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Guidelines for the integration of certifiable management systems in industrial companies

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ABSTRACT

Organizations often operate in turbulent environments characterized by intense competitiveness, constant technological progress, new market requirements, and scarce natural resources. This scenario imposes the constant need for change in the operation and companies' management. The integration of certifiable management systems is an effective alternative in this sense. The objective of the present study is to propose guidelines for the integration of the ISO 9001 Quality Management System (QMS), ISO 14001 Environmental Management System (EMS) and OHSAS 18001 Occupational Health and Safety Management System (OHSMS) in industrial companies. These guidelines were developed based on a theoretical framework and on the results from fourteen case studies performed in Brazilian industrial companies. The proposed guidelines were divided into three phases: a) integration planning, b) integration development, and c) integration control and improvement.

1. Introduction

Organizations often operate in turbulent environments characterized by intense competitiveness, constant technological progress, new consumer market requirements, and scarce natural resources. This scenario imposes the constant need for change in the operation and management of these companies in order for them to adapt themselves to these new conditions and become or remain competitive, which are consequently encouraged to engage in new projects such as the integration of certifiable management systems that allow a company to positively stand out in the market (Bayraktar et al., 2007; Raymond and Bergeron, 2008; López-Fresno, 2010).

In this context, Quality Management Systems (QMS), Environmental Management Systems (EMS) and Occupational Health and Safety Management Systems (OHSMS) have become increasingly important as clients begin to require high standards of quality and commitment to superior environmental practices and operations that protect workers from illegal or unsafe practices.

A growing number of organizations seek certification of their management systems. International standard entities have developed management models that provide a structure for certification and evaluation in various areas and functions. ISO 9001 QMS, ISO 14001 EMS and OHSAS 18001 OHSMS are the most widely used and universally accepted standards. There is a high degree of compatibility among these certifications, and their latest versions were developed with the purpose of achieving their integration (ISO, 2013).

According to ISO (2013), in 2011 there were 1,484,651 certifications of all kinds in the world guided by the International Organization for Standardization, of which 1,111,698 were related to ISO 9001 and 267.457 related to ISO 14001 and according to OHSAS Group Project (2009), there were 56.251 OHSAS 18001 certifications in 2009.

The certification of a system is the recognition that the system meets a specific normative standard. The certification is granted by a certifying agency accredited by a supervisory body. In Brazil, this function is exercised by the National Institute of Metrology, Standardization and Industrial Quality, also known as INMETRO (Oliveira and Grael, 2008).

Multiple certifiable management systems can function separately. However, they are counterproductive, difficult to manage, and involve collaborators which invariably lead to the question of whether they should prioritize either the productive processes or the excessive bureaucracy they generate. A collaboration of employees is easier to be accomplished for a single system than for two or more systems that are separately managed. Additionally, the synergy generated by integration has resulted in improved performance at a considerably lower cost for companies (Beckmerhagen et al., 2003; Oliveira and Grael, 2008; Bernardo et al., 2009).

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The integration of certifiable management systems can occur from the development of an Integrated Management System (IMS), which is an approach that seeks to take advantage from the synergies and elements common to all systems, for them to work together which strengthens their results, reduces time, human effort, as well as their technical and financial resources. The IMS must be appropriate for the culture and structure of the company, be inserted into the company's strategy and align itself with other functions of the organization (López-Fresno, 2010).

For these reasons, the main objective of the present study is to propose guidelines for the integration of ISO 9001 QMS, ISO 14001 EMS, and OHSAS 18001 OHSMS which are based on the theoretical framework and on the results from fourteen case studies performed in Brazilian industrial companies.

The decision to integrate these three specific systems is derived from the fact that they have many common elements that are based on the PDCA cycle (Plan, Do, Check and Action), and were developed and/or reformulated by considering each of them.

As it will be seen throughout this text, there is a considerable number of quantitative scientific studies on these three management systems and their integration. However, due to the vast amount of information that these studies generate from mapping and from the identification of primary opportunities for improvement in the integration process, as well as to the need for studies that accurately systematize applicable guidelines for improvement, this work has a significant opportunity for both applicable and academic contribution.

2. Synthesis of the theoretical framework

2.1. ISO 9001 quality management system

In an organization, quality is directly related to the identification and satisfaction of the needs and expectations of customers, other stakeholders and the community in which the company operates. Quality management combines management techniques and models that strive for excellence in projects, processes, products, and services through continuous improvement (Sun, 2000; Mackau, 2003; Magd and Curry, 2003).

ISO 9001 (2008) is a certifiable standard that is accepted worldwide and composed of requirements that aim to guarantee the quality of products and services and, consequently, the most effective relationship between the supplier and the customer. The standard suggests an approach through processes based on the PDCA cycle (Karapetrovic, 2003; ISO 9001, 2008).

The principal objective of ISO 9001 is to assist companies, regardless of their size and sector, with the development and effective operation of a QMS by increasing their capacity to design, produce and deliver high-quality products and services (Wahid and Corner, 2009).

According to Williams (2004), the main motivating factors for the implementation of ISO 9001 include the following: demand from customers, improvement in the quality of processes and products, strategic vision, advertizing, regulatory requirements, increased market competitiveness, and external governments requirements.

Overall, the benefits of adopting the ISO 9001 standard include the following: increased sales and profits, fewer customer complaints, increased exports, reputation improvement, greater product reliability, fewer quality problems, less delivery time, reduction in process variation, lower manufacturing costs, fewer customer audits, an increase in competitive advantages, greater awareness by employees, access to new markets and improvements in customer relations, and internal communication (Yahya and Goh, 2001; Williams, 2004).

According to Gotzamani (2005), the main difficulties of ISO 9001 include the following: significant impact on organizational culture, excessive focus on certification but not on the system, low commitment by management, and the use of a conventional quality auditing process instead of a more complex approach.

2.2. ISO 14001 environmental management system

An EMS supports organizations in the control and in the continuous reduction of their environmental impacts. This type of system is composed of policies, processes and auditing protocols that aim to reduce material waste and pollutants emission. The objective of ISO 14001 is to empower companies with mechanisms that have the potential to reduce environmental damage, such as the benefits that offset the costs of their implementation (Fryxell and Szeto, 2002; Matthews, 2003; Kilbourne, 2004; Silva and Medeiros, 2004; Rowland-Jones et al., 2005; Darnall et al., 2008).

The ISO 14001 standard is an EMS that is frequently used throughout the world. Although this EMS does not establish specific performance criteria, development levels for environmental processes or values for control indicators, it provides requirements that are based on processes and the PDCA cycle which are mandatorily completed to obtain certification (Watson and Emery, 2004; Matthews, 2003; ISO 14001, 2004; Chavan, 2005; Ann et al., 2006).

It is possible to associate the main motivations for the implementation of ISO 14001 with the benefits of certification which include the following: opening of domestic and international markets; improvement in management; increase in consumer satisfaction; compliance with a country's specific environmental legislation; standardization of environmental management procedures; waste reduction; improvement in the image of a company; increase in environmental awareness; compliance with pressure from external groups; and an overall improvement in environmental performance (Fryxell and Szeto, 2002; Zeng et al., 2005; Sambasivan and Fei, 2008).

2.3. OHSAS 18001 occupational health and safety management system

Constant technological progress and intense competitiveness as a result of globalization brings a subsequent change in working conditions, processes, and organizations. Legislation does not always sustain the rapid pace of change which is reflected in working conditions, including the perception of new risks by the employee. Thus, the development of an efficient OHSMS is necessary to inform collaborators, motivate them to act in a prudent and healthy manner, and provide mechanisms that companies can implement to monitor improvement in working conditions. OHSAS 18001 is an option of the OHSMS that is employed more frequently for this purpose (Mearns and Håvold, 2003; Hughes and Kornowa-Weichel, 2004; Nivolianitou et al., 2004; Attwood et al., 2006; WHO, 2007; Bottani et al., 2009).

OHSAS 18001 involves a generic specification for all companies, regardless of type, size and geographical, cultural and social conditions that comply with the requirements of an OHSMS. The objective of this standard is to establish components for the construction of an effective OHSMS that are aimed at minimizing accident risk and assuring protection of human resources. This standard is effective in ensuring that companies meet their legal, contractual, social, and financial requirements associated with occupational health and safety. Similar to ISO 14001 and ISO 9001, the OHSAS 18001 is also based on the PDCA cycle.

OHSAS 18001 enables the strengthening of the company's image as perceived by employees, customers and the general public, and highlights the company's commitment and respect for people, which results in a competitive advantage (Oliveira and Oliveira, 2008).

The main recurrent challenges for implementing the OHSMS, especially for OHSAS 18001, include the following: low educational

levels of workers; complexity of procedures and instructions; internal communication failures; low involvement by other sectors; lack of performance indicators; allocation of the responsibility of the OHSMS to the health or safety department alone; lack of management commitment; low awareness indices among workers; failure to establish safety and health as a strategic objective; and low involvement by the human resources area in training efforts (Hasle and Jensen, 2006; Loosemore and Andonakis, 2007; Choudhry et al., 2005; Aksorn and Hadikusumo, 2008; Duijim et al., 2008).

2.4. Integration of certifiable management systems

Integration is the alignment of the management systems in an organization by regulating the hierarchical levels and various sectors, and facilitating the use of a uniform language to improve stakeholder satisfaction (Bamber et al., 2002; Bernardo et al., 2009).

The IMS enables synergic gains with the execution of common tasks and a reduction in production costs as a function of reduced waste, and the improvement of a company's image. The separate and incompatible implementation of systems increases the probability of failure, resulting in the duplication of tasks and the creation of unnecessary bureaucracy (Beckmerhagen et al., 2003).

The International Organization for Standardization (ISO) and the British Standards Institution constantly develop and update their standards to improve their compatibility (ISO, 2013). For instance, the last edition of ISO 14001 considered the provisions of the ISO 9001 to enhance their compatibility for the benefit of all users (ISO 14001, 2004). The OHSAS 18001 standard was also developed to ensure compatibility with environmental and quality standards to facilitate the integration of the systems (OHSAS 18001, 2007).

The standards that are the subject of the present study, to a greater or lesser degree, directly or indirectly, include the following elements: process control systems, human resources, information, documents, design, production, and the distribution of products and services to meet the needs of customers and the company (Magd and Curry, 2003; Bernardo et al., 2009). These similarities make them synergetic and favorable to integration.

The ISO (2008) published a book, titled "The integrated use of management system standards", that details specific methodologies based on standards for the integration of management systems. Additionally, several countries have developed guidelines for the integration of systems: the AS/NZS 4581: 1999 (Sai Global, 1999) in Australia and New Zealand; the DS 8001: 2005 (Dansk Standard, 2005) in Denmark; the UNE 66177: 2005 (AENOR, 2005) in Spain; and the PAS 99: 2006 (British Standards Institution, 2006) in England.

Several models, guidelines and recommendations must also be considered, even though at theoretical level or with little detailing, proposed by such authors as Puri (1996), Karapetrovic and Willborn (1998), Wright (2000), Mackau (2003), Zeng et al. (2006).

Due to numerous classifications proposed in scientific literature, the selection of a single model as a standard is impractical. However, to create a reference for the comparative analysis of propositions, Bernardo et al. (2009) conducted an interesting review of the studies by Seghezzi (1997), Wilkinson and Dale (1999), Kirkby (2002), Karapetrovic (2002, 2003), Beckmerhagen et al. (2003), Pojasek (2006) and Jørgensen et al. (2006).

Zutshi and Sohal (2005) alerted that the degree of integration is depends on which systems are being considered, culture, nature, and size of a company. According these authors, the integration must be planned and implemented in a structured manner.

3. Research method

The present study was conducted through a qualitative analysis based on the multiple case study method. The qualitative study investigated social aspects that cannot be verified by quantitative studies. It is recommended to answer questions such as "how" and "why", interpreting the meanings of phenomena and social processes in the specific context in which they occur (Hyde, 2000; Jupp, 2006; Yin, 2009).

Fourteen case studies were performed. According to Stravos and Westberg (2009), this approach provides the investigator with a rich dataset that yields more robust and reliable results due to simultaneous studies with distinct situations.

The companies that were analyzed in these case studies were selected according to the following criteria: they utilize the most recent versions of ISO 9001, ISO 14001 and OHSAS 18001; they employ some type of integration between these systems; they have the potential to contribute to the formulation of guidelines, and they agreed to participate in the present study.

Data collection, as prescribed by Yin (2009), was accomplished through multiple resources: a) semi-structured interviews with the Management Representative (MR), production managers and selected key collaborators; b) in loco observation (a minimum of three visits to each company), and c) analysis of documents, including IMS manuals and/or manuals pertaining to each of the separate systems, work instructions and records (Jupp, 2006).

The guidelines proposed in this study were developed based on a theoretical framework, case study results, and the experiences of the authors.

4. Presentation and analysis of the case studies

Of the fourteen companies studied, eleven were large-scale companies (A, B, C, D, H, I, J, K, L, M, N), and three were medium-scale companies (E, F, G). Two of them do not export goods (E, G). The average age of the companies is 49 years.

Although with different levels of commitment, the majority of the companies sought to integrate their systems, starting with self-reflection regarding their operational and strategic situation (self-evaluation) to benefit from the existing synergy between the systems, reduce management costs, and increase competitiveness.

In all studied companies, an improvement in the effectiveness of operations and internal communication, greater ease of decision making, improvement in the quality of goods and services, and an increase in the reliability of products and processes were verified as benefits of integration.

Improvement in the effectiveness of operations stems from gains in system objectivity as a result of the integrated execution of processes with a consequent reduction in the number of activities enable a greater and enhanced dedication to their execution and control. The improvement in communication was achieved through a reduction in document generation. A significant evolution in the emission, distribution, discarding and control of documentation was also confirmed, generating positive consequences beyond production for certain internal sectors and processes, such as the sectors of human resources, strategic planning, and technical assistance.

The greater ease of decision making resulted from the integration of the three systems through improvement in the quality of information, which improved its availability and data analysis.

The least observed benefits, in relation to integration, include greater customer retention, increased productivity, enhanced flexibility, less lead time, and lower final product costs.

The low incidence of benefits with greater retention of clients and increased productivity was initially unexpected. The companies argued that integration does not retain customers, but quality does.

Regarding productivity, a certain divergence was observed between the information obtained from the interviewed managers and their disagreement regarding other collected data. The managers agreed that there was a reduction in documentation and the

number and duration of meetings, and that there were savings associated with training, audits, and inspections, with reduced costs and increased productivity.

The main challenges faced by the organizations were related to the compatibility of the standards and complexity of the integration process. For the majority of companies, the implementation of the three systems occurred at a distinct time and was guided by different consulting firms. Table 1 provides a summary of integrated functions and procedures for each of the studied companies.

It turns out that nine companies have integrated their manuals, policies, objectives and goals for the three systems. In fact, the decision to carefully plan and formally integrate the systems, as in the case of these nine companies, practically determines the need for an IMS manual creation that covers not only the elements of quality, environment and occupational safety and health, but also the effective elements of their integration.

With the decision of integrating their systems and with the development of a unique manual, the integrated establishment of policies, objectives and goals, corresponding to the three systems, were also observed in these companies. In all other organizations, other integrated elements were observed which will be discussed later in this paper, that did not start from a format which was not as well-structured as these nine.

Considerable integration of items related to "structure and responsibility" and the "management representative" was observed in the studied organizations. In ten of these companies, the MR is the same for all three systems. For thirteen of these companies, some degree of integration of the written procedures was verified (work instructions and control of records), and the control of documents was also verified for twelve of the companies.

In eight of the companies, the training was simultaneously conducted in more than one system. This combined activity depends on the type of training which is offered. Overall, the trainings focused on the motivation and maintenance of the systems, and were performed in an integrated manner in the companies that possessed a single manual. Company J, which opted to conduct the trainings separately, stated that the combined activities could lead to confusion and difficulty in assimilation by trainees.

Regarding internal communication, eleven companies used some of the following elements to simultaneously address the three systems: communication boards, signs, graphical displays, motivational documents, and communication by e-mail.

In seven companies, the emergency plans of the EMS had consistent and explicit overlaps with the emergency plans of the OHSMS. In addition to citing one another, the emergency plans explained common resources and consisted of a single document in some cases (5 companies).

Ten of the studied companies used indicators that provided feedback to two or three management systems simultaneously. Only five of them had some type of integration related to the process/requirement acquisition. Explicit guidelines for prospecting new suppliers and classifying existing suppliers, and recommendations for quotation and purchasing of materials, taking into account all aspects of the three systems was observed in them.

The treatment of non-conformities is another element that few companies conduct in an integrated manner. The most common situation is one in which non-conformities follow distinct instructions and procedures separately for each certifiable management system, even if the company has an integrated manual. However, the concern with integration of this item was also observed in four of the companies.

The control of equipment of inspection, the measurement and the testing is integrated in the same companies that possess a unique manual for the three systems. For this requirement, the combination of all equipment, regardlessly of the systems they served, in a single list for the purpose of controlling storage, maintenance and standardization was verified in these enterprises.

Four and five of the companies that analyze their procedures for preventative and corrective actions, respectively, with an integrated form were identified. Separate procedures for each of these items were observed in certain organizations that had a unique manual for the three systems.

Internal audits and external audits were performed in an integrated manner in eight and five of the companies, respectively. Although companies C and I adopted a single manual for their systems, they do not conduct internal audits in an integrated manner because they believe that this would remove the focus from what is being analyzed, and could generate deviations in the diagnosis of the sectors and identification of problems. Company L opted to conduct the audits of the three systems simultaneously, even with few integrated

Table 1
Integrated procedures.

Procedures/functions	Companies													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Manuals	✓	✓	✓	✓				✓	✓	✓	✓		✓	
Policies	✓	✓	✓	✓				✓	✓	✓	✓		✓	
Objectives and goals	✓	✓	✓	✓				✓	✓	✓	✓		✓	
Structure and responsibilities	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
Management representative	✓	✓		✓		✓	✓	✓	✓		✓		✓	✓
Work instructions	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Document control	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Record control	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Training	✓	✓	✓						✓		✓	✓	✓	✓
Internal communication	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓
Emergency plans	✓	✓	✓	✓				✓			✓		✓	
Performance indicators	✓	✓	✓	✓				✓	✓	✓	✓		✓	✓
Acquisition	✓	✓						✓			✓		✓	
Treatment of non-conformities	✓	✓									✓		✓	
Equipment control of inspection/measurement/testing	✓	✓	✓	✓				✓	✓	✓	✓		✓	
Preventative actions	✓	✓						✓			✓		✓	
Corrective actions	✓	✓									✓		✓	
Internal auditing	✓	✓		✓				✓		✓	✓	✓	✓	
External auditing	✓	✓									✓		✓	
Critical analysis meeting	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓

items. In general, the integrated external audits were less severely verified than the integrated internal audits.

Critical analysis of the systems by upper management, considering their inter-relations, is performed via a single meeting for three systems of eleven companies. This process is vital for the system's performance and for the company because the priorities, human, and financial resources for each of the systems, and their integration is defined through these meetings.

The midsize companies (E, F, G) had less integrated procedures than larger. Those do not export (E, G) had worse performance in this regard. In these companies the few integrated procedures were: document control, internal control, record control, and communication. The weak pressure from customers, limited capital for investment and low managers commitment were decisive factors for this low performance.

5. Guidelines for integration

The proposed guidelines have a greater degree of specialization and detail than the generic orientations of the standards. However, these guidelines are not closed and fixed requirements and allow tailoring of the systems to the specific reality of the companies (culture, organizational structure and availability of human, technological and financial resources).

The guidelines can be applied to companies of any size in the same manner as the standards that served as a reference for the present study. However, there are distinct conditions for their development as a function of the size of the company: in large-scale companies, there is generally a greater availability of human and financial resources to implement the proposed guidelines. Conversely, in small-scale companies, despite financial and personnel restrictions, there is greater flexibility in the organizational structure, fewer hierarchical levels, and hastier decision making. Medium-scale companies fit between these two situations.

While developing these guidelines for companies, the focus must be on eliminating bureaucracy from the processes. Although new procedures and documents are being generated in many cases, it is important to simplify the language, structure and, if necessary, the method of filling out documents. In general, illustrations (figures, photos, graphics and plans) can contribute to an improved comprehension of the message.

The guidelines proposed in the present study were divided into the following three phases: a) planning, b) development, and c) control and improvement, to facilitate their logical presentation and, consequently, the reader's comprehension. Its graphical representation is in Fig. 1.

5.1. Integration planning phase

5.1.1. External consulting

An important decision that an organization intending to integrate their certifiable management systems must make is whether to hire a specialized consulting firm to aid them in this process or not.

To decide, it is necessary to prepare a profile of current employees that possess the appropriate qualities, education and motivation to lead the company in this process. Even if no one possesses all necessary characteristics, those employees who possess many of the required skills can develop their incipient abilities.

The existence of these employees, in number and conditions that are sufficient for supporting the integration process, may cause the company to perform the transition autonomously.

If the organization chooses to contract a consulting firm that specializes in this type of service, certain basic precautions should be taken. The firm should possess specific experience in the system's integration because only working with the development and implementation of isolated systems may not be sufficient for providing consistent support to the contracting organization.

It is important to contact organizations that have already employed the services of the potential consulting firm to confirm references and verify any problems between the contracting organization and the contractor, and the obtained results.

5.1.2. Study of the inter-relations between standards

The process of integrating certifiable management systems, regardless of whether it involves a specialized consulting firm or not, must be subjected to the study of similarities, complementarities and contradictions of the standards.

It is important that the organization forms groups for this activity that are composed of, for example, the MR, multipliers of the integration process and quality teams. These groups are necessary to ensure that inquiries, adaptations and solutions for the main questions about integration are derived from the available human resources within the company and, therefore ensure that they are customized to its reality which will generate less resistance and efficiently to utilize the available resources.

Based on the current situation of the company, these studies should seek to identify documents, proceedings and processes for concurrent execution of the three possible organizational levels (strategic, tactical and operational). For example, the constant elements shown in Table 1 can be used as a basis for these studies.

5.1.3. Diagnosis

Once the information about what may be integrated is known, the company must subsequently perform a diagnosis to determine

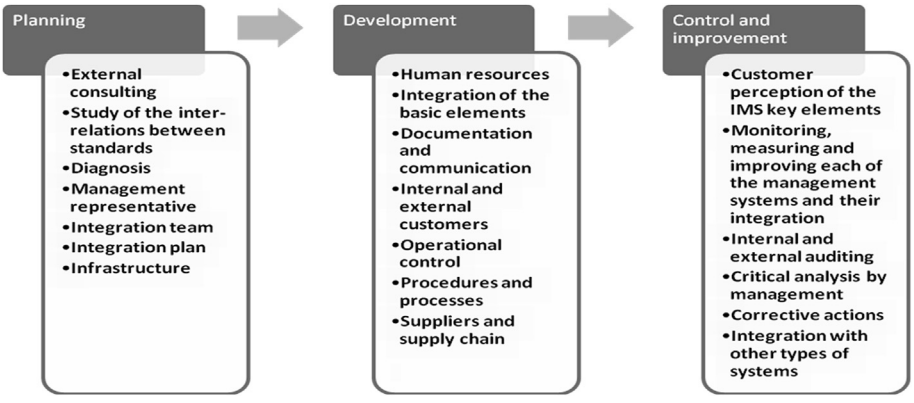

Fig. 1. Graphical representation of the guidelines.

the level of integration of the elements associated with the certifiable management systems of the company and the availability of resources to achieve integration.

This information is essential for the design of feasible plans in terms of the investment of human, technological and financial resources to achieve the desired level of integration.

When a company has already developed at least one certified system, the basis of documentation, communication, training, evaluation and continuous improvement are most likely to be already established which indicates that the organization has some experience with these elements, and therefore the gap between real and ideal should be smaller.

It is also advisable to verify the existence of systems, programs and tools that have a commonality with certifiable management systems (Balanced Score Card, Six Sigma, Cleaner Production, etc.) to consider their structure and elements as possible enhancers of the integration process.

5.1.4. Management representative

The MR is a figure of great importance for the performance of each certifiable management system and for its integration because their role is to connect the operational questions with upper management and to lead the company and team that are directly involved in the integration.

It is possible to have a MR for each certifiable system, one of them being responsible for the IMS. However, this approach is not recommended by the present study because this situation suggests a split in the macro-structure of the systems which could endanger the integration of their sub-items. Therefore, it is suggested to employ only one MR for the IMS.

The MR should have technical competence in the three systems and their integration, and possess a considerable behavioral ability. Technical competency can be derived from previous professional experience or formal training through, for example lead auditor courses. Behavioral ability exhibits a strong link with the personal characteristics of the MR: they are an individual with natural ascendency over a group, good interpersonal and communication skills, the ability to organize, delegate and control tasks, and are comfortable functioning as a role model.

Another topic that can be part of the discussion about the activities of the MR correlates to their full and exclusive dedication to the integration of certifiable management systems. This decision will depend on the size of the organization, the complexity of its structure, and processes and the scope of its systems. In general, it is too expensive for a small or medium-scale company to employ a professional exclusively for this function. Activities that exhibit a considerable overlap with integration can be assigned to the MR, as long as these activities do not compromise their position as a MR. For larger companies, it is desirable to have a MR that is completely focused on and dedicated to certifiable management systems and their integration.

5.1.5. Integration team

This team can have two functions: a) manage the integration process, and b) continuously improve the integration process, although this second function can be executed by a smaller team. Management considers the initial planning activities of integration, execution of the integration processes, and control of the initial integration activities. Improvement involves studying the integration indicators and proposal, implementation and control of the improvements in the system integration process.

It is suggested to acquire the team representatives from the main sectors of the company. The representatives must have technical and behavioral capacities (not as intense as the capacities required for MR) that allow them to be team leaders and perform such functions as multipliers of the techniques and integration tools of certifiable management systems which must be acquired through external training.

The integration team will directly assist the MR in the identification of potential resistances in the integration process. For this reason, the team must be familiar with the basic methods of conflict management to facilitate its mitigation. The team members must develop these activities in parallel with their routine activities. However, at the beginning of the integration process, the integration team must have the support of top management to prevent overburdening.

5.1.6. Integration plan

An integration plan that considers detailed elements, including a description of activities, their anticipated duration, the resources necessary for their execution, and the individuals responsible for them is suggested so that the integration of the systems can be properly directed and controlled.

Elements of the project management theory can be used for developing this plan which would allow greater accuracy and better visualization of the hierarchy and concurrency of activities in flow form.

5.1.7. Infrastructure

The organization must provide the necessary infrastructure for the development of the system integration. A large portion of the necessary resources coincide with those that are necessary for performing the routines of each of the three systems. Therefore, it is necessary for the MR to assess the multipliers of specific infrastructure required for integration.

5.2. Development phase of integration

5.2.1. Human resources

Human resources are a key factor for the success of the integration process for certifiable management systems. This sector makes it possible to plan, execute, and control the activities inherent to each system or integrated systems.

It is essential that the sector of human resources provides strong support and collaborates directly with the system integration process. The functions that it develops (recruitment, selection and integration of employees, training and evaluation of employee performance) can be performed from an integration perspective.

During recruitment and selection of personnel, the candidate's experience and/or work potential may be considered for integrated activities. During the integration period of the employee selected by the company, the employee must have contact with the main elements of the certifiable systems and with their integration, to facilitate the development of their daily professional activities while considering the employee.

Training plays an essential role in all integration processes. Technical and behavioral training at different levels of the company from the perspective of certifiable management systems, thus their integration is necessary. Specific training programs should be developed for the MR, the team of multipliers, managers, coordinators and responsible parties at every operational level. The training should ensure that employees understand the function of the IMS for the company such that each employee can contribute and benefit from it.

The evaluation of employee performance must consider the ability of the employees to handle questions related to the integration of the systems. The evaluation must support the training plan to ensure a continuous improvement of the staff profile.

The integration of the systems is a process that demands great personnel dedication because these activities are generally

performed simultaneously with their routine activities. Thus, motivation and workload exemptions encourage a successful integration. Motivational talks, awareness and an open game about the objectives, benefits and difficulties of the process of integration are elements that can be offered by human resources. A structured and systemic action of the human resources sector to foster the process of delegation in the company can contribute to the relief of individual workloads and enable greater focus on valued activities.

The direct participation of employees in the development of process instructions for the work that they perform, and in the definition of their respective indicators is important to guarantee greater practicability, foster greater commitment, and reduce resistance.

Upper management and the human resources sector must create an instrument to map and interpret the organizational culture, and use this information to feed the IMS to empower its results. The IMS can identify the need to perform adjustments in the elements of the organizational structure, and in the company's culture.

5.2.2. Integration of the basic elements

The integration of certifiable management systems must be conducted based on structuring elements that will guide all actions and resources in a common direction. An IMS can be based on the following elements: scope, policy, objectives, and responsibilities. Therefore, these elements need to be firstly integrated.

The development of a table of responsibilities is recommended to define who will lead and/or be responsible for the key elements of the IMS.

5.2.3. Documentation and communication

To provide robustness to the IMS, a great deal of attention and effort is necessary to the documentation integration. Initially, quality, environment and occupational health and safety management manuals must be merged individually, or created in an integrated form, depending on each case. The constant elements listed in the preceding items (policy, objectives and table of responsibilities) must guide the preparation of documentation integration and comprise its development.

In this manual, it is also important to develop flowcharts that represent the common processes to the three systems, as constrained by the scope defined for the IMS. Thus, the integration of the remaining documents is simplified, especially for the work instructions and records.

The integration of records is slightly easier due to the previous development of flowcharts and work instructions. From these records, it is possible to define the most important elements requiring control, while encompassing the technical, quality, environmental, occupational health, and safety portions of the process in the same record. With the development of these work instructions and integrated records, the basis for the unification of the control documents list (a control list of work instructions, a control list of records and other informational documents) is established.

5.2.4. Internal and external customers

Regarding internal customers, it is necessary to conduct a detailed mapping of working conditions, characteristics of productive processes, information flow, and waste generation. In order to accomplish this, tools available in the literature and frequently used in day-to-day routine of organizations (questionnaires, risk and accident analyses, ergonomic studies, process flow charts and identification and quantification of wastes from mass balances) may be employed.

Regarding external customers, it is important to identify their needs corresponding to quality and the environment to meet them. Various instruments are available for this task. Among them, the use of companies specialized in market research and internal multidisciplinary groups for the mapping of needs/requirements of customers are taken into account for the application of questionnaires, telemarketing, prototype testing, and interviews.

5.2.5. Operational control

The IMS will have a significant impact on processes, especially those directly related to production, but it will also be strongly influenced by them.

Work instructions must contain detailed technical information for the performance of processes and other activities, and also a clear and succinct explanation about elements related to quality, environment, and occupational health and safety.

Indicators are one of the most effective mechanisms for controlling processes. The process of implementation can be monitored by indicators and, at the end of the implementation, indicators can aid in the identification of deviations related to what was specified. These indicators enable adjustments to be made in the sense of guaranteeing the achievement of objectives and stipulated goals which include possible interventions in equipment, manpower, and specifications/designs.

Indicators that measure IMS performance, considering integrated perspectives of quality, environment and occupational health and safety, should be derived from their main elements such as human resources, suppliers and distributors, core and support activities, financial and market performance, information and society, among others.

5.2.6. Procedures and processes

Three other important integration options are related to preventative action procedures, control of inspecting, measuring, equipment testing, and treatment of non-conformities. Regarding the development of these procedures, elements that consider the three systems discussed in the present study should be inserted whenever possible.

Many preventative actions, such as maintenance, training and measurements, and items related to the inspecting, measuring, testing, control and treatment of non-conformities can be planned according to the needs of the three systems.

An emergency plan that contains elements common to EMS and OHSMS is also noteworthy. Such items as a list of emergency telephone contact numbers and information about the availability and/or sharing of ambulances and fire trucks, escape routes and meeting points can be developed to meet their demands.

5.2.7. Suppliers and supply chain

The integration of the certifiable management systems can and must generate positive consequences related to the activities of the internal and external flow of materials and information in companies.

Internally, a review of the material specifications of the receiving and storage procedures should be conducted. Elements other than the technical aspects that characterize the product should be included in each specification, that is, elements for the evaluation of the physical condition of products delivered, storage instructions that consider an employee's health, environmental preservation, among others.

Externally, integration actions must also be considered in the process of selection, evaluation and classification of suppliers. It is desirable that the suppliers share a concern for quality, environment, and occupational health and safety which can be partly evidenced by the existence of the three certifications. Therefore, companies that have certifiable systems or those that demonstrate them in an alternate manner should be prioritized, with the exception of price issues and production capacity.

5.3. Control and improvement phase of integration

After the planning and development of integration actions for certifiable management systems, it is necessary to proceed with their control and continuous improvement. This process can be undertaken using the following items: verification and comparison of the perception of key elements of the IMS from internal and external customers before and after the process of integration; monitoring, measuring and improving each of the three systems and their integration; internal and external auditing; critical analysis by management; corrective actions; internal competition and incentives for commitment and performance in favor of integration; and integration of the certifiable management systems with other types of systems. These elements are discussed in detail as follows.

5.3.1. Customer perception of the IMS key elements

Monitoring of the evolution of the integration process and opportunities for improvement can be accomplished through verification and comparison of customer perception (internal and external) of certain key elements that comprise the IMS. This verification should be performed before, during and after the integration process; after implementation, the verification should become continuous.

For instance, the degree of integration of the elements presented in item "5.2 − Development phase of integration", and the perception of its importance to customers can be verified.

5.3.2. Monitoring, measuring and improving each of the management systems and their integration

The indicators that monitor integration will allow the control of the processes that were integrated, and will aid in the identification of opportunities for improvement. These steps can be executed through an increase in the intensity of integration and involvement of new processes.

The monitoring and measurement of elements of the IMS must verify their ability to achieve the proposed objectives and pinpoint opportunities for improvement. Deficient items must be the objects of a corrective action plan to mitigate their causes and, consequently, improve the IMS.

5.3.3. Internal and external auditing

Auditing is a procedure used to verify if requirements of the three standards in an integrated or individual manner are fulfilled. These audits must be systematically performed and at regular intervals by competent personnel.

To intensify the inter-relation between these systems, it is suggested that these audits should be performed to simultaneously verify their elements, mainly their integrated aspects.

Management must ensure appropriate conditions for the internal audit to generate the greatest amount of reliable information possible, as this will allow the person responsible for auditing to obtain an accurate sense of the audited sector or process, and will subsidize the improvement actions of the IMS. These conditions include clarifying the importance of the auditing process to the sectors that will be audited and sharing required information (printed, digital and verbal) and physical resources (meeting rooms and computers).

External audits can certify or renew the certification of companies and can also have functions which are similar to internal audits, that is, they can be used for the maintenance and development of the systems and their integration. Even those audits that function for certification can be performed in an integrated manner; this practice is widely used by accredited certification bodies. In general, external audits are more objective in nature than internal audits, but they also have a higher cost.

5.3.4. Critical analysis by management

By corroborating the recommendations of the standards mentioned in the present study, in light of the system's integration, upper management must critically analyze the IMS at regular intervals to ensure its adequacy for organizational objectives, as well as its efficiency and effectiveness.

Opportunities for improvement and the adjustment of the needs of the IMS must be identified in these meetings, including a review of the integrated policy and objectives; training, awareness and expansion of resources (human, technical and financial). These meetings must be guided by work instructions, and records of their results must be generated and stored.

The critical analysis meetings must be supplied with the results of internal and external audits, investigations with internal and external customers and performance indicators from preventative and corrective actions, the results of previous critical analysis meetings, and other recommendations for improvement from alternate channels.

5.3.5. Corrective actions

These are actions that are taken to eliminate the causes of existing non-conformities or undesirable situations related to the three certifiable management systems, and to avoid their future recurrence. The effectiveness of these actions will depend on the degree of assertiveness that corresponds to the identification of those causes. For this reason, it is important that the company employs experienced and qualified personnel to control the main techniques for analysis and problem solving.

The mitigation of these causes can also aid in the solution of similar problems in other sectors or processes, thus, it is important that there is an effective system for the dissemination of information across the entire company.

Careful attention should be given not to confuse corrective action with preventative action. Corrective action avoids the recurrence of non-conformities detected from the elimination of their causes. Preventative action has the objective of eliminating a potential non-conformity. However, the process of analyzing causes of existing non-conformities connected to corrective actions can, directly or indirectly, encourage preventative actions.

5.3.6. Integration with other types of systems

After the integration of systems, it is believed that the processes will be appropriately documented, controlled and will continuously improve in terms of quality, environment and safety. Thus, the foundations are laid for integration with other programs and systems, such as Lean Production, Balanced Score Card, Six Sigma, and Cleaner Production.

For the expansion of this integration, the guidelines suggested in the present study will have to be repeated, but from the point of view of the new systems and programs, that is, the planning activities, development of integration and, finally, the control and improvement of integration of the IMS must be performed again with these new systems and programs.

6. Conclusion

The greatest contribution of the present study is the codifying of guidelines for the integration of certifiable management systems and their customization to the manufacturing environment; other studies examining this subject are more general, without the detailed and specific focus of the present study. As these certifications follow international standards and in general companies have similar difficulties in its implementation and integration, these guidelines can be extended to other realities beyond Brazil.

Integration is justified as a function of the benefits that it provides; certifiable management systems that work separately are more bureaucratic and costly, and generate poorer results than those obtained employing integration.

The presented guidelines are aligned with important studies and sought to include its recommendations and considerer its main limitations. The guidelines were formulated to be appropriate to the companies' culture and organizational structure, as highlights López-Fresno (2010). According to Bamber et al. (2002) and Bernardo et al. (2009), it was also considered the need to tune these guidelines with the hierarchical levels and different sectors of the companies.

However, the present study has limitations that deserve consideration, such as the impracticality of generalizing the results of the case studies. The results were used in this study to develop the elements considered in the theoretical framework and identify good practices, challenges and strategies adopted in the integration of the systems for the studied companies to support the proposed guidelines. Another limitation is that the set of proposed guidelines had not yet been tested.

The following two main difficulties were verified in the present study: the reluctance of companies to release information, even with a guarantee of anonymity and a commitment not to reveal data that could violate this anonymity. Also, an organization that collects information about companies with all three certifications (ISO 9001, 2008, ISO 14001, 2004 and OHSAS 1800, 2007) does not yet exist in Brazil.

The main academic contribution of the present study includes the research, fusion and contraposition of theoretical concepts in the form of scientifically based guidelines. The availability of guidelines for the integration of certifiable management systems adapted to the real needs of industrial companies is emphasized as an applied contribution.

To complementation and evolution of this research, it suggests to other researchers its expansion to other countries through new case studies in order to get contributions to the presented guidelines. The author of this work is available to discuss and establish partnerships with other researchers in order to facilitate expansion of this study.

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