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Implementing integrated management systems in chemical firms

Abstract

The main objective of this research is to study how MSSs can be integrated into a single system in organizations from the chemical industry. Data for this study include a survey carried out in 76 organizations, registered to, at a minimum, both the ISO 9001 and ISO 14001 standards for quality and environmental management, 17 of which were from the chemical industry. Additionally, six case studies are illustrated, revealing the process of integration of three chemical and three non-chemical organizations. The first conclusion to be drawn from this study is that organizations seem to prefer integration over keeping their Management Systems (MSs) separated, with these MSs evolving towards a state of complete integration. Although there are no significant differences between chemical and non-chemical firms regarding the benefits and difficulties of integration, the interviews and survey answers illustrated a number of benefits experienced by the companies from operating one integrated system, such as synergism promotion and cost savings for the firm, as well as a reduction of the time spent when managing the systems. However, some difficulties, such as the lack of human resources and the lack of employees' motivation, also arose during the integration process.

Keywords: Management System Standards, ISO 9001, ISO 14001, Integrated Management Systems, Spain

1. Introduction

The last few years have been marked by the development and diffusion of many quality, environmental and other management system standards (MSSs). Through them, firms commit to improve their quality, environmental or other management practices.

The importance of quality and environmental assurance in both chemical and non-chemical industries is demonstrated by the impact generated by the quality and other MSSs worldwide (ISO, 2010; Marimon et

al., 2009; Rocha et al., 2007; Karapetrovic and Jonker, 2003; Karapetrovic et al., 2010). ISO 9001 and ISO 14001 standards have generated the largest impact at the international level of all similar MSSs, concerning both the absolute number of registered organizations worldwide, with 1,064,785 certificates to ISO 9001 and 223,149 to ISO 14001, and the relative increase in the number of certificates, with an 8% and a 22% increase for ISO 9001 and ISO 14001, respectively, in 2009 (ISO, 2010).

When looking at the implementation and diffusion of such standards, one wonders whether organizations could easily unify their corresponding Management Systems (MSs) into a single or Integrated Management System (IMS). In other words, does this proliferation of new standards lead to their joint management and integration in order to benefit from the existing synergies among them?

In this article, we start from the premise that MSs should not be analyzed in isolation, but in conjunction with other systems, because of the similarities and parallelisms among the different systems and the potential benefits of adopting an IMS (Zutshi and Sohal, 2005). As firms with two or more MSs need to address the question about the convenience of having an IMS as well as considering the benefits and costs of such integration (Karapetrovic and Willborn, 1998b; Zutshi and Sohal, 2005; Rocha et al., 2007; ISO, 2008; Asif et al. 2009), the aim of this study is to analyze whether, how and why chemical firms with more than one standardized MS unify them into a unique and jointly managed IMS and to compare this integration process with the one used by non-chemical firms.

2. Literature review

The issue of integration started to appear in the literature almost two decades ago (e.g. Beechner and Koch, 1997; Wilkinson and Dale, 1998). Since then, a number of research studies have examined the ways in which individual organisations have addressed the introduction and integration of environmental (EMSs) and occupational health and safety management systems (OH&SMSs) with their quality management system (QMS) (e.g. Hillary, 1993, Karapetrovic and Jonker, 2003; Rocha et al., 2007). Other studies exist on how organizations have chosen to integrate their MSs focusing on different topics such as their integration methodologies and degrees as well as the advantages and challenges of the integration (e.g. Karapetrovic and Willborn, 1998a; Zeng et al., 2007; Bernardo et al., 2009).

Levels of integration

The integration level can range from no integration to full integration. According to Kirkby (2002), 'no integration' is defined as different MSs that cover their own distinct areas for each set of requirements and 'partial integration' refers to the fact that MSs make use of the common areas of the MSs; moreover, all the common elements such as the management review and the internal audits are routed through the same system. Finally, 'full integration' means that all standards are combined into one common MS (Bernardo et al., 2009), that is, the constituting MSs lose their unique identities, resulting in complete integration to a single multipurpose IMS (Karapetrovic, 1998b).

Karapetrovic and Willborn (1998b) claim that integration makes more sense than desintegration, therefore they propose that organizations will integrate rather than separate their MSs. Empirical studies regarding the scope of integration confirm such an idea (Zeng et al. 2007; Salomone, 2008; Karapetrovic and Casadesús, 2009, or Bernardo et al., 2009).

Integration strategies

One of the main issues to address is the strategy firms can adopt when integrating different MSs, namely the number and sequence of MSs that the organisation decides to integrate (Karapetrovic and Willborn, 1998b; Karapetrovic et al., 2006; Bernardo et al., 2009). Different strategies have been proposed, but the most cited is the two-step integration strategy based on the QMS and the EMS revised in Karapetrovic and Willborn (1998b) who, in the first step, suggest three options for integrating those two MSs: establishing the QMS first and then the EMS, establishing the EMS first and the QMs second, or establishing the two systems in a simultaneous way. The second step would imply integrating MSs other than the QMS and the EMS.

Integration benefits

Many studies have investigated firms' motivations for registration of MSs, their implementation experiences and the benefits received. Costs savings, minimisation of financial loss, operational benefits, better external image, improved customer satisfaction, compliance with legislation, effective allocation of responsibilities, and enhanced employee motivation are among the most cited improvements related to having an integrated system (Karapetrovic and Willborn, 1998b, Douglas and Glen, 2000, Renzi and

Cappelli, 2000, Pun and Hui, 2002, Zutshi and Sohal, 2005, Rocha et al., 2007; Salomone, 2008, Khanna, 2010, Asif et al., 2010; Zeng et al., 2011).

Integration difficulties

Despite the numerous benefits cited above, organizations also come across some challenges in the process of integration. The most-mentioned difficulties are the lack of human resources and the lack of government support Karapetrovic et al. (2006), Zutshi and Sohal (2005) and Asif et al. (2009). Internal organizational issues like departmentalization of functions, lack of resources and individual concerns of the people involved, are also mentioned by Karapetrovic and Willborn (1998a), Zutshi and Sohal (2005), Zeng et al. (2007) and Asif et al. (2009).

Integration of MSs in the chemical industry

Specifically for the integration of MSs in chemical firms, Wilkinson and Dale (1998) advocate to align several MSs with the organization's strategy and objectives, integrating them into a single system, and provide examples in the chemical industry where, in 1996, guidance on joint OH&SMSs and EMSs was provided. Within the context of the chemical industry as well, Delmas and Montiel (2008) tested, in 113 countries, whether the adoption of the ISO 14001 EMS was favoured or hampered by the adoption of other quality, health, safety, and environment standards, namely, ISO 9001, Responsible Care and EMAS. Their results showed that these MSSs in the chemical industry "complete rather than compete with each other".

Bonk-Kassner et al. (1997) found that integration of quality standards and requirements was useful in a group of firms that offered chemical, biological, physical analyses and consultation services. They analyzed the implementation and integration of various standards related to quality used in laboratory testing, such as the European standard EN 45001, ISO Guide 25, GLP (Good laboratory Practice), and ISO 9001. The authors found that these standards could not be allowed to be operated in isolation and the assignment of the management was therefore to unify these systems.

According to the European Chemical Industry Council (CEFIC) (2001), QMSs based on the ISO 9001 standard are now widespread and well established within the European chemical industry. In particular, in Spain, there are 2416 companies in the chemical sector (including chemical products, pulp and paper products and rubber and plastic products) that have an ISO 9001certification (ISO, 2009).

Having reviewed here the work of various authors regarding the integration of MSs, we subsequently present an empirical study in this field.

3. Method

The main objective of this paper is to study how chemical companies integrate their MSs and whether they do it differently from other firms. In order to do so, we carried out an empirical study in Catalonia, a Spanish region with one of the highest numbers of ISO 9001 and ISO 14001 certificates (Heras and Casadesús, 2006).

Our research is a follow-up study of the respondents to a mail survey carried out by Karapetrovic and Casadesús in 2006 in 176 companies with ISO 9001 and ISO 14001 certificates, the results of which were partially illustrated in Bernardo et al. (2009) and Karapetrovic and Casadesús (2009). A new field study was carried out during the months of February to July 2010, using the same questionnaire from the Karapetrovic and Casadesús (2009) study. However, an additional question about the benefits of integrating MSs was included following the literature on the topic.

The empirical study was conducted by means of a mail survey addressed to the person responsible for the QMS and/or EMS of each of the 176 organizations surveyed, and was subsequently followed up with a telephone call and additional e-mail communication with the firms. Valid responses were received from 76 chemical and non-chemical organizations, representing 43% of the sample, as shown in Table 1. From the 76 organizations, 17 belong to the chemical sector, according to the Spanish industrial classification (FEIQUE, 2009).

We consider that Spanish chemical firms account for 5% of the total number of companies with ISO 9001 certification among 39 sectors and that the chemical sector is 7th in terms of ISO 9001registrations (ISO 2009). From a strategic point of view, Spain is one of the leading countries in the implementation of sustainable chemical processes, together with the USA.

Table 1. Survey information

Study factor	Factor value
Location	Catalonia (Spain)
Time	February-July 2010
Initial Population *	535
Sample Size	176
Number of responses	76
Response rate	43%
Confidence level	93%

* approximate, including organizations with both ISO 9001 and ISO 14001 certificates, according to Karapetrovic et al. (2006).

In order to study the actual degrees of integration, an exploratory analysis of the survey data was performed. The survey included questions related to the level of integration and the use of specific guidelines to conduct the integration of different MSs. We also present responses on the benefits and challenges of integration and a comparison of the results between chemical and non-chemical firms. A descriptive analysis of the data obtained is provided in the following section.

Additionally to the survey exploratory results, this research provides six case studies of three specific organizations in the chemical industry and three non-chemical organizations that have integrated their systems at different levels, as we aim to compare the integration processes of the two groups of firms. The organizations studied provide different visions of the integration process as they differ from each other in terms of the management of their systems and were selected from the 76 organizations that responded to the mail survey in 2010.

A case study approach has been adopted to allow causes, processes and consequences of behaviour of the participants to be investigated (Yin, 1989). The end result is a series of case studies in which each case is treated as a replication and follows the same structure (Yin, 1989). In order to establish validity and reliability of the case study results, the investigation used multiple sources of evidence (interviews with managers, information from internet, reports and other documentation resources). The data gathering on site helped ensure the accuracy of the findings by providing more concrete information upon which to formulate interpretations. Moreover, an active corroboration on the interpretation of data between the authors and the organizations interviewed was maintained.

To protect confidentiality, the six companies are referred to as Firms 1, 2 and 3 (chemical firms) and Firms 1Nch, 2Nch and 3Nch (non-chemical firms).

4. Survey results

4.1. Level of integration

From the 76 companies surveyed, we find that 64 firms (84%) have either partially (22%) or fully integrated (62%) their MSs, in line with Karapetrovic et al. (2006), Karapetrovic and Casadesús (2009), Bernardo et al. (2009) and Khanna (2010). Thus, 12 companies (16%) did not integrate their MSs and were not considered further in this study. With respect to the 17 chemical firms considered, two (11.76%) have not integrated at all their MSs, whereas 13 (76.47%) had partially integrated their MSs and 2 (11.76%) firms had their MSs completely integrated.

In order to compare the results for chemical and non-chemical firms, it is necessary to analyze whether the two subsamples are significantly different. We tested the assumptions of normality, linearity and equality of variances which were not confirmed. Therefore, we used the non-parametric Kruskal-Wallis test (Kruskal and Wallis, 1952) to compare the two independent groups of sampled data. No statistical significant differences were found between both groups (Sig=0.695). Therefore, we cannot say that chemical firms integrate their MSs at a different degree than the rest of organizations at a 95% confidence level.

4.3. Use of integration guidelines

Regarding the use of different guidelines during the integration of different MSs, firms have the option to use no guidelines, to integrate their MSSs with internal guidelines or to use other published ones. The majority of chemical and non-chemical firms (77%) do not use any type of guidelines to integrate their MSs. However, some of the firms (14%) use the UNE 66177:2005 guidelines (AENOR, 2005). Fewer firms (9%) use other guidelines, namely the internal ones in the majority of these cases.

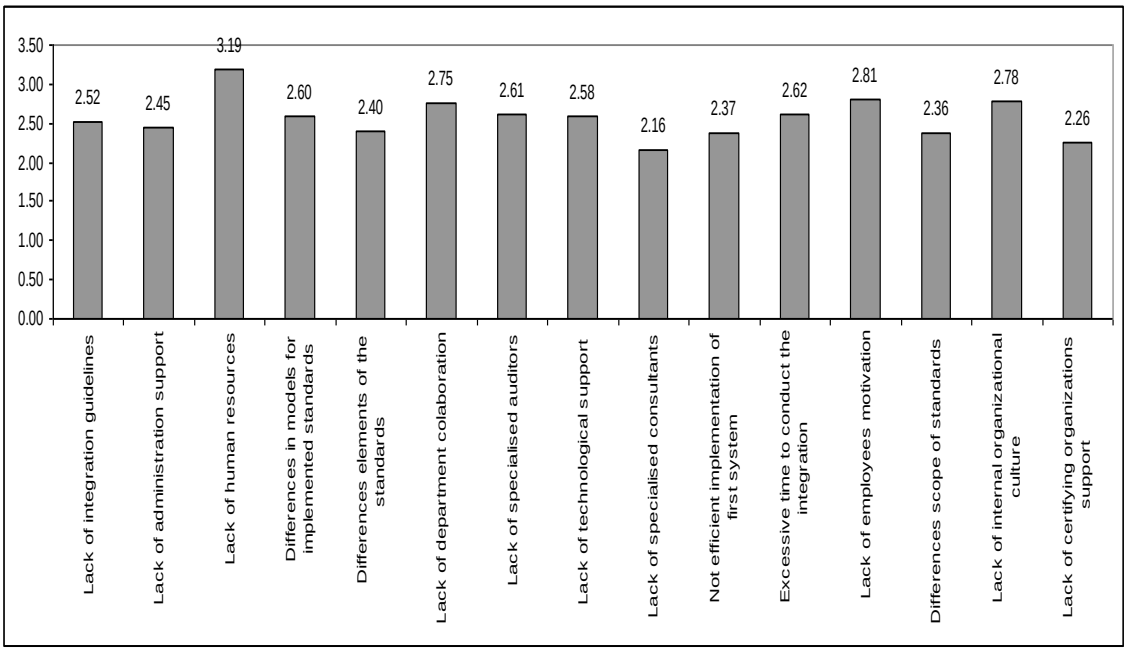
Comparing the 17 chemical firms with the rest of the organizations, we find that eight firms (47.05%) do not use any type of integration guidelines, whereas eight firms (47.05%) use UNE 66177:2005 to integrate their MSs. Finally, one chemical firm (5.88%) uses other guidelines during the integration process. Again, the results do not differ significantly from the results of the general sample (Sig=0.285).

Therefore, we cannot say that chemical firms use different integration guidelines compared to the rest of organizations, at a 95% confidence level.

4.4. Integration difficulties

Regarding the impediments experienced by the surveyed organizations during the integration process, the potential challenges most commonly experienced by companies integrating their MSs are listed below in Figure 1. The answers from the survey range from 1 to 5 on a Likert scale, 1 being "not important at all" and 5 "very important". The difficulties include, in the first place, the lack of human resources, in line with previous studies, the lack of employees motivation, and the lack of department collaboration, followed by other less-mentioned items, such as the excessive time to conduct the integration. The least important difficulties mentioned by the organizations were the lack of specialized consultants and the lack of support by the certification bodies.

Figure 1. Difficulties of integration



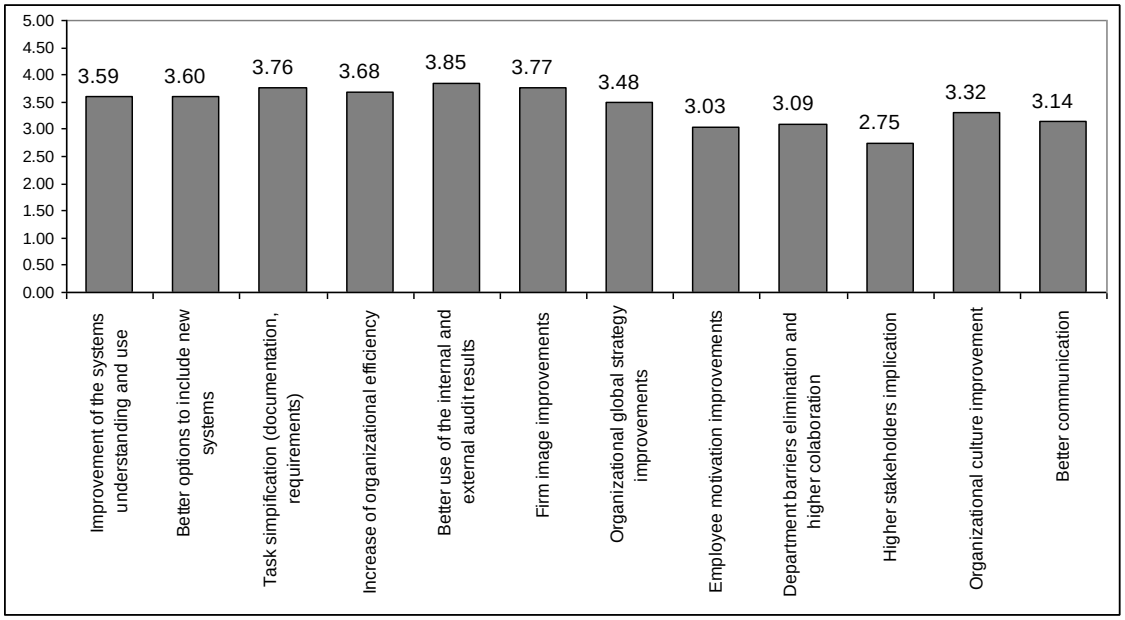
When compared to the non-chemical companies, these results do not differ significantly from the results of the general sample, with one exception for the variable *lack of administration support*, which is statistically different between the two samples (Kruskal-Wallis test significance = 0,049<0,05). In sum,

we cannot say that, in general terms, chemical firms have different types or levels of difficulties compared to the non-chemical firms when integrating their MSs at a 95% confidence level.

4.5. Integration benefits

Integration of separate MSs into one single integrated system has provided the surveyed companies with a number of benefits, as shown in figure 2. Within a range from 1 to 5 on a Likert scale, 1 being "not important at all" and 5 "very important", the main benefits of integration are a better use of audit results, improvement of the company image and task simplification. Again, these results match with the ones found by Zutshi and Sohal (2005), whose participants' MSs were viewed by external parties as single units, thus enhancing the credibility of the company and whose audits were reduced in number, time and cost. This results into a more dynamic and adaptive audit, harmonisation and integration of discipline-specific audits and corresponding audit guidelines (Karapetrovic and Willborn, 2001). Karapetrovic and Willborn (1998b) also mention the benefits regarding the improved company image associated with having an IMS. The benefits mentioned the least by organizations were higher stakeholders' implication and employee motivation improvements.

Figure 2. Comparison of chemical and non-chemical companies for the benefits of integration



Comparing the samples of chemical and non-chemical firms, a similar picture to the integration difficulties emerges with respect to the benefits of integration and none of the benefits of integration are significantly different between the two samples.

5. Case study analysis

5.1. Firm 1

Firm 1 has 31 employees. It develops and manufactures chemicals for process improvement in the paper and pulp industry. Its specialties and market segments include paper making, the production of cellulose, coated fine paper and recycling. The company distributes its products in 18 countries in Europe, America and Asia. Firm 1 has two standardized MSs, the QMS certified to ISO 9001:2008 and the EMS certified to ISO 14001:2004.

From the beginning, the implementation of the two systems was conducted without many problems, as the organization had formed part of a group and all the staff had already been working with the requirements established by the standards and were very involved with all the processes. Currently, the organization has fully integrated both MSs. The elements integrated to a higher extent are the human resources involved in the systems (system manager, director and inspectors), which are the same for the two MSs implemented, and the procedures, which are all fully integrated (e.g., system revision and improvement, control of non-conformities, preventive and corrective actions, planning, product realization, and documentation control). The documentation resources are also fully integrated (company policy, objectives, manual, work procedures) with the exception of the work instructions and the records which are partially integrated.

To carry out the integration, the company used tools such as a process map, an analysis of the common elements of the systems, the PDCA cycle for all the processes of the company, as well as an internal model of integration. They do not consider that integration had been a difficult process because they believe they are a small company and this constitutes a great advantage when working with the IMS. The company holds annual meetings to track the integrated system with all the heads of departments.

As for the benefits derived from integrating the two MSs, they believe that integration is necessary to simplify the two systems, because of the synergies created between them. In addition, the integration avoids duplication of efforts, especially in the electronic documentation and creation of procedures and

the management of the company becomes less expensive and more methodical. The difficulties that affected the company the most during the integration process were the excessive time to conduct the integration and the differences between the standards.

The firm intends to continue renewing the certificates of the two MSs. Additionally, they intend to implement OHSAS 18001 in a period of two years integrating it in the integrated management system. This wish is mainly due to the similarity with ISO 9001 and because the firm believes that they already meet all the OHSAS 18001 requirements. In addition to implementing this OH&SMS, they want to apply the EMAS standard for environmental management, but the company is not currently focused on achieving this recognition, as it aims to register to OHSAS 18000 first.

5.2. Firm 2

This company has 33 employees and it is dedicated to the manufacture and marketing of plastic vinyl compounds.

Currently, the firm has one single person, the quality manager, in charge of the two implemented MSSs, ISO 9001:2008 and ISO 14001:2004. The firm considers that, with time, it becomes easier to see what works and what does not work in the systems and to adapt them to the company needs, because the type of business and management determines the usefulness of the systems: *"There are aspects of the systems that we don't find especially useful, such as the process map, but instead, the record of incidents and complaints is very beneficial to us. Overall, having both systems is a positive thing".*

Regarding the implementation of other MSs, they considered introducing OHSAS 18001 as they belong to a French group that has a safety manual, with which the firm complies, so it would be relatively easy to certify to OHSAS, because they meet the law requirements for risk prevention issues. However, for now, they have decided not to implement the system due to a lack of time and resources.

Regarding the integration level, the elements integrated to the highest extent are the human resources (with the exception of the inspectors, which are partially integrated) and the procedures, which are all fully integrated, except for the planning. The documentation resources are also fully integrated, with the exception of the company policy and objectives, which are partially integrated.

Currently, Firm 2 has partially integrated the two MSs, but tries to gradually increase the number of procedures in the integrated system. For example, they recently increased the integration of the systems in relation to record control and internal communication. To do this, they used a detailed analysis of the common elements of ISO 9001 and ISO 14001 and an internal model.

The main benefits of integration for the firm are the reduction of bureaucracy and the exploitation of synergies between the two systems. It is also considered a good opportunity to include new systems in the company. However, the system is not considered as beneficial for the company image. One important disadvantage of running the integrated system highlighted by the company is the difficult planning and preparation of the integrated system, especially regarding the documentation, and the lack of human resources.In the future, the company plans to renew the certificates, but if ISO published an integration standard, they would not register to it because they consider that there are no benefits and that the costs would be too high.

5.3. Firm 3

Firm 3, with 135 employees, belongs to a group leader in the manufacture of lubricants. Its products include hydraulic fluids, laminating oil and biodegradeable lubricants.The firm has implemented ISO 9001:2008 and ISO 14001:2004 MSs. The quality manager is responsible for both systems and he considers that the most important benefit ISO 9001 has provided the company is the improvement of the efficiency and effectiveness in the processes. Regarding the benefits brought by ISO 14001, he emphasizes the elimination or at least the minimization of environmental impacts.

The quality manager of the company believes that the benefits from the time when ISO 9001 was implemented until now have changed in a positive way because *"working with processes requires all our employees to focus their attention to the customer"*.

Currently, the firm works with ISO 9001 and ISO 14001 as an integrated system, which has been integrated by combining the tables of contents of both standards and associating each of the points to match procedures. The company also used tools such as UNE 66177, the process map and an analysis of the common elements of the systems.

In recent years, the level of integration has not increased or decreased, and the company has not found any difficulties in maintaining the integrated system. Regarding the integration level, the elements integrated to the highest extent are the human resources (fully integrated) and the documentation

resources, which are all fully integrated except for the records. The procedures are also fully integrated, with the exception of the manufacturing.

The firm considers that the main benefit derived from the integration is avoiding the fulfilment of requirements in a repetitive way. It also improves the company image, the global strategy of the firm and the communication during the interaction of the different processes.

The company plans to recertify in the future, but does not consider the possibility of registering to a standard for integraton or any other standard in the short term.

5.4. Comparing chemical case study companies' management systems and their integration

Taking into account that the integration of MSs is a field with little empirical evidence, the research carried out here can be useful for companies aiming to integrate, or are in the process of integrating their MSs. Several relevant considerations about the three chemical companies are identified below.

In addition to all three companies having both ISO 9001 and ISO 14001 certificates, none of them implemented any other MS. However, two reported that they had considered the implementation of OHSAS 18001. All three firms achieved a high degree of integration of their human resources, objectives, documentation and goals, as suggested by Karapetrovic et al. (2006). In order to achieve this level of integration, two of them used an internal model, whereas one used UNE 66177. Regarding the integration tools, all the firms used an analysis of the common elements and in one case, the PDCA approach and the process map.

In line with previous studies, the most cited benefits of each system are the increase of the efficiency of processes, reduction of documentation and customer focus for ISO 9001 and the reduction or elimination of environmental impacts for ISO 14001.

Another relevant aspect is that these three organizations integrated their MSs, one partially and the other two completely. All of them have an IMS, which means the personnel responsible for the MSs, the documentation and the processes are integrated at some level for all the existing MSs in the firm.

One special concern of firms 1 and 2 is top management commitment, which is essential for the implementation and maintenance of the integrated management system (Zutshi and Sohal, 2005; Asif et al. 2009). In the three companies, the leaders are personally involved in communicating the company's

goals and plans and in motivating the employees. The management teams also conduct periodic reviews of the system with the rest of the personnel. This is considered necessary for any system implementation in the organizations. According to Zutshi and Sohal (2005), top management commitment provides resource savings and the reduction of costs that will result from operating an IMS.

No major challenges during the integration of MSs were found by organizations except for firm 2 which cited planning and preparation of the IMS, especially regarding documentation, as the most important difficulty, together with communication. This company encouraged internal communication among the personnel involved in the IMS as well as the communication with the company management. This resulted in better understanding across the various departments, in line with the findings of Zutshi and Sohal (2005).

All three firms consider that the integration of MSs has been beneficial and emphasize the reduction of bureaucracy and the exploitation of synergies between the two systems as the main outcomes, similarly to the findings of Khanna (2010). As for the disadvantages of having the systems integrated, as mentioned in Karapetrovic and Willborn (1998a) and Karapetrovic (2003), they encounter difficulties, especially when elaborating the documentation for the integrated system.

According to Zutshi and Sohal (2005), one of the key impediments faced by many organizations is the maintenance of their documentation system which "needs to be highly controlled so as to avoid duplication of procedures that may result in confusion among the employees". Two of the firms commented on the importance of making the documentation electronic, to ensure that all personnel within the organization have access to the whole IMS. In spite of the benefits that integration gives to the organization, only one of the firms increased the level of integration during the last four years by adding new processes to the integrated system such as records control and internal communication.

5.6. Case study analysis of non-chemical firms

Next, we analyze three case studies of non-chemical firms, in order to compare their integration processes with those of chemical firms. The aspects analyzed were, integration strategy and level and the benefits and difficulties of integration. The main characteristics of the organizations can be found in Table 2, compared to chemical firms.

Table 2. Firms' characteristics

Firm	N employees	Firm size	Geographical scope	Sector
1Ch	31	Small	International	Paper production
2Ch	33	Small	International	Plastic vinyl compounds production
3Ch	135	Medium	National	Lubricants production
1Nch	400	Large	International	Energy management
2Nch	115	Medium	National	Metallic components production
3Nch	14,100	Large	National	Railway infrastructure management

5.6.1. Integration strategy and level

The sequence of implementation of the management systems is similar in all three organizations, as no differences were found regarding the order of implementation (see Table 3). The three organizations implemented first the Quality Management System (QMS) and then the Environmental Management System (EMS). In one of the organizations, OHSAS 18001 for occupational health and safety was subsequently implemented. Regarding the future of standards, two of the organizations showed interest in implementing sector-specific standards in the following years.

Table 3. Integration strategy

	1Nch	2Nch	3Nch
MSs implementation and order	ISO 9001 ISO 14001	ISO 9001 ISO 14001	ISO 9001 ISO 14001 OHSAS 18001
Future	None	ISO 3834-2 DIN-EN 15085-2	SGE 21

With respect to the integration level, higher levels of integration were exhibited in MS procedures, such as record and document control or preventive and corrective actions, while the elements integrated to a lesser extent were product realization and internal communication.

Regarding the integration of the human resources, all three companies state that they have achieved a state of partial integration, where the person responsible for the systems is the same, but the rest of the

workers and inspectors are different for the different systems. Therefore, in terms of the human resources involved in the different MSs, the level of integration is much higher at the top level than at the shop-floor level.

The process of integration was conducted using an internal model in one of the companies whereas the other two used UNE 66177, the Spanish standard for MS integration. Regarding the integration tools, all three used the process map, an analysis of the common elements of the systems, an internal model and in two of the cases, the PDCA approach.

Table 4. Integration level

	1Nch	2Nch	3Nch
Level	Partial	Partial/Full	Partial/Full
-Human resources	Partial	Partial	Partial
-Documentation	Partial	Full	Partial
-Procedures	Partial	Full	Full
Guidelines	Internal model	UNE 66177:2005 (AENOR)	UNE 66177:2005 (AENOR)
Tools	Process map Common elements analysis Internal model	Process map Common elements analysis Internal model PDCA approach	Process map Common elements analysis Internal model PDCA approach

5.6.2. Integration benefits and difficulties

Integration has brought many positive effects for the three interviewed companies. Some of the most positive points mentioned by the managers regarding the integration of MSs are the improvement of the systems understanding and use, better options to include new systems, increase of the organizational efficiency, task simplification (in terms of documentation control, MSSs requirements), better use of audit results and improved company image.

Table 5. Integration benefits

Benefits	1Nch	2Nch	3Nch
Improvement of the systems understanding and use			X
Better options to include new systems		X	X
Increase of efficiency	X	X	X
Task simplification	X	X	X
Organizational global strategy improvements			
Better use of audit results			X
Culture improvement			
Better communication			
Higher stakeholders implication			
Company image improvement			X

The most cited difficulties during the integration of MSs are the differences in the models of the standards, problems with the implementation of the first system in the organization, the lack of specialized auditors, the lack of human resources and the lack of employees' motivation. These results are especially relevant, as they show the importance of implementing the systems well and motivating and implicating the human resources in order to achieve a successful integration.

Table 6. Integration difficulties

Difficulties	1Nch	2Nch	3Nch
Differences among the scope of the standards			
Differences in the models of the standards	X		X
Problems with the implementation of the first MS (ISO 9001)		X	X
Lack of department collaboration			
Lack of technological support			
Lack of specialized auditors	X		X
Lack of human resources	X		
Lack of employees' motivation			X
Lack of internal organizational culture			

5.7. Comparing chemical and non-chemical organizations

The case studies analyzed show that, in all organizations, the integration level is high in all elements of the IMS, althoughsome differences between chemical and non-chemical firms arise. For example, the three chemical organizations seem to have integrated the human resources to a higher extent that the non-chemical organizations. Regarding the integration level of the objectives, documentation and procedures, the elements that are integrated to the highest extent are the procedures, which are fully integrated in five of the six organizations. Higher levels of integration were exhibited in chemical firms in some procedures, such as improvement and control of the systems, resource management and documentation control.

The sequences of implementation of MSs are similar in all six organizations, as they implemented the QMS first and then the EMS. The process of integration was conducted using an internal model in three of the companies, whereas the other three used UNE 66177. Regarding the integration tools, all six firms used an analysis of the common elements of the MSSs. Additionally, in some of the firms, a process map, an internal model and a PDCA approach was used.

Regarding the benefits and difficulties of integration, chemical firms perceive more benefits about environmental impacts (e.g., reduction of the documentation, elimination of environmental impact), whereas non-chemical firms are more focused on the opportunities that the IMS brings to the company regarding the integration process (e.g., improvement of the systems understanding and use, better options to include new systems, and better audits). However, some benefits are common in all firms, such as improved efficiency and external image. The most cited difficulties in non-chemical firms were the lack of communication and top management commitment, which shows that these problems are similar to those of non-chemical firms, who also state that the problems with the people involved in the systems and the lack of employee motivation were their main challenges when implementing the IMS.

6. Conclusions

The main objective of this research was to study the integration of management systems in the chemical industry. In order to accomplish this objective, an empirical study was undertaken, with a descriptive analysis of the results of a survey and six case studies. As the results for chemical and non-chemical firms were shown not to be significantly different, the first conclusion drawn from the study is that chemical firms integrate in the same way and at the same level, that is, they highly integrate their MSs, compared to the non-chemical firms. However, although non-significant differences were found in the comparison tests, some differences between the two types of firms arose in the case study analysis regarding the integration level and the benefits and difficulties encountered during the integration process.

In the first place, from the results obtained we can conclude that the majority of firms with more than one MS integrate them into a single system. Only 13% of the organizations analyzed in the descriptive analysis decided not to integrate their MSs and we could not identify any firm that did not integrate quality and environmental MSs to a certain degree in the case study analysis. In other words, it can be concluded that the integration of systems is one of the major strategies for ensuring survival and savings for the organizations of the sample (Zutshi and Sohal, 2005). Therefore, in line with the results of Karapetrovic et al. (2006), Karapetrovic and Casadesús (2009) and Bernardo et al. (2009), organizations prefer integration of MSs to managing them separately. However, in chemical firms, the human resources and some procedures such as improvement and control of the systems, resource management or documentation control, showed higher levels of integration.

One of the most interesting contributions of this article is related to the numerous benefits that firms perceive of having an IMS (Karapetrovic and Willborn, 1998b; Karapetrovic, 2003; Sutshi and Sohal, 2005; Zeng et al, 2007; Bernardo et al, 2009). The interviews and survey answers revealed a number of benefits experienced by the companies from operating one integrated system, such as synergism promotion and cost savings for the firm as well as a reduction of the time spent when managing the systems. Integration also allows the organizations interviewed to minimize duplication and redundancy of effort, to eliminate overlapping roles and responsibilities and to increase the efficiency of resource management, to name a few of the benefits mentioned in the case studies. Regarding the differences between chemical and non-chemical firms, chemical firms perceive more benefits about environmental impacts, whereas non-chemical firms are more focused on the opportunities that the IMS brings to the company regarding the integration process.

However, for the benefits to be realized it is essential that organizations are aware of the challenges and obstacles accompanied by the integration of systems (Zutshi and Sohal, 2005). All of the firms interviewed highlight that during the integration process, some difficulties or challenges arose, with the lack of human resources and the lack of employees motivation being the most cited ones. Zutshi and Sohal (2005) outline the importance of personnel becoming aware of the inter-relations existing between the different systems and Karapetrovic and Willborn (1998b) insist on the importance of a good allocation and deployment of human resources in order to increase the efficiency and effectiveness of the interlinked systems. Another particular concern expressed by some of the companies is the lack of involvement of the rest of departments in the firm regarding quality and environmental matters. Moreover, it is worth mentioning that two of the six firms highlight the importance of top management involvement in order to implement and maintain the IMS.

This paper contributes to narrowing the gap between theory and practice in the field of MSs integration by providing examples of the steps, benefits and challenges that six firms encountered when implementing their IMS. This may have implications for other firms aiming to integrate their MSs, as well as for the consultants and auditors who help them in that process. Recommendations for other firms aiming at the integration of their MSs may include actions oriented towards the efficient management of human resources, motivation programs, top management commitment, interdepartmental collaboration as well as having integrated audits.

The major limitation of this empirical study is that the case studies analyzed only reflect the points of view of the company managers and not of the other people involved, such as the auditors or the employees. If this had been the case, the richness of the data gathered would have been higher and therefore the conclusions drawn for the study would have been more representative of the reality of these organizations. Another limitation of this empirical study is the number of organizations responding to the survey (the 76 firms analysed in the descriptive analysis), which does not allow extrapolating our results to other organizations. However, as this research aims to be an exploratory analysis of the situation of MS integration, we believe that our results can be significant for future studies conducted with a wider scope.

For future research, given the large number of companies with IMSs, it would be interesting to further study these exploratory results and develop more case studies to document the progress in the area of integration of MSs.

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