Handbook of Research on Strategic Innovation Management for Improved Competitive Advantage

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Chapter 27
Challenges of the Implementation of Research, Development, and Innovation Standards: A Case Study From a Glass Bottle Manufacturer

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ABSTRACT

This chapter analyzes the challenges faced by a glass bottle manufacturer when incorporating the research, development, and innovation (RDI) standards into the firm's integrated management systems. Based on a case study, this chapter explores how the firm managed to incorporate the new standards into the already set of integrated management system based on the ISO 9001, ISO 14001, and OHSAS 18001 standards that the firm has managed to internalize in its continuous improvement process. In order to incorporate this new RDI management system, the firm developed a set of three procedures that involve an ideas management and opportunity evaluation procedure, a production knowledge interface management procedure, and an RDI project management system. These three procedures are now internalized as part of the integrated management system.

INTRODUCTION

International competitiveness has forced many businesses to develop their intrinsic potential investing in the continuous improvement of their products and processes, in order to face the relentless challenges of a global changing context (Ribau, Moreira, & Raposo, 2017).

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Innovation is a key differentiation factor companies employ to improve their products/services and/or to increase their operational efficiency, so that they strengthen their competitiveness and increase customer satisfaction (Moreira, & Karachun, 2014).

Integrated management systems have normally been used for businesses to augment their competitive advantage. This integrated management systems have been incorporating quality (ISO 9001), environmental (ISO 14001) and safety standards (OHSAS 18001), sharing principles and management techniques. All of them have one target in common: continuous improvement (Zeng, Xie, Tam, & Shen, 2011; Sampaio, Saraiva, & Domingues, 2012).

The process of integrating new standards in the management systems has been troublesome for some companies as some tasks and challenges are brand new and some other are overlapping (Karapetrovič & Jonker, 2003). The incorporation of research, development and innovation (RDI) standards (NP 4457) into the integrated management systems has not been either an easy task. As such, this chapter addresses the study and elaboration of the procedures involved in the implementation of the standard NP 4457, in the integrated management system (IMS) of a glass bottle producing company.

In this work, the ISO 9001, ISO 14001 and OHSAS 18001 standards are addressed as part of the company's IMS. As they share common management principles and techniques, the incorporation of the new RDI standards (NP 4457:2007) is going to be analyzed.

Based on the company's IMS, the incorporation of the new RDI management system is analyzed and three new procedures created explaining: new ideas management and opportunity assessment; interface and production knowledge management; and RDI project management.

This work is organized in six sections. After the introduction, which involves the first section, the second section is presented addressing the literature review both on innovation and Integrated Management Systems. It encompasses RDI activities and the importance of the incorporation of a RDI management system. The third section addresses quality (ISO 9001), environmental (ISO 14001) and safety standards (OHSAS 18001) and the incorporation of the RDI management system (NP 4457:2007) as part of an IMS, as well as all related concepts, strategies, methodologies and motivations behind integrated management systems.

The fourth section deals with the presentation of the case study, involving the integration of the different management systems, and section five addresses the description of the new procedures, actions and contributions of the integration of the NP 4457. The chapter finishes with the conclusion in section six.

INNOVATION

Innovation and quality are receiving more importance as competitive and differentiation factors among competitors are becoming an important part of many management processes. In the recent context of globalization, businesses must have the capacity to innovate in order to maintain their competitiveness. On the other hand, quality management systems have an important administrative role in today's businesses, as an organizational change vehicle (Zeng et al., 2011).

As Moreira (2011) refers, innovation is a key factor to improve the competitiveness of the institutions. However, the concept of innovation has been analyzed abusively to talk about products, services, processes and values (Dantas & Moreira, 2011) without taking into consideration the multidisciplinary and systemic perspective that have characterized a more embracing usefulness of innovation (Volberda, Van Den Bosch, & Heij, 2013).

According to Moreira and Karachun (2014), without continuous product innovation, businesses run serious risks of succumbing; only those capable of growing in the long-term can become specialists in the process of innovating and creating new products.

The success of an innovation does not reside on being successful in a short term period, but in its capacity of contributing consistently for a sustained growth, supported by a continuous adaptation (Dantas & Moreira, 2011).

There is no innovation without change. Before an organization initiates the process of creating new products or adopting new quality management standards, it is necessary to understand the importance of the change process. In fact, change favors innovation and innovative firms tend to progress with change and face it as an opportunity to create new products or to alter the organization itself (Camisón & Villar-López, 2014; Moreira, & Karachun, 2014).

One of the most important tasks of an innovation strategy is related to its capacity to create or react to change, in order to contribute to continuous improvement (Moreira, & Karachun, 2014).

The Oslo manual (OECD, 1997) clarifies some conceptual aspects about the various types of innovation. One of the broader concepts of innovation is presented by Schumpeter (1934) that defines it as: a) the introduction of a new product or a qualitative change in an existing product; b) process innovation new to an industry; c) the opening of a new market; d) development of new sources of supply for raw materials or other inputs; and e) changes in industrial organization.

Newness, creativity, invention and diffusion are behind the concept of innovation, being defined by the European Commission (1995) as:

- The renovation and expansion of the range of products and/or services;
- The creation of new production methods, new sourcing activities and new distribution methods;
- The introduction of management changes in organization of the company, and also in the workers qualifications.

Clearly, in this definition the concept of innovation is structured around three principal blocks: products, processes and organizations, although the last two are frequently ignored because most of the time they are associated to product innovation.

Businesses, in general, try to manage their innovation process in order to find the best solutions for the continuous improvement of their products.

The processes of RDI encompass human resources and organizational change. Business innovation can be found in new products, new processes, new management systems, new ways of advertising to clients, among others (Dantas & Moreira, 2011).

Innovation is not only the production of new products or the adoption of new technologies (Dantas & Moreira, 2011). It is also a dynamic attitude before life and the capacity to assume challenges and to overcome them. In a world in constant change, innovation shows up and is encountered as a source of constant opportunities for new products and new processes.

Innovation arises in today's world as the power that makes it possible to decrease costs, differentiate products and services, enlarge market niches, and to tune up with market demand, in a long-term perspective, where the supply ends up creating the demand (Moreira & Karachun, 2014).

On the other hand, the underlying concept of innovation is approached as a mechanism able to create wealth, which impact and utility result in benefits for the organization and the society (Camisón & Villar-López, 2014).

The last goal when implementing an innovation management system, which is evaluated during the certification process, is the continuous improvement of the company's innovative performance, visible by the improvement of their results or by the incorporation of the knowledge gained during the activities that led to innovation.

Innovation has an important role at several levels:

- In introducing changes in organizational strategy and in the means used to materialize the strategy;
- In the renovation and/or enlargement of the range of products, services and markets;
- In development of new production processes, as well as in all the operational processes that can be critical for an organization.

Organizations with more competitive advantages are normally very innovative, namely in the introduction of new products and new market segments and in the modification of existing products (Moreira & Karachun, 2014). However, for this to be effectively achieved, there are certain conditions that have to be satisfied (Mosey, Clare, & Woodcock, 2002):

- The adoption of a multifunctional perspective when it comes to developing new products;
- The effective communication of this type of decisions to the whole organization;
- Internalizing market and competitor knowledge;
- The development of long-term strategic plans.

The advance of globalization and the consequent increase of competitiveness made it easier for innovations to be driven to the market. In this sense, various authors have been studying this theme and constructing theories that help understand and develop the concept within the organizations.

Dosi (1988) approaches innovation as being linked to demand, discovery, experimentation and adoption of new products, production processes and forms of organization. Continuously, companies are stimulated by clients and by competitors themselves to create something new to present or some sort of enhancement that creates more aggregated value to an existing product.

Taking into account the big diversity of work about this theme, there are two distinct types of innovation (Moreira, 2011). In this perspective, innovation has been usually classified as incremental and radical:

- Incremental innovation refers to linear innovation, where a basic concept is reinforced by continuous improvements, looking for the perfection of something that already exists. Basically, they are little changes of style, performance or shape. This process is known as continuous or incremental, when it refers only to the addition of a new function to a product or service so that it becomes more attractive to the market. The continuous innovations refer to modifications or extensions of already existing products, with which the consumer is already accustomed to.
- In turn, radical innovation is understood as a non-linear innovation, from where new concepts emerge, causing a disruption with traditional practices. This fact significantly alters consumer behavior patterns, knowing that it is the result of specific and deliberated research practices in research and development (R&D) laboratories, in universities, as well as in governmental institutions and in businesses. This type of innovation transforms the way we think and use a product/service.

Organizational and management innovations normally are non-technological innovations, only being included if they are a part of a technological innovation project (OECD, 1997).

Since the 1980s, quality management has assumed a transversal character at organizational level, introducing new business values: client satisfaction, the prevention of the occurrence of problems and the continuous improvement of performance. This new approach has been transforming business management and has been identified as Total Quality Management (TQM). In a gradual form, TQM has been used as an approach capable of guaranteeing the improvement of the business performance, leading to significant improvements of productivity and competitiveness (Mefford, 1991).

The relationship between innovation and quality is not new. However, there is a lack of consensus. Hoang, Igel, and Laosirihongthong (2006) demonstrate that the relationship between quality management practices and product innovation is positive. Gupta (2017) defends that the integration of Quality and Innovation practices are conducive to foster company growth and performance and sustainable competitive power. However, the balance between improved quality and more innovative ideas is not simple as quality is generally about conformance to standards whereas innovative activities are normally targeted at breaking new grounds and creating new products, services and processes (Ng & Ang, 2011). This ambiguous relationship – organizationally, operationally and culturally – is somehow difficult to manage (Steiber & Alänge, 2003).

Palm, Lilja, and Wiklund (2016) summarize the three possible relations between innovation management and quality management as: conflicting, when quality management affects innovation negatively; synergetic, when quality management affects innovation positively, and ambiguous, when quality management affects innovation both positively and negatively. Clearly, there are company-context factors that influence this relationship.

García-Fernández (2016) defends that the better quality management practices (leadership, quality planning, personnel management, process management, customer orientation, supplier management and product design) the better the innovation results in terms of product and process innovation. This result is achieved through better knowledge management practices (creation, storage and transfer, and application and use of knowledge).

Taking into consideration the importance of TQM as a method of organizational innovation, and to respond to this new competitive factor, the Portuguese Quality Institute created the NP 4457:2007, a Portuguese standard for managing RDI based on the ISO 9001:2000 standard.

The certification of the research, development and innovation management system (RDIMS) requires for an organization to demonstrate that it has implemented a RDI system that satisfies the requirements of the NP 4457:2007, being the RDIMS a part of the management system that includes the organizational structure, the planning of activities, the responsibilities, the practices, the procedures, the processes and the resources to develop, implement, review and update the organization's RDI policy.

The main goal is to make it possible for the organization to develop and implement a RDI policy that seeks to increase the effectiveness of its performance when it comes to innovation. The Portuguese standards of the RDIMS are aligned with the quality and environment management system ISO standards, following the Plan-Do-Check-Act (PDCA) approach, with wider innovation concepts, that beyond products and services consider the new methods of marketing and organization. The NP 4457 standard is based on an innovation model, supported by interfaces and interactions between the scientific and technological knowledge, the knowledge about the organization and its functionality, the market or the society in general.

According to Silva (2010), the RDIMS is composed of four standards:

- **NP 4456:2007** – Terminology and definitions of the activities of the RDIMS (IPQ, 2007a) – describes the definitions and terminology used by RDIMS.
- **NP 4457:2007**– Requirements of the RDIMS (IPQ, 2007b) – specifies the requirements to be used by an RDIMS every time a company is trying to increase the effectiveness of its innovative performance.
- **NP 4458:2007** – Requirements of a RDI project (IPQ, 20067c) – defines the requirements of a RDI project.
- **NP 4461:2007**– Competence and evaluation of the auditors of the RDIMS – defines the competences and the way the auditors should evaluate the RDIMS and the projects associated to it.

The main advantages of the RDIMS are the following:

- It makes it possible to receive internal know-how in the RDI activities;
- It incorporates technological prospective activities, which makes it possible to identify improvement opportunities;
- It makes it easier to evaluate RDI projects, especially from public entities financing point of view.

QUALITY STANDARDS

TQM has been understood as a management philosophy that encompasses all the processes of an organization. It aims at meeting the expectations of clients, employees, shareholders and the society in general. The management of the process presupposes the concrete definition of its boundaries, the attribution of responsibilities and the establishment of adequate performance indicators (Crowder, 2013).

ISO 9001 standards have been thoroughly implemented by most of the companies, at least in Europe. These standards have a formal recognition of quality management systems, after the company has been audited by a certifying organization. This well-done procedure has originated a certification that is recognized in the business world, which has made it an indispensable pre-requirement for the sourcing of products and services (Sampaio, 2009; Sampaio, Saraiva, & Rodrigues, 2009; Crowder, 2013).

Nowadays, it is imperative for a company to assure its competitiveness and growth, in a global changing context, by the continuous improvement of its business models, marketing, organization, information technologies and the supply of new products and services. Quality and innovation are essential for the survival of any company.

The International Organization of Standardization (ISO) developed a series of standards for some management systems, including quality, environment, hygiene and safety at work, client satisfaction, audit, innovation, research and development, among others.

The implementation and certification – involving mainly standards of quality (ISO 9001), standards of hygiene and safety at work (OHSAS 18001) and environmental standards (ISO 14001) – have very important roles in businesses activity, both for organizations that adopt the standards, and for those who relate to them (Zeng, Shi, & Lou, 2007; Chatzoglou, Chatzoudes, & Kipraios, 2015; Domingues, Sampaio, & Arezes, 2016).

Analyzing the standards ISO 9001:2008, ISO 14001, OHSAS 18001 and NP 4457: 2007, it is possible to verify that they share similar principals and management techniques. Although they approach specific subjects, they demand that the companies formulate policies, define functions and responsibilities, attribute management representatives and give work teams training. Their objectives are in agreement with a continuous improvement process (Chatzoglou et al., 2015; Domingues et al., 2016).

The ISO 9001 and ISO 14001 standards require that all procedures are traceable and auditable. In order to meet the requirements, each management system demands a lot of documentation, procedures, verification and control forms (Zeng et al., 2007). In a more practical way, it is very difficult to deal with management systems that embrace, separately, specific aspects like quality, environment, health and safety and innovation. Knowing that quality standards try to deeply promote management systems, it is necessary to guarantee the alignment of the diverse standards with the company's strategy.

The NP 4457:2007 standard specifies the requirements of a RDIMS and it is applicable to any company that looks forward to establish a RDIMS, in order to assure its RDI policy.

Quality Management Systems (ISO 9001)

The ISO 9001 standard describes a group of fundamental elements that make it possible to conceive and implement quality management systems. The most recent revision to this standard is based on the next eight principles of quality management (Sampaio, 2009): (a) focus on the client; (b) participation of people; (c) processes-based approach; (d) systemic approach; (e) continuous improvement; (f) factual approach; (g) decision making support; and (h) mutual benefit in the relationship with suppliers.

Based on these eight principles, the ISO 9001:2008 defines the five main management requirements:

1. Quality management system, responsibility;
2. Resource management;
3. Product realization;
4. Measurement;
5. Analysis and improvement.

Environmental Management Systems (ISO 14001)

The ISO 14001 was first published in 1996 and a revised version was published in November 2004. The ISO 14001 incorporates a series of guidelines with the goal for normalizing a company's environmental management systems. It is composed of five topics (Zeng et al., 2007): environmental management system; environmental audits; environmental labelling; environmental performance and life cycle evaluation.

Occupational Health and Safety Management Systems (OHSAS 18001)

The occupational health and safety management system (OHSAS) is intended to create and maintain a work environment, while it protects and maintains the health and well-being of the employees. The OHSAS 18001 was published in 1999 being compatible with ISO 9001 and ISO 14001. The goal was to facilitate the integration of the three systems. The OHSAS 18001 does not foresee the specific performance of safety and health criteria in work places and does not supply detailed specifications for the creation of a management system. However, it is applicable to any type of company that seeks to

minimize risks for employees and other interested parts and also to implement, maintain and enhance the management system continuously, as well as to assure its conformity with its OHSAS policy, show this conformity with others, seek the system certification by an external organization and to self-determine and declare the conformity with standard specifications (Vitoreli & Carpinetti, 2013; Carvalho, Picchi, Camarini, & Chamon, 2015).

Research, Development, and Innovation Management System (NP 4457)

The NP 4457:2007 is based on an innovation model, supported by interfaces and interactions between the scientific and technological knowledge, the knowledge about the organization and its functionality, the market, or the society in general (IPQ, 2007a). The concept of innovation underlying this standard comes from its interpretation as a mechanism capable of generating wealth, which impact and utility should generate benefits for the organization and the society.

This standard specifies the requirements of a RDI management system. It is applicable in any organization that wants to establish a RDIMS and assure the fulfilment of its RDI policy (IPQ, 2007a).

It is also applicable to organizations with RDI activities, regardless of size, complexity and nature of its activities. It is also applicable to every type of product-, process-, organization- or to marketing-based innovation.

INTEGRATED MANAGEMENT SYSTEMS

Quality management systems can also be used as a base for effective treatment of issues related to the environment, health and safety at work.

With the publication of the international standard ISO14001 for environmental management systems, and the specification OHSAS 18001 for health and safety of work management systems, the use of quality management system is greatly facilitated. Both ISO 14001 and OHSAS 18001 were created purposely to be coupled to systems based on ISO 9001.

An IMS considers the integration of quality management processes with environmental management and/or with the OHSAS, depending on the features, activities and organizational needs (Jørgensen, Remmen, & Mellado, 2006; Zeng et al., 2007; Zeng, Xie, Tam, & Shen, 2011; Domingues et al., 2016).

With the increasing competitive pressure, companies feel forced to continuously increase their productivity. Consequently, they see the integration of management systems as an excellent opportunity to reduce costs with the development and maintenance of separate systems, or of numerous programs and actions that mostly overlap themselves and cause unnecessary expenses.

Nowadays, it is increasingly difficult and costly to maintain separate systems (quality, environment, health and safety at work, etc.). Moreover, it is increasingly clear that it makes no sense to have similar procedures for planning, training, documenting and data control, acquisition, internal audits, critical review, among other processes, for different management systems. Progressively more challenging, the productivity goals require organizations to maximize their efficiency (López-Fresno, 2010).

Multiple management systems, where only an integrated system would be enough, are inefficient, hard to manage and hinder the effective involvement of people. It is much simpler to obtain the coop-

eration and involvement of employees in a single management system, than in several separate systems. Moreover, the synergy generated by IMS has led organizations to achieve greater levels of performance at a much lower overall cost (López-Fresno, 2010; Sampaio et al., 2012; Domingues et al., 2016).

For a company that has already implemented a certain quality management system and proposes to enter or add another management system it can choose integrated management systems, which are presented as an excellent opportunity to solve all of the problems mentioned, including the identification and structured access to legal requirements and to other requirements subscribed by the organization.

An IMS is a global system of an organization, which includes practices, processes and resources for development and implementation of its quality manual, environmental policy, health and safety policy and of RDI policy (López-Fresno, 2010; Sampaio et al., 2012; Domingues et al., 2016).

Since the integration of management systems become widespread, a significant number of differences have been identified, regarding its interpretation and the way the integration should be obtained (Sampaio et al., 2012; Domingues et al., 2016).

Griffith (2000) defines IMS as a single management system that provides the business processes through structured modular support of management functions configured around the main needs of the organization. Griffith and Bhutto (2009) propose a model approach to business processes.

For Wilkinson and Dale (1999), all the internal management practices should be placed in a system, but not as separate components.

Sampaio et al. (2012) defend that the functions that are not integrated are likely to be put aside when problems arise and stresses that the goal of an IMS must be essentially to be able to make the system put into practice a PDCA safety cycle in all of the organization's activities.

Uzumeri (1997) suggests that the integration can be based only on the standards requirements or in a total quality or continuous improvement approach. In the first case, the primary goal is to reduce the audit and management costs. In the second case, the standards continue to be necessary, but the main goal is to improve the business process performance.

In conclusion, an IMS should cover all requirements stipulated by the standards applied and should be extended to all parts of the business, so that organizations can obtain a significant benefit from the integration (Sampaio et al., 2012; Domingues et al., 2016).

Methodologies, Models, and Strategies for Integration

While integration was limited to the three main patterns of management – quality, environment and safety – all efforts were focused only on two perspectives: integration of standards and internal integration of management systems (Karapetrovič & Willborn, 1998; Sampaio et al., 2012).

Under the first perspective, the end result would be a standard management system that could possibly cover all areas and functions within an organization. However, the proliferation of management standards, specific and sectorial, is considered as an ineffective and unrealistic option because it would only be able to cover some standards. Under the second perspective, the definition of a model and methodology was emphasized to implement an IMS. Table 1 presents an overview of methodologies that facilitate the integration of management systems (Asif, Bruijn, Fisscher, & Searcy, 2010; Sampaio et al., 2012; Crowder, 2013; Domingues et al., 2016).

Wilkinson and Dale (1999) recommend a greater compatibility and alignment within the standards, in order to support the development of a methodology, based on either a process model, such as the

one used by ISO 9001 with a PDCA cycle, or the one used by ISO 14001, or in a systems approach (Karapetrovič & Willborn, 1998), although it is also important to identify and analyze the differences between the standards. However, a maturity model is proposed by Domingues et al. (2016) in order to integrate several management systems.

Jonker and Klaver (1998) see the lack of methodology as the main reason why integration is difficult and suggest the use of a conceptual model as a framework, such as the model of the European Foundation for Quality Management (EFQM). Jonker and Karapetrovič (2004) claim that any solution that seeks to facilitate the integration of a management system must contain two parts:

- A model to analyze, harmonize, align and integrate specific standard requirements;
- A methodology to support the conceptual model and guide an organization to integrate the internal management system.

Griffith and Bhutto (2009) are also focused on the need to have an overall framework, wherein the other parts include management procedures and work instructions. Through their research, they found that each analyzed organization had its own structure and operating methods to meet its own specific activity in its own market, but the "generic" characteristics of the IMS were identified. It is difficult to describe a unique model for integration, knowing that IMS are specific, even almost custom made for each organization.

There are a number of strategies to successfully implement the different management standards (Karapetrovič & Willborn, 1998; Wilkinson & Dale, 1999; Jonker & Karapetrovič, 2004):

Table 1. Overview of methodology that facilitate the integration of management systems

Sequence of integration	The literature describes the sequence used to show an IMS.
Approached systems for integration	The business plan is seen as an unique unformed system that acquires its shape according to the prevalence of the stakeholders and the desired goals.
Stage-based approach to organize a IMS	The integration can be used step by step from a partial to a total approach
Integration by hierarchical levels	Integration must reach activities in all levels of hierarchy/ management of the organization.
Integration trough a management team and audit system	Initially a management team is created to support the integration and an audit is used to evaluate the IMS.
Other means to support integration	Integration can be facilitated through audits, measuring business performance and the excellency of business models
Integration through "a total quality approach"	Use of integrated resources to satisfy all stakeholders during the process of the integration using a total quality approach.
Improving the management systems standards	The organizations can integrate and improve the system standards already existing and/ or potential new management systems by using three different styles: rise, increase, or internalization .
Expansion of the integrated norms	Increasing the integration of standards, will generally improve the quality of the management systems. it Requires an integration structure (PDCA, as an example) and from the content (such as processes, resources and goals).
Designing the main processes of the integrated management system	The IMS is designed and centered around the stakeholders requirements. The first modified processes will be integrated in the management system, forming an IMS.

Source: Adapted from Asif, Bruijn, Fisscher, & Searcy (2010)

- To implement the quality management system at the initial stage and only then add the environmental management system, using the ISO 9001 framework and the links identified between the two standards.
- To implement an environmental management system first and then add the quality management system, using the ISO 14001 structure.
- To implement the environmental management system and the quality management system simultaneously, using the model "system of systems", a process model or the PDCA cycle.
- To use a common core of IMS, and then procedures, developing first the common elements, followed by the incorporation of specific function procedures.

A successful integration of management systems cannot be achieved only by the junction of several management systems developed independently to satisfy requirements (Bamber & Dale, 2000; Sampaio et al., 2012; Domingues et al., 2016). All stakeholders, and their respective needs, should be given strong emphasis. In business management, the most appropriate model for integration of management systems should emphasize the following points, in order to meet the needs of stakeholders (Asif et al., 2010; Fonseca, Ramos, Rosa, Braga, & Sampaio, 2016):

- When the IMS is designed, the stakeholders are identified and their needs are determined;
- To make sure that none of the stakeholders is hampered when trying to benefit others.

These points are the bedrock of the methodological approaches for the integration of management systems. Initially, these methods require the input of all stakeholders, in order to guide the company's policy, objectives and targets. The organizational processes are designed to reflect the broader organizational goals, which are representative of the concerns of stakeholders.

The main stakeholders include shareholders, investors, employees, government regulatory agencies, suppliers and customers. The integration of management subsystems goes far beyond these and requires further study, considering the entire system. This way, business goals and strategy are designed to meet the requirements of the identified stakeholders (Fonseca et al., 2016).

The internalization of specific management systems can be advantageous. Increasingly, the organizations are pressured to meet the requirements of its stakeholders. Efforts to meet their needs through the implementation of business operations are often facilitated by the management of the subsystems, which regulates the behavior of the management system so that it behaves as wished. With the substantial increase of the number of standardized management systems, their integration becomes a necessity (Jørgensen et al., 2006; Domingues et al., 2016). However, dealing with separate management systems, ensuring that they are aligned with the organization's strategy has proved to be a difficult, inefficient and ineffective task (Wilkinson & Dale, 1999), with the risk of the systems operating independently.

The integration of management systems is the solution to many problems and can bring many benefits to the organization, saving time and resources and ensuring an alignment between the requirements of different standards (Jørgensen et al., 2006; Crowder, 2013; Carvalho et al., 2015; Domingues et al., 2016). Integration is seen as the only way to deal with and benefit from the increasing development of standards. The need to develop an IMS was born in the mid-90s, aiming to achieve significant benefits, and has been widely discussed in the literature on quality management, environment, health and safety.

The integration proves to be a false problem within an organization that has already implemented an IMS. The existence of common procedures to various management systems, due to the alignment of

the standards, greatly facilitates the integration work of new norms, because the operation of IMS activities are already undertaken being a part of the organization's routines, and the culture of continuous improvement is also already rooted (Zeng et al., 2007; Carvalho et al., 2015).

A comprehensive and integrated model should be designed for each organization, as there is no universal methodology that works in all cases (Jonker & Karapetrovič, 2004), but a set of guidelines and principles to guide organizations can be established in the sense of developing an IMS.

A methodology to implement an IMS should be defined specifically for each organization in order to support the conceptual model and guide the organization toward integration.

Barriers and Benefits of Integration

The main motivations for the implementation of an IMS include the requirements of customers, investors, legal requirements, marketing and image improvement, cost reduction, the liability insurance and the improvement of efficiency and results, among others (Zeng et al., 2011; Fonseca et al., 2016).

The main potential and advantages of implementing an IMS are related to cost reduction, competitive advantage and increase of employee motivation (Bernardo, Casadesus, Karapetrovič, & Heras, 2012; Carvalho et al., 2015; Chatzoglu et al., 2015). The increase in the workers motivation is ensured through the use of awareness and training to sensitize them to environmental issues, to the issues related to their own safety and health and to the reduction of nonconformities in the products, benefiting productivity.

For the implementation of integrated management systems to succeed one must meet certain criteria and guidelines.

The commitment of the top management is one of the main pre-requirements for the successful implementation of any project with strong management implications. Top management must adopt the appropriate leadership style, demonstrating its commitment by promoting a culture compatible with the vision and the mission of the project, being willing to accept change, providing the resources necessary to implement the new project (López-Fresno, 2010).

Top management's responsibility begins when the decision is made to integrate existing systems in the organization and should work to engage and involve all company employees in the process.

The integration of systems demands an effort to achieve the involvement of all the working groups in order to share information and interact using a common language. This process gives particular emphasis to communication and employee training, which is an effective way to reduce resistance to change (Bernardo et al., 2012).

Systems integration is a key requirement to ensure the survival and profitability of organizations and is also a great help in the decision process, in accordance with the policies and the adopted strategy (Zeng et al., 2007).

The motivations for the integration of management systems can be classified into two categories (López-Fresno, 2010): internal and external. The internal motivation is related to the goal of achieving organizational improvement, while external motivation is primarily related to customer pressures, for the construction of a solid marketing image, for improving market share and for meeting the regulatory government policies. For most companies, the quality management system served as an integration platform (Khanna, Laroyia, & Sharma, 2009; Sampaio et al., 2012).

The main reasons that lead to the adoption of an IMS are related to the promotion of synergies between different management systems, the combination of their objectives, avoiding duplication of procedures,

the improvement of the company's image to the general public and the reduction of the audits required to the various management systems (López-Fresno, 2010; Zeng et al., 2007).

Like the barriers, a number of quantitative and qualitative benefits were also identified (Griffith & Bhutto, 2009; López-Fresno, 2010; Sampaio et al., 2012; Crowder, 2013). Table 2 identifies some of the obstacles and the most common benefits, pointed out by the literature.

An IMS is a comprehensive system of an organization, which includes the organizational structure, planning activities, definition of responsibilities, practices and procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the quality manual, the environmental policy and the health and safety at work policy, defined by the organization.

DESCRIPTION OF THE COMPANY

This study was accomplished at a company of the Portuguese glass industry, which for confidentiality reasons, shall be called ALFA.

ALFA has an IMS that is structured according to the ISO 9001, ISO 14001 and OHSAS 18001, assuming an important role at all levels of the organization and involving all of its activities, with constant concern in continuously improving its management system, taking into account the domestic needs and those of its stakeholders. It fosters innovation and the emergence of new ideas through internal training sessions with all employees in order to enable their participation in their continuous improvement process.

ALFA considers as fundamental points for the exercise of their activity, the promotion of internal participation of its employees in order to foster continuous improvement of its performance, based on the support of a culture of creativity and innovation for the generation of ideas, simplification of procedures and reduction of response times, through recognition and professional development policies, encouraging teamwork and flexibility, setting and reviewing goals and targets that make it possible to improve their performance. It has 236 employees and is the leader in the glass container industry.

Table 2. Barriers and benefits of integration

Barriers	Benefits
Misinterpretation of the meaning of integration. Too focused on the integration of documents and administrative records.	Improvement of vision of the organization.
Absence of an integration model, strategy and methodology.	Decrease of attempts to implement and maintain the system by a reduction and simplification of the documentation and audits.
Lack of commitment from top management.	Cost reduction a more efficient use of resources.
Lack of adequate organizational culture.	Improved employee acceptance resulting in higher personal motivation and reduction of conflicts.
Lack of qualified resources.	A more effective internal communication by removing the traditional management system.
Lack of communication.	A better customer service of services but also of products delivered.
Resistance to change from people that lose the ownership of the systems implemented prior to integration.	Improved client satisfaction and a better image of the company.
Continuous change of regulations and goals.	Positive reaction from employees to change.

Source: López-Fresno (2010)

Since its inception, in 1987, ALFA focused its management efforts on three clear objectives: quality, service and price, always focused on the customer perspective.

The company produces glass containers in several colors (amber, green, cinnamon, white and blue-white) for the following market segments: table wines, Oporto wines, sparkling wines, beers, spiritual drinks, water, soft drinks, bottles, oils, juices and jars.

ALFA is organized by processes, being these tasks performed naturally, producing capital gains, serving customers and generating revenue. Monitoring and recording these activities are the key to the success of any organization.

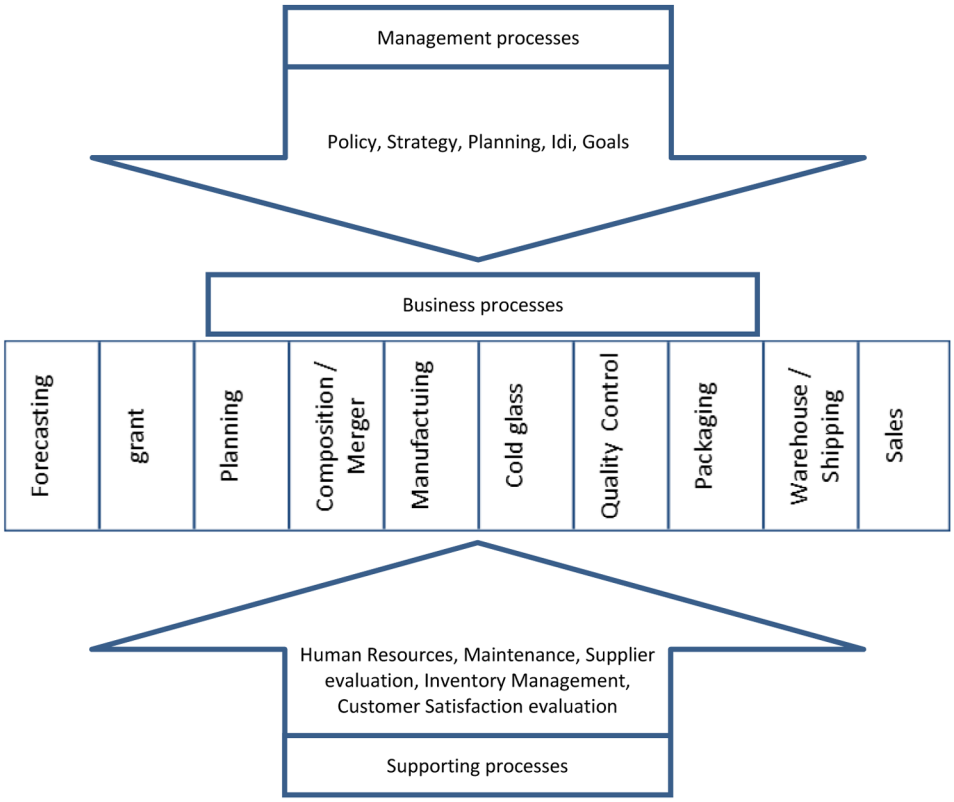
The structure of ALFA's IMS is based on a process approach to improve the effectiveness of the company and thereby increase customer satisfaction, meeting their requirements.

As can be seen on the scheme in Figure 1, in order for ALFA to define its objectives through processes, several inherent characteristics in each processes were found, allowing the identification of:

- Business Processes (BP) that are directly related to the main activity of the company;
- Management Processes (MP) that define strategies and manage the results according to the objectives and goals;
- Support Processes (SP) that interact with other processes.

Currently, ALFA has 10 production lines in operation, with a rate of about 12 million bottles a week.

Figure 1. ALFA's process approach
Source: *ALFA's IMS – 42.6.1/3A*



The Adoption of the NP 4457:2007 by ALFA

ALFA maintains a close relationship with its customers, whose partnerships are fundamental and therefore felt the need to implement the NP 4457:2007, to meet their requirements.

As ALFA has foreign capital, some of the methods, procedures and processes are obtained through the importation of technology. Its decision-making process, in what concerns the design and implementation of any product rests at headquarters level, as it involves the approval of the mother company. Only after this decision is taken, ALFA can start the production of molds to start with the manufacturing of the new product requested by customers.

As a result of the headquarters involvement in the new product development process, ALFA is much more focused on process innovation than on product innovation. It has strong production capabilities, given the high volume of bottles it produces. The design of the new models/designs is not made internally in the company, but at a corporate level. The internal development of new products is based on mere adaptations of bottles already in production. As such, it is strongly focused on incremental innovations, being product radical innovation very rare.

As there is little involvement in the development of new products, there is a strong focus on implementation of improvements in the production process.

ALFA's success results from the innovative and thorough knowledge of technologies, applicable to the process steps of melting and forming the container glass.

New products represent 50% of its turnover in 2011. The turnover of the company stood at 85.75M € in 2011 and 92.5M € in 2012 (data provided by the company).

Just as with quality, RDI certification is also a way of distinction among companies. Contrary to what happens in the quality management system certification, the number of certified companies in RDI is reduced.

As ALFA already had an IMS, and being already certified by ISO 9001:2008, there were already implemented processes and procedures to help in the implementation of this certification. As these two standards have several similarities between them, the work was facilitated at the outset, but it was still necessary to create three new procedures and adapt existing ones to include the requirements of this new standard.

ALFA had already implemented quality culture, as well as organizational and operational routines in the production process.

There was already implemented the practice of regular meetings, in which all issues related to quality systems, environment, safety and RDI of company were discussed. The general director, directors and department heads, the head of the IMS, marketing and commercial directors and the health and safety officer participate in these meetings. So that employees are involved in these issues, some elements of the workers union committee are also invited to participate.

ALFA operates in the container glass market, researching and developing new products, with high quality services and value that anticipates the needs and expectations of customers, meeting their requirements. Because customers so demanded, ALFA felt the need to internalize the NP 4457:2007 to its IMS.

With the adoption of this standard, and although it already had other management systems, ALFA aims to establish a regulatory framework that improves its performance, emphasizing its RDI management system as a key method of creating knowledge and in transforming it into economic and social wealth.

The proliferation of different classification practices and accounting of research activities, development and innovation, justifies the need for coordination between the adoption of the standards and the mapping of RDI activities in a perspective of value creation.

ALFA also had worked on the integration of audits previously, covering health, safety and environmental, operational and quality requirements and the good results obtained improved understanding and commitment of employees to create a new integration project, this time to integrate NP 4457:2007. The goal of this integration was to "take advantage of" an existing IMS, globalizing it so that it would include policies, guidelines and requirements on main management aspects, thus avoiding a fragmented view of the company and the costs derived.

ACTION AND CONTRIBUTIONS

Several steps have been taken to implement the IMS:

1. The analysis of the initial situation to identify the starting point;
2. The definition of the scope of integration;
3. The interrelationship of needs (requirements);
4. The identification of the processes and interrelation matrix between processes and requirements;
5. The design of the model: framework and procedures.

Step 1: Analysis of the Initial Situation to Identify the Starting Point

The regulations that should be applied, as well as their objectives and scope, and the documentation and organizational structure were identified.

Before the implementation of IMS, standards and corresponding management systems coexisted in the company. The introduction of certain voluntary standards was seen as an opportunity to avoid adding another independent management system.

Step 2: Defining the Scope of Integration

After the analysis of the initial situation, the scope of IMS was defined based on several factors: the experience in dealing with specific needs, the strategy and the complexity of its activities.

For ALFA, it became clear the need to conceive a fully IMS in order to address all requirements of mandatory or voluntary standards and cover all areas under one roof, to improve efficiency and effectiveness. The system's effectiveness would be measured in terms of "quality management", i.e., to what extent the company could improve its strategy, resources and the process of optimization, customer satisfaction and other stakeholders' involvement.

Step 3: Interrelationship of Needs (Requirements)

A detailed analysis was carried out to all the standards requirements, including those already implemented, those that are being followed-up and the guidelines and requirements that the company intended

to implement in order to optimize their management. The objective of the analysis was the creation of the framework for the IMS in order to identify:

- The universal requirements, common to all standards, which could be addressed with a corporate focus;
- The common requirements, only to a few standards, that must be addressed to some of the company's areas/business processes, and common requirements to all standards, but with a different scope;
- The specific and non-common requirements, which should be directed to a particular area or process; and
- The requirements that are not established by any standards, but that the company wanted to apply in order to optimize management, according to the needs and expectations of the stakeholders.

This analysis was performed by following an ad hoc commitment criteria led by the head of the IMS.

For a better understanding of the similarities between the standards, Table 3 was elaborated establishing the correspondences between the NP 4457:2007 and ISO 9001:2008.

This step is common to all organizations that go through this similar process.

Step 4: Identification of the processes and Interrelation Matrix, Connecting Processes, and Requirements

The application of an IMS focused on the process was identified as an opportunity to optimize management and increase productivity and competitiveness.

Initially, ALFA identified the macro processes. The change was not radical, knowing that is was applied to maintenance and production, where a correspondence between processes and functions already existed.

After identifying the macro processes, ALFA identified an operational and support process strategy, as there were common denominators between several processes. The idea was to use this approach to integrate all the requirements applied to each process to the working methods and procedures, and to apply the PDCA cycle to ensure continuous improvement. Once ALFA decided to pursue a process-based management and not by function-based management approach, all previously existing documentation had to be redesigned.

Step 5: The Design of the Model Framework and Procedures

The following criteria were taken into account for the design of the IMS:

1. **Systemic Approach:** ALFA is seen as a whole, formed by a group of interrelated components that operate with a certain degree of autonomy. The definition of fully independent documents compatible with different standards was avoided at the time of designing of the IMS.
2. **A Process-Oriented Approach:** The application of IMS was seen as an opportunity to focus on processes (Step 4).
3. **Virtual and Easy to Update Documentation:** The minimization of manuals and procedures in order to avoid bureaucracy, lack of coordination and risk of independence. In addition, the documentation has been designed with easy to update criteria.

Table 3. Correspondence between NP 4457:2007 and ISO 9001:2008

NP 4457:2007		ISO 9001:2008	
4.	Requirements of the RDI management system	4.	Quality management system
4.1	General issues	4.1	General requirements
4.2	Management's responsibility	5.	Management's responsibility
4.2.1	RDI policy	5.3	Quality policy
4.2.2	Responsibility and authority	5.5.1	Responsibility and authority
4.2.2.1	Top management	5.1	Commitment of management
4.2.2.2	Management representative	5.5.2	Management representative
4.2.3	Review by management	5.6.1	General issues
4.3	RDI planning projects		
4.3.1	Management of interfaces and production knowledge		
4.3.2	Ideas management and opportunities evaluation		
4.3.3	RDI planning projects		
4.4	Implementation and operation		
4.4.1	RDI management activities		
4.4.2	Competence and training	6.2.2	Competence and training
4.4.3	Communication	5.5.3	Internal communication
4.4.4	Documentation	4.2.1	General issues
4.4.5	Control of documents and records		
4.4.5.1	Control of documents	4.2.3	Control of documents
4.4.5.2	Control of records	4.2.4	Control of records
4.5	Evaluation of results and improvements		
4.5.1	Evaluation of results and improvements		
4.5.2	Internal audits	8.2.2	Internal audits
4.5.3	Improvements	8.5.1	Continuous improvements

Source: own elaboration based on the standards.

4. **Responsibility Distributed and Coordinated Within the IMS:** Each manager is responsible for managing the system's efficiency applied to processes under his/her responsibility. The quality management team coordinates and provides support for this goal.
5. **Flexibility:** The IMS framework was designed to be open and flexible, in order to:
   a. Respect the differences between activities, resources and organization, as well as the needs and culture of each area;
   b. Allow and promote continuous improvement; and
   c. Be able to incorporate new standards in the future.
6. **Sustainability:** The IMS should be easily maintained and improved. Thus, it is necessary to use assessment tools and an integrated audit plan was documented.
7. **An IMS as a Starting Point Towards Excellence:** The IMS wad focused as a starting point, to promote the cultural change necessary to apply the EFQM model in the future.

Taking into account all these criteria and ALFA's strategic plan, the IMS was structured as follows:

- **A Global Framework:** With general policies and guidelines (key elements) that describe the management system and provide an overview of ALFA. These guidelines were directly applied, or used as a reference for the specific development of procedures. When directly applied, the guidelines have been complied with, according to all the standards in consideration. For some processes, such as purchasing, information technology and human resource management, the framework itself served as a management system.
- **Procedures:** Developed for processes with specific requirements. These procedures respond to specific regulations, but also the specific features derived from the culture and needs related to each process. In the future, if it is necessary to implement new requirements, previous to the implementation an analysis should be carried out in order to assess whether these requirements should be implemented as a separate procedure or integrated into those that already exist. The framework will always be the reference for the whole system.
- **Monitoring and Evaluation Tools:** Refer mainly to an integrated audit plan and an integrated performance measurement model. ALFA had already implemented an audit integration plan, designed a few years earlier, thus facilitating the design of an updated plan of integrated audit.

Integrated Management Manual

In order to integrate the new standard (NP 4457:2007) in ALFA's IMS, the integrated management manual has been revised and updated to allow the addition of specific or future generic procedures in the global framework.

During the adoption process of the NP 4457:2007, three new procedures needed to be created:

1. Ideas Management and Opportunities Assessment;
2. Interface and Knowledge Production Management;
3. RDI Project Management.

Procedure "Ideas Management and Opportunities Assessment"

The methodology to be used to manage ideas and evaluate opportunities for improvement was defined with the first procedure. It was also established the guiding principles and the responsibilities of employees, to ensure the collection, analysis and evaluation and pre-selection of ideas. The responsibilities of the process were allocated as shown in Table 4.

The ALFA's top management committed itself to promoting the presentation of ideas, using a set of actions that allow employees to see their suggestions evaluated and to feel motivated to suggest and present their ideas.

It was decided that all employees can submit their ideas by registering them in a document created for this purpose, which is available to all employees in various parts of ALFA's premises.

The employee delivers a copy of this form, duly completed, to his/her supervisor and/or responsible for the IMS that does the management of ideas. This registration is made within no more than a one week term. The original copy of the registration of the ideas is the responsibility of the author of the idea.

Table 4. Definition of responsibilities: Procedure "ideas management and opportunities assessment"

Technical direction and/ or Commercial direction	• To promote the generation of ideas; • To analyze monthly the ideas presented by employees; • To prepare a pre-selection of ideas and to classify them in levels, from 1 to 4; • To allow the implementation of ideas classified in levels 3 and 4; • To communicate pre-selection results to employees • To communicate to employees the results of pre-selection and feasibility analysis of ideas.
Management representative and IMS manager	• To cooperate in the creation of ideas; • To receive every month the ideas presented by employees; • To collaborate in the pre-selection of the ideas presented and in their classification; • To collaborate in carrying out the feasibility analysis of the ideas classified at Levels 3 and 4; • To elaborate, review and distribute the procedure; • To assure the implementation of the procedure; • To conduct a status report every two months on the state of the ideas presented; • To collect the necessary information for the review of the management system.
Heads of other Directions / Departments	• To present the ideas generated; • To register in the software available all the ideas presented by employees in charge; • To inform the author of the idea of the process of evaluating; • To be available to answer any request for clarification arising on the ideas recorded.
All employees	• To register the ideas in the available software or by using the appropriate form for registration of ideas; • Be available to answer any request for clarification arising on the ideas submitted.

Source: own elaboration according to the procedure

Subsequently, the ideas are presented at the monthly meeting of the Integrated Management Commission, and there they are evaluated and classified. This classification covers four different levels regarding their continuity and innovation potential:

- **Level 1:** Idea or suggestion without applicability. It is registered in the "Ideas Management" file.
- **Level 2:** Idea or suggestion without innovative potential. It is classified as "Continuous Improvement." May or may not be implemented depending on the decision of the head of the department, and is recorded in "Ideas Management" file as well.
- **Level 3**: Idea or suggestions with innovative potential, although they already exist in the market. The analysis includes the viability, the level of priority and importance, the profitability and cost/ benefit, according to the "Ideas Management" file.
- **Level 4**: Ideas or suggestions with high innovative potential that are not in the market yet. The emergence of such ideas can origin a patent or brand registration process. The analysis includes the feasibility, the level of priority and importance, the profitability and cost/benefit, according to the criteria of "Suggestion System."

This whole process of selection and classification is recorded in the "Ideas Management" file. The ideas classified in Levels 3 and 4 proceed to feasibility analysis. This analysis is performed by ALFA's management, which carries out their selection and screening, based on the following criteria:

- Responsiveness capacity of the company;
- Probability of technical success;
- Financial return;
- Priority level;

- Degree of importance;
- Profitability and cost/benefit;
- Alignment with business strategy and corporate strategy;
- Acquisition of expertise or technical knowledge;
- Positive impact on the market and/or organization;
- Potential to establish partnerships with entities of the Scientific and Technological System.

The findings of the feasibility analysis (realization of the idea, creation of a RDI project, continuous improvement or archiving the file) are recorded. Whenever an idea meets the predefined criteria, it is carried on to a project, but if due to financial reasons it is not the right time to be developed, it is recorded on the Ideas file.

The author of the idea is informed of the outcome of the feasibility analysis.

With the implementation of this system (registration of ideas and suggestions), it was created the opportunity to take advantage of the ideas of employees, as all of them are heard and can participate.

Procedure "Interfaces and Knowledge Production Management"

The procedure interfaces and knowledge production management was created with the purpose of defining the methodology of interfaces and the knowledge production management within the organization as well as the technical principles and their respective responsibilities. In ALFA, three interfaces are considered: (a) the technology, which involves technological surveillance, technological cooperation and technology foresight; (b) the market, which involves internal and external analysis and intellectual property; and (c) the organization, which involves creativity and knowledge management. Table 5 defines the responsibilities of the interfaces and knowledge production management.

For proper knowledge management, particularly in its diffusion, ALFA uses an intranet, a file server and paper records created by the management system.

Procedure "RDI Project Management"

This procedure is created in order to define the methodology and responsibilities for the preparation of the plan, implementation, monitoring and evaluation of innovation projects in order to ensure their

Table 5. Definition of responsibilities: Procedure "interfaces and knowledge production management"

Management	To promote the realization of the interface management activities.
	To receive and review all records associated with the interface management activities.
IMS manager	To coordinate the preparation, review and disclosure of RDI activities records.
	To ensure, together with the management representative, the implementation of the procedure.
	To comply with the recorded RDI activities defined.
	To collect the necessary information for the management review.
All employees	To comply with the provisions in the table of RDI activities records.
	To suggest changes to RDI activities, where there is a need to monitor a new source of information.

Source: own elaboration according to the procedure

proper implementation and compliance with the requirements under NP 4457:2007. The definition of responsibilities is shown in Table 6.

The management of the RDI projects portfolio is held by the head of IMS that puts RDI projects levels 3 and 4 on the intranet and the updated register of ideas (ongoing, completed or unfulfilled).

Whenever an idea is approved and registered, the project manager creates a plan for it.

Once all the steps already mentioned are fulfilled, for a RDI project planning a project development is initiated, which is subject to revision, mid-term verification and validation.

In the revision phase, project managers carry out a project analysis to verify its correct development (planning, deadlines, tasks, stages, officers, etc.). The registration of reviews is not compulsory, given that it is a routine task of project managers. During the validation phase, the confirmation of the project results is carried out to see if it meets its purpose or the intended application that it was designed for.

The completion of the project is determined by the project manager, when the final results are validated.

CONCLUSION

This study presented the experience of a company in the glass sector, regarding the integration of the NP 4457:2007 standard in its existing IMS. The analysis of this study has confirmed the importance of an IMS: whenever a management system is functioning properly, the incorporation of new systems is greatly facilitated. Clearly, the integration of new standards to the system is greatly facilitated, given that most of the activities are already done and already apart of the organization's routines. As the culture of continuous improvement is already "embedded" in ALFA, it was only necessary to review and adapt the IMS and to add three new procedures to the existing IMS and adapt procedures already implemented in order to introduce this new standard. After these steps, it is only necessary to continue incorporating the new organizational routines.

Table 6. Definition of responsibilities: Procedure "RDI project management"

Technical direction and/or Commercial direction	To approve the participation of RDI projects
	To name the project responsible
	To validate the need to resort to partners
	To approve the budget of RDI projects
	To keep abreast of RDI projects
IMS Manager	To keep abreast of RDI projects
Projects coordinators	To prepare an outline of the RDI project
	To plan the RDI project
	To carry out the evaluation of the risks of the RDI project
	To coordinate the implementation of the steps set out in the RDI project plan
	To follow up the steps of the RDI project
	To coordinate contact with the partners, if applicable
	To evaluate the project

Source: own elaboration according to the procedure

As discussed previously, the overlaps between standards make it possible to integrate new particularities easier. Thus, the overlap between the NP 4457:2007 and the integrated system of ISO 9001, ISO 14001 and OHSAS 18001 makes it possible to implement new procedures to supplement the previously presented standards, which facilitated the integration of the NP 4457:2007.

There are two major benefits resulting from the integration of the NP 4457:2007 in the previously integrated (ISO 9001, ISO 14001 and OHSAS 18001) standards:

- The reduction of the duplication of processes and procedures and time spent on documentation review and auditing, resulting in a cost reduction. The resources are not divided for the management of different and independent systems;
- The strengthening of customer orientation, which results from a process management approach. This also results from the fact that it is an intensive capital company with a strong focus on the production process.

The observed benefits are in accordance with the ones advocated by Jørgensen et al. (2006) when they claim that integration brings many benefits to the organization, saving time and resources, ensuring the alignment with the other standards of the IMS used by ALFA.

ALFA's case study clearly indicates that there are two different periods: before and after NP 4457:2007. One can argue that "Before NP 4457:2007" ALFA was characterized by a coherent health, safety and environmental, and quality management system supported by a strong internal involvement of all stakeholders, with a participative decision-making process, a strong quality management culture and a strong focus on incremental innovation. It is clear that the integration of the RDIMS was facilitated by ALFA's culture of creativity and innovation.

"After NP 4457:2007", in addition to the previous capabilities, ALFA managed to incorporate: important capabilities related to the management of ideas and assessment of opportunities that facilitates the generation of new ideas; a procedure to manage knowledge production and interface within the firm – regarding technology, market and the firm – that is easily created and available to all employees; a RDI project management perspective that facilitates the planning, implementation, monitoring and evaluation of innovation projects. As such, one can argue that ALFA managed to gain a competitive edge with the incorporation of the RDIMS that allows the firm to map RDI activities.

In order for the benefits to be achieved, it is essential that the organization is aware of the challenges and obstacles involved in the integration. As far as the ALFA case has shown, those challenges involve the creation of a strong culture of creativity and innovation, the encouragement of teamwork and flexibility, a clear goal for integration management systems – which involve the simplification of procedures – and the capacity for setting and reviewing goals and targets systematically. If these challenges are not addressed and defined early in the process, they could delay the completion and limit the effectiveness of the integration process.

The great advantage of the introduction of the NP 4457:2007 standard, on a RDI system level, is related to the development of a set of procedures for idea generation and evaluation of opportunities and management of knowledge and RDI projects as any organization can capitalize when a database of ideas is generated and projects are shared by all stakeholders in the organization.

There is a clear benefit in the operation of the generation of new ideas with process innovation, particularly by ALFA's business type, i.e. a capital intensive company where mass production is essential for the company's survival in order to take advantage of economies of scale. Unfortunately, the

implementation of procedures in the generation of new products was not as favorable as it could have been. This can be explained by the fact that the responsibility of the new products development lays at corporate headquarters level.

ALFA's acculturation process was simple and the introduction of new procedures easy to implement, as ALFA has a previous record of successfully integration several management systems, which allowed a great involvement of all employees. The introduction of the new standard allowed all ideas to be heard and evaluated, even at the lowest hierarchical level, being this a cross-practice to all hierarchies.

When it comes to limitations, this case study made it possible to highlight the following: first, it was not possible to ascertain to what extent the degree of innovation in developing new products creates new opportunities, new knowledge and what is its contribution to the management of the research process within ALFA. The second major limitation was that it was not possible to measure the progress, over time, of the number of new ideas, nor what developments where achieved for the company's knowledge management.

Thus, it would be interesting to analyze these developments in order to analyze the idea management system evolution, what is its level of radicalness and the effect on ALFA's productivity over time, which could give an idea of the degree of involvement/motivation of the employees over time and the validity of incorporation of NP 4457:2007 standards.

Although this is an interesting case study, it would be of added value to analyze in the future how firms manage to introduce the NP 4457:2007 standard for incorporating RDIMS without the vast experience of having previously integrated other management systems, e.g. ISO 9001, ISO 14001 and OHSAS 18001. Although it may sound speculative, it would be interesting to address how proficient the firm is in its innovation culture, in its capability in encouraging teamwork and flexibility and in complying with the challenges posed by integrating, right from the beginning, the culture of generating brand new ideas/products with the requirements of the management system.

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KEY TERMS AND DEFINITIONS

Environmental Management System (EMS): Refers to all the management of an organization's environmental programs and procedures in order to achieve a continuous improvement process for developing, implementing and maintaining policy for environmental protection.

Environmental Standards: Involve business relationship in which one company is involved in a business relationship in the supply chain with other firm, involving the provision of raw materials, components, spare parts, products or services. Normally, this type of relationship is celebrated between two firms to abandon adversarial, transaction-based involvements and to embrace on a partnership-like involvement.

Innovation: It is the process of translating a new idea or invention into the market. It can be a good or a service that creates value to the consumers, who are willing to pay. It is related with the concept of newness, in which a new idea, in the form of a good or service, must satisfy a specific need. Innovation can include the renovation and expansion of the range of products and services and their markets; the creation of new production methods, new sourcing activities and new distribution methods; and the introduction of management changes, in organization of the firm, and also in the workers qualifications. It is normally structured around three main blocks: products, processes and organizations.

Integrated Management System: Is an integrated system that manages the totality of an organization's processes in order to achieve a continuous improvement process and equitably satisfy its main stakeholders. It may combine quality, environmental and safety management systems into one system in order to facilitate management operations.

Management Systems: It is the set of frameworks of procedures and processes used by organizations to ensure that they achieve a certain predefined set of objectives and equitably satisfy the stakeholders. They are normally based on a set of "Plan, Do, Check, Act" subroutine in order to achieve a continuous improvement process. They normally involve the certification process according to quality, environmental or an occupational health and safety management system to ensure the organization is improving its performance by means of continuous improvement.

Research, Development, and Innovation Standards: Are designed to ensure that there is a management system that ensures research, development, and innovation (RDI) programs and procedures to achieve a certain predefined set of objectives and equitably satisfy the stakeholders.