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# **Certification and Integration of Environment with Quality and Safety – A Path to Sustained Success**

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Gilberto Santos, Manuel Rebelo, Síría Barros and Martinha Pereira

Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/48414>

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## **1. Introduction**

According to Wright [1] certification of products and processes began during the 1960's in the manufacturing industry, as a tool to control and assure the quality/conformity of products and services provided by suppliers to customers/consumers. Thus, the series of ISO 9000 was published first time, in 1987 and it was been created with a flexible character, to be reviewed periodically. Later, were published others normative references, which highlight the ISO 14001 in 1996 and OHSAS 18001 in 1999. This was also, the natural sequence of the certification processes in the organizations, i.e., began with the certification of quality management systems (QMS) followed by the environmental management systems (EMS) and after for the Occupational Health and Safety Management System (OHSMS). Hence, a high percentage of organizations with an EMS, in accordance with the ISO 14001, had also implemented, a certified QMS, in accordance with ISO 9001. At first the implementation of a QMS was particularly relevant in high demanding activity sectors, like the automotive and aeronautical industries, but it has rapidly extended to every activity sector, becoming a common requisite of any company worldwide and a factor of competitiveness and survival. Due to the increasingly demanding environmental legislation in developed countries, companies nowadays are required to seriously take into consideration not only environmental aspects associated to the production chain itself, but also to the life cycle of their products.

They are forced to implement suitable EMS to manage the environmental issues as for example at the level of the prevention and reduction of wastes. Consequently to promote and protect environment in a sustainable way. This is a particularly important issue for small and medium-sized companies (SMEs), which are considered to make up the vast

majority of business in Europe)[2]. They are quoted as contributing 70% of global environmental pollution, with the majority coming from the manufacturing sector [3]. Thus, following both the Rio Conference in 1992 and GATT (General Agreement on Tariffs and Trade) negotiations, international standards have become important for succeeding and for getting access to the markets; at the same time, there has been an increase in the interest of environmental management. Such regulatory and competitive pressures have caused firms to take into consideration the environmental issues within their own production and market plans. Many firms have attempted to seek an effective environmental management system. These have led to implementation and development of the ISO 14001 standard for assessing environmental management processes. Today, all over the world, many firms are seeking ISO 14001 certification [4]. Thus, improved environmental management in the industrial sector is required to protect the environment, protect human health and property, and to satisfy environmental requirements associated with international trade [5]. In a sense, the value of the ISO 14001 certificate, as a proof of environmental performance, is a combination of the supplier's environmental ambitions, the advancement of supply chain practices of the customer and the ambitions of the certification bodies [6]. On other hand, according to Casadesús [7] and others authors, the interest shown by organizations and other entities linked by the implementation of environmental management systems (EMS), especially the family of ISO 14000 standards and the EMAS regulation in Europe, has grown spectacularly all over the world in recent years, even though a certain saturation has been detected in some countries. Thus, the implementation and management of all economical, environmental and social aspects within a company is gradually becoming a crucial requirement for any business and has become a widespread phenomenon around the world [8]. Large companies are increasingly requiring this management policy from their suppliers, establishing specific requests and performances that small and medium enterprises (SMEs) often find extremely difficult to accomplish. On other hand, there are many organizations which, either because of the demands of the market itself or because of other internal motivations, have implemented different Management Systems alongside their EMS.

In fact, although no reliable references on this matter have been found, it is quite plausible to think that the great majority of ISO 14001 – registered companies are also certified in accordance with the ISO 9001 standard [9]. Thus, quality management philosophy and methods have been imported into ISO 14001 from ISO 9000. As a result, it is not surprising that measurement and evaluation are enshrined as important hallmarks of an effective EMS. According Curkovic [38], a company's ability to reframe learnings from total quality management (TQM) is crucial to the successful implementation and use of environmentally responsible manufacturing (ERM) -based systems and procedures.

Generally speaking, this component of the EMS is considered effective when the contents of review meetings are well communicated, the focus of meetings is on improving the system, findings (i.e. about noncompliance, from various statistical charts, and audit results) are reported honestly, and corrective actions follow [10]. In some cases, the similarities between QMS and EMS systems can facilitate the integration of the two related management systems

[11]. The people that work in environmental management and at the same time are members of quality teams, assure that quality management goes hand-in-hand with environmental management. The actions that are carried out to achieve quality are, in many situations, the same actions necessary, for example, to achieve effective environmental management. In line with this, ISO 14001 has become compatible with the ISO 9001. Consequently, the integration of environmental issues (including environmental protection and pollution prevention in the management of organizations through the implementation of an environmental management system) allow acquiring a deep insight of the most important environmental aspects associated with its activity, and identifying the processes that need to be improved through the implementation of effective environmental measures [12]. On other hand, according Curkovic [38] TQM focuses on waste as it applies to process inefficiencies, whereas ERM focuses more on pollution in the form of air emissions and solid and hazardous waste. Because the two concepts share a similar focus, it makes sense to use many of the TQM tools, methods, and practices in implementing an ERM-based system.

Moreover, human resources are the most valuable resource of any company or country, but not always the most valued. Thus, the greatest asset of any organization, any region or any country, are people and their know-how [13]. Therefore, among others, another system to be implemented in the organizations is the OHSMS. Thus, according Fernández-Muñiz [14], several fields are showing increasing interest in safety culture as a means of reducing accidents in the workplace. The literature shows that safety culture is a multidimensional concept. Hence, nowadays, companies that search greater profitability and better organization implement the quality systems, aiming at a reduction of defective products and lost time, searching for the loyalty of customers and searching for excellence. The progressive implementation of ideas and techniques related with the quality management is one of the clearest demonstrations of organizational innovation in the industry in the last decades. From the standpoint of the risk prevention literature, it has been argued that the use of advanced quality management systems help reduce accident rates because quality management methods are based on the principle of prevention rather than corrective actions. Hence, the concept of an OHSMS has become common over the past 20 years [15]. The people that work in safety management and at the same time, are members of quality teams, assure that quality management has a great relationship with risk management.

More than ever, today, is in question the business sustainability of the organizations and the focus should be placed far much more than financial results. These results will not verify if that focus does not prioritize also, the satisfaction, balanced, integrated and growing of the customers and others relevant Stakeholders, that are clearly and objectively the employees for example [16]. But according to the ISO – IMS publication [17], a common objective of management system standards is to assist organizations to manage the risks associated with providing products and services to customers and other stakeholders. On other hand the management system of the organizations is frequently split into a number of parts or sub-systems, which must be managed separately with relative independence. These parts or sub-systems of an organization's management system reflect the different needs and expectations of the stakeholders. Many organizations use standards, such as those related to

quality, the environment and safety, among others, to manage certain aspects of their performance.

Within this framework, in order to have quality and excellence in products (or services), as well as in the management of the companies that manufacture and provide them, it has become imperative for the companies define and implement quality, environment and safety management system, according to ISO 9001, ISO 14001 and OHSAS 18001 standards, respectively. At the same time the companies must also improve and optimize, continually, these management systems to allow them to true added value for the companies and their stakeholders [16].

The following questions may arise: How can these three management systems be integrated? Can they be integrated? According to Santos [18] this is a problem that the most developed companies started to experience some time ago, and it has been discussed by various authors, that we highlight: McDonald [19], Arifin [20] and Bernardo [21] among others, who provides a summary of the degrees of integration according to some authors, and Labodová [22], who reported on the implementation of integrated management systems using a risk analyses based approach. Thus, according with the ISO 72:2001 Guide [23], the experience with management system standards issued by the ISO shows that there exist a number of common elements, which can be arranged under the following main subjects: policy; planning; implementation and operation; performance assessment; improvement and management review, as stated by Santos [13].

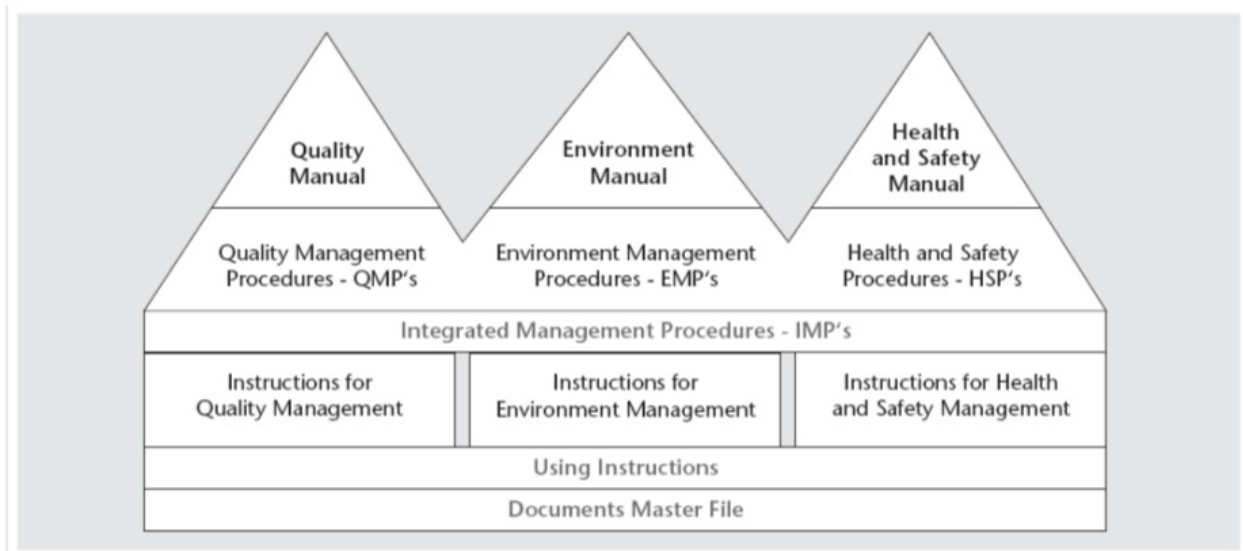
Related to the integration of management systems, Karapetrovic [9] states that there are many organizations that implement different management systems, either as a result of market demand either for internal reasons. During the combined audits in accordance with ISO 19011 [24] for Quality and/or Environmental Management Systems audits, it can be observed that the integration of the systems is implemented in a partial way by the integration of procedures by phases.

When it is observed that it exist similar procedures, those are adapted to the two systems, for exemple, quality and environment, and jointly audited. However, the manuals still individually separated. As stated by Santos [25], although an audit be integrated / joint, named as by "combined audit", the respective reports are often kept separate so that any nonconformities detected in one of the systems do not implicate to stop the other system that complies with the respective standard. This could implicate the loose of clients, which would be a backward step for the company, and is considered one of the obstacles to a quicker integration. Suditu [26], associates to the integration of management systems internal motivations and corresponding benefits, by dividing them into: 1 - Organisational – improvement of the quality of the management by downsizing of three departments into one and reducing barriers between individual systems; 2 - Financial – reduction in auditing costs; 3-Employees – increased motivation, awareness and competences; 4 - External motivations and corresponding benefits, by dividing them into: Commercial – competitive advantage, improved market position, gain of new clients and satisfying current ones;

Communication – improved image of the organisation, improved relationships with Stakeholders and evidence of legal compliance; In fact, significant differences in these areas have not been found, and it is fairly plausible that the vast majority of companies certified under ISO 14001 are also certified under the ISO 9001 standard, according to Santos [13].

Therefore, a new necessity has emerged in organisations, namely to integrate these systems into a single IMS - Integrated Management System and we cannot forget the fact that the environmental improvement of the product must be considered in relation to the impacts on Quality & Health and Safety, as mentioned by Jørgensen [27]. Therefore, the idea of an IMS - Integrated Management System consists of establishing correspondences and to combine two or more independent management systems, for example in accordance with ISO 9001, ISO 14001, and OHSAS 18001. Evidence of this can be seen in table A.1 - of the annex A - of OHSAS 18001:2007 [28]. Despite having their origins in different aspects of company performance, the Quality, Environment and Safety Management Systems have a lot in common, as mentioned by Fresner [12] and Block [29], among other authors. The integration of these management systems is a path that can be followed, and the ISO 19011 standard - Guidelines for auditing management systems [24] is a good example of the future. According to Santos [13] the future lies in the integration of these management systems, managed by only one multidisciplinary team with training and skills in several areas, thereby economizing both financial and human resources.

The Portuguese industry, mainly, consists of Small and Medium Enterprises (SMEs), which activity and performance are crucial factors for the country development. SMEs provide 75% of the total labour force employed in industry, trade and services. According to the website of the Ministry of Economy and Innovation [30] SMEs are responsible of 99.5% of national business, generating 74.7% of employment and held 59.8% of sales nationwide. They are the basis of Portuguese economy. A good example of Management Systems Certification and Integration in Portugal is represented in Figure 1.



**Figure 1.** Documental structure of the Integrated Management Systems at Kupper & Schmidt [13]

For a long time, the only Foundry in the country to have its Quality, Environment and Health and Safety systems certified was Kupper and Schmidt, a SME that supplies exclusively the automotive industry and exports about 98% of its production to the European and American markets. Just a few years after starting its activity the company had its Quality System already certified by the main customers. In 1997 it was certified according to ISO 9002 standard, in 1998 by QS – 9000, in 1999 by VDA 6.1, and in 2001 by ISO/TS 16949 standards. In 2000 the company focused in Environment, and got the certification according to ISO 14001 standard. Since 2002 the company has its OHSMS certified according to OHSAS 18001 [31]. Presently, the company runs an Integrated Management System in what concerns to management procedures, operating instructions and documentation.

The objective of this work was to contribute to characterize the situation about the Integration of Environment with Quality and Safety in the Portuguese companies, as well, highlight the benefits obtained with the certification and integration and show that, it is a path to sustained success.

## 2. Methodology

In the last years there has been a significant increase in the number of Portuguese companies certified in Quality, Environment and Health and Safety. Some of them have a degree of integration of such systems which are not known. In order to make such characterization a survey based on a questionnaire was carried out in several Portuguese SMEs.

The questionnaire was sent via e-mail or delivered personally in hand, explaining and justifying its main objectives and it was organized in five sections, according to Table 1. Both qualitative and quantitative answers were asked, depending on the nature of the question and the available data to give an accurate response. The questionnaire was sent by e-mail together with a cover letter describing the objectives of the research and including some answering instructions to 300 SME with a certified quality management system. 162 companies were located in the centre region of Portugal (including Lisbon area), 114 in the northern region (including Oporto area) and 24 in regions located south of Lisbon. According to the data available from the “SMEs Portugal Association” this distribution is proportional to the location of SMEs within the Portuguese territory [32].

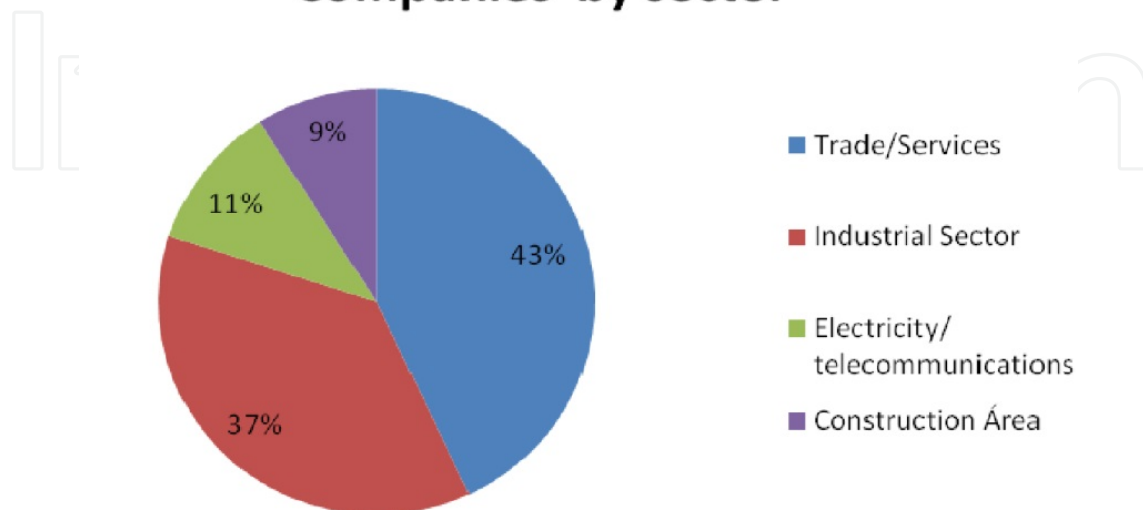
80 companies answered the inquiry, but only 46 have been validated, thus representing the sample size of the Portuguese territory. From those 46 companies, 20 (43%) were from the Trade/Services activity sector, 17 (37%) from the Industrial sector, 5 (11%) from the Electricity/Telecommunications sector and 4 (9%) from the Construction area (Figure 2).

About 80 questionnaires were received. The main criteria for validation were to be a SME, to have the ISO 9001 QMS certification and to have answered the main questions completely. Thus, only 46 were completed properly. Data was worked and some results presented [13 ; 33]. However, it is known that there are SMEs with other certified systems, among them the EMS. An additional criterion was to have the ISO 14001 EMS certification. Initially, 12 SMEs

Main Sections	Questionnaire main topics
General Description of the Company	<ul style="list-style-type: none"> <li>Number of employees; Volume of business; Branch of activity; Main products and markets; etc.</li> </ul>
QMS	<ul style="list-style-type: none"> <li>Year of ISO 9001 certification; Main reasons for Quality certification.</li> <li>Main difficulties; Main benefits that arose from certification (new costumers, image, competitiveness, business increase, quality improvement, customer satisfaction, products innovation, organization improvements, etc.); Main drawbacks; Quality tools that the company uses.</li> </ul>
EMS	<ul style="list-style-type: none"> <li>Year of ISO 14001 certification; Main reasons for Environmental certification; Main difficulties; Main benefits that arose from certification (waste reduction, waste destination, environmental costs reduction, etc); Main drawbacks.</li> </ul>
OHSMS	<ul style="list-style-type: none"> <li>Year of OHSAS 14001 certification; Main reasons for Health and Safety certification; Main difficulties; Main benefits that arose from certification (reduction of the number of accidents, productivity increase, absenteeism, etc);Main drawbacks.</li> </ul>
IMS	<ul style="list-style-type: none"> <li>Running independently or integrated; Degree of integration (integrated systems, what is integrated, reasons for integration, management structure, etc); Main benefits of integration (cost reduction, management simplification, etc); Main difficulties; Main drawbacks.</li> </ul>

**Table 1.** Main sections and question main topics of the questionnaire [13].

### Companies by sector



**Figure 2.** Distribution of participating companies by sector of activity



(26,1%) fulfilled such criterion but later, 5 questionnaires was completed what totalized 17 SMEs (36,9%). This was the sample for SMEs with EMS certified. Also initially only 7 SMEs (15,2%) had the OHSMS certified according OHSAS 18001. Later it was completed and validated more 5 questionnaires, which totalize 12 SMEs (26,1%) with the OHSMS certified according OHSAS 18001. This is the sample for SMEs with OHSMS certified.

Once the information has been collected, the next step consisted of the analysis and interpretation of data. An *Excel* file has been created with the collected data, and then exported to SPSS (Statistical Package for Social Sciences). SPSS is powerful software to support statistics, which provides complex statistical calculations. However, due to the small sample size, two obstacles came up: knowing what statistical test to use and to interpret correctly the results from calculations. Thus:

1. Statistical techniques - It was used primarily to inductive and descriptive statistics: average, frequency plots, the principal component analysis, cluster analysis and statistical inference to find the important conclusions about the population inferred from analysis of the sample, bearing in mind the limitation its reduced size.
2. KMO and sphericity test of Bartlett's - the KMO and Bartlett test are two statistical procedures that allow measuring the quality of the correlation between variables. The Kaiser-Meyer\_Olkin (KMO) is a statistic test that varies between 0 and 1 and compares the zero-order correlations with the partial correlations observed between the variables.
3. Internal consistency Cronbach's Alpha - Cronbach's Alpha is commonly used to measure internal consistency of a group of variables (items). It can be defined as the correlation that is expected to get between the scale and other scales used the same hypothetical universe with an equal number of items that measure the same characteristic.
4. Cluster analysis - is also a technique of exploratory multivariate analysis that allows to group variables into homogeneous groups or to compact one or more common characteristics. Each observation belonging to a particular cluster is similar to all others belonging to that cluster, and is different from the observations belonging to other clusters. We chose to use the method of cluster analysis to detect groups in the original variables, the issues where the sample was small, and the principal component analysis had not reached a conclusion. The analysis of the survey was directed to the most relevant items of the questionnaire.

The principal component analysis to data was applied with the help of SPSS, which allows an investigation of the multivariate structure, and a better interpretation of data. The internal consistency of the subject is given by Cronbach's Alpha index which was applied to the 19 selected variables, considering 5 analysis components, which was 0.901. As this value was greater than 0.7, the responses were considered as trustworthy and free of errors. [33]. On this context, we used punctuation 4 for "Greater Impact", 3 for "Impact", 2 for "Little Impact" and 1 for "No impact". The resume of results of this work was published in the Journal of Cleaner Production [13].

Moreover, it was made a case study. The investigation was developed in business environment at an Portuguese Company - the Itron – Portugal, that over the years has been adopting, in whole or in part, gradually and individualized standards or specifications of different Management Systems, relevant to the ISO 14001 (Environmental Management Systems) ISO 9001 (Quality Management Systems), OHSAS 18001/NP 4397 (Safety and Health Management Systems). While it is imperative to assess the perception of employees of the Company on the structuring, implementation and evaluation of the integration model and its validation in a real work environment, it was developed an internal research supported in an inductive approach in the context of the investigator's experiences with the object and the environment of the study.

The technique used to evaluate the contributions to the structure of the model proposed of IMS\_QES was the internal investigation by questionnaire to the Collaborators of the company. The total population was 160 employees which are the organization structure of the different branches and levels. The sample that was considered - 49 employees, represent around 30.62% of the total Collaborators. 42 Collaborators answered to the questionnaire which is an overall reply rate of 86%. This rate represents a strong adherence, at all hierarchy levels of the Organization.

In a first phase, the model was developed supported on the Lean philosophy , in order to the simplification and consequent resolution of problems and gains in efficiency of existing management systems in the company (referred as Sub-systems), which along the years were adopted gradually, but individualized and often isolated between to each other.

Were considered four main questions and for each of them several topics as described in the table 2.

Main Sections	Questionnaire main topics
1 - Importance of motivation factors for the implementation of the IMS_QES.	<ul style="list-style-type: none"> <li>• Improving the image of the Company</li> <li>• Rationalizing and optimizing the management of the resources ( financial, material and human)</li> <li>• Facilitating the management of the three components for the Sustainable Development of the Organization and of the Business</li> <li>• Increasing requirements of the Costumers</li> <li>• Competitive advantage and strategic vision of the Business</li> <li>• Natural evolution of the Management Systems in the Company</li> <li>• The continual improvement of Quality, Environment and Safety Management Systems involves their integration</li> </ul>

2 - Stakeholder influences on the performance and evolution of an IMS-QES	<ul style="list-style-type: none"> <li>• ITRON Group - Orientations and evolution of QES and Sustainability policies</li> <li>• Customers, competitors, insurance companies, suppliers and official QES entities</li> <li>• Financial institutions</li> <li>• Local Management group and Collaborators</li> </ul>
3 - Main Internal difficulties for the development of the IMS-QES model and its implementation	<ul style="list-style-type: none"> <li>• Deficit of human and material resources due to the strongly competitive environment and costs reduction;</li> <li>• Resistance to change</li> <li>• Diversity of products and services vis-a-vis Customer's requirements and legal and other requirements</li> <li>• Do not explicitly fit in the objectives and priorities of the ITRON - Portugal</li> <li>• Lack of internal competences in Integration Management Systems</li> <li>• Do not exist an international standard for the integration of Management Systems</li> </ul>
4 - Potential benefits resulting from the implementation of the IMS-QES	<ul style="list-style-type: none"> <li>• Elimination of conflicts between individual Systems, and consequent resource optimization, namely human resources;</li> <li>• Elimination of several organizational waste including at the level of bureaucracy associated to the sub systems Quality, Environment and Safety</li> <li>• Common management policy, objectives, goals and KPIs - Key Process Indicators related to QES performance</li> <li>• Improvement of the internal and external image of the company in the aim of the QES issues</li> <li>• Involvement and consolidation, by ALL employees, of a continual improvement culture, attitudes and values of global QES scope</li> <li>• Reduction of the number of internal and/or external audits and to Suppliers</li> <li>• Improvement at the level of coordinated and integrated management of the Risk associated to the Safety of People, Infrastructure, Environment, and Products</li> <li>• Greater employee valorization and motivation</li> <li>• Integrated management of several components of Sustainability in a Global Market;</li> <li>• Improvement of the partnership relationships with Suppliers of goods and services;</li> </ul>

The resume of results of this work of investigation performed at Itron - Portugal, was presented at the International Symposium on Occupational Safety and Hygiene SHO 2012 [16].

**Table 2.** Main sections and question main topics of the questionnaire used on the investigation [34].

### 3. Survey results

The first system that was certified in majority of the companies was the QMS. When this system was consolidated, then the EMS was certified. Only when this system was consolidated, companies certified the OHSMS which has started quite recently. After the three certifications, they started in a staggered way to develop integrated procedures to integrate two systems (quality and environment or safety), and whenever possible, the three systems (quality, environment and safety) [13 ; 25] .

This has been, more or less, the general rule that Portuguese SMEs have adopted, fact that was confirmed by the number of certifications, where the quality stands out in the first place (QMS), followed by environmental certification (EMS) and finally the safety certification (OHSMS).

However, we know that some companies have adopted another rule in sporadic cases. After the certification of quality according to ISO 9001, common procedures have been designed for the Environmental Management System (EMS) and the Occupational Health and Safety Management System (OHSMS) at work certification, which worked as the embryo for the implementation of a set of Integrated Management procedures [13].

#### 3.1. The main benefits that companies have gained from QMS certification

Certification is certainly a strategic option for developing organizations in the sense of a wiliness to improve and gain market share. With the reality of the growing number of certified companies, it is important to analyze and quantify the benefits that companies have gained from the certification of their quality system.

Considering the descriptive analysis of responses and the analysis of each item separately, it can be concluded that certification of QMS led companies to improve their internal organization, to make it easier the access to information, improved the internal evaluation of the management systems (namely through continuous audits in time) and had a beneficial effect on the company image, as depicted in Table 3.

	Major Impact	Impact	Little Impact	No Impact
Internal Organization of the company	72%	22%	6%	0%
Continuous assessment through internal audits	54%	44%	2%	0%
Company image	52%	46%	2%	0%
Ease of access to information	44%	39%	15%	2%

**Table 3.** Aspects of the company management where QMS had the greatest impact/benefit [13]

It is clear from Table 3 that these were, in fact, the major benefits of QMS certification. 72% of the companies referred that the major achievement was in their internal organization, and only 6% have referred that certification had little impact on this particular aspect. 52% of the companies stated that their image was improved as a consequence of certification. The basis for these statement was the increase in the number of new or potentially new customers, the drastic reduction of customers rejections and increase of customers satisfaction (evaluated not only by the decrease in the number of rejections, as well as by the increase in the sales volume for those same customers and the increased satisfaction with the overall quality of the products). Moreover, any company reported to have not felt some sort of impact in any aspect of their management structure, as inferred by the results presented in column "no impact" of Table 3.

### **3.2. The main benefits gained from the EMS certification**

In what concerns to EMS certification, the main reasons referred for certification have been environment promotion and protection, improvement of the company's image on this field, improvement of life quality inside and in the surroundings of the enterprise and a marketing strategy, with particular relevance for the first three. The main benefits of EMS certification were classified as having had major, relevant and low or any impact in several fields. Those fields where a major impact of certification have been detected were environment protection (evaluated by the decrease in the amount of residues and disposal costs), better integration of the company in the community, rationalization of natural resources, implementation of recycling techniques (and consequent decrease of costs related to raw-materials acquisition), legislation compliance and consequent decrease of penalty costs. Those companies with non-certified EMS refer to lack of investment support, high implementation costs when compared with the foreseen benefits of certification, or irrelevant environmental risks associated to their activity as the main reasons for their non-certification option/decision.

### **3.3. The main benefits that companies have gained from the OHSMS certification**

The main benefits that companies have gained from the OHSMS certification were: "Improvement of working conditions" clearly took the majority with 91.6% of the responses. Another important question with great impact was "Ensuring compliance with legislation" with 83.3% of responses. Legislation exists which must be fulfilled and most of Portuguese SMEs with certified OHSMS fulfill that legislation work; another strong question was "Notice to workers about the risks and dangers at work" and 75% of the SMEs responded affirmatively. Hence, it can be concluded that there is "better internal communication for workers about the risks and hazards" when an OHSMS is implemented and certified.

#### **4. The Integration of Management Systems (quality, environment and safety)**

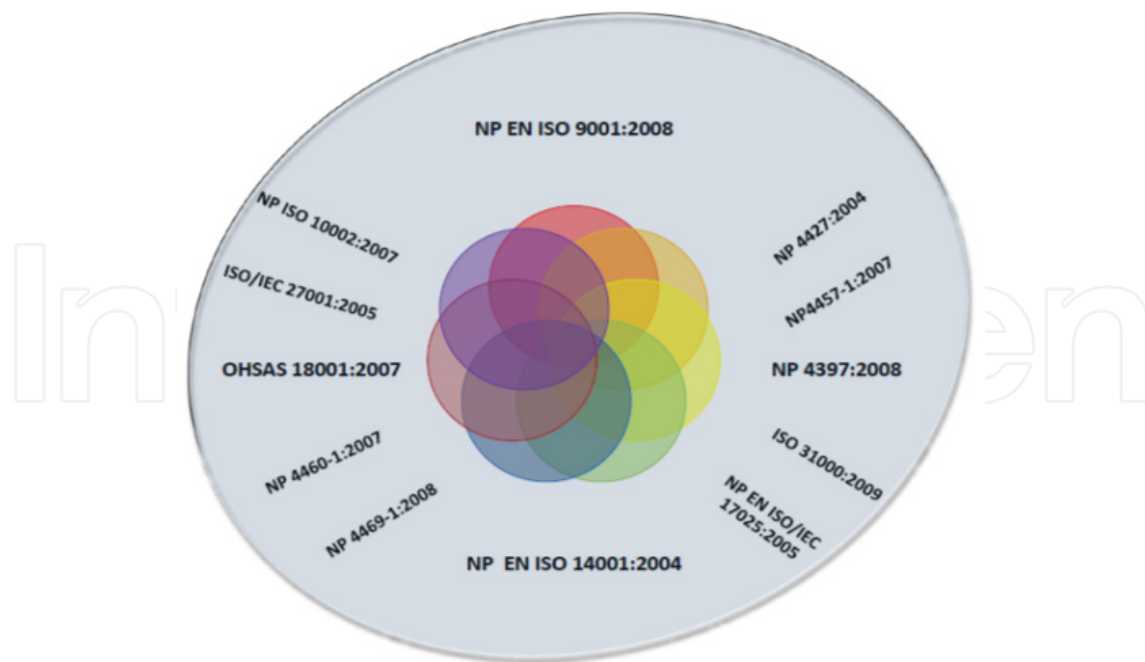
More than ever, today is in question the sustainability of the organizations and the focus should be placed far beyond the financial results. These will no longer verify it is not prioritize also the continual satisfaction, balanced, integrated and growing of the customers and other stakeholders taking as benchmarks for orientation and acting the dimensions of sustainability - economic, environmental and social and too the organizational and operational factors of the competitiveness.

There exist a set of management system standards that apply to any type of organisation and activity. Others will certainly be created. These standards like as: NP EN ISO 9001:2008, NP EN ISO 9004:2011, NP EN ISO14001:2004, OHSAS 18001:2008/NP 43397:2008, NP EN ISO/IEC 17025:2005, SA 8000:2001 /NP 4469-1:2008, NP 4457:2007, ISO 31000:2009, ISO/IEC 27001:2005, NP 4427:2004, PAS 99:2006, cover a wide array of different disciplines, aims and activities of organisation and operation of the Enterprises including the interfaces and satisfaction of all their stakeholders. In itself, this fact leads to a greater perception and awareness of challenges and brings sustainability to businesses, with which Organisations face a fiercely competitive global market in which the only thing that does not change is change itself [34]. Several of these standards, having been published recently, require that a lot of supplementary effort first be put at the level of the learning process needed considering the route that must be taken by organisations towards full implementation, which should be carried out in a balanced manner with added value.

In this context, Quality, Environment and Safety Management Systems certification have a great impact in companies, at internal, external and operational levels. The certification of these Management Systems includes many common procedures that can be run in an integrated basis, as illustrated in Figure 3.

In fact and according to the ISO – IMS publication (The integrated use of management systems standards) [23], a common objective of management system standards is to assist organisations to manage the risks associated with providing products and services to customers and other stakeholders. On other hand the management system of the organisations is frequently split into a number of parts or sub-systems, which must be managed separately with relative independence. These parts or sub-systems of an organisation's management system reflect the different needs and expectations of the stakeholders. Many organisations use standards, such as those related to quality, the environment and safety, among others, to manage certain aspects of their performance.

The synergy that an Integrated Management System (IMS) can offer have driven organizations into higher levels of performance at a cost lower than that associated to independent certification management systems. The simple schematic Figure 3 represents the vision of an IMS, suggesting that they have common information and procedures and at same time others standards, used in the companies, are involved in the organization and functioning of them.



**Figure 3.** Integration - a route towards sustained success [34]

Integration can be achieved at different levels, leading to partially or fully integrated systems. A partial integrated system keeps their manuals separated using, as far as possible, integrated procedures. A fully integrated system is based in a single manual that integrates unified management systems requirements.

Integration of Quality, Environment and Safety Management Systems are known to have potential benefits over the companies' efficiency. Moreover, integrating IMS-QES enhances organizational performance. Thus, in a team, all employees contribute to the mission and to the defense of the values of a unique organization, bringing up the overall development of the company, thus improving the image of the organization. However, an unsuitable integration process can bring additional problems, like increased strictness, inefficiency and even professional and cultural conflicts. Thus, a careful reflexion about the way to start and run an integration process is crucial.

#### **4.1. Similarities between the Management System standards which enhance the integration - Matrix of compatibility of the requirements and of support to the integration**

One of the activities that forms part of the scope and objectives of the case study to which we have paid particular attention is the compatibility of the requirements of the standards, in context and framework of the characterization of the company's situation, backed up by an analysis of these standards. According to the Table 4 this compatibility represents, at our understanding, the starting point for consequent activities of integration, simplification and optimization, to achieve a level of the strictly necessary and consequently the three subsystems - QMS, EMS, and OHSMS are integrated to the maximum extent possible.

		ISO 9001	ISO 14001	OHSAS 18001			ISO 9001	ISO 14001	OHSAS 18001			ISO 9001	ISO 14001	OHSAS 18001			
PHASE I - PLAN	<b>1 - INTEGRATED MANAGEMENT POLICY</b>				<b>3 - IMPLEMENTATION AND OPERATION</b>						<b>4 - CHECKING AND CORRECTION</b>						
	1.1 - Management commitment		5.1 5.3 8.5.1	4.2	4.2	3.1 - Resources, organizational structure, roles, responsibilities and authority		5.1 5.5.1 5.5.2 6.1 6.3	4.4.1	4.4.1	4.1 - Performance monitoring and measurement of processes and products		7.6 8.1 8.2.3 8.2.4 8.4	4.5.1	4.5.1		
	<b>2 - PLANNING</b>				PHASE II - DO		3.2 - Training, awareness, competence and qualifications		6.2.1 6.2.2	4.4.2	4.4.2	4.2 - Evaluation of compliance		8.2.3 8.2.4	4.5.2	4.5.2	
	2.1- Identification of : product requirements, aspects, impacts, hazards and risks and their assessment		5.2 7.2.1	4.3.1			4.3.1	3.3 - Communication, participation and consultation of the Stakeholders		5.5.3 7.2.3	4.4.3	4.4.3	4.3 - Incident investigation		---	---	4.5.3.1
	2.2 - Identification , access to and updating of legal requirements and other requirements of Stakeholders		7.2.2	4.3.2			4.3.2	3.4 - QES Management System documentation		4.2.1	4.4.4	4.4.4	4.4 - Non-conformities; corrections; corrective and preventive actions		8.3 8.4 8.5.2 8.5.3	4.5.3	4.5.3.2
	2.3 - Definition of objectives, targets and Programmes of QES management and improvement		5.4.1 5.4.2 8.5.1	4.3.3			4.3.3	3.5 - Control of documents		4.2.3	4.4.5	4.4.5	4.5 - Records Control		4.2.4	4.5.4	4.5.4
	2.4 - Definition of the plans of response to emergency situations		8.3	4.4.7			4.4.7	3.6 - Product realization		7.1	4.4.6	4.4.6	4.6 - Combined Internal QES Audits		8.2.2	4.5.5	4.5.5
								Operational control		7.5.5			<b>5 - MANAGEMENT REVIEW</b>				
								3.7 - Operationalisation of contingency plans.		8.3	4.4.7	4.4.7	5.1 - Critical analysis and combined QES Management System review		5.1 5.6.1 5.6.2 5.6.3 8.5.1	4.6	4.6
													PHASE III - CHECK				
													PHASE IV - ACT				

**CONTINUAL IMPROVEMENT OF THE IMS\_QES**

**Table 4.** Matrix of compatibility of the standards requirements and of support to the integration of the Sub-systems [16 ; 34]



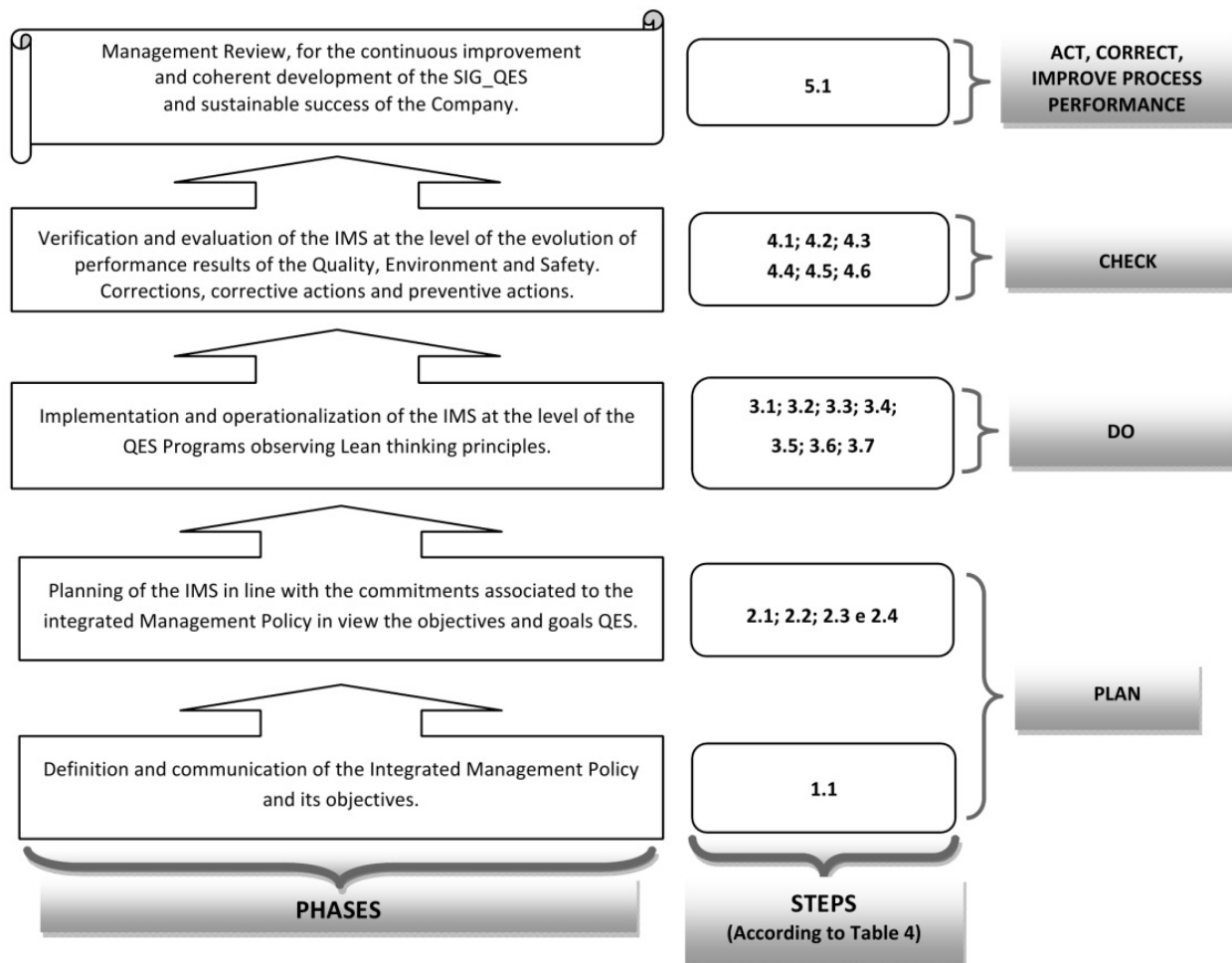
The ISO defines as principles of Quality Management: Customer focus; leadership; involvement of people; process approach; system approach to management; continual improvement; factual approach to decision making and mutually beneficial supplier relationships. According to the ISO Guide 72:2001, anyone drafting these and other management standards must take into account that the corresponding management systems must consider the following phases of the PDCA cycle - *Plan, Do, Check, Act*: Policies and principles; planning; implementation and operation ; performance assessment. Within this framework, taking into account the structuring of standards - management responsibility/planning; resource management; product realization/operational control and measurement, analysis and improvement, on the matrix of the Table 4 we have shown the requirements of the ISO 9001, ISO 14001 and OHSAS 18001 (NP 4397:2008), as well as we have established correspondences, made them compatible with each other and associated with the phases of the PDCA methodology - “Plan-Do-Check-Act”. With this matrix, we aim to orientate and align the organizational structure of the company in the same direction, while at the same time creating a structured and useful work referential to support an effective alignment and correspondence of the Sub-Management Systems of Quality, Environment and Safety with consequent compatibilities between each other, for consequent implementation of the IMS-QES. From this matrix we can also, at the same time, to made a correspondence with the Deming Cycle, in this circumstance for the Integrated Management System, as well as a set of stages (1.1; 2.1...2.4; 3.1...3.7; 4.1...4.6 and 5.1) associated with each other these phases of the PDCA cycle, according to Figure 4.

#### **4.2. Model of development of the IMS-QES based on Deming`s Cycle (Plan-Do-Check-Act)**

The continuous improvement of the global performance of a Company shall be an objective always present in the development of the IMS [34]. The Company should therefore potentiate for each stage: Plan, Do, Check, Act, a careful and methodical analysis of the differences that effectively can be observed in terms of standards requirements under clauses equivalent involved and for each phase and each stage of development of the IMS-QES, according to the model of Figure 4 to ensure its compliance and evidence of it, in full conformity.

First of all, the definition, approval and communication of the Integrated Management Policy, a common requirement to the different normative references, which must take into account and be consistent with the Mission and Vision of the Company, these supported on a strategy and specific objectives which in turn , support the implementation of that policy and its consequent effectiveness.

The planning of activities in the aim of the Integrated Management System - Phase I (Plan) - is perhaps the most important [34]. In fact, a neglected planning will lead to inefficiencies that can be translated into potential deviations to the objectives. It is therefore fundamental to invest resources and expertise at this stage, via a thorough and careful work, in order to respond effectively to all requirements arising from the involved standards and others applicable requirements in this phase of the planning of the IMS [34].



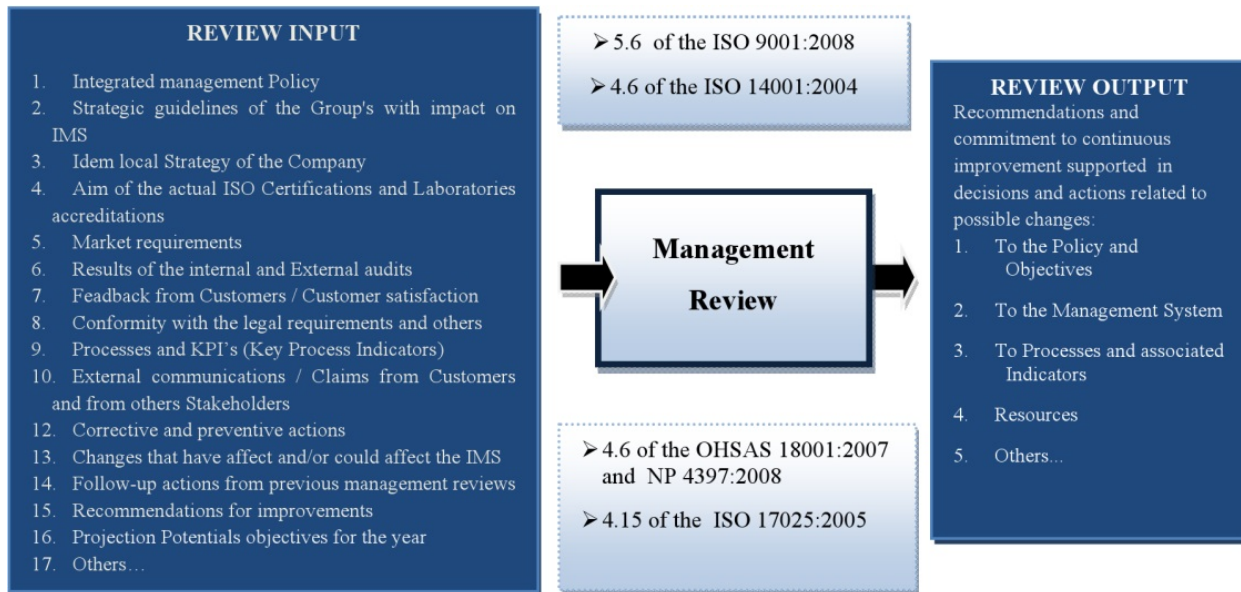
**Figure 4.** Model of development of the IMS-QES [16 ; 34]

Following is the Implementation and Operation - "Do", the Company should, in this Phase II - Do - promote, the "Make / Do" in coherence with the pre-planned. Corresponds mainly to clauses: 7 - Product Realization, of ISO 9001 - and 4.4 - Implementation and operation of the NP 4397 and ISO 14001 and in the case of ISO 9001 should be considered associated with the product realization, other complementary clauses, particularly in context of resource allocation (6.1, 6.2, 6.3, 6.4) and management commitment (5.1, 5.5.1).

In the Phase III - Check, we identified six steps (4.1 to 4.6) designed to meet the requirements of clauses: 8 - Measurement, analysis and improvement of ISO 9001, 4.5 - Checking of the ISO 14001 and OHSAS 18001/NP 4397. With the exception of step 4.3 - Investigation of incidents resulting from a specific sub-section, the 4.5.3.1 - Incident investigation, the OHSAS 18001/NP 4397 has no correspondence in the ISO 9001 and ISO 14001.

At the end, in the Phase IV - Act, we identified the step 5.1 - Critical analysis and review of the Management System, which refers to the requirements of clauses: 5.6 - Management review of the ISO 9001 and 4.6 - Management review of the ISO 14001 and OHSAS 18001/NP 4397. The Management review process can be done in an integrated manner [34]. It requires,

in itself, a very careful preparation face, particularly, to the level of various information that supports the inputs, as is schematized in Figure 5.



**Figure 5.** IMS-QES - Management Review - Standards, inputs and outputs [16 ; 34]

The continuous improvement of the global performance of organizations must be always a present goal in a perspective of sustainability [34]. The development Model of the integration of the Management System of Safety and Health at Work with the Quality Management Systems and Environmental Management at the Company should therefore to potentiate, for each phase: Plan, Do, Check, Act, a careful and methodical analysis of the differences that effectively are observed at the level of normative requirements under the equivalent clauses and for each step of their development as the advocated model of integration.

The compatibilization of the normative requirements supported by an analysis of similarities, of the normative referentials of Management Systems, which promotes the integration and it's formatting on a Matrix of compatibilization of the requirements and of support to the integration of the referential - NP EN ISO 9001:2008, OHSAS 18001:2007 / NP 4397:2008 and NP EN ISO14001:2004, establishing correspondences, matching them with each other and associate them, according to ISO Guide 72:2001, the following phases of the methodology *PDCA - Plan, Do, Check, Act*: Policy and principles; Planning, Implementation and Operation, Performance Evaluation, Improvement, Management Review, is one of the activities that in the aim and objectives of the integration model was given special attention in context of characterization and framework of the situation in the Company. That compatibilization constitutes, the starting point for subsequent activities of integration, simplification and optimization, to a level of the strictly necessary and consequent integration maximized as desired of the three sub-systems – the EMS, the QMS and the OHSMS in context of strong competitiveness [34].

As can be expected, there are several difficulties involved with implementing an Integrated Management System (IMS). However, Beckmerhgeni [35] points out that *“the management systems implemented separately in an incompatible way results in costs, an increased probability of faults and errors, duplicated efforts, the creation of unnecessary bureaucracy and a negative impact near the Stakeholders, particularly Employees and Costumers”*.

The integration of the Environmental System supported on the ISO 14001:2004 with the Management Systems of Quality - ISO 9001:2008 and Occupational, Health and Safety - OSAS 18001:2007 represent real added value both in the present and, fundamentally, for the future, not only for the Company, as well as for a whole range of Stakeholders.

Environmental management in organizations is therefore a fundamental process for an more and more integrated and responsible management of sustainability [34]. Aims essentially, an efficient resource management, consumption, wastes and effluents, the use of cleaner technologies and compliance with applicable environmental legal requirements for protecting and promoting environmental and pollution prevention.

An Environmental Management System (EMS) is translated in practice in a continuous cycle of planning, implementation and operation, checking, analyzing and improving of the actions that drives an organization to continuously improve their environmental performance, covering a wide range of issues, including those with strategic implications as well as of competitiveness. The ISO 14001:2004 [36] is integrated in a family of standards developed by the ISO in the fields of Environmental Management according to Table 5.

The ISO 14001:2004 describes the requirements that an EMS of an Organization must meet in order to help the Organization to manage the impact of their activities on the environment, bringing advantages that are considered of high relevance to the promotion of continuous improvement in environmental performance of the Organization and to the prevention of pollution, taking into account the socio-economic surroundings. It allows an organization to develop and implement a policy and objectives, taking into account legal requirements and other requirements that the organization subscribes, and information about significant environmental aspects which the organization can control and influence. While a reference for an EMS, the ISO 14001:2004 contains guidelines that enable their implementation and the requirements that can be objectively audited for certification.

Today, the success of an organization goes through Sustainability [34]. According to ISO 9004:2009 [37], the sustained success of an organization is considered the result of its ability to achieve and maintain their long-term objectives that pass unfulfilled, in a consistent way, the needs and expectations of its Stakeholders, in a balanced and long-term as well.

Furthermore the fact that, in turn, other normative references of Management Systems, namely the ISO 14001 and OHSAS 18001/4397 NP, are valuable auxiliaries in the evolutive management of Organizations and, hence, on the three strands of its Sustainability: the Economic, the Social and Environmental. In fact, today Quality, Environment, Safety and Occupational Health are fundamental pillars of the Sustainable Development and therefore should be considered at the level of the management activities and of strategic planning of Organizations that want to take a leadership role, at present, but fundamentally in the future.

SERIE	CONTENTS	STANDARDS
ISO 14000	Environmental Management Systems	<ul style="list-style-type: none"> <li>- ISO 14001:2004 – Environmental management systems – Requirements with guidance for use</li> <li>- ISO 14004:2004 – Environmental management systems – General guidelines on principles, systems and supporting techniques</li> <li>- ISO 14005:2010 – Environmental management Systems - Guidelines for the phased implementation of an environmental management system, including the use of environmental performance evaluation.</li> <li>- ISO 14006:2011 – Environmental management Systems - Guidelines for incorporating ecodesign</li> </ul>
ISO 19011	Audits to Management Systems	<ul style="list-style-type: none"> <li>- ISO 19011:2011, Guidelines for auditing management systems</li> </ul>
ISO 14020	- Environmental label	<ul style="list-style-type: none"> <li>- ISO 14020 - Environmental Labelling: General Principles</li> <li>- ISO 14021 - Environmental Labels and Declarations: Self-Declaration Environmental Claims, Terms and Definitions</li> <li>- ISO 14022 - Environmental Labels and Declarations: Self-Declaration Environmental Claims, Symbols</li> <li>- ISO 14023 - Environmental Labels and Declarations: Self-Declaration Environmental Claims, Testing and Verification</li> <li>- ISO 14024 - Environmental Labels and Declarations: Environmental Labelling Type I, Guiding Principles and Procedures</li> </ul>
ISO 14030	Environmental performance evaluation	<ul style="list-style-type: none"> <li>- ISO 14031:1999 - Environmental management -- Environmental performance evaluation - Guidelines</li> </ul>
ISO 14040	Life cycle assessment	<ul style="list-style-type: none"> <li>- ISO 14040:1997 - Environmental management -- Life cycle assessment -- Principles and framework</li> <li>- ISO 14041:1998 - Environmental management -- Life cycle assessment -- Goal and scope definition and inventory analysis</li> <li>- ISO 14042:2000 - Environmental management -- Life cycle assessment -- Life cycle impact assessment</li> <li>- ISO 14043:2001 – Environmental management – Life cycle assessment – Life cycle interpretation</li> </ul>
ISO 14050	Understanding of Terms and Definitions	<ul style="list-style-type: none"> <li>- ISO 14050:2002 – Environmental management – Vocabulary.</li> </ul>

**Table 5.** ISO Standards in the fields of Environmental Management [34]

Q M S	100% are certified by ISO 9001			
	Reasons for certification	Very Important	Empowering knowledge workers	Business benefits
		Important	Better Quality of the products	Improvement of company image
	Benefits	Major Impact	Improvement of the company image	Ease of access to information
			Internal organization of the company	Continuous assessment through internal audits
		Impact	Better productivity and profitability	Deadlines
			Cost reduction	Number of defects / complaints
			Competitive position	Satisfaction of internal and external customers.
		Little Impact	Absenteeism	Product innovation
	Tools	Most commonly used	Surveys	Charts (graphics)
		Less used	Sheets of data collection	Cause and effect diagram
	Difficulties		High certification costs	Difficulties to change company's culture
Difficulties to motivate personal				
E M S	36.9 % are certified by ISO 14001			
	Reasons for non-certification	Main reason	Lack of investment support	A form of marketing
		Secondary reason	Benefits do not outweigh the costs	Investments are high
		Less Relevant	Environmental risks are low	
	Reasons for certification	Very Important	Progress but always protect the environment	Raising public
			Improved quality of life inside and outside the company	
		Important	Obtaining an asset in terms of marketing	
	Benefits	Major Impact	Environmental protection	Rational use of natural resources
			Business image in the community	Recycling
			Ensuring compliance	Prevention of environmental risks
		Impact	Clear, organized work environment	Waste generation
			Awareness of employees in environmental issues	
		No impact	Insurance costs	Costs of raw materials and equipment
			Ability to obtain financing at low interest rates	
	Drawbacks		Overall costs increased on the early stages of certification.	
Main Difficulties		High certification costs	Difficulties to change Company's culture	
		Difficulties to motivate personal		
O H S M S	26.1 % are certified by OHSAS 18001			
	Reasons for non-certification	Main reason	Investments are high	Certification is seen as a cost and marketing
		Secondary reason	Benefits do not outweigh the costs	

		<b>Less Relevant</b>	Risk of accidents at work are low		
	<b>Reasons for certification</b>	<b>Very important</b>	Eliminate or minimize risks to workers		
		<b>Important</b>	Improving the organization with the reduction of accidents at work		
		<b>Less Important</b>	Rate of absenteeism due to occupational diseases		
	<b>Benefits</b>	<b>Major Impact</b>	Improvement of working conditions	Better internal communication	
			Improvement company image.	Ensuring compliance with legislation	
		<b>Impact</b>	Less number of accidents	Reduction in cost of accidents and occupational diseases	
		<b>No impact</b>	Dissemination in the media of data on safety and health of the company		
	<b>Drawbacks</b>		No drawbacks have been referred		
	<b>Main Difficulties</b>	High certification costs		Difficulties to change Company's culture	
		Difficulties to motivate personal		Increase bureaucracy	
		Management difficulties in the early stages of certification			
	IMS	<b>Main Benefits</b>	Management costs reduction		Unification of internal audits
Reduction of bureaucracy			Better definition of responsibilities and authority		
Easier compliance of legislation			Increased performance and efficiency		
Improved external image of the company			Better and easier communication system.		
Improved organization			Simplified management systems resulting in less confusion, redundancy and conflicts in documentation		
Increased employee training			Optimized resources(financial and humans)		
<b>Drawbacks</b>		One problem on a single system affects the overall management system		Initial costs increase associated to an increase in non-conformities;	
		Initial higher organizational problems		Continuous update of every documentation with negative impact in the management activity itself	
		Complex organizational system		Incompatible concepts between systems	
<b>Main Difficulties</b>		Long time to implement the integration process		Insufficient integrability of the standards	
		Deep changes in the management system due to operational changes		Difficulties to implement systems integration	
		High difficulty associated to training and changes in the organization methods and culture		Higher difficulty and cost to implement all systems simultaneously when compared with individual implementation	

**Table 6.** Summary of the benefits and impact grade characterization that companies obtained with certification of the management systems (Adapted of [13])

Also in this context of Sustainability, the integration of the EMS with other management systems is, nowadays, a strategic decision of the organizations, influential of its competitiveness and continuity in the Market, fostering a better and increasing satisfaction of all Stakeholders, increasing the image and brand reputation near them [34]. Are too examples of advantages of the integration, also highlighted by the survey respondents: the elimination of conflicts between individual systems with optimization of Resources; the improvement at the level of the Coordinated and Integrated Management of the Risk associated to the Safety of the Persons and Company Assets, Environment and Quality of the Products; the reduction of the number of internal and/or external audits and audits to Suppliers and spent time versus associated costs; the creation of added value for the business through the prevention and/or elimination of several types of operational and organizational wastes.

#### **4.3. Summary of the benefits and impact grade characterization that companies obtained with certification and integration of the management systems**

The three standards ISO 9001, ISO 14001 and OHSAS 18001 have a common underlying principle: continuous improvement based on Deming's Cycle (Plan-do-Check-Act) [16 ; 34]. According to Labodová [22], basically one PDCA approach governing the aspects of quality, environment and safety, consistent with clear priorities, shows hot spots in companies, makes it easy to focus procedures and responsibilities on important areas.

According to the survey, 100% of the companies of the sample had their QMS certified. 36.9 % of these companies had also their EMS certified, and only 26.% had OHSMS certification. In Table 6, a summary of the main benefits, classified according to their impact relevance, as well as the main reasons for the three certification systems is presented. Moreover, the main factors that justify the option for non-certification of EMS and OHSMS of the remaining companies are also presented. The main factors that justify the option for non-certification of QMS are not presented, since every company participating in the survey had their QMS certified. Are also presented the main benefits, drawbacks and difficulties what concern Integration of Management Systems.

## **5. Conclusions**

The theoretical fundamentation was supported on the concepts of Quality Management Systems, Environment and Safety, Integrated Management Systems, orientations, guidelines and ISO standards as well as a group of other sources of knowledge, such as Integrated Management Systems QES.

Were identified the main benefits of implementing an EMS and its certification after receiving the QMS certification on Portuguese SMEs performance. In fact the main benefits that the Portuguese SMEs have gained from the referred certifications have been, among others, prevention of environmental risks, environment protection, improvement business image in the community, ensuring compliance with legislation and rational use of natural resources. In addition, the main reasons for non-certification were analyzed.



Those companies with non-certified EMS mentioned “lack of investment support” and “consider the certification as a form of marketing”. Drawbacks that have been concluded were “overall costs increased on the early stages of certification”, because there is a better control. The main difficulties uncovered in relation to EMS certification can be pinpointed to difficulties in changing company culture, high certification costs, and difficulties to motivate personal. With respect to environment, there is still a lot to do in Portugal. Several Portuguese SMEs have already implemented the EMS and others will follow, mainly, because money can't pay for an environmental disaster.

In terms of the potential benefits of the integration of the Environmental Management System (EMS) with the Quality Management System (QMS) and Occupational Health and Safety Management System OH&SMS and its certification, will be mostly a whole range of opportunities for performance improvements of the organization as a whole, and throughout its supply chain such as: the elimination of conflicts between individual systems with resource optimization, creation of added value to the business by eliminating several types of wastes, reducing the number of internal and external audits, common policy management, greater valuation and motivation of Collaborators, among others.

The proposed model of IMS\_QES has led to the simplification and consequent resolution of problems and gains in efficiency of existing management systems in the company (referred as Sub-systems), which along the years were adopted gradually, but individualized and often isolated between to each other.

All these benefits will enhance the competitiveness of the Companies and its differentiation by the positive in the face of competition, national and/or international.

The developed model of an Integrated Management Systems (IMS), generic, flexible, integrator, evolutionary and lean namely what concerns to Quality (ISO 9001), Environment (ISO 14001) and Health and Safety at work (OHSAS 18001/ NP 43397:2008), but too to others standards, such as, Risk Management (ISO 31000:2009), Social Accountability (SA 8000) and Information Security, among others, could be progressively more integrated and allow the Companies to even more capable, enhancing in this way too the development of the businesses and consequently their sustainable successes .

## Author details

Gilberto Santos\*, Manuel Rebelo, Síría Barros and Martinha Pereira  
*College of Technology, Polytechnic Institute Cávado e Ave, Imasys Research Centre, Campus do IPCA 4750-810 Barcelos, Portugal*

## 6. References

- [1] Wright T (2000) IMS-Three into One Will Go!: The Advantages of a Single Integrated Quality, Health and Safety, and Environmental Management System. *The Quality Assurance Journal* 4: 137–42.

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\* Corresponding Author

- [2] Zorpas A (2010). Environmental management systems as sustainable tools in the way of life for the SMEs and VSMEs. *Bioresource Technology* 101, 1544 -1557.
- [3] Burke S, Gaughran WF (2007). Developing a framework for sustainability management in engineering SMEs. *Robotics and Computer-Integrated Manufacturing* 23, 696 -703
- [4] Turk A M (2009). The benefits associated with ISO 14001 certification for construction firms: Turkish case. *Journal of Cleaner Production* 17 (2009) 559–569.
- [5] Kwon D M, Seo M S, Seo Y C (2002). A study of compliance with environmental regulations of ISO 14001 certified companies in Korea *Journal of Environmental Management* 65, 347-353.
- [6] Nawrocka D, Brorson T, Lindhqvist T (2009). ISO 14001 in environmental supply chain practices *Journal of Cleaner Production* 17 1435–1443.
- [7] Casadesus M, Marimon F, Inaki Heras H (2008). ISO 14001 diffusion after the success of the ISO 9001 model. *Journal of Cleaner Production* 16. 1741 – 1754
- [8] Zeng SX, Jonathan JS, Lou GX (2007). A synergetic model for implementing an integrated management system: an empirical study in China. *Journal of Cleaner Production* 15, 1760 -1767.
- [9] Karapetrovic S, Casadesús M (2009). Implementing environmental with other standardized management systems: Scope, sequence, time and integration. *Journal of Cleaner Production* 17. 533–540.
- [10] Fryxell G E, Szeto A (2002). The influence of motivations for seeking ISO 14001 certification: an empirical study of ISO 14001 certified facilities in Hong Kong *Journal of Environmental Management* 65, 223–238
- [11] Tarí J J, Molina-Azorín J F (2010). Integration of quality management and environmental management systems Similarities and the role of the EFQM model. *The TQM Journal* Vol. 22 No. 6, pp. 687-701
- [12] Fresner J, Engelhardt G (2004). Experiences with integrated management systems for two small companies in Austria. *Journal of Cleaner Production*, Vol. 12, pp. 623-631.
- [13] Santos G, Mendes F, Barbosa J (2011). Certification and integration of management systems: the experience of Portuguese small and medium enterprises *Journal of Cleaner Production* 19 1965-1974
- [14] Fernández-Muñiz, B, Montes-Peón J M, Vázquez-Ordás C J (2009). Relation between occupational safety management and firm performance. *Safety Science* 47, 980–991.
- [15] Robson L S, Clarke J A, Cullen K, Bielecky A, Severin C, Bigelow P L, Irvin E, Culyer A, Mahood Q (2007). The effectiveness of occupational health and safety management system interventions: A systematic review. *Safety Science* 45, 329–353.
- [16] Rebelo MF, Santos G (2012) - Integration of the Occupational Health and Safety Management System with the Quality Management System and Environmental Management System - from the Theory to the Action. *International Symposium on Occupational Safety and Hygiene SHO - 2012*. Minho University 9, 10 March 2012. ISBN 978-972-99504-9-0
- [17] ISO (2008) *The integrated use of management system standards – Switzerland*.
- [18] Mendes F, Santos G (2009). Impacto de la certificación de los sistemas integrados de gestión en las PMEs portuguesas. *Forum Calidad* nº 198, 46-51

- [19] McDonald M, Mors T A, Phillips A (2003). Management system integration: can it be done? *Quality Progress*; 67-74.
- [20] Arifin K, Aiyub K, Awang A, Jahi J M, Iten R. (2009). Implementation of Integrated Management System in Malaysia: The Level of Organization's Understanding and Awareness *European Journal of Scientific Research* ISSN 1450-216X Vol.31 No.2:188-195.
- [21] Bernardo M, Casadesus M, Karapetrovic S, Heras I (2009). How integrated are environmental, quality and other standardized management systems? An empirical study. *Journal of Cleaner Production* 17: 742–50.
- [22] Labodová A (2004). Implementing integrated management systems using a risk analysis based approach. *Journal of Cleaner Production*; 12: 571–80.
- [23] Guide ISO 72:2001, Guidelines for justification and development of management System standards.
- [24] ISO 19011:2011, Guidelines for auditing management systems
- [25] Santos G et al. (2008). Implementação de Sistemas Integrados de Gestão (Qualidade, Ambiente e Segurança) – ISBN 978-972-8953-26-3; Publindústria.
- [26] Suditu C (2007). Positive and negative aspects regarding the implementation of an integrated Quality, Environment, health and Safety Management System. *Annals of the Oradea University, - Fascicle of Management and Technological Engineering, Volume VI (XVI)*,
- [27] Jørgensen T H (2008). Towards more sustainable management systems: through life cycle management and integration, *Journal of Cleaner Production* 16, 1071-1080.
- [28] OHSAS 18001:2007, Occupational Health and Safety Management Systems – Requirements - BSI, first published July.
- [29] Block M R, Marash IR (2002). Integrating ISO 14001 into a Quality Management System. ASQ – Second edition. Milwaukee.
- [30] <http://www.min-economia.pt/> 2007.
- [31] Santos M G, Barbosa J, Pedro C.(2004). Integration of “QES” systems on the small and medium size foundry companies in Portugal. Communication presented at the 66<sup>th</sup> World Foundry Congress. Istanbul, Turkey.
- [32] <http://www.pme.online.pt/> 2007.
- [33] Mendes, F. (2007). O Impacto dos sistemas QAS nas PMEs portuguesas – Master Thesis – Univ. Minho.
- [34] Rebelo M F (2011). Contribuição para a estruturação de um modelo de sistema integrado de gestão QAS. Master Thesis. Polyt Inst Cavado Ave. Portugal.
- [35] Beckmerhageni A; Berg H. P.; Karapetrovic S. V.; W. O. Willborn (2003). Integration of Standardized Management Systems: focus on safety in the nuclear industry. *International Journal of Quality & Reliability Management*, Vol 20 N<sup>o</sup> 2, pp. 210-228.
- [36] ISO 14001:2004, Environmental management systems. Requirements with guidance for use.
- [37] ISO 9004:2009 – Managing for the sustained success of an organization – A quality management approach.
- [38] Curkovic S, Melnyk S A, Handfield R B, Calantone R (2000). Investigating the Linkage Between Total Quality Management and Environmentally Responsible Manufacturing. *IEEE Transactions on Engineering Management*, Vol. 47 N<sup>o</sup>4, pp.444-464.