A Model to Assess the Impacts of ISO Management Systems Standards

M. Cabecinhas*[1], P. Sampaio[1], M. Casadesús[2]
[1]Department of Production and Systems, University of Minho, Braga, Portugal; ALGORITMI Research Centre, School of Engineering – University of Minho, Guimarães, Portugal
[2]Department of Business Management and Product Development, Universitat de Girona, Girona, Spain
*Correspondente: id7273@alunos.uminho.pt

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Abstract - **The most widely diffused ISO standards are ISO 9001 and ISO 14001. The main objectives of those are to demonstrate the capability to satisfy the requirements of the customers and to demonstrate the continuous search to reduce the impacts on the environment, respectively. However, these certifications will not necessarily be reflected in the performance of the company. Through the analysis of the literature, mixed results are observed, showing that not all certified companies could achieve benefits and improve the performance of the organization due to the ISO standards certification.**

Based on a literature review and a questionnaire survey, this paper defines a model where the main critical success factors which will influence the internalization level of the ISO 9001 and ISO 14001 are presented, and consequently their impacts on the organizations. This model could help researchers and practitioners in the process of evaluating the ISO standards impacts and the possible reasons for different outcomes.

Keywords - **ISO 9001; ISO 14001; ISO Standards; Critical factors; Internalization; Impacts.**

I. INTRODUCTION

The globalization process induced organizations to implement management standards to enhance their business practices and to facilitate the international trades of goods and services. To satisfy this need, several standards were created, but the ISO certifications stand out.

This research focuses on the most widely diffused ISO standards worldwide: ISO 9001 and ISO 14001. Despite the different focus, they have several similarities, and even the main goal of the quality management (zero defects) parallels the main goal of the environmental management (no waste) [1][2]. In Boiral's work, (2011) it is even mentioned that "the separation between ISO 9001 and ISO 14001 in the literature often seems artificial and should be questioned in future research" [1].

The main objective of this work is to present a model which will allow the analysis and evaluation of the impact of the ISO 9001 and ISO 14001 implementation. The model developed included critical success factors which are more likely to affect the ISO standards implementation. Although there is a gap in the literature related with the effects of the critical success factors on the internalization level, in the model developed we assumed that the critical success factors which affect the implementation of the ISO standards will also affect the internalization level and consequently the outcomes of those management systems. Additionally, a questionnaire survey was sent to a group of specialists to assess their agreement with the model and possible changes needed.

This research is important for both academics and practitioners since it provides a comprehensive model for analyzing and assessing the impacts of ISO 9001 and/or ISO 14001 management systems in the organizations.

II. LITERATURE REVIEW

An extensive literature could be found related to management systems, especially the ISO standards. This literature focuses mainly on the ISO 9001 standard, the most diffused and applied ISO standard.

The main sources used to identify relevant papers were the ISI Web of Knowledge and Scopus. To proceed with the identification of the relevant papers, a combination of the words 'critical success factors', 'ISO9001', 'ISO14001' and 'internalization' was used. The selected papers needed to address at least one of the following topics: factors which affect the ISO standards; the internalization of the ISO standards; or the impacts of the ISO standards. Furthermore, conference papers and literature reviews were excluded and only relevant peer reviewed papers from 1999 until early 2020 were selected. A total of 117 papers were selected.

The topic which had major focus was the impacts of the ISO 9001, namely the impacts on business performance. Another predominant topic found in the literature of the ISO standards is the motivations to implement the ISO 9001.

A. Internalization (literature review)

In the literature, the internalization was addressed by several authors for both ISO standards, ISO 9001 (e.g.[3]–[7] and ISO 14001 (e.g.[8], [9]). This term can be associated with the use of other terms such as 'assimilation', 'daily use' or 'going beyond'[8], [10], [11].

According to Nair & Prajogo (2009), "the benefits of ISO 9000 in terms of operational performance are derived from internalization of practices underlying ISO 9000, it is not the certification, but the way firms attain it that matters" [6].

Also, organizations that integrate ISO 14001 standard in their daily operations have greater environmental performance and are more likely to attribute this success to the ISO standard, when compared to organizations with lower levels of integration [9].

All the studies found in the literature agreed that higher levels of internalization are reflected in the impacts

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of the ISO management systems. Thus, performance improvement depends on the internalization level of the ISO standard [7].

Some authors demonstrated that critical factors which affect the ISO standards implementation such as motivation, organizational culture, pre-implementation analysis and human source management could influence the internalization process [5]–[7], [12], however research focusing the critical factors which affect the internalization level is still scarce.

B. Critical success factors (literature review)

Through the literature, it is possible to resume the reasons to pursue the ISO implementation in two main motivations and these are internal and external motives [6], [13]–[16].

According to most of the studies, if the main motive to implement the ISO standards is internal, greater benefits and outcomes could be achieved (e.g. [17]–[22]). However, the diversity of results observed could not be totally and exclusively explained by the "motivation" [6].

Another factor which is presented in the literature which affects the ISO standards implementation is the involvement of all employees. This seems to be the most consensual critical success factor for ISO 9001 and ISO 14001 implementation which is referred to in several papers (e. g. [23]–[34]). Other factors such as training, communication, empowerment, reward and recognition are also pointed out as important elements in the process for both standards (e.g. [25], [27], [29], [30], [32]–[37]).

An additional critical success factor that contributes to the heterogeneity of results of the ISO standard that seem to be usually consensual is the "management commitment" or "top management commitment" or "leadership" as can be observed in the following references for both ISO standards (e.g. [1], [23], [25], [27], [28], [30], [32]–[39]). This factor is also related to the "internal resource availability and allocation" and "coordination and communication" which are correlated with the leadership (e.g. [28], [35], [40]), since generally the leaders had these tasks.

According to Terziovski et al., (2003), quality culture and motivation have a significant influence in the business performance, although weak or non-observable effect on the waste reduction [22]. Also, Willar, Trigunarsyah, & Coffey, (2016) conclude that different cultures result in different outcomes, influencing the success of the ISO 9000 implementation [41]. Furthermore, Balzarova, Castka, Bamber, & Sharp, (2006) showed that organizational culture influences the ISO 14001 implementation [42]. Additionally, some authors identified as critical success factors for example "the maturity level of quality management" [26], "the previous level of organization" [32], "attitude towards the environment" [27], "continuous improvement" [33], [36], "teamwork" [33], [36], "environmental consciousness of top leaders" [39], which are all related with the culture of the organization. Therefore, culture is also an important factor to have in consideration when implementing an ISO standard.

Besides the previous factors presented, Psomas et al., (2010) and Psomas and Antony, (2015) identified also 'company attributes' as one of the main areas which affects more significantly the effectiveness of the ISO 9001 [24], [40]. However, del Castillo-Peces et al., (2018) have not found differences due to the size of the companies [17].

Additionally, Zeng, Tam, Tam, & Deng, (2005) also identified the following critical factors "legal system" and "legal enforcement", however it is indicated that it could be linked to the region studied, in this case, China [39].

C. ISO standards effects (literature review)

The recurring themes related to the effects of the ISO standards generally focus the following dimensions: performance/business performance (e.g. [14], [18], [20], [43]–[46]), financial/market performance (e. g. [45], [47]–[52]), operational performance (e.g. [7], [31], [43], [44], [46], [53]–[55]) and quality performance (e.g. [53], [56]–[59]).

The extensive literature analyzing the effects of the ISO standards ISO 9001 and ISO 14001 showed several contradictory results namely related to the performance/business performance. Several authors found positive results in business performance, when compared to non-certified organizations for ISO 9001 and ISO 14001 (e.g. [18], [43]–[45], [58], [60]).

On the other hand, there are other authors which have not found the same outcomes [57], [61], supporting the vision of Dick et al., (2008) and Martínez-Costa et al., (2008) that could not attribute the improvements found in performance in their works to the ISO 9001 implementation [20], [50].

Also, through the analysis of the literature focusing on the effects of the ISO standards on financial and market performance, it is possible to find contradictory results. There are studies where the ISO 9001 leads to higher financial and market performance (e.g. [32], [45], [48], [49], [51], [52], [56], [62], [63]) and others studies where the evidences do not support financial or market improvements due to the implementation of ISO 9001 (e.g. [16], [40], [64]–[69]).

Focusing on the effects of operational performance, although most of the papers found that the literature showed a positive correlation (e.g. [11], [43], [60], [69]–[71]) between the ISO certification and operational performance, some works could not support this results (e.g [47], [56]).

Focusing on the topic quality performance, some authors found improvement in quality practices [57], [59], product and services quality [14], decrease in the number of complaints and non-conformities [14], [54], [59], [72], [73], increase of the quality awareness [43], [46], [56] and improvement in the product design [58].

Other authors could not find improvements in quality practices [74], [75], defective part production [58], quality design [76] and e-service quality [77].

Less explored performance dimensions are for example environmental performance, innovation performance and organizational performance.

At the level of the environmental performance, in the work of Potoski & Prakash, (2005), it was concluded that the pollution emissions of ISO 14001 certified companies decreased more than companies not certified [78]. Additionally, Link & Naveh, (2006) and Russo, (2009) show results which corroborate improvements in the environmental performance [79], [80]. However, other authors could not state the same [81]–[83].

Other studies report that ISO certification had a favorable influence on the organizational context [84], [85], nevertheless there are studies that concluded that it was not the standard itself that had an impact on the organizational performance but the conditions and context behind the implementation [86].

Thus, the purpose of this paper is to establish a model that allows the analysis of the impact of the ISO management systems in different dimensions of performance and the possible reasons to achieve different outcomes.

III. PROPOSED MODEL

The proposed model englobes the internalization level, the critical success factors which affects the ISO standards implementation and the performance dimensions which could be affected due to the ISO standards. Additionally, inside each critical success factor, internalization level and in each performance dimension, several variables are included to describe what should be analyzed within each critical success factor, internalization level and each performance dimension.

To develop the proposed model, we defined critical success factors as Psomas et al., (2010) [24]. So, the critical success factors are "the crucial elements that require examination and categorization to ensure effective management and implementation of an individual system and/or the overall mission of an organization". In this case, the individual system will be ISO 9001 or ISO 14001.

A. Internalization level (model development)

Since the internalization level is highly associated with the translation of the standard to the organization, internalization is presented in the proposed model as an intermediary between the critical success factors and the performance dimensions affected in the organization.

The internalization of the ISO standard leads to the necessity of implementing daily practices and operating procedures generating consistent outputs produced by the processes [6]. Unlike the certification, this process is difficult to imitate, and it will be translated into higher performance [6].

The internalization of ISO 9001 leads to the necessity of employee training on the ISO 9001 concepts and requirements, clarifying the company's quality policy, objectives and procedures to the employees, documenting and updating continuously the quality policy and procedures for quality management, using daily practices to ensure conformance to the documented procedures of the QMS and conducting internal audits regularly to ensure continuous improvement [87]. The necessary elements described here are similar to those needed for the internalization of ISO 14001, however with focus on the environment, instead of quality.

Furthermore, the performance measurement is a key aspect well known in the quality literature. Padma et al. (2008) state that the measurement of performance is extremely important since we cannot improve what we do not measure [88].

Thus, according to the literature, the internalization process includes the following variables: Documentation [3], [7], [55], Audits [3], [6], [11], [12], Training [3], [6], [11], [12], Performance measurement [8], [9], Continuous improvement [3], [11] and Quality/Environmental practices [7], [9].

B. Critical success factors (model development)

Based on the literature, it is recognized that employees are a vital resource in the organizations, by both practitioners and academics [29]. The employees can influence directly the environmental and quality performances being responsible for the survival and the prosperity of the organizations, since they mark the difference between organizations [23], [29]. Thus, we include the critical success factor "employees' engagement" which contains the following variables: "Training" [29], [35], [88], "Empowerment" [29] and "Recognition and reward" [29].

Leadership is essential to succeed in the ISO implementation and its maintenance since the leaders are responsible for the mission of overcoming the unwillingness to change and also for the promotion of actions to boost the employee's morale and motivation [35]. Consequently, we incorporate the critical success factor "Leadership" that encompasses the following variables: "top management commitment and support", "middle management commitment", "allocation of resources", and "motivation".

Implementation strategy involves aspects such as integration of the strategic goals of the organization [1], aims of the system [88], agenda for implementation and maintenance [35], [89], definition of a team or person responsible for the implementation or maintenance of the ISO system [35], [89] and stakeholders' involvement [25], [28], [30]. Also, the factor "Implementation Strategy" was introduced in the model with the following variables: "Execution team", "Management of information systems", "stakeholders' involvement", "Integration with organization's objectives".

All projects and everyday tasks of all individuals in the organization are influenced by the organization's culture [35], [88]. Therefore, it has been included under the critical success factor "culture", the following variables: Quality/environment awareness [26], communication and coordination between departments [35], continuous improvement awareness [35], [88] and previous environmental/quality practices [90].

C. *Performance dimensions (model development)*

Business performance and financial and market performance were excluded, since it is important to consider the dimensions which were most directly impacted by ISO 9001 and ISO 14001, and some authors already showed that business performance and financial/market performance impacts achieved were an indirect result (e.g. [31], [56], [73]).

Since ISO 9001 and ISO 14001 focus on quality management and environmental management, the model includes a dimension which is associated with the focus of the standard, named "standard focus". Therefore, when the proposed model is used for the analysis of the impacts of ISO 9001, the quality performance items should be considered. When the proposed model is used for the analysis of the impacts of ISO 14001, the environmental performance items should be the ones considered. So, the proposed model has a dimension adjustable to the focus of the ISO standard under study.

The variables chosen to be included in the "standard focus" performance dimension were based on the literature. Nevertheless, due to the scarce literature focusing environmental impacts due to ISO 14001, the variables chosen to analyze environmental performance were based on literature and in identical variables of quality performance. Therefore, the "Standard focus" includes the following variables: quality/environmental awareness [79], conformance [53], [74] and quality/environmental results [75].

Operational performance dimension is also included, once it is expected ISO standards implementation affect the operational process. This dimension incorporates the following variables: "Productivity" [7], [53], [55], [56], [69], [91]; "Process Efficiency" [53], [91]; "Process effectiveness" [53] and "scrap generation and rework" [44], [75].

The organizational performance dimension is also incorporated to allow the analysis of the effects on the organizational resources. Therefore, organizational performance includes the following variables: "internal communication" [32], [72], [84], "organizational climate" [84], [85], "systematization" [11], [32], [43], [72], [84] and "autonomy" [79], [92].

Additionally, innovation performance is included because, although being under studied, generally it is influenced by the ISO implementation. In the innovation performance, the following variables are included: product innovation [93]–[95] and process innovation [94], [95].

Furthermore, it is documented that ISO standards affect employees and customers. Likewise, although not wildly explored in the literature, impacts are also expected on the suppliers since they have an important role on ISO 9001 implementation or even in the ISO 14001 implementation [59], [96]. Therefore, it includes a dimension where it expresses the impacts generated due to ISO implementation in the stakeholder's performance. In this dimension, the following variables are included: customers [54], [73], [96], employees [88] and suppliers [96]. Also, 'society' was added, since ISO 14001 could influence the environmental impacts which is an interest of the communities near pollutant companies and society in general due to climate changes.

Last, an additional dimension is added to analyze costs performance to facilitate the identification and evaluation of the different costs of ISO implementation and maintenance. Cost's performance includes the following variables: Audit costs [97], Consultancy costs [46], Training costs [46], [58], [97], on-going costs [46], [58], operational costs [66], and environmental/quality costs.

In figure 1, the proposed model is presented and how the critical success factors, the internalization level and performance dimension could be correlated.

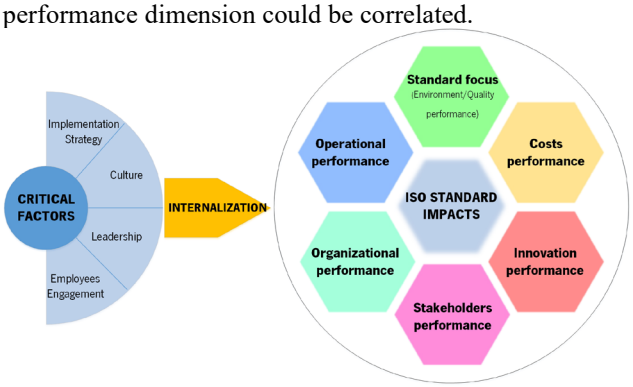

Figure 1 - Model developed.

IV. PROPOSED MODEL

To examine the model developed, we develop a questionnaire survey to a selected panel of specialists to evaluate all the elements included in the model.

A total of 40 experts from around the world (for example, Australia, Brazil, Canada, China, Italy, Sweden…) were contacted to give their level of agreement about the different aspects of the model according to a 5-point Likert scale (1 – strongly disagree, 2 – disagree, 3 – nor agree or disagree (neutral), 4 – agree and 5 – strongly agree). A total of 22 responses were received, corresponding to a response rate of 55%.

The questionnaire survey was analysed by a group of academic researchers to evaluate if the questions presented would allow to obtain the data intended and if all aspects expected to be evaluated are covered. From this phase, minor changes were made in linguistic terms of the questionnaire survey.

In the following section, the results for each aspect of the survey are presented.

V. RESULTS

Figures 2, 3, 4, 5 and 6 present the results obtained from the questionnaire survey. Figure 2 presents the mean value achieved among the specialists for each of the critical success factors of the model.

According to the results, generally the experts agreed with the critical success factors of the model. Furthermore, the factors that seemed to be more consensual are the "Leadership" with a mean value of

4.64 and a standard deviation of 0.658 and "Employees Engagement" also with a mean value of 4.64 and 0.790 of standard deviation. The less consensual critical factor included was the implementation strategy since it presented the highest standard deviation, with a value of 1.151 and a mean value of 3.91.

Since the lower mean value for a critical success factor was of 3.91, presenting a mean value between 3 (neutral) and 4 (agree), and all the other factors presented higher values then 4, the critical success factors chosen based on the literature to be included in the model seem to be appropriated, meaning that generally the experts agree that the "Employees engagement", "Leadership", "Culture" and "Implementation strategy" will affect the implementation and/or maintenance of the ISO standards (namely ISO 9001 and ISO 14001).

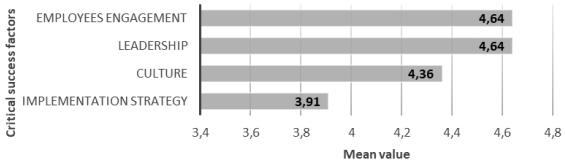

Figure 2 - Average results for the critical success factors

Similarly, to the critical success factors, generally the experts agreed with the performance dimensions included in the model. In this case, the lower mean values are reported for the dimensions "Standard focus" and "Innovation performance" with 3.73. The dimension which presented the lowest level of consensus was the "Innovation performance" with a standard deviation of 1.241 and a mean value of 3.73. In the literature review, it was also possible to observe that this was the dimension that presented the less accordance among the researchers.

Since the minor mean value for the different performance dimensions was 3.73, the performance dimensions chosen based on the literature to be included in the model seem to be generally accepted by the experts. This means that generally the experts agreed that the performance dimensions more directly affected by the ISO standards implementation and/or maintenance are "standard focus", "operational performance", "organizational performance", "stakeholders' performance", "innovation performance" and "costs performance".

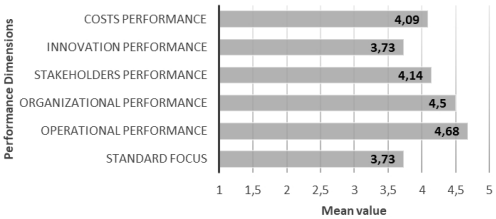

Figure 3 - Average results for the performance dimensions

Additionally, also the variables included to analyse each critical success factor, the internalization level and each performance dimension were evaluated. Figures 4, 5 and 6 present the results of the questionnaire survey for the variables of each critical success factor, internalization level and each performance dimension, respectively.

Based on figures 4, 5 and 6, similarly to the previous results, the variables chosen to describe each critical success factor, internalization level and the performance dimensions seemed to be appropriated, since the lowest mean score obtained (3,59) is still superior to 3 (which is the neutral value). Furthermore, in the questionnaire survey, we allowed the possibility to include other variables or add comments and observations. Based on some of the comments of the specialists, two variables, one from the "implementation strategy", and another from "innovation performance" were adjusted. Consequently, the variable "Execution team" was changed to "team or person responsible for the ISO system", since it was commented that "Execution teams is not 100% clear" (comment of the specialist). Also, the variable "product innovation" from the "innovation performance" was changed to "service/product innovation" based on the additional variable suggested "service innovation organization innovation" (suggested variable from the specialist).

Additionally, at the end of the questionnaire survey it was requested to answer the question: " The model presents a logical relationship between critical success factors, internalization process and impacts (critical success factors → internalization level → impacts)? ". Approximately 77% agree or strongly agree that the model presented shows a logical relationship.

Figure 4 - Average results for the variables to analyze each critical success factor.

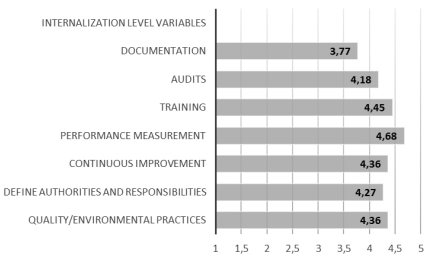

Figure 5 - Average results for the variables to analyze the internalization level.

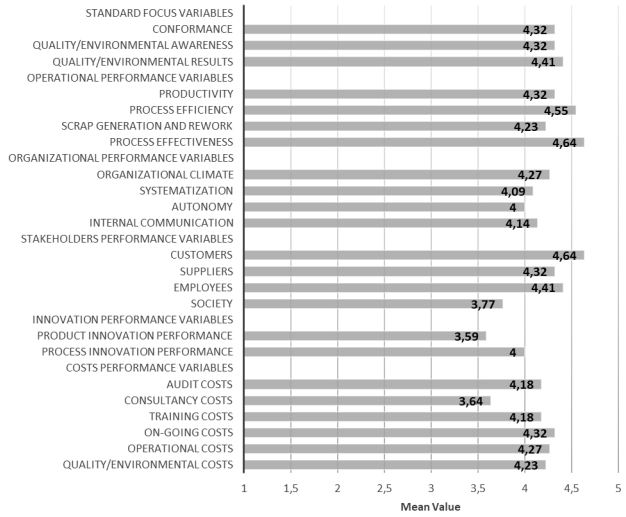

Figure 6 - Average results for the variables to analyze each performance dimension.

VI. CONCLUSIONS

The main objective of this work was the presentation of a model which allows the analysis and assessment of the impacts of the ISO 9001 and ISO 14001.

Despite the efforts made to understand the implications and impacts of these standards, only the operational dimension seemed to be consensual. Additionally, if the ISO 9001 and ISO 14001 implementation and/or maintenance could result in similar results remains unclear, and further research should be undertaken.

According to the results of the questionnaire survey, generally the specialists agreed with the proposed model and with the relationships described. In the future, it is intended to analyze the several elements of the model through case studies, to understand its suitability for organizations and possible adjustments that should be done.

The main contribution of this work is the model proposed. This model will allow a clearer way for the analysis and evaluation of the ISO standards effects, since it presents a summary of the main critical success factors which affect the internalization level, what should be analyzed when it is intended to understand how the ISO standard is incorporated within the company and the different performance dimensions which could be affected more directly by the ISO standards.

To the best knowledge of the authors, there is a scarcity of studies analyzing these topics focusing both ISO standards (ISO 9001 and ISO 14001) simultaneously. Therefore, future research is needed, especially the ones focusing both ISO 9001 and ISO 14001, because although both are similar in several aspects, generally the literature which analyses the critical success factors and ISO impacts aims just one of the standards.

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