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Integrated quality, environment, food safety, and security management systems using a systemic approach.

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Abstract

The integrated management system (IMS) has been a global concern in recent decades; many theoretical models are developed so as to integrate the most common used systems, such as quality, health and safety, and environment ones. But, a very limited work has been done to integrate, the food safety system to others. The aim of this article is to propose a theoretical model that integrates the four management systems (quality, safety and health, environment and food safety) into a single one based on a functional analysis of the systemic approach. The integrated model is based on the process approach, with the PDCA cycle and a risk-based approach. This model, which is in phase test, will encourage companies, especially in the food sector, to implement multiple management systems.

Keywords: APTE, HLS, IMS, management system, QHSE-FS
Jel Classification Codes.

Introduction

Organizations are increasingly resorting to the implementation and integration of several management systems in order to benefit from certain advantages, such as reducing wastes, improving efficiency [2];cost savings, access to new markets, environmental advantages, and particularly strengthening customer satisfaction (ISO). According to the survey conducted by the ISO organization, in 2014, a

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[2] M. Rocha, C. Searcy, and S. Karapetrovic, "Integrating Sustainable Development into Existing Management Systems," *Total Qual. Manag. Bus. Excell.*, vol. 18, no. 1–2, pp. 83–92, 2007.

number of 1 138 115 agencies are certified ISO 9001, 324 148 are ISO 14001, and 30 500 are ISO 22000.Currently, small and medium enterprises which constitute the majority of companies worldwide, including Algeria, find difficulties in the implementation of ISO standards, especially when they have to integrate several management systems simultaneously.

An integrated management system is a set of related processes that share information about human, financial and infrastructural resources in order to achieve preset objectives, while focusing on the requirements of all stakeholders[1]. This means that there is a harmonization and alignment with the strategies and operations of the organization. To facilitate the integration of different standards simultaneously, within an organization, and to harmonize the format with a precise structure, adaptable to all ISO standards, the *International Organization for Standardization (*ISO) has proposed the high-level structure (HLS). Currently, a lot of work is found in the literature, in relation with the integration of systems using various methods, especially those related to quality (QMS), health and safety (HSE), and environment (EMS) management systems. However, despite the importance of the food safety management system (FSMS), little researches have been done so far on its integration with other standards.
The objective of the present work is to propose a theoretical model based on a functional analysis of the systemic approach for the integrated management system on quality, health and safety, environment and food safety (QHSE-FS) and using the principle of high-level structure (HLS). The fundamental question that deserves to be asked is "*does the Integrated Management System (IMS) facilitate the implementation of four systems simultaneously, and can it meet the needs of different stakeholders (customer, supplier, employees and socio-economic world) within the organization?*" The answer to this question suggests considering two important parameters; the first one is to analyze the internal and external environment and the second one lies within the HLS principle itself. The system chosen is based on a structure of seven (07) items, i.e., the organization context, leadership, planning, support, implementation of operational activities, performance evaluation and improvement. In order to have a harmonious system, some relationships are assumed to exist between these six latter functions, in order to increase the intensity of the process and also to produce more value. These relationships are analyzed by the APTE method, which allows defining the system, its external environment, its basic functions as well as its sub functions related to the delivery of the product/service, and especially to meeting the stakeholders' requirements which the system must satisfy. The proposed model provides a global overview on the functioning of the Integrated Management System (IMS); its application to food companies aims at simplifying the reading and understanding of

[1] W. Willborn, "Integration of quality and environmental management systems concepts Integration of quality and environmental," *TQM Mag.*, vol. 10, no. 3, pp. 204–213, 1998.

different standards by those interested managers; and allows them to integrate different management systems in a unique one, without great difficulty.

1. Literature Review

A system is defined as a "set of interrelated or interacting elements to establish a policy in order to achieve the preset objectives"[1] (ISO9000, 2000). It consists of procedures, processes and resources that are designed to reach the objectives of the organization[2] . According to the ISO guide 72: 2001, a system consists of 6 items, i.e. principle and policy, planning, implementation and operation, performance evaluation, improvement and management review[3] .Presently, companies, especially the small and medium-sized companies, encounter many difficulties in the implementation of ISO standards, one by one. It becomes almost impossible for them to have several independent management systems[4]. their integration is more than necessary. A systemic approach could be the best solution, because it can link the process approach and the PDCA approach, and bring them under one roof. Moreover, in this approach, considering the different functions of the system (quality, health and safety, environment and food security) is of paramount importance, the approach is based on a functional analysis which remains a methodological approach for designing systems, by listing exhaustively all the functional, internal and external relations, which allow one to understand the functioning of the systems.

The concept of integrated management system (IMS) emerged from the publication of the standard ISO 14001. A variety of approaches and strategies then appeared, and this led to the existence of several definitions in the literature. Kara Petrovic and Wilborn (1998) considered similar elements, of the two management systems *QMS* and *EMS*, and integrated them into one single system [5]. A few years later, this model was improved using the systemic approach which was organized around three elements: objectives, processes, and resources[6]. Wilkinson and Dale (2001) suggested a total management approach of quality, structured around seven key elements, i.e. policy, leadership, resources, processes, culture, objectives and

[1] Iso9000, "International Standard Iso," vol. 2000, 2000.

[2] ISO8402, "Quality management and quality assurance -- Vocabulary," 1994.

[3] iso 72, *ISO Guide 72:2001 Lignes directrices pour la justification et l'élaboration de normes de systèmes de management*. 2001.

[4] A. Labodovà, "Implementing integrated management systems using a risk analysis based approach," *J. Clean. Prod.*, vol. 12, no. 6, pp. 571–580, 2004.

[5] W. Willborn, "Integration of quality and environmental management systems concepts Integration of quality and environmental," *TQM Mag.*, vol. 10, no. 3, pp. 204–213, 1998.

[6] S. Karapetrovic and J. Jonker, "Integration of standardized management systems: Searching for a recipe and ingredients," *Total Qual. Manag. Bus. Excell.*, vol. 14, no. 4, pp. 451–459, 2003.

stakeholders[1]. Zeng (2007) proposed a model based on three synergies, i.e. knowledge management, operational processes and deployment of resources, and translation of the objectives towards the horizontal integration of operational processes[2]. In the same year, Kara Petrovic and Rocha (2007) proposed a model organized around seven elements: stakeholders, resources, leadership, processes, values, objectives and results. Their model was based on the systemic approach as well as on the concept of sustainable development[3]. In 2013, Rebelo & al. present seven fundamental components and their corresponding guiding principles and actions were included in the structure of the proposed model: commitment and leadership; strategy, policies and objectives; organizational structure and resources; management of stakeholders (internal and external); risk management; monitoring of processes and products; and assessment, improvement and innovation[4]. In 2014, Idrisi proposes a model of generic processes who integrated four systems of management: quality, health and safety, environment and food safety. The model, with three circular shapes, demonstrates continuous interactions in time and space. The model of Bernado considers three factors : integration of MSS aspect, integration of MSS level and innovation management performance and analyses the relationship among them[5].

From this synthesis, it can be noted that the strategies presented revolved around the systemic approach, Our objective in the present work is to remain in the systemic approach, based on the functional analysis, to describe all the IMS processes while taking into account the food safety system, in addition to the systems of quality, health and safety, and environment.

2. The proposed integrated management system (IMS) model

Many integration models have been developed in literature. In this research, a model is proposed based on the new principle of "HSL" (high-level structure) for

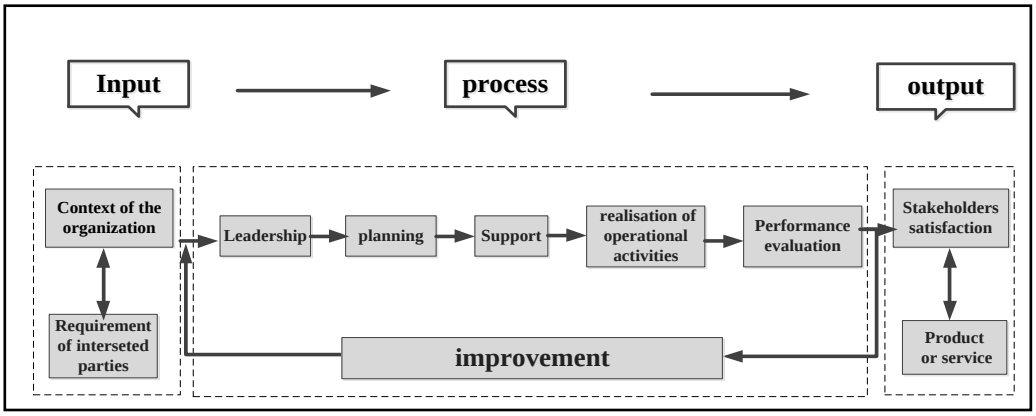
[1] G. Wilkinson, "Perspectives Integrated management systems : a model based on a total quality approach," *Manag. Serv. Qual. An Int. J.*, vol. 11, no. 5, pp. 318–330, 2001.

[2] S. X. Zeng, J. J. Shi, and G. X. Lou, "A synergetic model for implementing an integrated management system: an empirical study in China," *J. Clean. Prod.*, vol. 15, no. 18, pp. 1760–1767,
[3] M. Rocha, C. Searcy, and S. Karapetrovic, "Integrating Sustainable Development into Existing Management Systems," *Total Qual. Manag. Bus. Excell.*, vol. 18, no. 1–2, pp. 83–92, 2007.
[4] M. Rebelo, G. Santos, and R. Silva, "Conception of a flexible integrator and lean model for integrated management systems," *Total Qual. Manag. Bus. Excell.*, vol. 25, no. 6, pp. 683–701, 2013.

[5] M. Bernardo, "Integration of management systems as an innovation: A proposal for a new model," *J. Clean. Prod.*, vol. 82, pp. 132–142, 2014.

the standardization of *future ISO management system standards* .The HLS introduces new concepts :The determination of external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of management system; and ensuring the integration of the management system requirements into the organization's business processes[1]
This would lead to a good compatibility of standards and would also ease their integration and implementation by certified organizations. This model is a cycle of seven requirements, namely the context of the organization, leadership, planning, support, implementation of operational activities, performance assessment and improvement. It follows the process approach, while integrating the PDCA cycle and a risk-based approach. It urges companies, especially those in the food chain, to implant multiple management systems; it also facilitates their deployment using one system. The overall structure of this model is illustrated in Figure 1

Figure 1. Proposed integrated management system (IMS) model



To conduct this research, a functional analysis was performed to define the internal and external relationships and facilitate the implementation of the system (QHSE-FS). This approach is difficult because it must meet the expected theoretical requirements and also face reality, but this difficulty remains an asset since the purpose sought is an interpretative method for the functional analysis of the IMS. The difficulties with the functional analysis lie within the fact that it requires a modeling system [2]. The primary objective of the functional analysis is to provide a guide for the design of a system in conformity with the expression of functional needs. Several functional analysis models, such as SADT, CDCF, MERISE, FAST, and the APTE, have been developed, in various fields. This latter is used in the

[1] ISO/IEC, "Annex SL (normative) Proposals for management system standards," , pp. 131–154, 2012.
[2] G. Zwingelstein, *la maintenance basee sur la fiabilite. Guide pratique d'application de la RCM*. 1996

functional analysis approach of the integrated management system of quality, health and safety, environment and food safety. Gilles ZWINGELSTEIN considers APTE as a method that is "*adapted to the organization and description of the functioning of the organization*"[1]. This method takes place on three stages[2] :

- Research and expression of need "horned beast tool"
- The external functional analysis "diagram of inter-actors"
- The internal functional analysis.

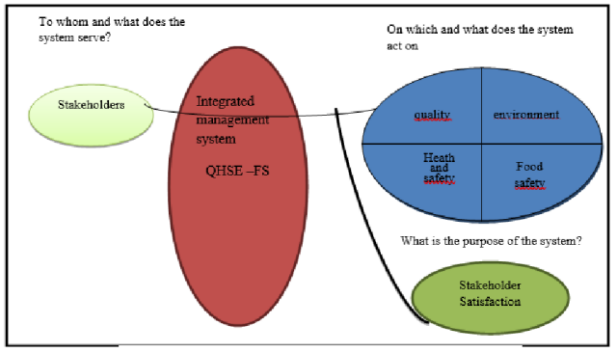
The APTE method is used to give an initial definition of IMS (QHSE-FS), for its purpose and its relationship with its environment. This system relies on the data of quality, health and safety, environment and food safety systems, to manage the objectives of each process in accordance with the organization's strategy. The integrated management system is defined as a set of related processes that share information on human and financial resources, as well as infrastructures, in order to achieve preset objectives, while focusing on the requirements of all stakeholders[3] [19].

2.1 The research and expression of the need.

This first step consists of analyzing the "need" using the "horned beast" tool. To express this need, it is necessary to define the requirements of all actors (stakeholders) involved in our Integrated Management System. This is done by answering the following three questions: To whom and what does the studied system serve? On which and what does the system act? What is the purpose of the system? The following figure 2 describes this functional requirement by positioning the overall function of the Integrated Management system (QHSE -FS)

[1] ibid.
[2] Bertrand de La Bretesche, *La méthode APTE analyse de la valeur, analyse fonctionnelle*, Edition pe. 2000.
[3] W. Willborn, "Integration of quality and environmental management systems concepts Integration of quality and environmental," *TQM Mag.*, vol. 10, no. 3, pp. 204–213, 1998.

Figure 2 :Defining the overall function of the SMI



To answer the first question *"to whom and what does the studied system serve? "*, we must determine the key actors or stakeholders of our IMS. A large number of actors influence the evolution of the system. They are classified into two groups; one is internal and consists of management, employees, and shareholders (owners), and the other is external and comprises customers, suppliers, industry association, labor unions, general public, authorities.

Each of the systems, i.e., QMS, OHSAS, EMS and FSMS, has its own stakeholders. For the sake of integration, the following potential actors (table 2) were selected, as they may act on our IMS.

Table 2 Definition of the interested parties of the IMS

Category	Interested parties
Owners	Manager
User/customer	Customer
User occupant / Customer	Employee
external user / Customer	external interested parties (shareholder, supplier, state, legal company, competitor, non-governmental organizations ...)

Therefore, the main issue in the Integrated Management System (IMS) is to satisfy all the interested parties, by first defining and understanding their requirements which are later transformed into the main objectives of the organization. In our approach, the IMS entrants are supposed to have a strong bond between them. When each system is taken separately, it is found that it is based on one or two elements of the interested parties, and tries to satisfy them. For example, when the

QMS focuses on customers in the first place, the OHS centers on finding a work place with zero accidents.

In our Integrated Management System, it is assumed that the organization must determine the internal and external issues related to quality, health and safety, environment and food security, and then monitor and review the information relating to these issues. This must be followed by determining and understanding the requirements of all interested parties (Clauses 4.1 and 4.2 of ISO 9001: 2015, and ISO 14001: 2015, 4.3.2 of OHSAS 18001: 2007). Then, the organization should determine the limits and applicability of the IMS in order to define its field of application (4.3 of ISO 9001 and ISO 14001; 4.1 of ISO 22000 and OHSAS 18001), based on the issues and requirements previously established. Finally, in the IMS, the organization shall determine, implement, update and continually improve its integrated system. (4.4 of ISO 9001: 2015 and ISO 14001: 2015; 4.1 and 4.2 of ISO 22000: 2005 and 4.1 of OHSAS 18001: 2007)

To answer the second question, *"on which and what does the system act?"*, one must first understand the concepts of quality, health and safety, environment, and food safety, next see how each management system (QMS, EMS, OHS, FSMS) works, and finally how to apply them all at once to achieve their complete integration knowing that the integrated management system (IMS) is the result of merging these four systems to meet the requirements of all interested parties. The study of the environment of the IMS completes this first typological interpretation.

The answer to the third question "*What is the purpose of the system*?" consists of defining the purpose of the system as well as its objectives. To this end, one must analyze the requirements of all interested parties. The organization establishes an integrated management system not only to enjoy its benefits (cost, deadline ...) but also to satisfy all interested parties, which is not easy. The difficulty in defining the purpose of the IMS is due to the multiplicity of stakeholders and the changes in the external environment of the organization. Indeed, the objectives of the system are determined by the stakeholders and its effectiveness is measured through their satisfaction. This satisfaction generally comes from the perception of the offer which results from the comparison between this perception and the expectations of stakeholders with regard to this offer[1].

Literature is full of models to evaluate the requirements of the interested parties constituting the company's performance indicators[2]. The Atkinson model, which

[1] B. Bartikowski, "La satisfaction des clients dans les services : une vue situationnelle du poids fluctuant des éléments," *Cah. Rech. n°542, Univ. droit, d'économie des Sci. d'Aix-Marseille, Inst. d'Administration des Entrep. Cent. d'études Rech. sur les Organ. la Gest.*, p. 48, 1999.

[2] A. Neely, "Business Performance Measurement: Theory and Practice," *J. Chem. Inf. Model.*, vol. 53, no. 9, pp. 1689–1699, 2002.

defines two types of objectives (primary and secondary), considers that stakeholders compose themselves the dimension. Their respective objectives are the criteria that are measured by performance indicators. In the Neely performance prism model, the successful organization achieves its objectives by satisfying the expectations of its stakeholders, while ensuring efficiency and effectiveness. This performance prism consists of five dimensions: (1) stakeholders' satisfaction, which determines the most important expectations of stakeholders, (2) stakeholders' contribution, which determines what the organization expects from stakeholders, (3) strategies to be established in order to satisfy the stakeholders (4) the process that allows the organization to implement its strategies, and (5) the means that the organization must provide so that the process works. The BSC (Balance Score Card) model formulates the overall performance of the organization in four perspectives: (1) financial, (2) customer, (3) internal business processes, and (4) learning and growth. The following table summarizes some of the performance indicators of the stakeholders concerned.

Table 3. Performance indicators of the interested parties

	Atkinson model	BSC	Performance Prism
Shareholders	**Primary measure:** * Return on investment of Shareholders **secondary measure** * Revenue growth * Spending Growth *Productivity * Capital Ratio * Liquidity Ratio * Asset Quality Ratio	Growth in turnover Cost reduction Improved profitability	Return on Investment
The customer	**primary measure** * Customer satisfaction (quality, health and safety, environment and food safety) **econdary measure** Survey of customers for different markets / products	Market share Number of New Clients Segment Rate of Return	Quick delivery, competitive prices and quality
The employee	**primary measure** * Employee Engagement * Employee Skills	Labour productivity Motivation Turnover	Loyalty, flexibility, productivity and creativity

	* Employee productivity **secondary measure** * Opinion Survey employees * Index on various customer service elements * Financial ratios employee cost by different income classifications	* Quality of information (reliability and relevance)	
The community	**primary measure** * Public Image **secondary measure** * Various external investigations	* Product quality * Manufacturing delays * Number of patents * Number of New Products * Quality of customer service	* Profitability relative to competitors

The elements of KPI (key performance indicator) are those byes one of the model presented on table 3, These KPIs are evaluate the organization's progress towards the vision and realization of the defined objectives.

3.2 The external and internal functional analysis of the IMS

The functions of the integrated management system characterize the processes that govern the system of QMS, OHS, EMS and FSMS. These functions are derived from the requirements which are defined according to the HLS philosophy, i.e., leadership, planning, support, implementation of operational activities, performance evaluation and improvement. They are derived from the PAS 99: 2012 guide, the ISO 9001: 2015 and the ISO 14001: 2015. The following table summarizes all the theoretical studies that justify our choice for the process.

3.2.1 Leadership The leadership consists of leading a group of people to accomplish a task or to reach an objective through various means. According to the proposed model, the "leadership" receives its inputs from the definition and the understanding of the requirements of the interested parties, from the organization and its context to turn them into actions that are necessary for the planning (next step). In this step, the "leadership" function consists of three (03) sub-functions: **(1) leadership and commitment** (5.1 in ISO 9001: 2015 and ISO 14001: 2015). In standard OHSAS 18001: 2007, it is not directly referred to leadership and commitment of management; a small mention is included in clause (4.4.1, item a). Finally, in ISO 22000: 2003, the commitment of management is clearly mentioned in clause (5.1)), **(2) establishment and communication of a policy of quality, health and safety, environment and food safety** (5.2 in ISO 9001: 2015 and ISO 14001: 2015, 4.2 in OHSAS 18001: 2007 and 5.2 in ISO 22000: 2003), and **(3)**

roles, responsibilities and authorities (5.3 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.1.b in OHSAS 18001: 2007 and 5.4.5.5 in ISO 22000: 2003).

3.2.2 Planning.The planning data must be collected from the "leadership" outputs; these are leadership and commitment, policy and roles, responsibilities and authorities, which are themselves defined while respecting the organization and its context, as well as the interested parties' requirements. Planning shall be done in two stages. One has first to determine the risks, dangers and opportunities, then to think of appropriate actions to address them, while establishing objectives for quality, health and safety, environment and food safety. Appropriate measures should be undertaken to achieve these objectives. Finally, if any changes need to be introduced in the system, they should be carefully planned. From there, one considers that the "planning" function should include three (03) sub-functions: **(1) implementation of actions against risks, dangers and opportunities** (6.1 in ISO 9001: 2015 and ISO 14001: 2015, 4.3.1 in OHSAS 18001: 2007, and 5.3 in ISO 22000: 2003). **(2) establishing objectives for quality, health and safety, environment and food safety, and also planning actions to achieve these objectives** (6.2 in ISO 9001: 2015 and ISO 14001: 2015, 4.3.3 in OHSAS 18001: 2007, and no mention in ISO 22000: 2003), and **(3) planning changes** (6.3 in ISO 9001: 2015, 6.1.2 in ISO 14001: 2015, 4.3.1 and 4.4.6 explicitly noted in OHSAS 18001: 2007, and 5.3.b in ISO 22000: 2003).

3.2.3 Support of the IMS For the system to be properly implemented, it must be supported along its life cycle. Human and material resources are required for a successful system. Human resources should be managed, trained and motivated for a good implementation. Material or infrastructural resources, such as buildings, equipment's, must be 4.2 and 7.7 in ISO 22000: 2003). available in the organization. According to the principle of HLS, the "support" function may be divided to five (05) sub-functions: **(1) identification and availability of resources (human and material),** (7.1 in ISO 9001: 2015 and ISO 14001 : 2015, 4.4.1 in OHSAS 18001: 2007, and 6.1 in ISO 22000: 2003), **(2) determination of competencies** (7.2 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.2 in OHSAS 18001: 2007 and 6.2.2 in ISO 22000: 2003), **(3) sensitizing employees** (7.3 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.2 in OHSAS 18001: 2007 and 6.2. 2 in ISO 22000: 2003, **(4) the needs for internal and external communication** (7.4 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.3 in OHSAS 18001: 2007 and 5.6 in ISO 22000: 2003 and **(5) documenting information** (7.5 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.4 and 4.4.5 in OHSAS 18001: 2007.

3.2.4 Implementation of operational activities in the IMS: This section discusses the implementation of the processes necessary for the supply of products and provision of services. According to the HLS principle, the "operability" function can be divided in seven (07) sub-functions: **(1)operational planning and**

control, (8.1 in ISO 9001: 2015 and ISO 14001: 2015, 4.4.6 in OHSAS 18001: 2007, and 7.1 in ISO 22000: 2003), **(2) requirements for goods and services** (8.2 in ISO 9001: 2015 and 8.1 in the ISO 14001: 2015, 4.3.2 in OHSAS 18001: 2007 and 7.2 in ISO 22000: 2003), **(3) design and product development** (8.3 in ISO 9001: 2015 and 8.1.a in ISO 14001: 2015, 4.4.6 in OHSAS 18001: 2007 and 7.3 in ISO 22000: 2003), **(4)control of processes, products and services supplied by external providers** (8.4 in ISO 9001: 2015 and 8.1.c in ISO 14001: 2015, 4.4.6 OHSAS in 18001: 2007 and 7.3.3 in ISO 22000: 2003), **(5) production** (8.5 in ISO 9001: 2015 and 8.1 in ISO 14001: 2015, 4.4.6 in OHSAS 18001: 2007 and in 7.2.2 ISO 22000: 2003), **(6) release of products** (8.6 in ISO 9001: 2015 and 8.1 in the ISO 14001: 2015, 4.5.2 in OHSAS 18001: 2007 and 4.2.3 in ISO 22000: 2003), **(7**) non-conforming products and response to emergencies (8.7 in ISO 9001: 2015 and 8.2 in ISO 14001: 2015, 4.4.7 in OHSAS 18001: 2007 and 7.10 in ISO 22000: 2003).

3.2.5 Evaluation of the performance of the IMS :Several concepts and numerous variables to measure performance are found in the literature. Neely (1999) defined performance as "the set of indicators used to measure the efficiency level and the effectiveness of the action carried out by employees within the company"[1]. Mathe and Chague (1999) defined performance measurement using two criteria, namely effectiveness and efficiency[2]. Standards establish performance measurements in order to facilitate the verification of each system. The report written after the performance evaluation will be shared within the organization. The PDCA cycle can be used for three levels of performance (ISO 9000):

1) Maintenance: take measures to maintain performance at current levels while reaching the objectives;
2) Improvement: take steps to improve performance, while meeting or exceeding the objectives;
3) Innovation: take actions to fundamentally transform performance, by generating and using new knowledge.

In this section, the "performance evaluation" function is divided into three (03) sub-functions**: (1) supervision, measurement, analysis and evaluation,** (9.1 in ISO 9001: 2015 and ISO 14001: 2015, 4.5.1 and 4.5.2 in OHSAS 18001: 2007, and 7.6.4 and 8.4.2 in ISO 22000: 2003), **(2) internal audit** (9.2 in ISO 9001: 2015 and ISO 14001: 2015 , 4.5.5 in OHSAS 18001: 2007 and 8.4.1 in ISO 22000: 2003), and **(3) top management review** (9.3 in ISO 9001: 2015 and ISO 14001: 2015, 4.6 in OHSAS 18001: in 2007 and 5.8 in ISO 22000: 2003).

[1] A. Neely, "Business Performance Measurement: Theory and Practice," *J. Chem. Inf. Model.*, vol. 53, no. 9, pp. 1689–1699, 2002.
[2] Mathé, J.-C. and V. Chagué (1999). "L'intention stratégique et les divers types de performance de l'entreprise." Revue Française de Gestion: 39-49

3.2.6. Improving the Integrated Management System (IMS): To ensure continuous improvement, an official mechanism must be established for all employees. It contains their recommendations, concerns, and ways to improve each step in the continuous improvement system. It provides a way to identify the non-conforming conditions and trigger a preventive and corrective action. A process analysis must be done at all levels of the organization to measure and improve quality, health and safety, environment, and security of food products. Designing an improvement system involves three (03) main functions: **(1) identification of improvement opportunities and implementation of actions to achieve results**, (10.1 in ISO 9001: 2015 and ISO 14001: 2015, 4.5.1 and 4.5.3.1 in OHSAS 18001: 2007, and 8.5 in ISO 22000: 2003), **(2**) **non-conforming and corrective action** (10.2 in ISO 9001: 2015 and ISO 14001: 2015, 4.5.3.2 in OHSAS 18001: 2007 and 7.10 in ISO 22000: 2003), and **(3) continuous improvement** (10.3 in ISO 9001: 2015 and ISO 14001: 2015, 4.1 in OHSAS 18001: 2007 and 8.5.1 in ISO 22000: 2003).

Figures 2 to 7show the graphical representation of the six functions and their sub-functions used in the IMS model

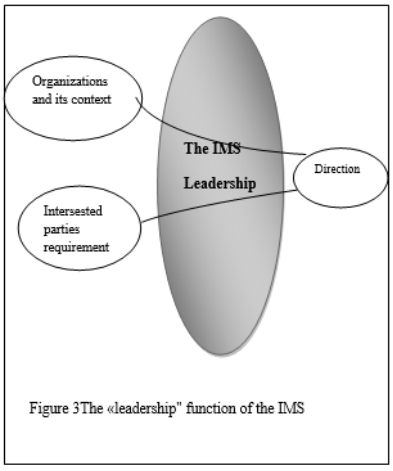


Figure 3The «leadership" function of the IMS

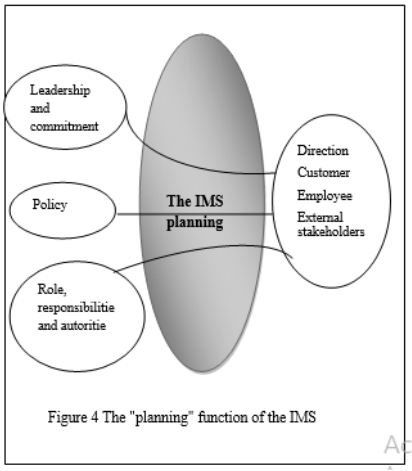


Figure 4 The "planning" function of the IMS

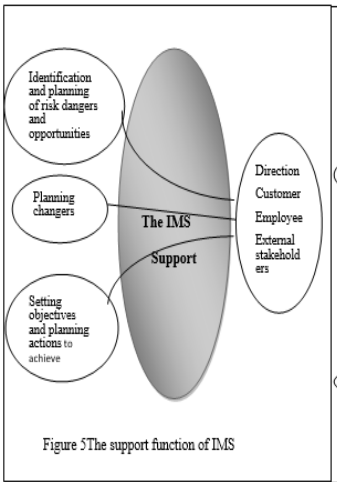


Figure 5The support function of IMS

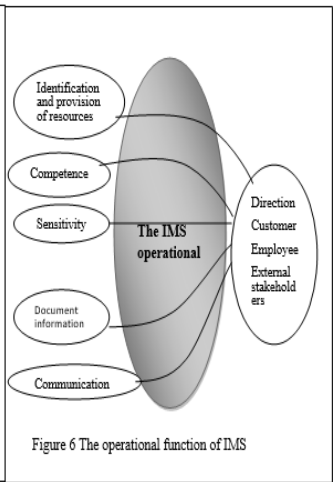


Figure 6 The operational function of IMS

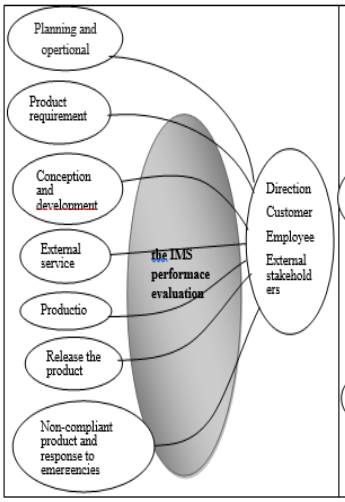


Figure 7 The performance evaluation function of IMS

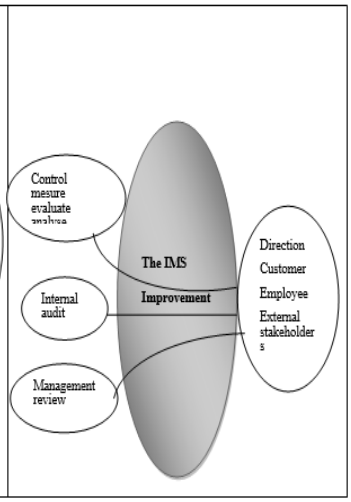


Figure 8 The improvement function of IMS

The literature review provided a theoretical foundation for this study. The questionnaire surveys and statistical analyses will provide many insights into the application (totally or partially) of the IMS within companies and its contribution to possibly improve the performance of all type of companies, in general and the Algerian ones in particular. Thus, the defined theoretical model is currently in experimental phase, it will be tested by surveys to be carried out with the collaboration of some Algerian companies, even though it can also be tested in any other companies in the world.

Conclusion

Organizations increasingly resort to the implementation and integration of multiple management systems in order to benefit from certain advantages such increase in operational efficiency by harmonizing organizational structures with similar elements and sharing information across, alignment of objectives, processes,

resources in different areas, time saving, reduce risks. Currently, small and medium-sized companies which form the majority of companies worldwide, including in Algeria, have great difficulties in implementing the ISO standards, especially when it comes to integrating several management systems.

The concept, a system of systems, is the ideal solution for developing multiple management systems. In this work, an attempt is made to integrate the food safety management system (FSMS) into management systems of quality, health and safety and environment (QHSE-FS), based on a functional analysis of the systemic approach. The theoretical model proposed in this document will help organizations and practices to implement the new version the ISO9001:2015 and ISO 14001:2015 with the old version OHSAS 18001:2007 and ISO22000:2005, to satisfy the interested parties. A functional analysis is developed, using the APTE method, to describe the IMS process by giving an overview of the IMS entries through the identification of the requirements of the four management systems (QMS, EMS, OHS and FSMS) and integrate them into one single system to ultimately see its effectiveness by measuring the interested parties' satisfaction (customer, supplier, employees, legitimate corporation). The integrated model is established based on the new principle of High-Level Structure (HLS) for the standardization of the future ISO standards of the management system. The approach of HSL allows the organization to better meet the needs of stakeholders. This leads to good compatibility between standards; it also helps to integrate and implement them by certified organizations (see table 13). The proposed model is a cycle of six requirements (leadership, planning, support, implementation of operational activities, performance evaluation and improvement), in addition to the inputs (organization and its context; definition of requirements) and output satisfaction of interested parties). This model follows the approach process while integrating the PDCA cycle and a risk-based approach. It will encourage companies, especially in the field of food, to develop multiple management systems; it will also facilitate their distribution using only one system. The principal limitation of our research is in its theoretical nature. But this theoretical part will be followed by an experimental phase, which is ongoing and where the proposed model will be tested by surveys to be carried out with the collaboration of some Algerian companies in general and particularly the region of Telemen city. Results will be evaluated and recommendations will be given to improve the implementation of different management systems.

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