,347E17	2,823E16	7,296E16	3,899E16	1,825E17	2,780E8	5,906E13
	Covariance	1,505E15	1,809E14	4,677E14	2,500E14	1,170E15	1782304,327	3,786E11
	N	157	157	157	157	157	157	157
Assets	Pearson Correlation	,849	,750	,833	,717	1	,269	,221
	Sig. (2-tailed)	,000	,000	,000	,000		,001	,005
	Sum of Squares and Cross-products	1,876E18	1,403E17	4,414E17	1,825E17	1,663E18	2,091E9	2,287E14
	Covariance	1,203E16	8,992E14	2,830E15	1,170E15	1,066E16	1,340E7	1,466E12
	N	157	157	157	157	157	157	157

		Sales	Corr Res	GVA	Liq Res	ISO 9001	Active	Produtiv
ISSO9001	Pearson Correlation	,328	,225	,337	,234	,269	1	,130
	Sig. (2-tailed)	,000	,005	,000	,003	,001		,105
	Sum of Squares and Cross-products	3,392E9	1,969E8	8,350E8	2,780E8	2,091E9	79,839	628664,237
	Covariance	2,174E7	1262089,191	5352454,888	1782304,327	1,340E7	,234	4029,899
	N	157	157	157	157	157	342	157
Productiv	Pearson Correlation	,207	,383	,312	,373	,221	,130	1
	Sig. (2-tailed)	,009	,000	,000	,000	,005	,105	
	Sum of Squares and Cross-products	2,853E14	4,454E13	1,030E14	5,906E13	2,287E14	628664,237	6,437E11
	Covariance	1,829E12	2,855E11	6,603E11	3,786E11	1,466E12	4029,899	4,126E9
	N	157	157	157	157	157	157	157

. Correlation is significant at the 0.01 level (2-tailed).

At last an econometric model was tried. The variables of the sample were defined according to the assumptions and the ones belonging to the econometric model are summarized in the table below (see Table 9).

Table 9 Definition of the variables

Variable	Definition	Unit
$Sales_{it}$	Annual sales value i, year t	Million Euros
GAV_{it}	Gross Added Value i, year t	Euros
Current $profits_{it}$	Annual operational balance for company i, being the difference between operational income and expenses in period t.	Euros
Net $profits_{it}$	Net profit of company i, being the difference between income and expenses, including operational profits, financial charges and extraordinary results, in year t.	Euros
Certification ISO_{it}	Binary variable identifying if company i, is certified (assuming value 1) or not certified (assuming value 0) in year t.	Certified company=1 Non certified company=0
$Asset_{it}$	Set upon f factors of the company i – able to generate financial inflows – year t	Euros
$Productivity_{it}$	Work apparent productivity: ratio between GAV and the number of employees	Euros

A descriptive analysis, elaborated from the database built by sector of activity, was carried out. After identifying the sectors of activity with a major relevance of ISO certification, a brief description of the sample will follow.

In the construction sector, and considering the 52 (N) firms on the database referred to, only 16 (31%) held ISO certification in 2002. This number has evolved considerably in recent years, standing, in 2009, at 44 companies (85%). The temporal analysis (T) is 8 years (2002-2009). This data set constituted a panel data with a sample size (N * T) of 416 observations (52 * 8). However, the used database had some information gaps that forced the resizing of the panel. Considering the dependent variables to be used in the model and the non-existence of 123 observations for the variable sales, these observations were removed in the econometric analysis. However, it was necessary to remove from the sample 52 observations resulting from the unavailability of data for the year 2007 (missing in the database considered). Thus, the original panel data was reconfigured in an unbalanced panel with about 241 observations.

The sample concerning the sector of the agro-food industry includes a total of 38 companies with observations in the period from 2002 to 2009, setting up a panel data with 304 observations. However, and similarly to what happened in the construction sector, the erroneous information in the database eliminated 144 observations. Of those eliminated observations, 38 were a result of lack of data for all companies in the sample, for the year 2007. Thus, the unbalanced panel data results in 157 valid observations included. In 2002, about 52% of the sample (n = 20) were certified, this proportion rising to 71% in 2009, with about 27 companies certified.

This study will focus on the econometric analysis. It was possible to construct an unbalanced panel data with about 52 companies in the construction sector and 38 companies in the agro-industry for a period of eight years (in construction, the sample size will be approximately 52x8 = 416, whereas the agro-industry sample size will be approximately 38x8 = 304). However, in some years the financial information was not available, which reduced the size of the actual sample values shown in the tables of results and drew together an unbalanced [3] panel data. Therefore, in the research an unbalanced panel was used, since it does not involve significant changes in the theoretical model [4]. Moreover, the software used (LIMDEP) allows treating the absence of information as such and not as a zero. The fact of working with a panel of data allows the use of multivariate regression methods that are more complex than the simple OLS or the pooled OLS (Greene 2003) [5]. In brief, we carried out the following: *Pool OLS, Fixed Effects Model (FEM), Random Effects Model (REM),* but from these only one was adopted. As mentioned previously, the OLS pool method in practice results from its application to a sample juxtaposed for various periods. The FEM and REM methods (which, in their estimation, consider the temporal evolution of the causal relationship in each individual) lead to more efficient estimates, if there are, indeed, group effects that capture the idiosyncratic characteristics.

In this research it is expected that there is no correlation between the observed and intrinsic component of the company and any of the explanatory variables. Thus, the fixed effect model will be used. There are a set of statistical procedures and tests that contribute to a greater security in the decision making. Therefore, the first test of statistical analysis implemented in this practice is the F-test or global significance, which seeks to infer the statistical significance of the artificially set of dummies created to capture the individual-specific effects in panel data. The null hypothesis assumes that these dummies are zero and, as such, there would be no statistically significant idiosyncratic characteristics that should be taken into account in the estimation process. In case of rejection of this null hypothesis, this implies that there are, indeed, effects of group and, thus, FEM outlays more efficient estimators. In addition, one might consider also the Lagrange Multiplier (LM) test. Similarly to the F-test, this test considers the analysis of the significance of the dummy model compared to the method underlying the REM (where there is no correlation between the individual-specific component and the independent variables, which leads to an estimated transformed model different from the FEM).

Finally, to test if whether $a_{ir\ or}$ w_t are correlated or not, with the explanatory variables and, thus, opt for the method FEM or REM, the Hausman test was performed. The Hausman test compares the fixed effects model with the random effects model, assuming as a null hypothesis that the component is not observed and specific to each individual and did not correlate with the regressors of the model (Greene 2003). If there is evidence of correlation, the null hypothesis is rejected and one should opt for the fixed effects model, because the random effects model would produce inconsistent estimators. If the null hypothesis is not rejected, then it is preferable to adopt the random-effects model because it leads to consistent and more efficient estimators than the ones obtained by the method of fixed effects (Greene 2003). In this analysis there are theoretical reasons that support the choice of the fixed effects model - statistical tests. Accordingly, and given the restrictions imposed by the available data, it is not possible to model a complete listing that captures all these structural effects. Usually, idiosyncratic aspects are captured by the group effects, something that allows identifying the individual characteristics of each company and which favours the choice of FEM or REM.

Considering the possible inefficiency of the model, the probability of correlation between the non-stochastic component of the error and any of the independent variables would result in the non-validity of the statistical inference.

Thus, a more conservative and safe approach was undertaken, selecting a method that cannot produce more efficient estimators and, therefore, allow statistical inference. Moreover, as already mentioned, the statistical means intended to assist in this choice, mainly the Hausman – test, have a high overall statistical test, indicating that, for significance levels usually taken as a reference, the fixed effects model is, in fact, preferable and it shall be used in the estimates of the models in this research.

It is recalled that, in the present investigation, the influence of ISO 9001 on the performance of the organization is to be evaluated. A model of regression

considering GAV (as a proxy of operational performance) and Sales (as a proxy of economic performance) was defined. Thus, the generic models presented —(1) and (2)— are, respectively

$$AE1: \quad GAV_{it} = Z_i^{'}\alpha + \beta_1 ISO_{it} + X_{it}'\theta + \nu_{it} \quad (1)$$

$$AE2: \quad Sales_{it} = Z_i^{'}\alpha + \beta_1 ISO_{it} + X_{it}'\theta + \nu_{it} \quad (2)$$

Based on the models described above, several sub-models were estimated, using alternative control variables, in order to disguise the possible overestimation of the impact of ISO and further evidence as to the robustness of the results. To evaluate the operational performance of ISO 9001, a regression was made on three versions of model (1), trying to capture the impact of certification on Gross Added Value (GAV) and / or productivity (GAV / Workers), controlling the scale of operation of enterprises measured by the assets.

$$AE1-Mod.1: \quad VAB_{it} = \beta_0 + \beta_1 ISO_{it} \quad (1.1)$$

$$AE1-Mod.2: \quad GAV_{it} = \beta_0 + \beta_1 ISO_{it} + \beta_2 Assets \quad (1,2)$$

$$AE1-Mod.3: \quad \Pr oductivity_{it} = \beta_0 + \beta_1 ISO_{it} + \beta_2 Assets + \beta_3 Sales \quad (1.3)$$

Theoretically, it is expected that the impact of ISO 9001 is positive, whether as to GAV or as to productivity. It is also expected that the assets have a positive impact on the GAV and productivity due to a larger scale of operation, which would enable bigger economies of scale and an accrued ability to create value. Similarly, to assess the economic performance of ISO 9001, a regression on three versions of model (2) was considered, in order to capture the impact of certification on the volume of sales and assets controlled by the company's productivity. It is expected that companies with a larger scale of operation and, consequently, greater production capacity, have larger sales volume, as well as a positive impact of productivity on the company's competitiveness.

In order to estimate the effects of ISO 9001 certification on the performance of an organization, other regression models were considered:

$$AE2-Mod\ 1: \quad Sales_{it} = \beta_0 + \beta_1 ISO_{it} \quad (2.1)$$

$$AE2-Mod\,2: \quad Sales_{it} = \beta_0 + \beta_1 ISO_{it} + \beta_2 Assets \quad (2.2)$$

$$AE2-Mod\,3: \quad Sales_{it} = \beta_0 + \beta_1 ISO_{it} + \beta_2 Assets_{it} + \beta_3 \Pr oductivity_{it} \quad (2.3)$$

As concerns testing hypotheses, it is well known from literature that certification should influence positively the market and it is expected that the estimate for β1 is positive for both sectors.

In model 2.3, in addition to the assets, the productivity was also included, which means a way of evaluating the efficiency of enterprises and the extent to which the assets could induce workers' productivity. It has been tested, as well, whether this could also influence the volume of sales reflecting a higher added value.

Table 10. Estimated results for the construction sector

	AE2			AE1		
	Model 2.1 Dep. Var.: Sales	**Model 2.2 Dep. Var.: Sales**	**Model 2.3 Dep. Var: Sales**	**Model 1.1 Dep.Var.: GAV**	**Model 1.2 Dep Var.: GAV**	**Model 1.3 Dep. Var.: Productivity**
Independent Variables						
Certification ISO	27.6524**	25.2837**	25.6922**	1.79947	1.47595	2940.911
Assets		0.25237***	0.24982***		0.05762***	0.000050
Productivity			192.658			
Sales						0.000032
Constant	103.479			24.2671***		
R^2 adjusted	0.83125	0.86788	0.86867	0.56603	0.59325	0.19234
Test F	496.390***	10.4120***	10.5440***	6.414***	2.693***	1.947***
Chi-square	21.349***	354.591***	353.703***	219.164***	150.554***	117.888***
LM – test	466.68***	119.06***	117.590***	210.49***	14.93***	6.62**
Baltagi-LI LM	240.14***	61.26***	63.41***	108.32***	7.68**	3.40
Hausman	1.0	10.11***	11.58***	0.2	8.85**	1.84
NT	241	241	241	241	241	241
Model	REM	FEM	FEM	REM	FEM	FEM

Notes: statistic significance *** a 1% ** 5% * 10%.

Table 10 presents the estimation results for the construction sector. The model 2.1, containing one only explanatory variable (ISO certification), shows an impact estimated in more 28 million Euros than non certified companies. This impact decreases slightly when the control variable through the firm size, the combination of ISO and assets is effected (model 2.2). As to the effect of ISO certification, it is estimated that certified companies observe an average turnover of more than 25 million Euros as to the companies that are not certified. This value is statistically significant at 5% of the estimation; it is similar also, in model 2.3, where the introduction of variable productivity proved to be not statistically significant. These estimates confirm the theoretical hypothesis of an effect of an external motive for certification. This process seems to enhance the visibility of the company through quality and the value assigned by customers relying on quality assurance (noting that this perception is progressively promoting the development and acquisition of

certified companies in the sample). In model 2.2 it was observed (by analyzing the results of the estimation) that the firm size/ scale of operation, being the assets a proxy, is also relevant, confirming that the scale of operations/firm size is associated with sales volume.

In model 2.3, the relationship of ISO 9001 with the variable sales, introducing as control variables the asset and the productivity, was recorded. As to these last items the estimated models did not point their statistical significance. As concerns the assets, the estimation results indicate that the relationship between firm size, measured by assets and sales, is positive. In this case, it is estimated that, under a *caeteris paribus* assumption, a company whose assets increases by 1 million Euros register sales increase by 0.25 million. In fact, the larger companies are the more interested in marking their presence in the most technologically advanced and demanding market segments. As regards the estimation of the multivariate regression model created to assess the internal impact of ISO, it is observed that both in terms of GAV (models 1.1 and 1.2) and in terms of productivity (model 6) the estimation results indicate a not statistical significance of ISO 9001 at 10% significance level. This suggests that, at least in the context of the construction sector, where there are the largest companies, ISO is not a factor inducing greater productive efficiency.

Anyway, it is relevant to clarify that this does not necessarily imply that ISO 9001 has no positive impacts on productivity. The size of firms of the sample, the fact that some companies that are not quality certified possess technological skills and expertise in the fields of construction of high specialization, these are reasons that may contribute to distort the potential impact of certification. Regarding the control variables, in Model 5, it is registered that the Assets is statistically significant. As to the this variable, we observe a positive relationship between the size (through the value of Assets) and GAV estimated at about 6 cents for each additional euro of assets, indicating that there is a significant positive relationship between the scale of operation/size and the GVA which may possibly explain the exploitation of economies of scale. As to the results of estimation of model 1.3, the use of productivity as an alternative dependent variable did not result in a better adjustment. On the contrary, this model 1.3 presents a low quality adjustment (also in the case of models 1.2 and 1.3 quality adjustment was not high) resulting in a lower adjusted (chi square) R2, enabling the ability group explanatory model and variables, individually, to be considered statistically insignificant.

In brief and according to the above estimates, one can conclude that ISO impact is more visible on the external side of the organization than on the internal one. The market seems to demand quality requiring it as a matter of assurance. Larger companies that operate in markets with higher levels of demand assume certification process as a requirement. Thus this process, in these companies, does not mean a big gain on efficiency (internal effect). Moreover, the model 1.3, after introducing the control variable sales whose high correlation with the independent variable assets makes it hard to get a consistency within the estimators.

Table 11. Estimated results for the food sector

	AE2			AE1		
	Model 2.1 Dep. Var.: Sales	**Model 2.2 Dep. Var.: Sales**	**Model 2.3 Dep. Var: Sales**	**Model 1.1 Dep.Var.: GAV**	**Model 1.2 Dep Var.: GAV**	**Model 1.3 Dep. Var.: Productivity**
Independent variables:						
Certification ISSO	30.705**	29.727**	10.5447	10.7968**	0.3745	-0.01092
Assets		1.09247***	0.72082***		0.18726***	0.000131***
Productivity			25.9504			
Sales						0.0000276
Constant				16.487***		62896.07***
R^2 adjusted	0.80321	0.925978	0.979268	0.870336	0.955900	0.959766
Test F	36.095***	51.851***	51.552***	25.666***	24.698***	95.94***
Chi-square	394.234***	448.442***	448.857***	345.795***	341.624***	542.153***
LM – test	266.68***	248.19***	247.64***	193.81***	200.71***	16.02***
Baltagi-LI LM	192.84***	179.77***	179.07***	140.15***	145.14***	11.58***
Hausman	1.52	9.76***	9.95**	2.26	9.85***	1.02
NT	157	157	157	157	157	157
Model	FEM	FEM	FEM	REM	FEM	REM

Notes: statistic significance: *** a 1% ** 5% * 10%.

Table 11 summarizes the results for the Agro-food industry. The results of the estimation done from the fixed effects model for this industry sector denote a good quality adjustment with a (chi square) R2 adjusted presenting high values in several models. As to ISO 9001 there is a significant positive relationship between the certification of companies in the food industry and its sales volume. Specifically, the model estimates that, under *caeteris paribus* assumptions, a certified company gets more 30.7 million Euros in sales than a company which is not certified. This is a higher absolute value than the one registered in the construction sector. The external visibility or assurance arising from a certification are highly valued in this particular market. Considering the assets, model 2.2 shows that, the relationship between certification and sales remain relevant, and it is estimated that any certified

company enables more 29.7 million in sales than a not certified company. Besides, companies with a greater scale of operations have higher sales volume, but the relevance of the assets as an explanatory variable assumes lower values than the verified in the construction sector. In model 2.3 it was introduced the variable productivity in order to analyze if the better efficiency of firms influences the volume of sales. It was found that not only it was not significant in this sector (as happened in the construction sector) as well as the model presents little interest as to its explanatory capacity. The estimation results of model 2.3 reveal that certification is no longer significant, decreasing the explanatory power of the variable assets. The gains in (chi-square) - R2 are marginal and probably they do not reflect the best adjustment but, they mean, the statistical effect of the degrees of freedom reduction due to the introduction of an additional variable. As regards the estimation of the multivariate regression model to assess the internal impact of ISO 9001, it is observed that for all certified companies evidencing sales value close to the average or above the sector average, the impact of ISO on GAV is significant (model 1.1) considering a significance level of 5%. It is also estimated that ISO will have a positive impact on GAV of around 1 million Euros. In models 1.2 and 1.3 (the latter uses as an alternative the dependent variable productivity) ISO is not significant at a 10% level, though in this model 1.2 significance is reached for a level of 15%. Regarding the control variables, the assets working as proxy of company size, is statistically significant at 1%, and really estimated a significant positive relationship between assets and GAV. In model 1.3 it was introduced the control variable Sales but the high correlation of this variable with the variable Asset jeopardizes the consistency of the estimators. The choice of model of fixed effects and variable effects is due to the tests of Hausman and Lagrange, similarly as performed for the construction industry.

Using the two samples (sectors of activity), the method of fixed effects, selected on the basis of the defined theoretical assumptions and on the findings of the achieved statistical tests (Hausman, LM, and F), results are the following (see Table 12).

Table 12 Research Hypotheses and associated results

H1 - ISO 9001 implementation may contribute to a better productivity and accrued business value (defined in terms of Gross Added Value - GAV)	*H2 – Sales accruals in certified companies can be associated to ISO 9001*
On a correlation basis it can be said: There is a strong correlation in quality certified companies between GAV and Sales and between Sales and the assets	On a correlation basis it can be said: There is a strong correlation in quality certified companies between GAV and Sales and between Sales and the assets

Statistics analysis revealed that the average values of Sales and GAV in ISO 9001 certified companies were bigger than the sector average; mainly as to companies belonging to the food industry	Statistics analysis revealed that there is a positive association between sales value and quality certification. Sales values, in ISO 9001 certified companies – in both sectors of activity , were bigger than the sector average
The econometric model refers that the effect on management performance, in ISO 9001 certified companies, measured through GAV and productivity, was not significant	The econometric model reveals that the effect of ISO 9001 on sales was more significant in the food sector than in the construction one

6. Conclusions

The qualitative study confirmed that ISO 9001 was a demand from the market thus becoming a competitive advantage and furthermore it was clarified that without an ISO 9001 adoption the organizations would not enter and stay in the market (see graph 1). Respondents stated that ISO was a need to survive in the market. Later through the results from the quantitative analysis it was confirmed that within these sectors of study this idea was quite true once for quality certified companies better financial values and some correlated variables were found. Thus, from the quantitative perspective the organizations main big numbers evidenced a correlation as to ISO 9001 and better values in terms of higher productivity, business value and sales after the adoption of the ISO 9001 (confirming this way the answers got in the interviews). Nevertheless, the econometric model also evidenced that the effect on performance of ISO 9001 measured through GAV and productivity was not significant. Similarly, a different impact of ISO 9001 on performance considering the sectoral variable was also evidenced. Then, the outcomes should be interpreted cautiously.

A major conclusion from this empirical study puts forward the compulsion of organizations towards ISO 9001 certification, as it seems to become a resource that improves their efficiency and performance so that they keep in the market. This study enabled the classification of these conclusions ―got either from the qualitative analysis or from the quantitative analysis― under the scope of a theoretical holistic umbrella made up of resources (RBV) taken under an institutional perspective, but which may be changed at any time by unforeseen events from the contingent of the present times.

In brief, and according to the theoretical scope, the following ideas can be considered. As to the resources theory RBV, it was registered that in ISO 9001 certified companies, Sales and Gross Added Value and Sales and Assets were correlated variables to ISO 9001, what makes of ISO 9001 an enabler resource. This seems also to be true for the statistical analysis done as to the ISO certified and not certified companies once the quality certified organizations presented better average

values. As to the Institutional perspective, one can state that the best the organization is ruled —using norms and procedures and indicators associated, the best performance is attained. Finally, as to the Contingent perspective, one must stress that the market is something dynamic and not stable thus influencing any time anywhere the course of the organization. This way, looking at ISO 9001 benefits and to their incidence on the performance of the companies one could envisage ISO 9001 itself as a resource (RBV) that implies the good use of many other resources in organizations (human and material), providing for some rules and procedures about management (institutional), in order to face a dynamic market (contingent).

Some implications for managers should be underlined in the light of the findings of the study carried out. Firstly, the fact confirmed by the qualitative study about ISO 9001 as being a *ticket* to enter the market (notably the international one) what should be taken into account by managers, particularly as concerns SME's. Secondly, managers should avoid considering inflated expectations of performance improvement motivated for the mere implementation and certification of a Quality Management System based on ISO 9001 meta-standard. The way as the underlying principles and practices of ISO 9001 are internalized in the adopting companies that makes the difference, as evidenced by the recent literature on the subject (e.g. Heras-Saizarbitoria, 2011; Tarí *et al.*, 2013; Allur *et al.*, 2014), despite many practitioner and mainstream scholarly works tend to underline the generalized and *validated* positive impact of ISO 9001 on company performance (Heras-Saizarbitoria and Boiral, 2013).

The main limitations of this study lay in the small scale of the sample used, together with the geographical focus of the study and the consideration of just two sectors of activity. Therefore, the results cannot be generalized. In the case of the qualitative study the respondent's self-reporting *bias* should be considered. As underlined by Heras-Saizarbitoria and Boiral (2013), performance variables based on perceptual measures of managers can be biased due to the person providing the information having a personal interest in overvaluing it (a type of social desirability bias that might be assumed by managers). Some enlargement of the scope of analysis to other sectors and an international sample consideration would be advisable in order to compare results. Regarding the quantitative study, another limitation refers to a set of bias that could influence the results such as the selection bias. The selection bias can lead to a very wrong inference, with all the difference in income falsely attributed to the adoption of ISO 9001 and not to any of a large set of characteristics, many of them extremely difficult to observe and measure (Hiscox *et al.*, 2008).

The limitations of this study raise some avenues for further research. The holistic perspective of analysis and the mixed-method used could be applied on a bigger sample not limited to a set of sectors or to a specific geographical placement. For that purpose, the collaboration of researchers from several countries already carrying out research on the adoption of ISO 9001 would be advisable.

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Endnotes

[1] From the ISO 9001 Standard, points 1 to 3 of the ISO 9001 Standard are respectively: 1. Fundamental concepts of its application; 2. Regulatory framework; and 3. Terms and definitions. The last is not relevant or fundamental for the present research aim.
[2] Guia de empresas certificadas. Edição (2009) Cem Palavras.
[3] Alternatively, we could have used a balanced panel. A panel of this kind implies that there is complete information for all the observations considered, which, in this case, would only be possible by eliminating some of the observations.
[4] For further details, see Greene (2003, pp. 289-290).
[5] As in this case, the non-availability of data over a long period discourages the use of methods of time series analysis such as the GMM – Generalized Moment Method (Greene, 2003).

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