

# **Proposition of conceptual model of Integration Management Systems based on five step of DMAIC approach**

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## **Abstract**

Through this work, we will try at first, to provide a look at the literature to define the concept of integrated management system (IMS) and define the different approaches of study on the topic.

The results for this research confirm the usefulness to potential contribution and the development of a single model of integrated management systems according to the revolutionary DMAIC methodology that integrates a set of tools and techniques designed to achieve the objectives in terms of product quality, health and safety of personnel, and the protection of the working environment.

The integrated management system (IMS) proposed, gathers three aspects and observes the following key standards: quality (ISO 9001), environment (ISO 14001) and occupational health and safety (OHSAS 18001)). The chosen integration is based on a conceptual model governed by a simple and consistent form of generic processes and requirements to be an adaptable model to all types and sectors of business.

## **Keywords**

DMAIC, QSE, Integrated Management Systems.

## **1. Introduction**

By the accelerated social and technological change, increased competition and pressure the company to expand production and management of services, while preserving the environment and workers' health, encourages organizations to remain competitive in their external challenge and look for new ways to improve the organization and management of production systems to move towards success.

With this goal more and more organizations choose to implement management systems called (IMS), which concludes the quality, health, safety and environment management systems, into one unique system that gives him the opportunity to expand and improve its effectiveness.

In the literature, the research on integrated management systems, began simultaneously with the publication of the environmental management system (EMS) in 1996 where a set of guidelines have been proposed which aims to integrate the EMS and QMS. Once the OHSAS was made, the need to consider the three systems have been felt.

Many benefits and motivations are related to the integration of management systems have also been widely studied. For example, some studies (Glen Douglas, 2000; Zutshi and Sohal, 2005; Salomone, 2008, Asif et al., 2009; Khanna, 2010; Simon and al, 2012; Zeng et al, 2011) present the related improvements of an integrated system such as cost savings, operational advantages, better external image, customer satisfaction, improving and maintaining employee motivation.

Despite the many advantages cited, organizations also face some challenges in the integration process (Karapetrovic, 2003). The most mentioned difficulties (Karapetrovic et al., 2006; Zutshi and Sohal, 2005; Asif and al., 2009) are the lack of government support, lack of resources and individual concerns of those involved, are also mentioned by (Karapetrovic and Willborn, 1998; Zutshi and Sohal, 2005; Zeng et al., 2007; Asif et al., 2009).

The existing Management Systems are based on fairly similar approaches to management. For example, the quality management system (ISO 9001: 2015), environment (ISO 14001: 2015) and safety (OSHAS: 2007) follow the so-called "process approach" and are based on the Plan-Do-Check-Act (PDCA), and contain items such as management responsibility, policy, planning, implementation of the system and operation, resource management, product realization, the verification, measurement, analysis and improvement and the management review. To harmonize, align and finally integrate these MS, a generic model compatible with the specific MSS function approaches is required.

The proposed systems approach defines an IMS as a composite of interdependent processes that work harmoniously, sharing the same pool of human and financial resources, material, information, infrastructure and is directed towards achieving the objectives. Under this approach, a company is considered as a single system rather than as a set of specific management for independent function and operational systems. Therefore, MS-specific functions represent different forms of the same system, tailored to meet the specific requirements of various stakeholders.

The framework for the integration of OHS, QMS and EMS in the organization process is designed around DMAIC approach to explicitly stress that the integration of MSs is an iterative process that requires continuous improvement. During the first step towards integration "Define", we can harmonize the contrasting elements of specific function of management systems using the model illustrated systems. For example, goals, policies, objectives and targets related components (such as quality, environment, safety, CSR and others) can be grouped. In the same context, planning and design, acquisition and deployment of resources, the implementation and operation for phase "Measure", as well as elements of analyze and evaluation can be made compatible during phase "Analyze", the improvement and the proposition of the solutions in the "Improve" step and results of communication and management review during Phase "Control".

## **2. Literature review**

### **2.1 Integrated management system**

Many researchers have addressed various topics on the theme of IMS. It may cited the work of Bernardo and al. (2015), Simon et al. (2012), Zeng et al. (2011) and Almeida et al. (2014) on the benefits obtained from the successful integration of MSs. The major obstacles, difficulties and disadvantages regarding the implementation of IMS was a subject focused by the work of Bernardo et al. (2012) and Simon et al. (2012). Karapetrovic (2002), and Karapetrovic Casadesús (2009) and Sampaio et al. (2012) discussed strategies adopted during the implementation of IMS, while the achieved levels of integration were discussed by Bernardo et al. (2011, 2012) and Jørgensen et al. (2006). Throughout the years, models and approaches to integrate MSs have been proposed, among others, by Karapetrovic Willborn (1998), Zeng et al. (2007) and more recently by Bernardo (2014), El Idrissi and al. (2014), Genaro and Loureiro (2015) and Rebelo and al. (2014). The specifics of the audit function were detailed by Beckmerhagen et al. (2003), Bernard et al. (2009), Domingues et al. (2015b) and Kraus and Grosskopf (2008) and lately Kauppila et al. (2015) discussed the major developments and models within IMS and Domingues et al. (2015a) discussed the underlying complexity of IMS (Domingues et al. (2016).

The implementation and certification of quality management systems (ISO 9001), environment (14001) and health and safety (OHSAS 18001) was an important activity for many organizations to light of increasing pressure from their stakeholders, including certification bodies, the community, customers, employees, suppliers and the government. This research topic is particularly relevant, a vast literature has been published in recent years on the field of integrated management systems (IMS). The revisions issued in 2015 both ISO 9001 and ISO 14001, and the one in preparation for the ISO 45001 standard by the end of 2016, describe the common requirements of top management in order to simplify and accelerate synergies with the various management systems.

The research methods adopted by the researchers are either case studies, investigations or transversal analyzes, they serve to experiment some functionalities by specific topics that revolve around the theme of IMS. Among the characteristics studied, can be cited motivations, advantages and disadvantages of integrating management systems, strategies and models adopted, the level of integration achieved and many other subjects. Several models and implementation strategies have been proposed, which led to different levels of integration. In fact, one of the key research questions to be answered is:

**How this integration can be developed to have a more efficient management system, consistent and above all operational?**

## **2.2 Precaution before integration**

Before to prepare for or even before starting the integration process, organizations need to ask a very important question: "Why? Indeed, " why brings out the cause, reason" to proceed with the specified or desired process or system (in this case, the integration of systems such as QMS, EMS and OHS). The answer to "why" question would ensure that the integration decision is correct and if the company already has an existing QMS that would be considered a good basis for progress towards the implementation of the EMS and OHS or and the accreditation process. This is based on the simple fact that most moving companies towards the adoption and implementation of the EMS and OHS have in common, that is, "they all have a quality management system in operation". Furthermore, in the wave of new targets and objectives, organizations must not forget or neglect the balance between "environmental values with the financial and business goals", otherwise conflicts of interests between different departments can result. Regardless of the strategies employed by organizations to integrate their existing management systems, some of the issues that must be considered the first include (Zutshi and Sohal, 2005):

- If the organization follows a simultaneous integration of different management systems?
- If integration will take place in stages?
- How the integration project will be financed?
- The project should be funded for all units at once or in phases, at appropriate intervals? and
- How to organize a cross-functional team that ensures the participation of the various resources of the organization, their representatives, experience, expertise concerns resulting in a balanced team aware of the quality, environmental and OHS systems / standards technical requirements.

## **2.3 Critical success factors of an IMS**

There are several requirements that an organization must consider when a MSS integration of processes. Top management commitment, adequate resources, communication and joint training across the enterprise, customers, workers and certification bodies support (Zeng, Shi, and Lou, 2007) are some of these requirements. Other authors such as (Zutshi and Sohal, 2005), stressed that the organization complexity, the 'closeness' between the environment and OHS system features with the company's business and the fact that issues related to QMS, EMS and OHSMS are, or not included in the same document are other key parameters affecting the success of the integration process (Domingues and al., 2014).

The approach to take before and during the integration process should consider the following issues, as highlighted (Winder, 2000): The availability of an organizational policy, the existence of systemic management, corporate reputation, its market position, its size and resources.

On a survey conducted by the OECD, the following best practices were identified as crucial in the implementation of an IMS:

- Promote an effective continuous improvement in compliance with regulatory requirements;
- Ensure that the system in place is not excessively bureaucratic;
- Ensure an effective internal audit process, selection audit team instead of individual auditors and opt for the value, not for the cost;
- Considering that external audits are not the only source for improvement opportunities (internal audit reports as a precursor of external audits);
- Integration of different processes at the highest level.

Many authors have stressed the relevance of several features, such as: the experience of the team involved, communication between team members, the interface with customers and the inputs provided by the implemented subsystems. Winder (2000) reported that the pillars supporting an IMS are sincere commitment by management, the involvement of all stakeholders, identification of basic management structures, the adoption of a standard hierarchical system, the integration of management activities on organizational capacity planning and vision by top management (Domingues and al., 2014).

## **3. Similarities between the management systems which supports the integration**

For the development of the integration process a careful study of the similarities between the three management systems Quality Safety and Environment requirements is fundamental, analysis of the evolution of these management systems, characterization of the level of integration of the business and the potential relationship between the ISO 9001: 2015, ISO 14001: 2015 and OSHAS: 2007, identification of common needs and areas as well as, the analysis of policies, management manuals, documented procedures, and others, are also fundamental.

Historically, ISO 9001 is the basis for other management standards, such as the environment, safety. For example, the environmental management standard ISO 14001 shares the same approach and the same principles with ISO 9001 (customer focus, leadership management, staff involvement, continuous improvement; the mutually beneficial relations with suppliers ...). Thus, the 2015 version of the ISO 9001 standard aims to improve consistency with other

management systems by adopting the structure called "top-level structure." This is to facilitate the integration of other management systems by adopting a perspective referring to a structure, a common text and common terminology. This structure "high level" or "universal" designated by AFNOR is organized into ten chapters, articulated according to the PDCA cycle. For example, the terminology of the 2015 version of ISO 9001 is evolving to promote compatibility between different themes (quality, environment, safety). In summary, ISO 9001: 2015 is intended to improve consistency between management ISO standards.

The PDCA model provides an iterative process used by organizations to ensure continuous improvement. It can be applied to an environmental management system and / or a health and safety management system at work and to each of its individual elements. It can be briefly described as follows:

- **PLAN**: establish the objectives, programs and processes required to achieve results consistent with the QSE policy of the organization.
- **DO**: implement the process as planned.
- **CHECK**: monitor and measure activities and processes under the QSE policy and objectives, and operational criteria, and reporting results;
- **ACT**: Take actions for continuous improvement of the performance of the QSE system to obtain the desired results

In this context, taking into account the structure of standards the responsibility of management, planning, resource management; implementation of operational activities / control and verification, improvement and management review, the matrix of **Table 1** are presented the requirements of ISO 9001, ISO 14001 and OHSAS 18001, as well as correspondence between them, which makes them compatible with each other and also combine them with the phases of the PDCA method. This matrix helps with orientation and alignment of the organizational structure of the company and at the same time creates a structured and useful reference to support alignment and effective correspondence QSE sub-systems with consequent compatibility between each other for the consistent implementation of a QSE management system. This correspondence matrix can also be made with the Deming cycle in this circumstance for IMS, and a set of steps of chapters ISO standards associated with each phase of the PDCA cycle.

Table 1. Correspondence between the quality, safety and environment management systems

|   |  | <i>ISO 9001</i> | <i>ISO 14001</i> | <i>OHSAS 18001</i> |
|---|--|-----------------|------------------|--------------------|
| <b>PLAN</b>   | <b>Contexte of the organisation</b>                              | <b>4</b>        | <b>4</b>         | —                  |
|   | Understanding the organization & its context                     | 4.1             | 4.1              | —                  |
|   | Understanding the needs & expectations of interested parties     | 4.2             | 4.2              | —                  |
|   | Determining the scope of the integrated management systems       | 4.3             | 4.3              | —                  |
|   | integrated management system and associated processes            | 4.4             | 4.4              | 4.3.4              |
|   | <b>Leadership</b>  | <b>5</b>        | <b>5</b>         | —                  |
|   | Leadership & commitment  | 5.1             | 5.1              | —                  |
|   | QSE policy   | 5.2             | 5.2              | 4.2                |
|   | Organisational roles, responsibilities & authorities             | 5.3             | 5.3              | 4.4.1              |
|   | <b>Planning of IMS</b>   | <b>6</b>        | <b>6</b>         | <b>4.3</b>         |
|   | Actions to address risks & opportunities                         | 6.1             | 6.1              | 4.4                |
|   | QSE objectives & planning to achieve them                        | 6.2             | 6.2              | —                  |
|   | Planning of changes  | 6.3             | —                | —                  |
| <b>DO</b>   | <b>Support</b>   | <b>7</b>        | <b>7</b>         | —                  |
|   | Resources  | 7.1             | 7.1              | —                  |
|   | Competence   | 7.2             | 7.2              | 4.4.2              |
|   | Awareness  | 7.3             | 7.3              | 4.4.2              |
|   | Communication  | 7.4             | 7.4              | 4.4.3              |
|   | Documented information   | 7.5             | 7.5              | 4.4.4              |
|   | Control of documents and data                                    | —               | —                | 4.4.5              |
|   | Records Management   | —               | —                | 4.5.3              |
|   | <b>Operation</b>   | <b>8</b>        | <b>8</b>         | <b>4.4.6</b>       |
|   | Operational planning & control                                   | 8.1             | 8.1              | —                  |
|   | Emergency Preparedness and Response                              | —               | 8.2              | 4.4.7              |
|   | Determination of requirements for products and services          | 8.2             | —                | —                  |
|   | Design and Development of Products and Services                  | 8.3             | —                | —                  |
|   | Control of Externally Provided Products and Services             | 8.4             | —                | —                  |
|   | Production and Service Provision                                 | 8.5             | —                | —                  |
|   | Release of Products and Services                                 | 8.6             | —                | —                  |
|   | Control of Nonconforming Process Outputs, Products, and Services | 8.7             | —                | —                  |
| Determination of requirements for products and services | 8.2  | —               | —                |                    |
| <b>CHECK</b>  | <b>Performance Evaluation</b>                                    | <b>9</b>        | <b>9</b>         | 4.5.1              |
|   | Monitoring, measurement analysis & evaluation                    | 9.1             | 9.1              | 4.5.1              |
|   | Internal Audit   | 9.2             | 9.2              | 4.5.4              |
|   | Management Review  | 9.3             | 9.3              | 4.6                |
| <b>ACT</b>  | <b>Improvement</b>   | <b>10</b>       | <b>10</b>        | —                  |
|   | Generalities   | 10.1            | 10.1             | —                  |
|   | Nonconformity & corrective action                                | 10.2            | 10.2             | 4.5                |
|   | Improvement  | 10.3            | 10.3             | —                  |

#### **4. Proposition of conceptual model of integration based on DMAIC approach**

In the last two decades, the number of international management systems standards (MSS) has grown quickly. Following the introduction of the quality assurance standard ISO 9001 in 1987, standards have been developed for environmental management (ISO 14001), safety and security management (OHSAS 18001), and Social Responsibility (ISO 26000). It is clear that the new standards continue to emerge and existing standards will be subject to periodic updates. Although the choice of MSS to be implemented still depends on particular circumstances faced by the organization, IMS is required to ensure that each is integrated into the corporate strategy of the company.

In view of this, we can see how the field of quality management, environmental management and occupational health and safety have many similarities, including:

The existence of common management principles or fundamentals (process-based approach, focusing on achieving results and continuous improvement).

A similar structure in the standards, based on the continuous improvement cycle (see Figure 1).

These three standards contain the same basic principles and a common general structure. All of them require the definition of roles and responsibilities, to train staff to define written procedures to monitor and keep records of documentation and data, to continuously improve and perform internal audits (Wright, 2000; Zeng et al, 2007).

According to Jorgensen (2004) about 80% of the work is common to all three disciplines:

Quality, environment and health and safety. The similarities between these management systems refer to:

- Top management commitment.
- Definition of a policy.
- Planning of objectives and targets.
- Sensibilization and training of employees.
- Communication procedures.
- Audits.
- Control of non-compliance.
- Corrective and preventive actions.
- Management review.
- Amelioration

These elements allow to build a progressive integration and more wide-ranging of different MSS. So the proposed scheme could be a working repository to support the development and structuring of an IMS.

At the same time, they also establish the whole organization philosophy. (Figure 1)

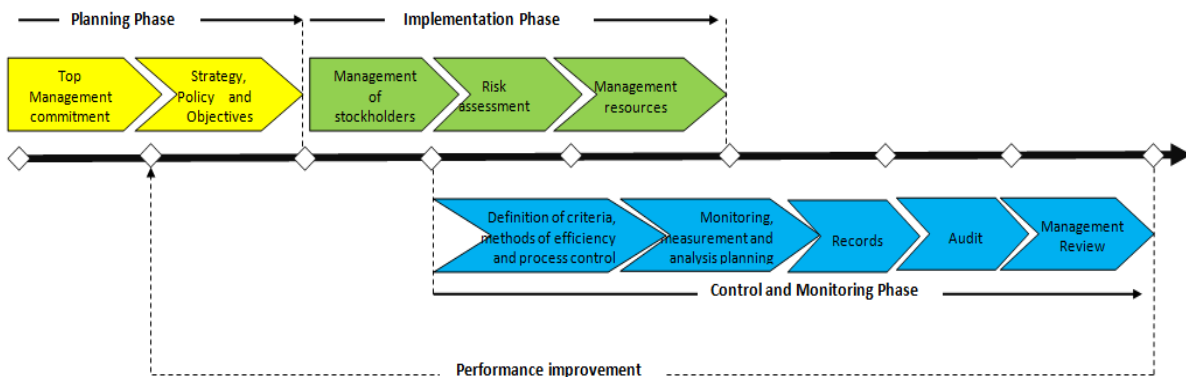


Figure 1. The Key elements of an Integrated Management System

In fact, organizations use different tools and models to integrate their management systems, such as:

- PDCA Cycle
- Process Mapping
- Analysis of common elements between the different management systems

- Either they follow their own specific models

To build a coherent integrated management system, we resort to the use of a structured approach to solving problems that implements a set of appropriate tools to posed situations. However, the application of the DMAIC approach ensures proper guidance process of integration management systems, in other words, this is a process for performing specific activities in a specific order based on the data collected at each step to support decisions, while ensuring that the established solutions and actions taken complies with the requirements of each stage. This approach is often used to balance several objectives, provide the organization with measurable and effective actions, reduce losses and the cost of quality, and improve the brand image of the group.

The DMAIC Six Sigma approach is theoretically applicable to any type of business, regardless of its size and activity. On the other hand every step of the DMAIC specifies a list of useful tools, but none are particularly prescribed, choose those that are most appropriate for the problem in question. The figure below (Figure 2) lists the key QSE tools according to each stage of the DMAIC wheel.

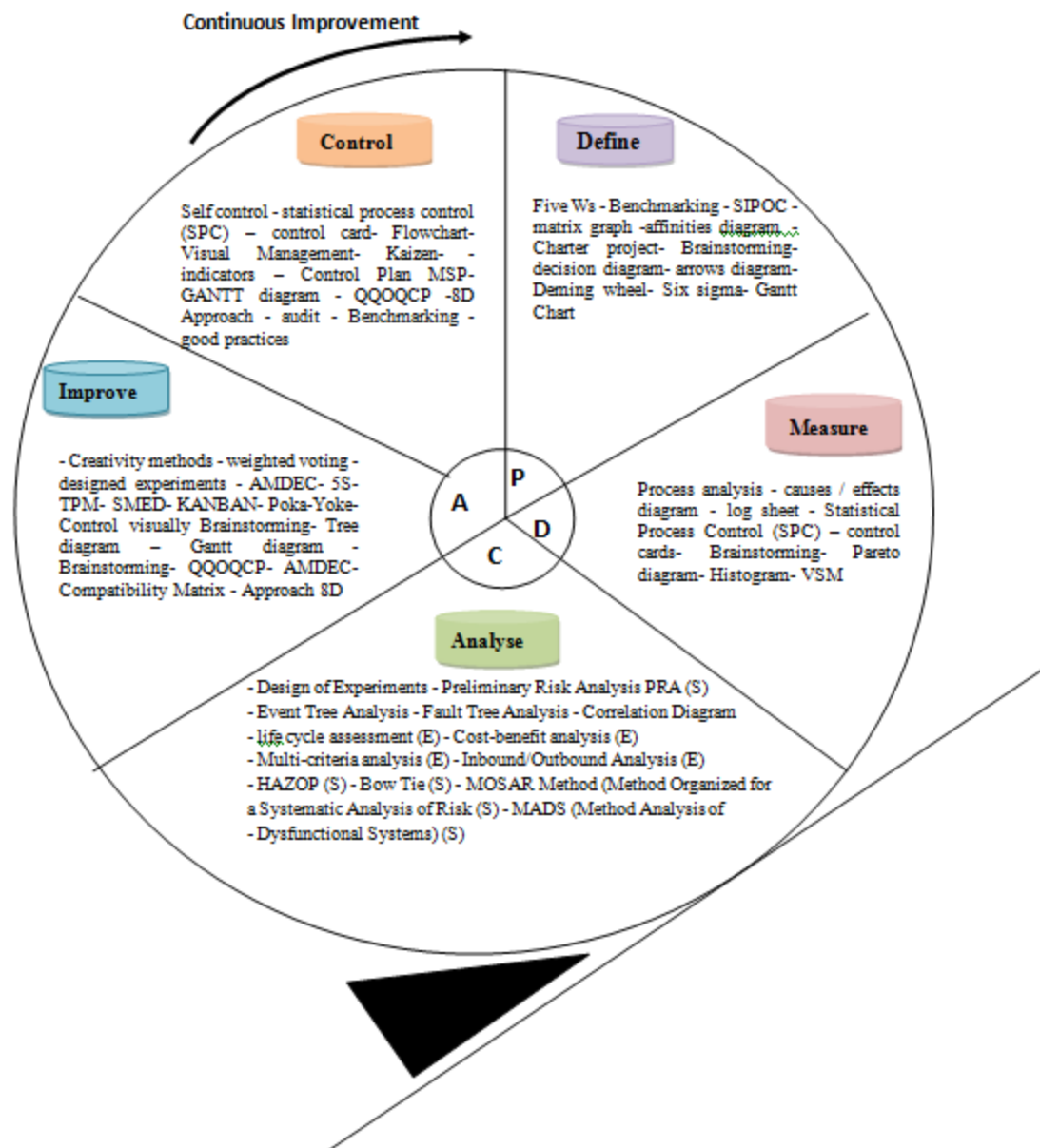


Figure 2. QSE tools according to the DMAIC approach

To move from one step to another, it will validate through a review that the goals of step have been achieved. The strength of Six Sigma is to offer a comprehensive approach including fundamental principles, organization, methods and tools around the same logic centered on the measure.

In addition, DMAIC focuses on evolutionary and continuous improvement in manufacturing or service process. It is almost universally defines the following five phases: Define, Measure, Analyze, Improve and Control.

We propose a process of integration of the three management systems according to the five stages of the DMAIC approach:

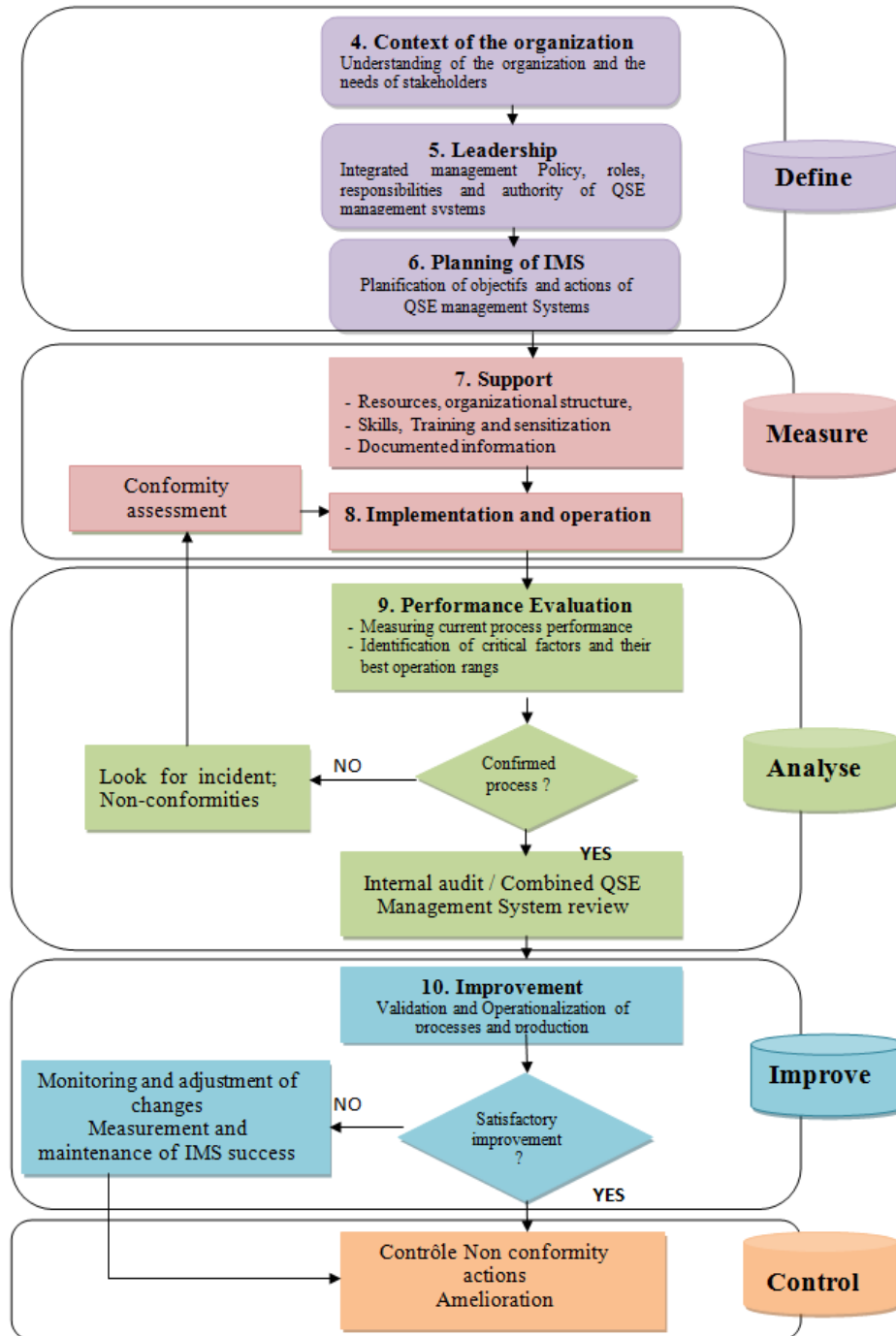


Figure 3. Proposed approach to integration management systems



#### ***D. Define***

The integration process begins with step "**Define**" of the DMAIC approach (see Fig. 3). During this first stage, we are responding to news headlines versions of ISO 9001 and ISO 1400 V2015:

##### ***1. Organizational context***

During this first stage, we conduct a benchmarking study to clarify the issues of the project, identify the customer expectations, shareholders, staff and societal demands, to set goals and to designate the protagonists of the project.

We carry a:

- **External Analysis:** is based on the study of the expectations and needs of the market, it aims to develop a strategic integration policy. It helps position the company relative to its competitors.
- **Internal analysis:** is based on a self-diagnosis of needs, skills, technical, financial and human resources. It helps to understand the current situation and identify the main points of strengths and weaknesses of existing.

##### ***2. Leadership***

The top management must provide the necessary guidelines and the conditions for the organization to achieve success and make it continually improve, should also demonstrate strong commitment and personal involvement to QSE management systems, and determine the implementation activities, appropriate verification and validation at each stage of development of a QSE system. The inclusion of customer requirements and the successful integration of QSE requirements in the specification allows it validated and to guarantee its compliance with specifications.

The organization shall establish, document, implement and maintain the strategy, policy, objectives and targets for QSE and other aspects, the organization must also plan and develop necessary processes for QSE project realization, and should be disclose and communicate at all levels of the organization and to other stakeholders, and continuously improve its effectiveness.

The management should ensure that the Quality, Safety and Environment Policy:

- Is appropriate to the purpose of the organization;
- Includes a commitment to comply with requirements and continually improve the effectiveness of the Quality, Safety and Environment practice;
- Provides a framework for establishing and reviewing quality, Safety and Environment objectives;
- Is implemented, communicated within the organization and available;
- Is reviewed for its continuous adequacy.

##### ***3. Planification/ Planning***

The establishment of a global planning of integration that takes into account both the crossing of the following:

- Identification of key stakeholders and their needs. A detailed analysis, including an assessment of strengths, weaknesses, opportunities and threats
- Determine policy and strategy, common goals
- Determine all the necessary processes during all stages of development from planning, implementation, verification, validation, monitoring
- Assess the risk on the person, on the product and the environment
- Acquire resources and information necessary for the operation, monitoring, measurement and analysis of process
- Ensure good communication throughout the process of realization
- Establish programs or procedures to achieve compliance and security products for people and the environment.
- Programming implementation of the actions necessary to achieve planned results and continuous improvement of processes
- The synergy between the different management systems
- Improving the efficiency and effectiveness of the company
- The elimination of redundancy documentary
- Priority task management by integrating all human resources;
- Identification of regulatory requirements in planning integration tasks
- Taking into account the constraints and difficulties of integration;
- Evaluation of adjusted schedule performance.
- **Risk assessment**

To plan and determine the Quality, Safety, Environment objectives, it is necessary to conduct a risk assessment. The risks in relation organization / stakeholders. They concern the Health Safety at Work, Environment and Quality. The risk assessment process requires the identification of hazards, estimating the severity, probability, negotiation (acceptable or unacceptable risk), the choice of preventive measures and their monitoring. The risk assessment process should be implemented based on the reasoning supported by the MADS model. It will cover the OHSAS 18001 and ISO 14001 as well as all activities that could lead to customer dissatisfaction.

The tools developed for this step are: SIPOC, the project charter and QQQQCP, etc.

### **M. Measure**

The purpose of the Measure phase is to completely understand the current performance and gather sufficient informations, The aim is to determine what is able to provide the concerned process. During this step it is important to focus on the critical parameters for quality, safety and for environment, that is to say, those whose influence on the result is the largest. This phase includes the following steps:

#### **4. Support**

- **Management of resources**

The nature of the resources is very diverse, including human, technical, material or financial.

#### ❖ **Human resources**

Are those who have some influence or interest in the performance of the organization. Their role from the perspective of the organization is a double, suggesting that all stakeholders provide both input to organizational systems and receive the output of these systems. The continued success of the company is ensured by its ability to identify external requirements and convert them in internal specifications, the needs, requirements and expectations of all stakeholders, with priority for current and potential customers, employees and suppliers, in view of their continued and consistent satisfaction

The organization must:

- Ensure that members of its personnel are aware of the relevance and importance of their activities and how they contribute to the Quality Safety Environment objectives;
- Determine the necessary competence for all staff in terms of quality, health safety and environment. These skills must be relevant to the tasks they perform;
- Provide training or take other actions to satisfy these needs;
- Evaluate the effectiveness of actions taken;
- Maintain appropriate records of training and experience; maintain records on the monitoring of professional expertise and professionalism.

#### ❖ **Technical Resources**

The organization shall determine and maintain the infrastructure needed to achieve product conformity, facilities and equipment. Infrastructure includes, as applicable,

- Buildings, workspaces and associated facilities;
- Equipment (both hardware and software) associated with processes, including provided services by external companies;
- Logistical resources (such as transportation and communication).

#### ❖ **Documented information:**

Examine, update as necessary and re-approve required documents for the quality, safety and the environment management system to provide evidence of conformity to requirements and proof of the effective operation of management systems. They must remain legible, readily identifiable and accessible.

#### **5. Implementation and operation**

The realization of the process requires good control of production and service provision. Thus, the company must carry out its activities by checking the availability of information describing the characteristics of the products, the necessary work instructions, appropriate equipment and facilities monitoring and measures. This achievement

highlights the best use of equipment and the implementation of monitoring and measurement activities, products, deliveries and services.

This second phase enabling the realization the adopted QSE strategy. It aims to ensure effective implementation of the management system Quality, Safety and Environment through which the company can achieve the objectives. This implementation is to provide the necessary resources (human, financial, technological, etc.), implementation of the actions, to sensitize staff, to develop a training plan to develop a communication plan taking account staff and external stakeholders.

- **Mapping cause effect relationship**

Prior to the 'Analyze' phase, initial identification of the potential input parameters affecting the response(s) is an important step. Cause-effect diagram (Ishikawa/ Fishbone diagram, pareto diagram) is the most frequently used and easily interpretable visualisation tool that puts together all the potential factors affecting a process. This step provides the basis for relevant data collection and selection of proper data mining techniques for further analysis.

The developed tools for measure and implementation step are, such as: Quality Circle, Statistical Process Control, Priority Matrix for quality management system. MOSAR Method, HAZOP, Critical Task Method for security management system and Cost benefit Analysis, life cycle assessment, multi criteria analysis for environment management system.etc

#### A. Analyze

In this step, it is a quantitative analysis of data using appropriate mathematical and statistical tools, confirm or refute the initial assumptions. At this stage, improvement solutions are proposed in order to respond to objectives.

#### **6. Performance Rating**

- **Definition of criteria, methods of efficiency and process control**

The organization shall establish, document, implement and maintain a management system integrating QSE specific and continuous improvement in the efficiency according to the requirements of this guide, namely:

- Rely on the chapters of Quality, Safety and Environment standards to integrate QSE requirements in the process and ensure a functioning and optimal tracking.
- Based on performance indicators to measure and analyze its processes;
- Rely on its corporate culture to offer efficient actions for continuous improvement.

- **Monitoring, measurement and analysis planning**

The organization shall plan and implement the monitoring, measurement, analysis and needed improvement processes:

- Demonstrate the conformity of the product;
- Demonstrate the conformity of machinery and installations;
- Remove compliance with technical standards relating to working conditions and environmental emissions;
- Ensuring compliance of the QSE integrated management system.
- Continuous improvement in the effectiveness of the QSE integrated management system.
- This shall include determination of applicable methods and tools as well as their field of use.

The organization shall establish and maintain procedures for defining responsibility and authority for the consideration and analysis of nonconformities for taking measures to reduce any possible interference with interested parties and to initiate and conduct corrective and preventive actions.

The use of KPIs to monitor the management processes, their control and continual improvement must be made systematically and guaranteed by the process owners through the active involvement and participation of employees

- **Audit**

The organization shall conduct internal audits at planned intervals. These audits may be conducted, depending on the skills of auditors on quality, safety or environment, separately or jointly manner to determine if the QSE integrated management system:

- Conforms to planned arrangements, the requirements of this guide and QSE requirements established by the organization;
  - Is implemented effectively;
  - Contributes to achieving the QSE policy and objectives of the organization effectively.
- **Management review**

Management Review must also take into account the assessment of opportunities for improvement and the need for change to be made in management system implementation, including policy and objectives and QSE targets. Then, records of management reviews shall be retained. When the Management Review leads to possible changes in policy objectives, QSE targets and other elements of the system, a new cycle begins with the same phases: definition of a new policy, conducting a joint analysis of three management systems, designing a QSE program, setting up a communications program, training and documentation, conducting audits and evaluation of the system during a Management Review.

The management should, at planned intervals, conduct a proper analysis of its integrated management system to ensure that it remains relevant, adequate and efficient. This review shall include assessing opportunities for improvement and reflect updates required by specific regulations and the possible need to modify the integrated management system. These requirements may concern the QSE policy and objectives.

❖ **Input elements of the management review**

They should include information on:

- The results of QSE audits;
- The feedback from stockholders;
- The operation of the physical production system and product conformity and facilities;
- The status of preventive and corrective actions;
- The status of actions from previous management reviews;
- Incidents / accidents QSE statistics;
- The results of the visits of the committees and other control or monitoring bodies;
- QSE selected indicators;
- Recommendations for improvement.

❖ **Output elements of the management review**

They must contain QSE objectives which will be declined in the various decision-making centers. The decisions will be concretely implemented through specific actions. The objectives in question can cover as examples:

- The performance of the Quality Security environment management system;
- Improving the working conditions and skills of personal,
- Product quality related to customer requirements,
- Improving the social responsibility of the company,
- Meeting the requirements of stakeholders;
- Resource requirement

The tools of the analysis phase are numerous, such as: Preliminary Risk Analysis PRA - Event Tree Analysis - Fault Tree Analysis life cycle assessment - Cost-benefit analysis- Multi-criteria analysis - Inbound/Outbound Analysis- HAZOP (S) - Bow Tie, etc.

**I. Improve**

**7. Amelioration**

The proposed solutions to dysfunctions are validated by the project team and the ability of the optimized process is evaluated to ensure their impact. Finally, an action plan detailing the implementation of the solutions must be developed to best manage the changes resulting from the implemented solutions.

- **Operationalization of Processes:**

Manage documentation: Development of an integrated manual, which is a guidance document for the management and provides guidance on how management would achieve its objectives. The integrated manual then gives rise to integrated procedures, which are transversal managers and guides on how to run the business processes in an

integrated manner. Finally, the integration work instructions at the operational level provide operators with details on how to perform a specific task in a manner aligned with organizational objectives.

- **Monitoring and adjustment of changes Measurement and maintenance of IMS success**

Measurement and evaluation are the basis of the item "**Improve**" step. This step focuses on the need for the organization to reflect on the changes made. It also highlights the need for the organization to identify and respond to the challenges in the implementation of the IMS approach. The stadium "Improve" of the DMAIC approach is a key component of organizational improvement faces the changing needs and stakeholder requirements. Measurement and evaluation can be performed in three ways: 1) monitoring using the measures already created, 2) integrated audit, and 3) comparative analysis. A combination of these methods may also be used. The use of performance indicators to monitor the management processes, their control and continual improvement shall be made systematically and guaranteed by the process owners through the active involvement and participation of employees.

The activities they must be made during this stage are:

- Carry out monitoring activities and the measures required to bring proof system and product conformity with its provisions and to requirements.
- The company should develop an internal audit program that takes into account the status and importance of process areas to be audited.
- The realization of periodic reviews of the IMS depending on the availability of data and the type of activity performed by the company (management and / or management reviews).

The company collects and analyzes measurement data performed to demonstrate the suitability and effectiveness of the IMS. It assesses the achievement of previously set objectives and by studying how the opportunities for improving system performance.

Information collected from this analysis should inform the company on various aspects, including: customer satisfaction, conformity with requirements, characteristics and trends of processes and products, opportunities for preventive actions and suppliers

The tools developed for improvement phase, such as: Control Plan, Creative method, internal audit, Design of Experiments, etc

**C. Control**

Control step consists in monitor the new situation, analyze the results and measure the effectiveness of applied solutions, control the process to ensure that the problem is solved and stay on level reached. During this step, we must maintain the benefits gained by standardizing the process. Finally, the financial balance sheet is prepared to quantify the gains.

During this last step, the organization must maintain a continuous improvement, establish procedures for the review and analysis of non-conformities, take measures to reduce potential interference with stakeholders to initiate and conduct corrective actions.

The tools used in this step are:

- The visual management and indicators are used to communicate around goals, to ensure that they are achieved and that they do not drift over time.
- Managing change is used to master change and approve the modifications.

In parallel, there are other tools, methods and management approaches such as training and awareness programs, communication, indicators, and audits, contributing to the development of skills of employees aimed to ensure better involvement in the activities assigned to it, and to establish relationships between personnel, customers and suppliers. Therefore employees feel involved and committed to the progress and success of an integrated approach.

**Conclusion**

This paper contributes to the understanding on how Integrated Management System evolves over time. However, we have been analyzed a multiples studies (Bernardo et al. (2012); Simon et al. (2012); Karapetrovic (2002); Karapetrovic Casadesús (2009); Sampaio and al. (2012); El Idrissi and al. (2014); Genaro and Loureiro (2015) and; Rebelo and al. (2014)) to identify drivers of IMS implementation and factors that influence IMS implementation, we have concluded that the Integration of management systems is considered as a viable organizational approach to cost

reduction, operational improvements, efficient management and utilization of resources, employee motivation, and a means to better compliance to social obligations and requirements of different stakeholders. However difficulties were encountered in implementing (integration of individual management systems and their implementation) due to lack of formal MSS for IMS and unavailability of methodologies for implementing IMS.

We have acquired that the IMS implementation can be facilitated by catalysts such as get the full support of top management, addressing IMS in strategic planning, allocation and prioritization of resources, setting goals, targets and milestones for IMS, involvement of end users in the design and implementation phase, expert support IMS, promoting a teamwork culture, and through employee training.

The results of this review confirm the usefulness to develop own integration model based on a conceptual model governed by a simple and consistent form of generic processes and requirements, following the continuous DMAIC approach, to be an adaptable model to all types and sectors of business. The aim of the IMS model presented in this work is to combine or integrate the different MSS in use in a company. The development, implementation, maintenance and improvement of IMSs in organizations require that they affect human resources with multi-faceted competences.

From this work, we found that the involvement of the DMAIC approach to integrated management systems is a competitive strategy and competitive advantage for any company that wants to improve its quality, to address environmental problems, and ensure the safety of staff. It could provide a basis for continuous improvement for the entire organization. Therefore, the QSE tools should be widely used in everyday progressive measures and should be integrated into the company strategy in order to respond to competitive challenge.

According to the results of our study, it is essential that managers and practitioners become aware of the challenges and barriers of systems integration. If these challenges are not dealt earlier in the process, they can delay the completion of the integration process. Recommendations for IMS management include obtaining senior management commitment; using the implementation and integration of guidelines; with training through the organization in aspects of integration, and last but not least with integrated audits. The implementation of these recommendations can vary from one organization to another, however, it would mean less resistance for organizations that follows them. In addition, having IMSs is particularly important for organizations wishing to move to continuous improvement and business excellence, because it can help organizations effectively address quality, security and the environmental issues more effectively and systematic.

For future research, taking into account the perception of enterprises regarding the benefits of integration evolves over time and answers concerning the difficulties encountered by organizations, it would be interesting to further investigate these results and identify the relationship between integration difficulties and measures of financial performance. Finally, another future line of research could be conducted towards the exploration how the new standards contribute to the integration, how the standards structure impacts integration if they were written in order to facilitate integration.

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