University of Alberta

Implementation, Integration and Auditing of
ISO 14001 Management Systems in Canada

by

Tijana Durdevic

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science

in

Engineering Management

Department of Mechanical Engineering

Spring, 2014
Edmonton, Alberta

Abstract

The main goal of this research was to investigate the application of the ISO 14001 standard in Canadian organizations. Seventeen research questions were defined and addressed using a survey of 32 organizations registered to the standard. Descriptive, explorative factor, reliability and cluster analyses, as well as structural equation modeling, were employed. A relationship between the implementation motives and benefits was found to exist. The results regarding the integration and auditing processes were different from a previous Spanish study. For example, the majority of Canadian organizations faced difficulties related to the differences in the standards. The main limitation was a very small sample size. Nevertheless, the research presents a valuable contribution to the fields of research in integration, internal and external auditing, as well as the implementation of ISO 14001, since the examination of these fields has either not been done or has been limited in Canada.

Table of Contents

List of tables

List of figures

List of acronyms and abbreviations

BNQ Bureau de Normalisation du Quebec
DA Descriptive Analysis
EAs External Audits
ES Environmental System
EMS Environmental Management System
EFA Explorative Factor Analysis
FA Factor Analysis
GETF Global Environmental and Technology Foundation
HR Human Resources
IAs Internal Audits
IEAs Internal and External Audits
IMS Integrated Management System
ISO International Organization for Standardization
MS Management System
MSs Management Systems
MSS Management System Standard
MSSs Management System Standards
OHSAS Occupational Health and Safety Assessment Scheme
OHSMS Occupational Health and Safety Management System
PWGSC Public Works and Government Services Canada
QS Quality Systems
QMS Quality Management System
QMI-SAI Quality Management Institute - SAI Global
RA Reliability Analysis
RQ Research Question
RQs Research Questions
REB Research Ethic Board
SEM Structural Equation Modeling
SMEs Small and medium enterprises

1. Introduction

This research was conducted in order to obtain and analyze the results of a survey regarding the influence of the ISO 14001 standardized system on Canadian organizations and the integration of this system with other standardized management systems (MSs). The literature review and the methodology that support the research are presented in Chapters 2 and 3, respectively. The results of the survey are divided into three major Chapters (4, 5 and 6) and cover several sub-topics, including the ISO 14001 implementation motives, benefits, time and costs, the other management systems standards (MSSs) employed by Canadian organizations registered to ISO 14001, the extent to which the ISO 14001 environmental management system (EMS) is integrated with other standardized MSs, the level of MSs integration, the ISO 14001 internal and external audits (IEAs) and the level of integration of IEAs. The following three sub-chapters (1.1, 1.2 and 1.3) introduce the three major topics covered in this research.

1.1 ISO 14001 implementation motives and benefits

There are a large number of studies that examine ISO 14001 motives and benefits (e.g. Pan, 2003; Turk, 2009; Massoud et al., 2010; Psomas et al., 2011; Arena et al., 2012). These studies have been conducted around the world in the last two decades or so. For instance, Turk (2009) investigated these aspects in

Turkey, Silva and Medeiros (2004) in Brazil, Christensen and Rasmussen (1998) in Denmark and Poksinska et al. (2003) in Sweden. However, the number of studies that cover and investigate ISO 14001 motives and their accompanying benefits in Canada is limited. Only two studies have been found (Boiral and Sala, 1998 and Jiang and Bansal, 2003). Therefore, this research aims to investigate, among other research questions (see 2.4), the main ISO 14001 motives and benefits in ISO 14001- registered Canadian organizations and the relationship between them. The study discusses the major motives that drive Canadian companies to adopt ISO 14001, the benefits that Canadian organizations perceive from adopting ISO 14001, the relationships between the implementation motives and their associated benefits, and the differences in the reported motives and benefits with respect to the organization size and industry sectors.

1.2 Integration of standardized MSs

Having an integrated management system (IMS) has become popular for organizations in the last decade or so. The number of studies regarding the integration of standardized MSs is increasing as well. Some of these studies focus on the integration levels (Douglas and Glen, 2000; Karapetrovic, 2002; Beckmerhagen et al., 2003; Jorgensen et al., 2006; Salomone, 2008; Bernardo et al., 2009; Karapetrovic and Casadesus, 2009; Asif et al., 2010; Bernardo et al., 2012a; Bernardo et al., 2012b; Simon et al., 2012a), others on the motives (Fresher and Engelhardt, 2004; Zutshi and Sohal, 2005; Salomone, 2008; Khanna

et al., 2010), and some on the benefits that organizations perceive from having an IMS (Karapetrovic and Willborn, 1998a; Wilkinson and Dale, 1999; Douglas and Glan, 2000; Beckmerhagen et al., 2003; Zutshi and Sohal, 2005; Griffith and Bhuto, 2008; Simon et al., 2012b). However, studies regarding the integration levels, integration difficulties and the reasons for keeping the MSs separated in Canada do not exist. The literature also lacks in the studies regarding the integration with respect to the organization size and industry sectors in general. Therefore, one of the goals of the thesis is to investigate these aspects in ISO 14001-registered Canadian organizations. The thesis also examines the level of integration of standardized MSs with respect to three different aspects: documentation, processes and human resources.

1.3 Auditing

There are a small number of studies that discuss integration of IEAs (e.g. Karapetrovic and Willborn, 2001; Douglas and Glen, 2000; Pojasek, 2006; Bernardo et al., 2010; Simon et al., 2011). These studies could be classified into two different groups: theoretical (Karapetrovic and Willborn 1998b; Karapetrovic and Willborn, 2000; Karapetrovic and Willborn, 2001; Karapetrovic, 2002a; McDonald et al., 2003; Pojasek, 2006; Kraus and Grosskopg, 2008) and empirical (Wilkinson and Dale, 2000; Douglas and Glen, 2000; Karapetrovic et al., 2006; Casadesus et al., 2007; Salomone, 2008; Bernardo et al., 2010; Simon et al., 2011). However, only one study investigates the relationship between the level

of integration of MSs and the level of integration of audits, namely, Bernardo et al. (2011). Therefore, one of the goals of this research is to examine the level of integration of IEAs in ISO 14001-registered Canadian organizations. The research specifically investigates how integrated IEAs are with respect to three different aspects, namely audit simultaneousness, plans and report, and view. It also discusses the frequency of conducting the ISO 14001 IEAs, the structure of internal audits (IAs) as well as the main usage of the audits. The relationship between the level of audits integration and the level of MSs integration was investigated as well.

1.4 Organization of the thesis

Chapter 2 presents a literature review on the ISO 14001 implementation, integration of ISO 14001 with other MSs and auditing. Chapter 3 illustrates the methodology employed in the research, including the survey used, the characteristics of the organizations that completed the survey, the samples used for data analysis and structural equation modeling (SEM). Chapter 4 presents and discusses the results regarding ISO 14001 implementation. Chapter 5 illustrates and discusses the results with respect to the integration of ISO 14001 with other standardized MSs. Chapter 6 presents and discusses the results regarding auditing. Finally, Chapter 7 summarizes the findings and contributions obtained in the study. It also highlights the limitations that exist in the study and makes recommendations for possible future research.

2. Literature review

This chapter presents the literature review on the three major topics discussed in the thesis:

2.1 ISO 14001 implementation,

2.2 Integration of ISO 14001 with other MSs, and

2.3 Auditing.

2.1 ISO 14001 implementation

Section 2.2.1 focuses on the motives that drive organizations to apply the ISO 14001 EMS. Section 2.2.2 discusses the benefits that organizations perceive from having the ISO 14001 EMS. Section 2.2.3 reviews the time and costs that organizations invest in the ISO 14001 implementation.

2.1.1 ISO 14001 motives

The ISO 14000 family of environmental standards is the work of the International Organization for Standardization (Watson and Emery, 2004). From this family, ISO 14001 illustrates the world's most-recognized framework for managing organizations' environmental impacts (Rezaee and Elam, 2000; Ann et al., 2006). Additional information regarding the ISO 14001 EMS can be found in Appendix A.

There are a large number of studies regarding the motivation for implementing the ISO 14001 EMS. These studies are widely spread around the world and cover

various countries, sizes and types of organizations (e.g. Turk, 2009, and Silva and Medeiros, 2004). However, recently conducted studies (e.g. in the last five years) are limited. Moreover, there are only two studies in Canada (Boiral and Sala, 1998 and Jiang and Bansal, 2003) and both were conducted about 10 years ago.

The studies regarding the ISO 14001 motives could be divided into two groups: 'review of the existing literature' studies (Hillary, 2004 and Liyin et al., 2006) and empirical studies (Wilmshurst and Frost, 1997; Georgiadou and Tsiotras, 1998; Christensen and Rasmussen, 1998; Boiral and Sala, 1998; Pan, 2003; Poksinska et al., 2003; Jiang and Bansal, 2003; Silva and Medeiros, 2004; Chan and Wong, 2006; Salomone, 2008; Turk, 2009; Rodriguez, 2009; Massoud et al., 2010; Psomas et al., 2011; Arena et al., 2012).

Most of the empirical studies used descriptive analysis (DA) for analyzing the data, e.g. Wilmshurst and Frost (1997), Christensen and Rasmussen (1998), Georgiadou and Tsiotras, (1998), Boiral and Sala (1998), Poksinska et al. (2003), Salomone (2008), Turk (2009) and Arena et al. (2012). Some of the studies employed factor analysis (FA) (Chang and Wong, 2006; Psomas et al., 2011). In addition to FA, Pan (2003) also used cluster analysis (CA). However, there is only one empirical study, namely Rodriguez (2009) that used SEM. Nevertheless, that study was conducted in Spain, so the country was different than in this research.

Appendix B illustrates the major findings regarding the motivation for implementing the ISO 14001 EMS with respect to the country where the studies were conducted in a chronological order. According to these studies, it can be concluded that the most cited motives could be separated into two groups: internal motives, such as "*improvement of organization image"* (Georgiadou and Tsiotras, 1998; Poksinska et al., 2003; Salomone et al., 2008), *"environmental friendly policy"* (Psomas et al., 2011)*, "environmental performance improvement"* (Arena et al., 2012), *"following international trend"* (Massoud et al., 2010)*, "easy access to international market"* (Turk, 2009)*, "improving the environmental aspects inside the firms"* (Mohammed, 2000), *"positive environmental attitude"* (Christensen and Rasmussen, 1998), *"better control of human behavior*" (Boiral and Sala, 1998) and external motives, such as *"ecological concerns"* (Rodriguez, 2009), *"regular responsibilities"* (Silva and Medeiros, 2004)*, "task visibility"* (Jiang and Bansal, 2003)*, "external pressure"* (Pan, 2003)*, "satisfying customer requirements"* (Wilkinson and Dale, 1999c) and *"legal obligations"* (Wilmshurst and Frost, 1997).

The most common motive reported by the majority of studies was 'enhancing / improving / increasing organizations image' (Christensen and Rasmussen, 1998; Georgiadou and Tsiotras, 1998; Poksinska et al., 2003; Salomone, 2008). The least cited one was environmental performance improvement, reported only by Arena et al. (2012). Some other commonly-reported motives were: "*gaining*

environmental friendly policy" (Psomas et al., 2011), "*following the international trend*" (Massoud et al., 2010), "*easy access to international market"* (Turk, 2009), *"ecological concerns"* (Rodriguez, 2009) and "*satisfying customer requirements"* (Wilkinson and Dale, 1999c).

2.1.2 ISO 14001 benefits

As there are a large number of different motives that drive organizations to implement the ISO 14001 EMS, there are also a number of different benefits that organizations perceive from having ISO 14001. According to To et al. (2012), organizations experience benefits from having an ISO 14001 EMS and those benefits are usually reported as follows: "*reduced cost of waste management, savings in consumption of energy and materials, lower distribution costs, improved corporate image among regulators, customers and public, framework for continual improvement of environmental performance"* (To et al., 2012).

Studies that cover ISO 14001 benefits can be split into two groups: 'review of the existing literature' studies (e.g. Jones et al., 2005) and empirical studies (e.g. Christensen and Rasmussen, 1998; Boiral and Sala, 1998; Holt, 1998; Chavan, 2005; Goh et al., 2006; Nga, 2009 and Arena et al., 2012). The majority of empirical studies are descriptive (Boiral and Sala, 1998; Holt, 1998; Poksinska et al., 2003; Goh et. al., 2006; Nga, 2009; Turk et al., 2009; Arena et al., 2012). However, there are others that use the case study method (Petroni, 2000; Chavan, 2005), grounded theory (Griffith and Bhutto, 2008; Griffith and Bhutto,

2009), CA (Pan 2003) and FA (Goh et al., 2006; Psomas et al., 2011). However, there are no empirical studies that employed SEM.

Appendix C shows the findings of the above mentioned authors with respect to the country where the studies were conducted in a chronological order. It can be concluded that companies indeed benefit from an ISO 14001 EMS, as was said by To et al. (2012). However, most of the benefits reported by the different authors were also different. Therefore, it was very difficult to group these benefits into smaller groups, as was done for the ISO 14001 motives. Nevertheless, the following benefits were cited as the most important ones: image improvement (Poksinska et al., 2003), environmental performance enhancement (Arena et al., 2102), the market benefits, such as reputation (Goh et al., 2006), market position (Psomas et al., 2011), appeal to customers (Christensen and Rasmussen, 1998), competitive edge (Pan, 2003), "*support(ing) the interest of stakeholders"* (Nga, 2009), reduction of resources, such as energy (Radonjic et al., 2006; Mohammed, 2009), paper (Mohammed, 2009) and water (Mohammed, 2009), "*improvement of the environmental awareness"* (Turk, 2009), and reduction of costs (Chavan, 2005; Griffith and Bhutto, 2008; Griffith and Bhutto, 2009).

2.1.3 Time and costs of ISO 14001 implementation

Even though ISO 14001 implementation brings a number of benefits to an organization, it also brings expenses generally associated with the process of implementation and certification. How much it would cost to implement and

maintain a standardized MS usually depends on various factors, such as the number of employees in a company, previous experience with the system and the availability of financial and human resources (Jiang and Bansal, 2003). According to an estimate by the Global Environmental and Technology Foundation (GETF), the initial implementation and certification could cost firms between CAD24,000 and CAD128,000, depending on the size of the company and the procedures (Jiang and Bansal, 2003). Moreover, the systems maintenance could cost about CAD5,000 to CAD10,000 annually (Jiang and Bansal, 2003). However, *"if a firm already has a sophisticated in-house EMS*, *the additional costs of certifying and maintaining ISO 14001 could be considerably lower*" (Jiang and Bansal, 2003).

Three studies were found that reported time and costs associated with the implementation and certification to ISO 14001. Turk (2009) reported that 18 out of 28 companies in Turkey obtained their ISO 14001 certificates within six months, nine organizations between 6 and 12 months, and only one organization needed more than 12 months for ISO 14001 certification. With respect to the costs linked to the ISO 14001 implementation, 24 organizations spent less than USD50,000, two organizations between USD50,000 and USD100,000, and only one more than USD100,000 (Turk, 2009). In addition, Zeng et al. (2007) reported that 37 out of 104 firms needed over three years, 53 firms between one and three years, and the remaining 14 firms less than one year to implement ISO

14001. Strachan et al. (2003) also reported the "*timeframe"* for the oil and gas as well as service companies in the United Kingdom. From the start of the implementation to the certification, oil and gas companies needed from 6 to 24 months, while service firms needed between 12 and 24 months (Strachan et al. 2003). In addition, Chavan (2005) provided information on what the main cost could include. According to him, the main cost associated with the ISO 14001 implementation includes hiring a consultant to "*oversee implementation*", additional wages to staff and management for helping to establish the EMS, purchase of new equipment to comply with ISO 14001, and the cost of ISO 14001 certification and maintenance of the registration (Chavan, 2005).

2.2 Integration of ISO 14001 with other standardized MSs

This sub-chapter illustrates the literature regarding the five integration sub-topics discussed in the thesis:

- 2.2.1 Integration time
- 2.2.2 Order of integration
- 2.2.3 Level of integration
- 2.2.4 Integration difficulties, and
- 2.2.5 Keeping the MSs separated.

Additional information on integration as well as its aspects, such as motives and benefits can be found in Appendix D, E and F, respectively.

2.2.1 Time required for integration

The time required for integration depends on the efficiency in the use of resources and the effectiveness of the application of the standards (Karapetrovic and Casadesus, 2009). Karapetrovic and Casadesus (2009) reported that the average lead time for the implementation of the first MSS was 19 months. For the second MSS, it was 15 months and for the third and fourth MSS, the lead time was the same at 11 months. In addition, the average time for a simultaneous implementation of ISO 9001 and ISO 14001 was 13.8 months, which shows that by implementing MSSs at the same time companies could save on implementation time, since the average sum for the sequential implementation of these two standards was 33.5 months. On the other hand, according to Zeng et al. (2011) in China, 23% of the companies invested over three years in implementing their IMS, 36% between one and three years and the remaining 41% needed less than one year to implement an IMS.

2.2.2 Order of integration

According to Karapetrovic and Willborn (1998a), there are three possible strategies for integrating an ISO 14001 EMS and an ISO 9001 quality management system (QMS). The first strategy implies that the QMS is established first. The second strategy is the opposite, namely the EMS is established first. Finally, the third strategy implies that the QMS and the EMS are established together. Furthermore, Beckmerhagen et al. (2003) also defined

three strategies for the integration of three systems, namely the QMS, the EMS and the occupational health and safety management system (OHSMS): QMS first, then EMS and OHSMS together; QMS and EMS first, followed by other MSs; and all MSs together.

Griffith and Bhutto (2008) identified three strategies as well: *"merged system"* (QMS and EMS are established together; QMS is used as the basis for developing an EMS), *"conversion system"* (environmental elements are developed within an established QMS) and *"engineered system"* (integration of EMS with OHSMS and QMS to form *"a holistic system")*. On the other hand, Labodova (2004) identified two strategies only: *"step-by step"* (sequential implementation of individual systems and combining them into IMS) and implementation of IMS (one system covers all areas directly using methodology based on risk analysis, since it can be used as an integrated factor, for example, risk for quality and risk for the environment).

There are also empirical studies regarding the order of the implementation of MSs. Douglas and Glen (2000) reported that the QMS was implemented prior to an EMS in all organizations in their sample. Zeng et al. (2007) and Zeng et al. (2011) found that more than 60% of Chinese companies implemented the ISO 9001 QMS prior the ISO 14001 EMS. Salomone (2008) also found that over 50% of the companies had a QMS as a base for the integration (first ISO 9001, then ISO 14001 and OHSAS 18001).

Karapetrovic and Casadesus (2009) reported that 96% of the companies registered against ISO 14001 also have a QMS registered in accordance with ISO 9001, while 22% of the companies have OHSAS 18001 in addition to having ISO 14001 and ISO 9001. Only 2% of the companies implemented a corporate social responsibility MS in accordance with SA 8000 and 11% a sector-specific standard ISO/TS 16949:2002 (Karapetrovic and Casadesus, 2009). Similarly to the research of Douglas and Glen (2000), most of the companies in the Karapetrovic and Casadesus sample implemented ISO 9001 first, followed by ISO 14001 and then OHSAS 18001. In addition, 11% implemented EMS and QMS simultaneously, while 3% implemented an EMS prior to a QMS (Karapetrovic and Casadesus, 2009). Bernardo et al. (2012a) also examined the order of MSs implementation. According to their results, the most common sequence is: 'QMS first, followed by EMS', then 'QMS and EMS simultaneously', and finally 'EMS first, followed by QMS' (Bernardo et al., 2012a). These results are in line with the theoretical proposal by Karapetrovic and Willborn (1998a). They have also found that large companies tend to implement more standards than the small and medium enterprises (SMEs) (Bernardo et al., 2012a).

2.2.3 Level of integration

The effectiveness of integration is measured in terms of the degree of integration, which represents the extent to which integration of MSs takes place

at different levels of the organization (Asif et al., 2010). According to Asif et al. (2010), there are three levels at which integration could be carried out: strategic, tactical and operational level. There are also three main elements of standardized MSs that can be integrated at different levels: goals, processes and resources (Karapetrovic and Willborn, 1998a). It may also be possible that the level of integration depends on the hierarchical level (Karapetrovic, 2002b). The higher levels are more likely to achieve full integration, while function-specific MSs at the intermediate levels could stay independent (Karapetrovic, 2002b). However, the function-specific MSs should be fully integrated at the level of individual work operation (Karapetrovic, 2002b). Nevertheless, the degree to which an organization will integrate its MSs into a single IMS mostly depends on organizational specific needs (McDonald et al., 2003).

The following paragraphs discuss levels of integration as found by different authors. Wilkinson and Dale (2000) identified two approaches reflecting the differences in the culture and the needs of organizations: *"the aligned approach"* (merging of the documentation or the integration through the standards) and "*the total quality approach"* (implementation of an IMS). Beckmerhagen et al. (2003) identified three integration degrees: "*harmonization, cooperation and amalgamation".* The same authors agreed that in the case of a large organization full integration *("MSSs are amalgamated into a new, single IMS"*) should not occur at all hierarchy levels (Beckmerhagen et al., 2003). It is required at the top

and the bottom, while the function-specific elements should be separate at intermediate levels (Beckmerhagen et al., 2003). However, in the case of small organizations, full integration is required at all levels (Beckmerhagen et al., 2003). Renzi and Cappelli (2000) also agreed that integration should be maximal at the top management level and between the technical employees, while staying low in the middle. As they say, keeping the system separate at the middle level is more useful, since specific technical skills are required (Renzi and Cappelli, 2000). Therefore, "*total integration is in the handbook and in the general procedures, while working procedures are partly shared and partially different"* (Renzi and Cappelli, 2000). Jorgensen et al. (2006) also identify three degrees of integration: *"corresponding system"* (*"increased compatibility with cross-references between parallel systems"*), *"coordinated and coherent system"* ("*generic process with focus on tasks in the management cycle*") and *"strategic and inherent system" ("organizational culture of learning, continuous improvements of performance and stakeholder improvement related to internal and external challenges").*

There are also a large number of studies that provide empirical information regarding the degree of integration. For instance, Douglas and Glen (2000) reported that 71% of the responding companies had integrated some aspects of their QMS and EMS. Of these 71%, 45% had developed a single manual and procedures, while 55% used different documentation for both systems, because

as they said *"it reduces audit time by keeping them separate"* (Douglas and Glen, 2000). With respect to the human resource integration, 57% reported that the management of both systems was the responsibility of one representative (Douglas and Glen, 2000). Salomone (2008) also reported the levels of integration as follows: *"control of document 100%, policy management review and continual improvement 93%, objective and targets, control of records and internal audits 87%, education and training 86%, manual 84%, emergency preparedness and response 83%, strategy and scope 77%, internal and external communication 73%, operational control 68%, analysis of environmental aspects and health and safety risks 66%, programme 64%, responsibility and authority 63%, certifier audit 61% and customer audit 35%"* (Salomone, 2008). Karapetrovic and Casadesus (2009) reported that 85% of companies claim some kind of the integration, while only 15% have not integrated their MSs into a single IMS.

Moreover, Bernardo et al. (2009) found that 86% of respondents had partial or full integration. However, with respect to the human resources at all hierarchical levels studied (manager, representative and inspector), the most common case was to have different people responsible for different functions, which do not agree with Karapetrovic (2002b) and Beckmerhagen et al. (2003) according to whom a certain level of integration is expected for all levels. With respect to the goals and documentation, the highest integration was reported for the policy,

objectives and the manual, while records and instructions were fully integrated in a smaller number of organizations (Bernardo et al., 2009). In addition, procedures related to product realization were the least integrated, while procedures related to measurement, analysis and improvement had the highest degree of integration (Bernardo et al., 2009). In addition, Bernardo et al. (2012a) divided companies into six groups, according to the order of standards' implementation and reported that the level of integration is higher in companies with two MSSs, compared to the ones that three MSSs. Simon et al. (2012a) examined the integration level over time (from 2006 to 2010), finding that the percentage of companies reporting 'full integration' and 'no integration' had increased, while the 'partial integration' percentage had decreased over time. With respect to the human resources, the integration was found to be higher at the top management level than at the 'shop floor level', while there was increase in the percentage of companies reporting integration at the inspector level over time (Simon et al., 2012a). These results align with the theoretical proposal by Karapetrovic (2002b), who said that level of integration would depend on the hierarchical level. The overall level of the integration of procedures had increased over time, especially 'internal audit', which was fully integrated in more than 80% of the companies (Simon et al., 2012a).

2.2.4 Integration difficulties

By identifying which difficulties hold back the process of integration, an organization can be better prepared to face and overcome them in the integration process (Bernardo et al. 2012b). Communication is found to be one of most effective ways to overcome a number of different obstacles (Zutshi and Sohal, 2005). Attitude and motivation of the people, their understanding and involvement also play an essential part during the integration process (Zutshi and Sohal, 2005; Simon et al., 2012b). More highly motivated employees would result in a reduction of conflicts in the organization (Zutshi and Sohal, 2005), while managers aware of the obstacles of MSs integration can reduce them early in the integration process and realize the benefits from integration (Simon et al., 2012b). Otherwise, if the challenges are not addressed early in the process, they can delay the completion of the integration (Zutshi and Sohal, 2005).

The number of studies that cover integration difficulties is limited. Nonetheless, the ones that exist may be classified into three explicit groups: theoretical, such as Karapetrovic and Willborn (1998a) and Wilkinson and Dale (2000), 'review of the existing literature' studies such as Asif et al. (2009) and empirical, such as Beckmerhagen et al. (2003), Zutshi and Sohal (2005), Karapetrovic et al. (2006), Casadesus et al. (2007), Zeng et al. (2007), Salomone (2008), Griffith and Bhutto (2009), Bernardo et al. (2012b), Simon et al. (2012a) and Simon et al. (2012b). All the above empirical studies normally cover different areas at one specific period

of time, except Simon et al. (2012a), who examined integration difficulties in Spain over time. Nonetheless, studies that cover integration difficulties in Canada, either longitudinal or at a specific point of time, have not been found in the current literature.

The majority of empirical studies employed DA to analyze their data (Beckmerhagen et al., 2003; Karapetrovic et al., 2006; Casadesus et al., 2007; Zeng et al., 2007; Salomone, 2008). In addition to DA, Simon et al. (2012a) used logistic regression, and Bernardo et al. (2012b) and Simon et al. (2012b) employed EFA and SEM as well. Zutshi and Sohal (2005) used an exploratory cross-case study, while Griffith and Bhutto (2009) employed grounded theory.

Appendix G shows the findings of the above mentioned authors in a chronological order. These studies generally cite the following difficulties as the most significant: "*various customers and stakeholders, inter-functional clashes and different operational management methods*" (Karapetrovic and Willborn, 1998a), "culture differences" (Zeng et al., 2007), *"organizational and communication difficulties"* (Beckmerhagen et al., 2003), *"people attitude, lack of expertise and use of consultants"* (Zutshi and Sohal, 2005), *"differences in the models supporting the standards, lack of government support, lack of employee motivation and lack of department collaboration"* (Bernardo et al., 2012b; Simon et al., 2012a; Simon et al., 2012b), "*lack of resources*" (Asif et al., 2009; Bernardo

et al., 2012b; Simon et al., 2012a; Simon et al., 2012b), "*lack of strategic planning"* (Zutshi and Sohal, 2005; Asif et al., 2009) "*resistance of employees to changes"* (Asif et al., 2009; Griffith and Bhutto, 2009) and "*the need to capture hearts and minds to secure support for system implementation"* (Griffith and Bhutto, 2009). Salomone (2008) also identified that the risk of not attributing the right level of importance to each QMS, EMS and OHSMS, and the organization of the IMS were the most important integration difficulties. Additionally, Zeng et al. (2007) and Bernardo et al. (2012b) classified integration difficulties into "*internal*" and "*external*" difficulties, and "*internal*", "*external*" and "*difficulties with standards*", respectively.

2.2.5 Reasons for keeping MSs separated

There are only three studies that investigated why companies choose not to integrate their MSs, namely, McDonald et al. (2003), Karapetrovic et al. (2006) and, Casadesus et al. (2007). According to Karapetrovic et al. (2006) and Casadesus et al. (2007), the major reasons are: "*different departments in charge", "lack of interest" and "lack of resources"*. In addition, McDonald et al. (2003) reported *"a tendency to develop over-documented, bureaucratic process", "turf battles"* (if the QMS already exists, other systems professionals often resist putting their requirements into the QMS) and *"limits on degree of integration"* (some MSs are more and some are less compatible with each other) as the major reasons.

2.3 Auditing

Auditing, as a profession, has been developed across various management disciplines in the last 50 years or so (Karapetrovic and Willborn, 2001). There are a number of sources that provide the definition of an audit (ISO, 2005; ISO, 2011; Karapetrovic and Willborn 1998a, 2000 and 2001). Differences between IAs and external audits (EAs) can be found in ISO (2005) and ISO (2011) as well. However, the number of empirical studies that cover different aspects of audits is limited. For instance, only two studies, namely Karapetrovic et al. (2006) and Casadesus et al. (2007), were found to report empirical evidence regarding the structure of IAs, frequency of IAs and EAs and the purpose of IAs and EAs. In those two studies, 61% of organizations reported that their IAs were *"executed process-by-process"* and 34% of organizations reported that they were performed *"requirement-by-requirement"* (Karapetrovic et al., 2006; Casadesus et al., 2007). The same authors reported a higher frequency of IAs over EAs (Karapetrovic et al., 2006; Casadesus et al., 2007). They also found that 79% and 90% of organizations had identified improvement opportunities for the implementation of the standard from their IAs and EAs, respectively (Karapetrovic et al., 2006; Casadesus et al., 2007).

Another aspect of audits is their integration. According to Karapetrovic and Willborn (1998b), integration of IAs presents the first important step toward the

integration of MSs (Karapetrovic and Willborn, 1998b). It also presents one of the most important benefits perceived from having an IMS (Karapetrovic and Willborn, 1998a; Karapetrovic and Jonker, 2003). However, an organization cannot conduct an integrated audit unless it has achieved at least the beginning stages of integration (Pojasek, 2006).

There are a number of studies that reported various benefits that could be gained by integrating audits (Karapetrovic and Willborn, 1998a; Boiral and Sala, 1998; Jiang and Bansal, 2003; McDonald et al., 2003; Zutshi and Sohal, 2005; Pojasek, 2006; Kraus and Grosskopf, 2008; Simon et al., 2011). However, the number of empirical investigations on integration of audits is very small, namely Douglas and Glen (2000), Wilkinson and Dale (2000), Karapetrovic et al. (2006), Casadesus et al. (2007), Salomone (2008), Bernardo et al. (2010) and Simon et al. (2011). What is more, there is only one empirical study that investigates the relationship between the integration of MSs and audits specifically, namely Bernardo et al. (2011).

In the detailed study of Bernardo et al. (2010), 66.5% of the responding companies had simultaneously conducted their IAs, 67.5% had a single plan and report, and 53.25% reported that auditors audited MSs as mutually integrated (in the rest of the thesis this is called 'audit view'). In the case of EAs, 65.25% of respondents reported simultaneous EAs, 55.3% had a single plan and report and 55.3% reported integrated 'audit view' (Bernardo et al., 2010). Karapetrovic et al.

(2006) and Casadesus et al. (2007) also reported similar values for the *"full integration"* of IAs, namely, 68%, 69% and 54% for the simultaneity, plans and reports, and view, respectively. For the *"full integration"* of EAs, the results reported were 73%, 59% and 47% for the simultaneity, plans and reports, and view, respectively (Karapetrovic et al., 2006; Casadesus et al., 2007). In addition, Simon et al. (2011), in their case study of four organizations, report very high levels of IEAs integration in the same three aspects. Salomone (2008) found that 78% and 65% of companies respectively, reported that their MSs were internal and external audited as mutually integrated systems. On the other hand, Wilkinson and Dale (2000) reported that out of three examined companies, only one had a single audit system, while the other two had separate audits, but a single audit plan.

2.4 Research Motivation

Given that the thesis covers three major topics included in Chapters 4, 5 and 6, the motivation regarding each topic will also be presented in the three separate sub-chapters (2.4.1, 2.4.2 and 2.4.3).

2.4.1 Motivation for the investigation of the ISO 14001 implementation

One of the main motives for investigating the first topic covered in Chapter 4 was the fact that the number of empirical studies regarding the ISO 14001 implementation motives and benefits was limited in Canada. The ones that were

found were mostly outdated, conducted over 10 years ago (Boiral and Sala, 1998; Jiang and Bansal, 2003). Specifically, two studies were found that investigated ISO 14001 motives (Boiral and Sala, 1998; Jiang and Bansal, 2003) and only one that investigated ISO 14001 benefits (Boiral and Sala, 1998). The majority of empirical studies in the literature employed DA in the analysis of their data (e.g., Boiral and Sala, 1998; Poksinska et al., 2003; Jiang and Bansal, 2003; Salomone, 2008; Turk, 2009 and Arena et al., 2012). There are also some studies that have used FA (Goh et al., 2006; Psomas et al., 2011), CA (Pan, 2003) and a case study (Petrovic, 2000; Chavan, 2005). However, there was only one study that investigated ISO 14001 motives and employed SEM (Rodriguez, 2009) and that study was conducted in Spain. No studies were found that investigated ISO 14001 benefits by using SEM. The fact that SEM was not frequently used in the empirical studies was another motive for this research which does apply SEM.

With respect to the mentioned motivation, the following research questions (RQ) were defined:

RQ1. What motivates Canadian organizations to implement the ISO 14001 EMS?

RQ2. What are the benefits that Canadian organizations perceive from having the ISO 14001 EMS?

RQ3. What is the relationship between the ISO 14001 motives and the ISO 14001 benefits in Canadian organizations?

The information about the time and costs for ISO 14001 is limited as well. One study was found in Canada that provided general information on the implementation cost only. However, that study dates from almost 10 years ago (Jiang and Bansal, 2003). No studies were found regarding the implementation time in Canada. The following RQ was delivered from this motivation:

RQ4. How long does it take Canadian organizations to implement ISO 14001 and what are the associated costs?

Another motivation was the lack of studies regarding the practice and usage of guidelines as a part of an EMS, such as ISO 14004, ISO 14015, ISO 14050, ISO 14064 and ISO 14065. There is only one study, namely Salomone (2008), who provided information regarding the ISO 14040, ISO 14031 and ISO 14025 application. No studies were found in Canada. The following RQ is drawn from this motivation:

RQ5. What environmental guidelines are implemented by Canadian organizations in addition to ISO 14001?

2.4.2 Motivation for the investigation of the integration of standardized MSs

Even though there are numerous studies regarding the integration, e.g. Douglas and Glen, 2000; Beckmerhagen et al., 2003; Jorgensen et al., 2006; Salomone, 2008; Bernardo et al., 2009; Karapetrovic and Casadesus, 2009; Asif et al., 2010;

Bernardo et al., 2012a; Bernardo et al., 2012b; and Simon et al., 2012a, studies with respect to the integration in Canada have not been found. The interest to see the situation in Canada with respect to the implementation of other MSs, the order and time for their implementation, the integration difficulties, the level of integration and the reasons for keeping the MSs separated was the main motivation for conducting this research. Another incentive was to compare the results obtained in Canada with the results previously obtained in Spain. Therefore, the survey and questions asked in this part of the research were the same as in Casadesus and Karapetrovic (2005); Karapetrovic et al. (2006) and Casadesus et al. (2007) (see 3.1). The following seven RQs were drawn from the motives to discuss the situation in Canadian organizations:

RQ6. What is the scope of MSs standardization?

RQ7. What is the number of standardized MSs integrated into an IMS?

RQ8. How much time is required for MSSs implementation?

RQ9. In which order are MSSs implemented?

RQ10. What are the main difficulties that companies face during the integration process?

RQ11. What is the level of integration of standardized MSs?

RQ12. What are the main reasons for keeping the MSs separated?

2.4.3 Motivation for the investigation of auditing

There are three principal motives for conducting research regarding auditing. First, there is a limited number of empirical studies with respect to auditing in general (e.g. Douglas and Glen, 2000; Wilkinson and Dale, 2000; Karapetrovic et al., 2006; Casadesus et al., 2007; Salomone, 2008; Bernardo et al., 2010; Bernardo et al., 2011 and Simon et al., 2011). Second, no studies were found in Canada. Third, only one study was found regarding the relationship between the integration of standardized MSs and audits (Bernardo et al., 2011). That study was conducted in Spain. The following RQs were delivered from the motivation with respect to the Canadian organizations:

RQ13. What is the frequency of ISO 14001 IAs and EAs?

RQ14. How do organizations structure their ISO 14001 IAs?

RQ15. What is the main purpose of ISO 14001 IAs and EAs?

RQ16. How integrated are ISO 14001 IAs and EAs with other MSS audits?

RQ17. What is the relationship between the integration of standardized MSs and audits?

2.5 Research Objectives

The main objective was to address the seventeen RQs proposed in section 2.4 by analyzing the responses obtained from the survey designed prior to this research (see 3.1) and by employing the following techniques for data analysis: DA, EFA, RA, CA and SEM.

The objectives are divided into three paragraphs with respect to the topics that were covered in the thesis (4, 5 and 6). Each paragraph describes which RQs were addressed in each topic and what techniques were used for data analysis.

The research objectives of addressing RQs 1-5 (see 2.4.1) is presented in Chapter 4. Four techniques were used for analyzing the survey data, namely DA, EFA, RA and SEM. In addition, Microsoft Excel was used for DA, SPSS Statistics 20 for EFA and RA, LISREL 8.80 for SEM and Microsoft Visio for the graphs.

The research objective of addressing RQs 6-12 (see 2.4.2) is presented is Chapter 5. The survey data was analyzed using DA and CA. Microsoft Excel was used for DA and SPSS Statistics 20 for CA.

Finally, the research objective of addressing RQs 13-17 (see 2.4.3) is presented in Chapter 6. The survey data was analyzed using DA and the software Microsoft Excel.

3 Research Methodology

This chapter presents the methodology employed in the thesis. It includes the following sub-chapters:

3.1 Survey

3.2 Organizations characteristics

3.3 Sample

3.4 SEM

Out of five techniques that have been employed in the thesis, namely DA, EFA, CA, RA and SEM, only SEM is presented in detail. The reason for such an approach is the fact that SEM is the least written and known technique in the literature on the implementation and integration of standardized MSs.

3.1 Survey

The survey used in this study was conducted on Canadian organizations registered to the ISO 14001 standard. The survey got the approval from the research ethics board (REB) in 2009 and was mailed to 483 organizations in June 2012. However, the design of the survey and its preparation were done prior to this research and therefore were not included in the thesis. Nevertheless, it should be noted that most of the questions in the survey were the same as in the ones used in 2006 in Spain (Casadesus and Karapetrovic, 2005; Karapetrovic et al., 2006; Casadesus et al., 2007).

The surveys were addressed to the managers responsible for the EMS. The target organizations were identified through publicly-available lists of ISO 14001-registered organizations provided by BNQ (Bureau de Normalisation du Quebec), PWGSC (Public Works and Government Services Canada), and QMI-SAI (Quality Management Institute - SAI Global). For the companies in Quebec, the surveys were sent in French (44 out of 483). All other surveys were sent in English. A total of 22 surveys were returned as undeliverable. Out of the remaining 461 organizations, 32 completed and returned the survey. This represented a response rate of approximately 7%.

The survey contained 32 questions divided into six sections: 1) ISO 14001 Implementation, 2) ISO 14001 Audits, 3) ISO 14001 Benefits, 4) Other Management Systems and Integration, 5) Sustainability Guidelines, and 6) Organization Profile. Three types of questions were used:

1. Yes/no questions,
2. Circle the applicable or the most applicable answer, and
3. 3, 4 and 5- point scale questions, where '1' generally meant the most negative response and '5' the most positive response.

3.2 Characteristics of the surveyed organizations

With respect to the questions regarding the profile of the organizations, included in the section 6 of the questionnaire (see Appendix H), three different aspects were analyzed: size of the organization, the industry sector and the role the respondent had within the organization. The last question, 'primary destination of the goods/services produced', is presented in Appendix I.

With respect to the organization size, seven had less than 100 employees, fourteen had between 100 and 500 employees and eleven organizations had more than 1000 employees (Figure 1).

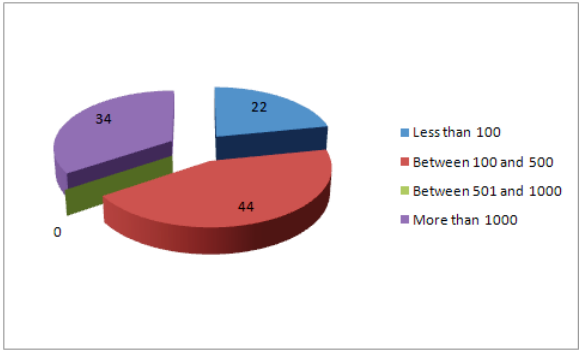


Figure 1. Organization size (%)

In order to simplify the interpretation of the results regarding the industry sector, the sectors were divided into three major groups: 'manufacturing', 'services' and 'other' (agriculture, forestry, fishing and hunting, mining and oil and gas extraction, utilities and construction). Twelve organizations were identified belonging to the manufacturing industry, three to the service industry, and seventeen organizations were grouped under 'other' (Figure 2).

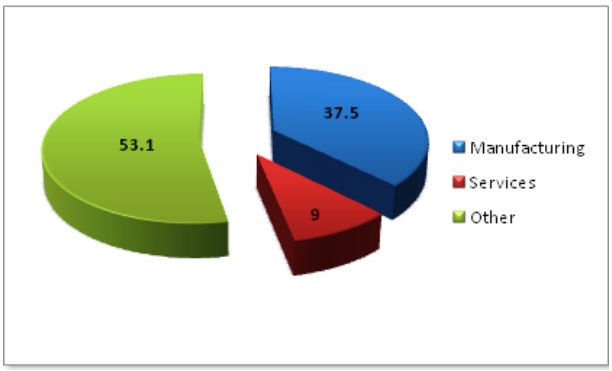


Figure 2. Industry sectors (%)

Even though the survey was addressed to the person responsible for the EMS, the data shows that it was answered by a variety of people. More than 50% of the companies have commissioned someone other than the person responsible for the EMS to complete the survey. In detail, an environmental manager accounted in fifteen (47%) companies, a quality manager in two (6%), and 'other' positions in fifteen (47%) organizations. Two companies out of the last fifteen responded that the 'other' position was an 'environmental-quality manager'.

3.3 Sample

In order to address the first five RQs included in section 2.4.1, a sample of 32 organizations was employed. From the 32 participant organizations, seven (22%) were small with less than 100 employees, 14 (44%) were medium with between 100 and 500 employees, and eleven (34%) were large with more than 500 employees. Moreover, twelve (38%) were manufacturing organizations, three (9%) were in services and 17 (53%) were 'other' types of companies. The same sample was used for addressing research questions RQs 6-9 (see 2.4.2) and RQs 13-15 (see 2.4.3).

For addressing the remaining questions, namely RQs 10-12, two different groups were used. Specifically, 13 organizations that marked 'all' and 'only the following…' in question 19 of the survey (see Appendix H) and reported some level of integration were used for addressing the integration difficulties (RQ10) and the level of integration (RQ11). Nine organizations that said that 'none' in question 19 of the survey (see Appendix H) and had kept their MSs separated were used to examine the reasons for making such a decision (RQ12). It should be noted that, out of the 13 organizations in total that have reported some level of integration, eight (61.5%) were SMEs with less than or equal to 500 employees and five (38.5 %) were large with more than 500 employees. With respect to the nine organizations that have kept their systems separated, six (66.7%) were SMEs and three (33.3%) were large. Regarding the sectors where the responding 13 organizations operated in, six (46.2%) were manufacturing and seven (53.8%) were 'other' types of companies. With respect to the nine organizations with separate MSs, four (44.4%) were manufacturing organizations and five (55.6%) were 'other' types of companies.

A total of 26 companies that had implemented more MSSs in addition to ISO 14001 were used for addressing RQ16 and RQ17. It should be noted that, out of 26 organizations, four (15.4%) were small with less than 100 employees, thirteen (50%) were medium with between 100 and 500 employees, and nine (34.6%)

were large. With respect to the industry sector, twelve (46.2%) were manufacturing and fourteen (53.8%) were in the 'other' sectors.

3.4 Structural Equation Modeling

SEM is a multivariate technique that examines directions and intensity of influences between the constructs in a model (Spasojevic –Brkic, 2009). More details on the components, concepts, symbols and advantages of SEM, the structural model, the two measurement models, and the guidelines for choosing the criteria for the acceptance of the final model are presented in Appendix J. In this thesis, the following indicators and acceptance criteria (Hooper et al, 2008; Spasojevic – Brkic, 2009, Joreskog and Sorbom, 1996) were used (Table 1):

Fit Index (indicator)	Acceptance criteria
Chi-Square χ^2	Low value relative to degrees of freedom an insignificant p-value (p>0.05)
RMSEA (Root Mean Square Error Approximation)	Values less than 0.07
GFI (Goodness of Fit Index)	Values greater than 0.90
RMR (Root Mean Square Residual)	Good models have small RMR
SRMR (Standardized RMR)	Values less than 0.08
NFI (Normed Fit Index)	Values greater than 0.95
CFI (Comparative Fit Index)	Values greater than 0.95

Table 1. Fit indexes and acceptance criteria

4. ISO 14001 implementation

This chapter presents and discusses the outcomes obtained from data analysis regarding the ISO 14001 implementation. It covers the following sub-topics:

4.1 ISO 14001 motives and benefits

4.2. ISO 14001 time and costs

4.3 Usage of the EMS guidelines.

4.1 Motives and benefits

Data regarding ISO 14001 motivation were collected from question 5 in the survey (see Appendix H) by assigning the importance for each motive on the 5-point Likert scale: 1- 'very unimportant', 2 – 'somewhat unimportant', 3- 'neutral', 4 – 'somewhat important' and 5 – 'very important' . The collected data were grouped into three categories. Organizations that had assigned '1' or '2' were grouped into one category called 'not important'. Organizations that had indicated '3' were grouped into the 'neutral' category. The remaining organizations were grouped into the category called 'important'.

Data regarding ISO 14001 benefits were collected from question 11 (Appendix H) by assigning the rate for each benefit on a 3-point scale (Casadesus and Karapetrovic, 2005; Karapetrovic et al., 2010): 1- 'ISO 14001 negatively affected the item in question', 2- 'ISO 14001 made no difference', and 3- 'ISO 14001 positively affected the item in the question'.

In order to simplify the work, appropriate codes were assigned for each variable used in the study. Lists of the variables corresponding to the ISO 14001 motives and benefits with the associated codes are presented in Table 2 and 3, respectively:

Variable	Code
Improvement in environmental performance	Imp_ep
Improvement of image and social impact	Imp_imag
Customer pressures	Cust_pres
Government pressures	Gov_pres
Other stakeholder pressures	Stake_pres
Improvement in efficiency and control	Imp_eff
Decreasing problems and accidents	Deac_prob
Provision of competitive advantage	Prov_adv
Natural continuation of a previous standard	Continue
Synergies among management systems	Synergies

Table 2. Variables and codes corresponding to the ISO 14001 motives

Variable	Code
Prevention of pollution	Prev_pol
Improved legal compliance	Imp_leg
Improved environmental performance	Imp_ep
Increased environmental awareness	Inc_ea
Improved public image	Imp_imag
Reduced risk	Red_risk
Reduced costs	Red_cost
Improved relations with stakeholders	Imp_rels
Improved employee motivation	Imp_empm
Increased customer satisfaction	Inc_cuss
Increased market opportunities	Inc_maro
Improved emergency preparedness and response	Imp_epr

Table 3. Variables and codes corresponding to the ISO 14001 benefits

4.1.1 Descriptive analysis

4.1.1.1 *ISO 14001 motives*

According to the descriptive statistics (Figure 3), the most important motives for ISO 14001 implementation are 'improvement in environmental performance', reported by 90.6% of the companies, 'improvement of image and social impact' (78.1%) and 'provision of competitive advantage' (68.8%).

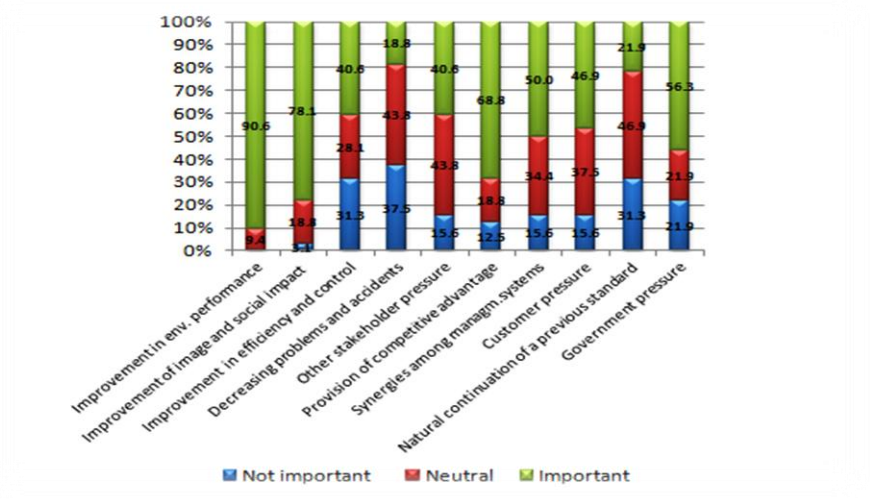
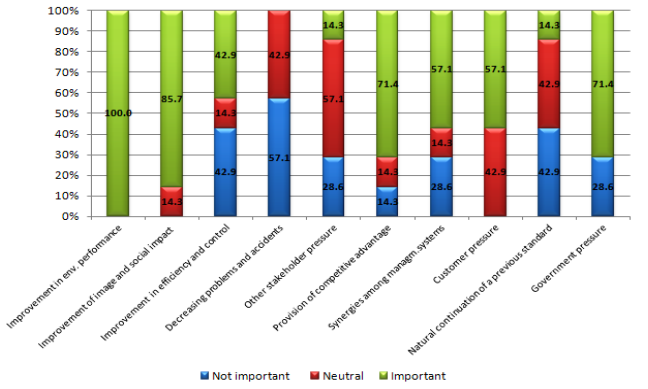


Figure 3. Motives for ISO 14001 implementation

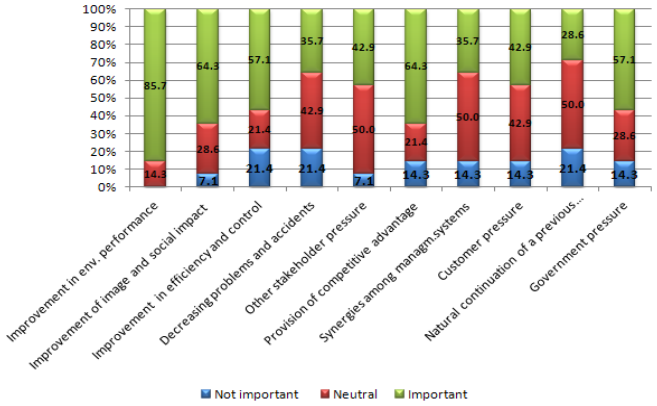
With respect to the organization size (Figure 4), the reported motives do not show any important differences among small, medium, and large organizations. However, large companies report 'synergies among MSs' to be one of the top drivers for the ISO 14001 implementation, which is not the case with either small or medium organizations. This might be due to the fact that large companies face more requirements from a larger variety of stakeholders and therefore introduce more MSSs (ISO, 2008). With more MSSs, synergies among systems

are necessary in order to put them in place and run them smoothly (Bernardo et al., 2009).

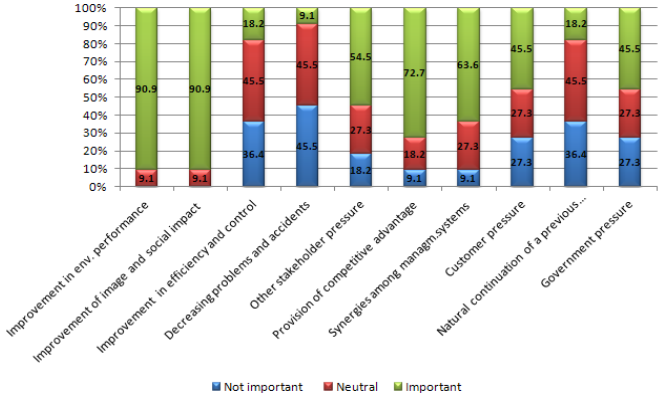
With regard to the sectors where the organizations operate (Figure 5), differences in motives can be noticed between manufacturing and service companies. In addition to the 'improvement in environmental performance', 'improvement of image and social impact' and 'provision of competitive advantage', manufacturing companies attach 'government pressure' as one of the important motives for implementing the ISO 14001 standard as well. This might be due to the fact that manufacturing companies have a higher probability to impact the environment than service and 'other' companies (Jabbour et al., 2008). On the other hand, service companies list 'customer pressure' as the third most important motive place, while 'provision of competitive advantage' comes as the fourth. Having customer pressure as one of the top three motives for the ISO 14001 implementation is an obvious motive for the service companies, due to the their business, which is providing services to the customers.



Small

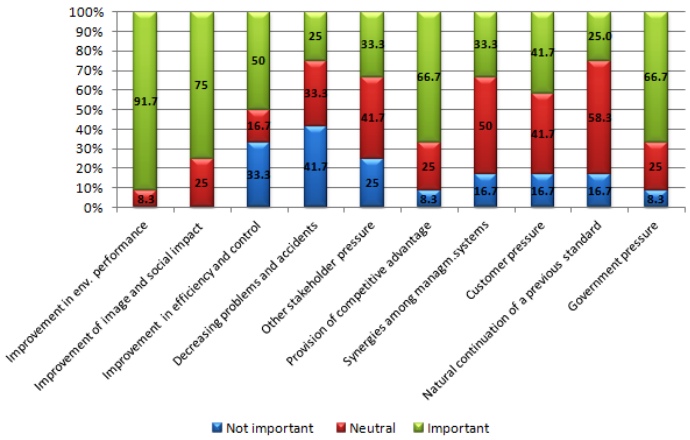


Medium

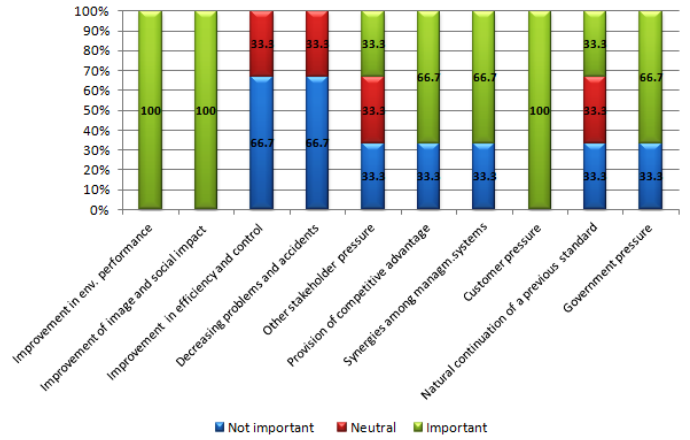


Large

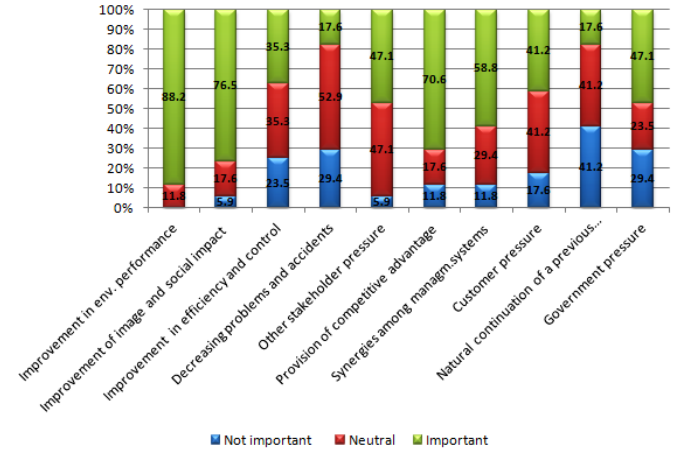
Figure 4. ISO 14001 motives by organization size



Services



Manufacturing



Other

Figure 5. ISO 14001 motives by industry sector

4.1.1.2 ISO 14001 benefits

The most important benefits perceived from having an ISO 14001 EMS (Figure 6) are 'increased environmental awareness', reported by 93.8% companies, 'improved environmental performance' (75%) and 'prevention of pollution' (75%). These results are in line with the results obtained by Turk (2009) and Arena (2012), who reported improvement of environmental awareness and environmental performance as the two most important ISO 14001 benefits, respectively. Conversely, cost reduction did not seem to be an important benefit, which aligns with Goh et al. (2006), who also reported 'cost reduction' as the least important benefit among others. However, these results are opposed to the results found by other researchers, who mostly reported reduction of costs (Petroni, 2000; Chavan et al., 2005; Griffith and Bhutto, 2008; Griffith and Bhutto, 2009.; Nga, 2009), resources and waste reduction (Mohammed, 2000; Chavan et al., 2005; Radonjic et al., 2006), enchasing a company image (Petroni, 2000; Pan, 2003; Poksinska et al., 2011) and public relations (Pan, 2003), and reputation (Goh et al., 2006; Griffith and Bhutto, 2008; Griffith and Bhutto, 2009) as the major benefits companies perceived from the ISO 14001 EMS.

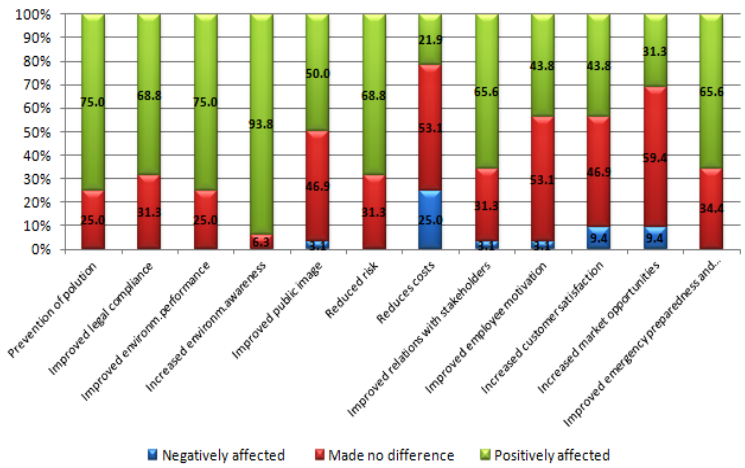
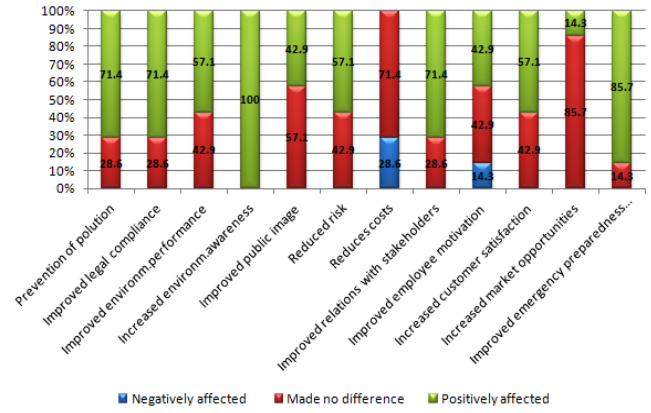


Figure 6. Benefits perceived from having the ISO 14001 EMS

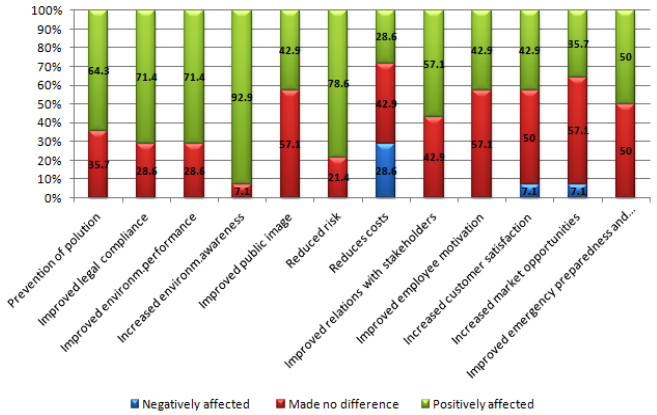
With regard to the size of the organizations (Figure 7), differences in responses are mostly seen between small and medium organizations. Small organizations place 'improvement of emergency preparedness and response' in the second place after 'increasing of environmental awareness', while 'prevention of pollution' shares the third place with 'improved relations with stakeholders'. However, they do not assign any importance to the 'cost reduction'. Medium companies place 'risk reduction' as second after 'increasing of environmental awareness', while 'improved environmental performance' shares the third place with the 'improved legal compliance'. The 'prevention of pollution' benefit falls into the fourth place in the case of medium organizations. Moreover, the majority of large organizations reported 'important' for all previously-mentioned benefits. This part of the thesis was difficult to compare with other studies, due to the fact that benefits analyzed were different. Nevertheless, Massoud et al. (2010) reported that the benefits are "*more appealing*" to large companies than to SMEs. Radonjic et al. (2006) also reported that large organizations reduced

"emission of water" more than SMEs. In this research, all three groups of organizations perceive the benefits from having ISO 14001 and there are no significant differences discernible from organization size. A possible reason can be that the number of SMEs that implemented ISO 14001 has increased in the last few years, which lead to increasing the number of SMEs recognizing the benefits as well.

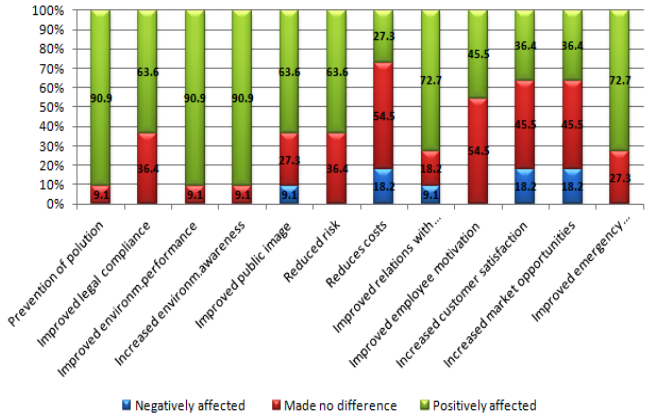
Regarding the sectors where companies operate, manufacturing companies reported 'increasing environmental awareness' and 'prevention of pollution' as the most important benefits, followed by 'improved legal compliance', 'improved environmental performance' and 'reduced risk', which were equally important (Figure 8). Service companies attached 'reduced risk' and 'improved employee motivation' to the three most important benefits reported by all organizations. 'Other' companies do not show any significant differences in benefits. Comparisons of this part of the work with other authors were not possible, due to the fact that studies analyzing ISO 14001 benefits in different sectors have not been found. However, the results obtained show that manufacturing companies obtain what they have been wishing to get from the ISO 14001. Namely, one of the most important motives was 'government pressure' (see 4.1.1.1) and one of the most important benefits is 'improved legal compliance'.



Small

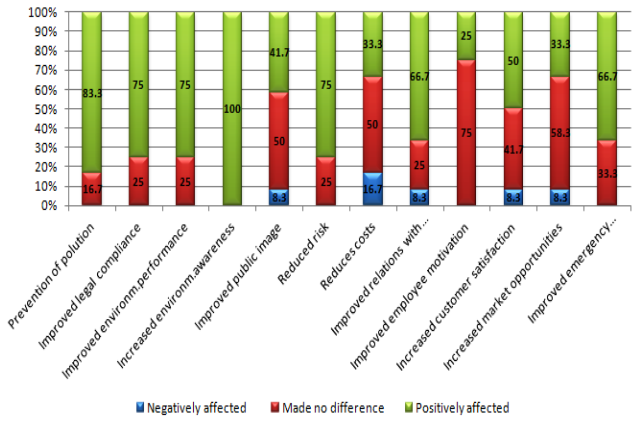


Medium

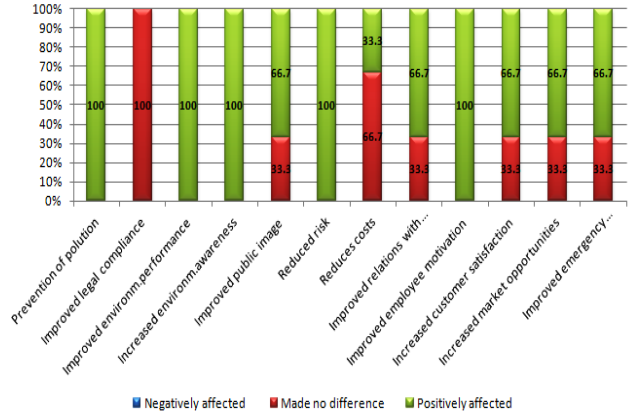


Large

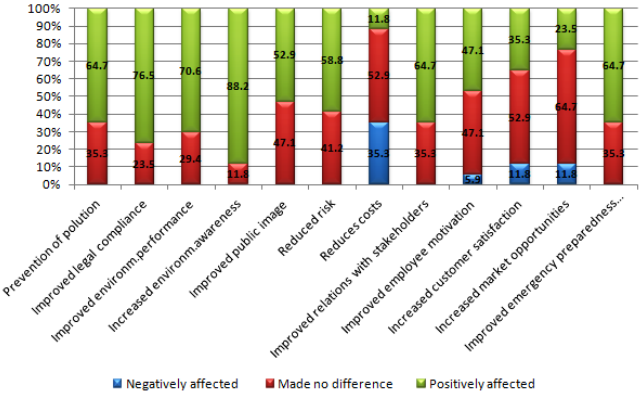
Figure 7. ISO 14001 benefits by organization size



Manufacturing



Services



Other

Figure 8. ISO 14001 benefits by industry sector

4.1.2 Explorative Factor and Reliability Analysis

4.1.2.1 *ISO 14001 motives*

In order to find a smaller finite number of motives' dimensions, EFA with principal component analysis and varimax rotation with Kaiser Normalization (Kaiser, 1960) has been performed. Only factors with "eigen" values greater than 1 were accepted. Four factors, explaining 67.52 percent of total variance, have been extracted (Table 4).

	Factors (components)			
	1	2	3	4
Imp_ep	-.231	.728	.376	-.154
Imp_imag	-.153	.374	.125	.750
Cust_pres	**.772**	.038	.011	.184
Gov_pres	.499	.126	-.177	.352
Stake_pres	.741	.178	.164	-.164
Imp_eff	.220	.725	-.038	.219
Deac_prob	.374	**.768**	-.153	.091
Prov_adv	.271	-.112	.120	**.797**
Continue	-.185	.000	**.822**	.186
Synergies	.362	.044	.759	.004

Table 4. Component matrix for ISO 14001 motives

According to Winter et al. (2009), for four factors extracted and a sample size of 23, the minimum factor loading is 0.8. For the same number of extracted factors and a sample size of 68, the minimum factor loading is 0.6 (Winter et al., 2009). Using linear interpolation, for four factors extracted and sample size of 32, the minimum obtained factor loading is 0.76. Therefore, only the items with the value of 0.76 and greater were accepted for further consideration. Those items are marked as bold in Table 4. Highlighted items in Table 4 do not satisfy the criteria and therefore were excluded from additional analysis.

Four factors, including their names and the items retained, are presented in Table 5.

	Factor 1 *Motives related to customer pressure*	**Factor 2** *Motives related to EMS improvement*	**Factor 3** *Motives related to integration*	**Factor 4** *Motives related to competitive advantage*
Items included in each of the factors	Customer pressure	Decreasing problems and accidents	Natural continuation of a previous standard	Provision of competitive advantage

Table 5. Motive factors and the corresponding items

Table 6 illustrates the codes for the factors defined to correspond to the motives. These codes will be used in SEM (sub-chapter 4.1.3), instead of the full factor names, because it is easier to follow the results. The shortened names are also able to fit the symbols on the SEM graph.

Motive factors	**Codes**
Motives related to customer pressure	Motiv_A
Motives related to EMS improvement	Motiv_B
Motives related to integration	Motiv_C
Motives related to competitive advantage	Motiv_D

Table 6. Motive factors and the corresponding codes

Since each motive factor has only one item that describes it, RA was not performed. RA is only necessary when there is more than one item within the factor (for example Benef_A in this research), to ensure that the items represent

a factor in the way it was obtained from EFA. The minimum criteria to accept a construct is the Cronbach alpha value (Cronbach, 1951) of 0.6 (Nunnallyn, 1987).

4.1.2.2 *ISO 14001 benefits*

Exactly the same procedure with the same criteria was repeated for the ISO 14001 benefits. Three factors, explaining 67.04 percent of total variance, have been extracted (Table 7).

	Factors (components)		
	1	2	3
Prev_pol	-.170	.673	.377
Imp_leg	.148	.729	-.071
Imp_ep	-.002	.485	.712
Inc_ea	.053	.686	.247
Imp_imag	.723	.287	.158
Red_risk	.423	.275	.719
Red_cost	.195	-.111	.601
Imp_relst	**.808**	.380	-.018
Imp_empm	-.051	-.023	**.822**
Inc_cussat	**.884**	-.211	.053
Inc_maropp	**.822**	-.335	.192
Imp_epr	-.025	**.793**	-.118

Table 7. Component matrix for ISO 14001 benefits

Following the same recommendations for the sample sizes as in the case of ISO 14001 motives, only items with the factor loading equal or greater than 0.76 were accepted. Those items are noted as bold in Table 7. All highlighted items (with factor loadings less than 0.76) were excluded from future analysis. These factors, including their names and items, are presented in Table 8.

	Factor 1 *Benefits related to improving relationships with stakeholders*	**Factor 2** *Benefits related to EMS improvement*	**Factor 3** *Benefits related to improving employees' motivations*
Items included in each of the factors	Improved relationships with stakeholders Increased customer satisfaction Increased market opportunities	Improved emergency preparedness and response	Improved employee motivation

Table 8. Benefit factors and the corresponding items

Since only Factor 1 had more than one item, RA was performed for that factor. The Cronbach alpha was 0.83, which is greater than the recommended minimum value of 0.6 (Nunnallyn, 1987). Therefore, there is 83.3% chance that the three items within Factor 1 would really explain and represent that factor. Table 9 illustrates the codes used for the benefit factors in SEM (see 4.1.3).

Benefit factors	**Codes**
Benefits related to improving relationships with stakeholders	Benef_A
Benefits related to EMS improvement	Benef_B
Benefits related to improving employees' motivation	Benef_C

Table 9. Benefit factors and the corresponding codes

4.1.3 Structural Equation Modeling

Before deciding what particular relationships to propose, a number of different 'relationship combinations' between motives and benefits were tried. This was done using SEM, regression analysis, and ANOVA. Unfortunately, only one relationship combination showed promising results. The following paragraphs present the chosen relationship model, the modifications made, as well as the final model.

Figure 9 and Figure 10 present the chosen model. Figure 9 illustrates a general path and Figure 10 a path after the estimation. Latent variables in the model factors were retained after EFA and RA (see 4.1.2). This model is chosen to test the following relationships between the variables (see Table 6 and Table 9):

- Motiv_A has a positive impact on Benef_A
- Motiv_B has a positive impact on Benef_B and Benef_C
- Motiv_C has a positive impact on Benef_B and Benef_C
- Motiv_D has a positive impact on Benef_A.

All variables have a "*single indicator",* except the Benef_A variable. When a variable has a single indicator, it is indicated with the value of 1 (Hayduk, 1987). On the other hand, if a variable has more than one indicator, called *"multiple indicators"* (e.g. Benef_A), one of the indicators has to be fixed at the value of 1, while others remain 'free' for estimation (Hayduk, 1987; Hayduk and Littray,

2012). Fixing the variable ensures consistency in the measurement scale (Hayduk, 1987).

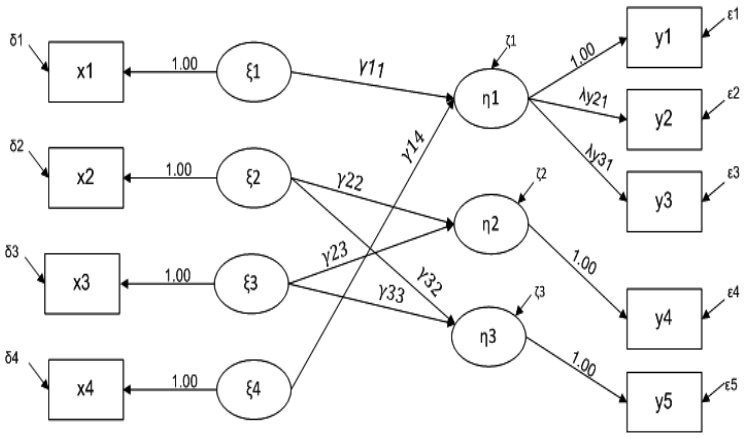


Figure 9. General path diagram for the ISO 14001 motives and benefits

The structural equations for this model are (see 3.4):

$$\eta_1 = \gamma_{11}\xi_1 + \gamma_{14}\xi_4 + \zeta_1$$

$$\eta_2 = \gamma_{22}\xi_2 + \gamma_{23}\xi_3 + \zeta_2$$

$$\eta_3 = \gamma_{32}\xi_2 + \gamma_{33}\xi_3 + \zeta_3$$

The measurement model equations for the 'γ' variable are:

$$y_1 = \eta_1 + \varepsilon_1$$

$$y_2 = \lambda_{21}^{y}\eta_1 + \varepsilon_2$$

$$y_3 = \lambda_{31}^{y}\eta_1 + \varepsilon_3$$

$$y_4 = \eta_2 + \varepsilon_4$$

$$y_5 = \eta_3 + \varepsilon_5$$

The measurement model equations for the 'x' variable are:

$$x_1 = \xi_1 + \delta_1$$

$$x_2 = \xi_2 + \delta_2$$

$$x_3 = \xi_3 + \delta_3$$

$$x_4 = \xi_4 + \delta_4$$

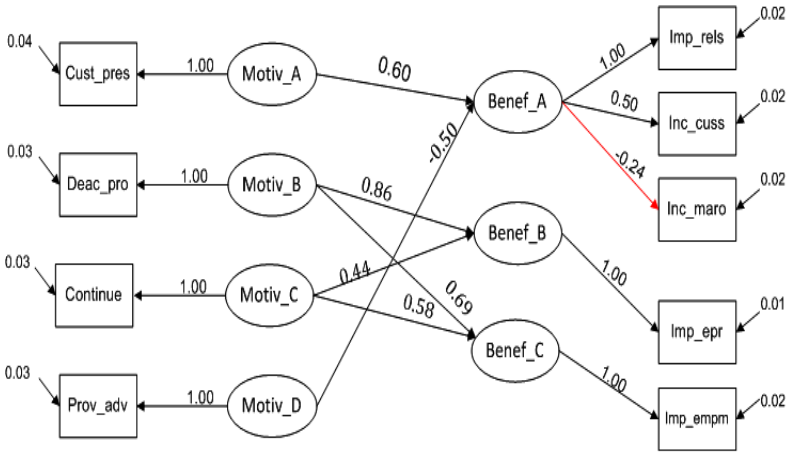


Figure 10. Estimated path diagram for the ISO 14001 motives and benefits

After testing the proposed model, two conclusions were made. First, the measurement model tested under confirmatory factor analysis (CFA) did not 'approve' the model construct in the way it was obtained from EFA. As it can be seen from Figure 10, there is a negative value between the endogenous latent variable Benef_A (benefits related to improving relationships with stakeholders) and its observed variable, indicator Inc_maro (increased market opportunities). Negative values between latent variables and their indicators could be a sign of model problems, especially if accompanied by a failing model chi-square (Hayduk, 1987). Therefore, model modifications are needed. Second, none of the model fit indicators (e.g. chi-square, RMSEA, GFI, NFI and CFI) showed satisfactory values proposed by Hooper et al. (2008) and Spasojevic-Brkic (2009).

Before proceeding with testing the model again, the following modifications were made. First, the Inc_maro indicator was eliminated. Second, the theory of *"a single best indicator"* proposed by Hayduk and Littvay (2012) was followed, as "*single indicators remind us that measurement is not separate from theory*" (Hayduk and Littvay, 2012). In this case, all latent variables had their 'single indicators', except the Benef_A variable. After eliminating the negative indicator Inc_maro, there were only two indicators left for the Benef_A variable: Inc_cuss (increased customer satisfaction) and Imp_rels (improved relations with stakeholders). As *"a single, best indicator"*, the 'improved relations with stakeholders' was chosen, since it is broader than the other indicator and it includes customer satisfaction, which is described by the rejected 'increased customer satisfaction' indicator. Better relations with stakeholders will be enhanced by satisfying customers as one of the groups of the companies' stakeholders. The modified model is presented next (Figure 11).

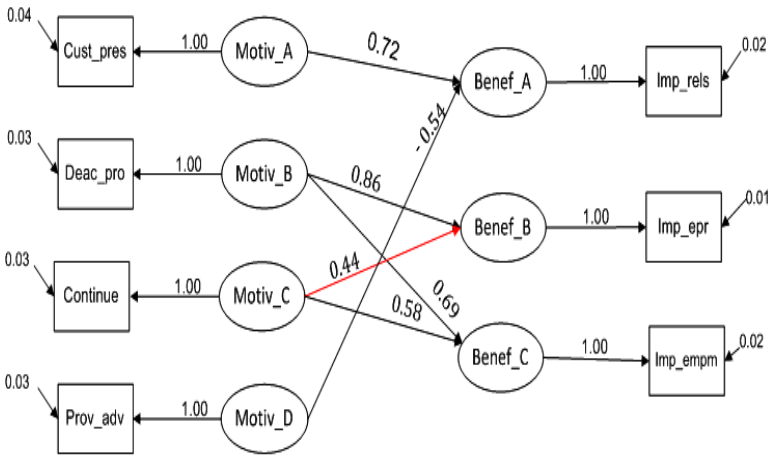


Figure 11. Acceptable path diagram for the ISO 14001 motives and benefits

This model passed the SEM test. All relationships between the latent variables are significant, except the one between Motiv_C (motives related to integration) and Benef_B (benefits related to EMS improvement), indicated by the value of 0.44 (Figure 11). The analysis gave the following significant relationships (equations):

1. Benef_A = 0.72*Motiv_A – 0.54*Motiv_D + 0.42
2. Benef_B = 0.86*Motiv_B + 0.30
3. Benef_C = 0.69*Motiv_B + 0.58*Motiv_C + 0.13

Moreover, model fit indices showed satisfactory values (Table 10). Only NFI showed a lower value than recommended by Hooper et al. (2008). However, according to Bentler and Bonnet (1980) referenced in Hooper et al. (2008), the NFI values of 0.90 and greater indicate a good fit. Therefore, the NFI value in this model can be accepted as a satisfactory one.

Fit Index	Values	Recommendations
Chi-Square χ^2	7.71 (p=0.56)	Small value for p>0.05
RMSEA	0.0	Less than 0.07
GFI	0.93	Greater than 0.90
RMR	0.027	Small value
SRMR	0.064	Less than 0.08
NFI	0.91	Greater than 0.95
CFI	1.00	Greater than 0.95

Table 10. Fit indices for the model

Two relationships out of four in total were accepted, one was partially accepted, and the last one was not accepted (Table 11). The analysis confirmed that

Motiv_A (motives related to customer pressure) had a positive impact on Benef_A (benefits related to improving relationships with stakeholders). This result is in line with expectations, since customers are one of the company's stakeholders. Therefore, the prediction (see page 51) in the research was supported by SEM as well.

It was also confirmed that Motiv_B (motives related to EMS improvement) had positive impacts on Benef_B (benefits related to EMS improvement) and on Benef_C (benefits related to improving employee motivation). These two relationships are also logical. What motivated the companies to implement ISO 14001 in the first place was found to be a benefit of having implemented ISO 14001. Moreover, improvement of an EMS enhances employee motivation, since a better system in place brings better results, and hence more satisfied employees.

The analysis also showed that Motiv_C (motives related to integration) had no significant impact on Benef_B (benefits related to EMS improvement), but positive one on Benef_C (benefits related to improving employees' motivation). The first relationship was surprising, since one could think that integration would bring improvement of an EMS in an organization. The second relationship confirmed the expectation made. Integration of MSs should bring numerous benefits, such as minimization of the documentation (Douglas and Gle, 2000;

Beckmerhagen et al., 2003; Zutshi and Sohal, 2005; Zen et al., 2011; Simon et al., 2012a) therefore a simplification of employee work. Following one guide, one policy, one set of objectives, targets and instructions would make the employees' life easier than following multiple ones. That would lead to more satisfied and motivated employees.

Motiv_D (motives related to competitive advantage) did not have a positive significant impact on Benef_A (benefits related to improving relationships with stakeholders), as it was proposed. The result was surprising, since one would think that stakeholders would prefer a 'competitive company'. However, stakeholders are numerous and diverse, and satisfying all of them can be an impossible mission.

Table 11 is a summary of the proposed relationships and the decisions made.

Proposed relationships	**Decisions**
Motiv_A has a positive impact on Benef_A	Accepted
Motiv_B has a positive impact on Benef_B and Benef_C	Accepted
Motiv_C has a positive impact on Benef_B and Benef_C	Partially accepted
Motiv_D has a positive impact on Benef_A	Not accepted

Table 11. Proposed relationships and the decisions made

4.2 ISO 14001 time and costs

Figure 12 shows the time that organizations needed to invest in the implementation of ISO 14001. As can be seen, 12 out of 32 organizations required between six and eleven months to implement the standard. Seven organizations needed between one year and seventeen months, six between 18 and 23 months, and the remaining six organizations more than 24 months. Only one organization obtained its implementation within six months. These organizations report different implementation time than the organizations analyzed by Turk (2009) in Turkey and by Zeng et al (2007) in China. Canadian organizations implement ISO 14001 faster than organizations in China, but slower than Turkish companies. One of the reasons could be stakeholder demand. It is possible that the demand for ISO 14001 registration was higher in Turkey than in Canada or China. Therefore, organizations had to work faster in Turkey in order to fulfill the stakeholders' requirements.

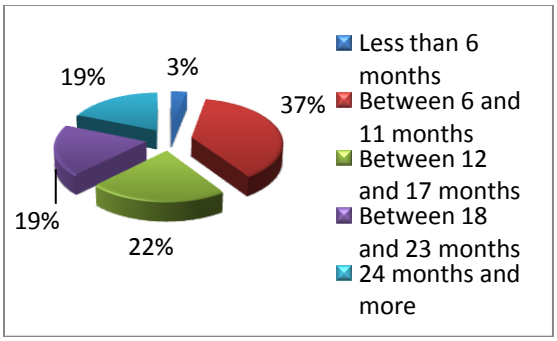


Figure 12. Time required for ISO 14001 implementation

With respect to the costs linked to the ISO 14001 implementation, thirteen organizations spent less than CAD50,000, eleven between CAD50,000 and

CAD100,000 and seven organizations more than CAD100,000. These results do not match the results obtained by Turk (2009), who reported that the majority of companies (24 out of 28 in total) spent less than USD50,000. Some of the possible reasons for higher costs in Canada versus Turkey might be a difference in the "*quality of life*" (*"life standard"*). According to the Maps of World (2013), Canada is one of the ten countries with the highest quality of life. Higher quality of life is lead by higher salaries, which leads to higher expenses as well.

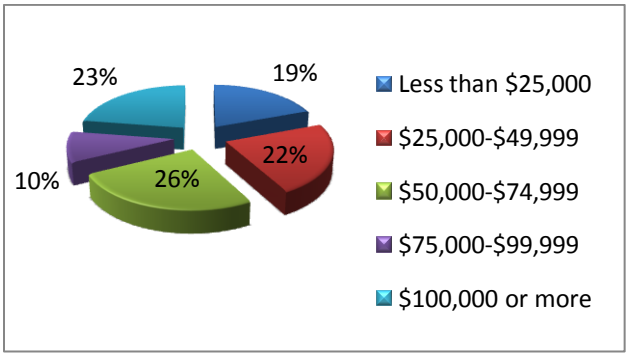


Figure 13. ISO 14001 implementation costs

However, the reported maintenance costs were lower than the implementation costs. The majority of organizations, 23 out of 32, spend less than CAD50,000 annually. These results were not compared to other authors due to the lack of studies that cover this aspect.

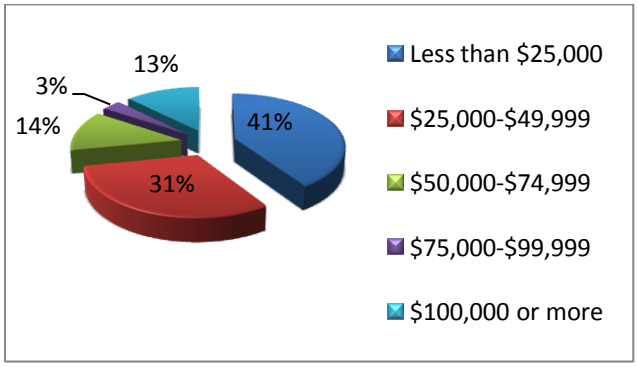


Figure 14. ISO 14001 maintenance

4.3 Usage of the EMS guidelines

Figure 15 presents the results of the application of the EMS guidelines, such as ISO 14004 and ISO 14064. Specifically, 18 out of 32 organizations in total used these guidelines. Eight organizations employed the ISO 14050 EMS vocabulary, four ISO 14064 and four ISO 14065, both for greenhouse gas emission, and only one organization applied ISO 14015 for environmental assessment. Moreover, 22 organizations used the ISO 19011 standard for auditing as a part of their EMS.

The results indicate that the majority of organizations use ISO 14004 and ISO 19011 out of 18 standards offered in the questionnaire. This can be due to the fact that these two standards were published for the first time in 2004 and 2002, respectively, so companies had enough time to learn more about and start applying them. Moreover, it is logical to include at least the ISO 14004 implementation and auditing guidelines as a part of an EMS. These two standards should even be a 'combo', since ISO 14004 guides companies to a successful EMS and ISO 19011 informs them how to find non-compliances in the EMS, thus giving them an opportunity for improvement. There is only one study with respect to the EMS guidelines, namely Salomone, 2008, that provides the percentages of companies that applied the following EMS guidelines: ISO 14040 (23%), ISO 14031 (10%) and ISO 14025 (8%).

Some of the possible reasons why the majority of guidelines were not used by any Canadian companies could be that they did not have enough time to learn

about these guidelines and their benefits. Other reasons could be that either the guidelines were withdrawn (ISO 14041, ISO 14042 and ISO 14043) or that the companies were not interested or did not need them. On the other hand, possible reasons for using specific standards, such as ISO 14050, ISO 14064 and ISO 14065, by particular organizations might be that these organizations were pressured by their stakeholders to adopt the standards. However, a reason for a small number of companies applying ISO 14064 could be the fact that this standard has three volumes. The companies perhaps thought that instead of bothering themselves with one standard with three parts, they could adopt other three standards that were more of their interest or need or both.

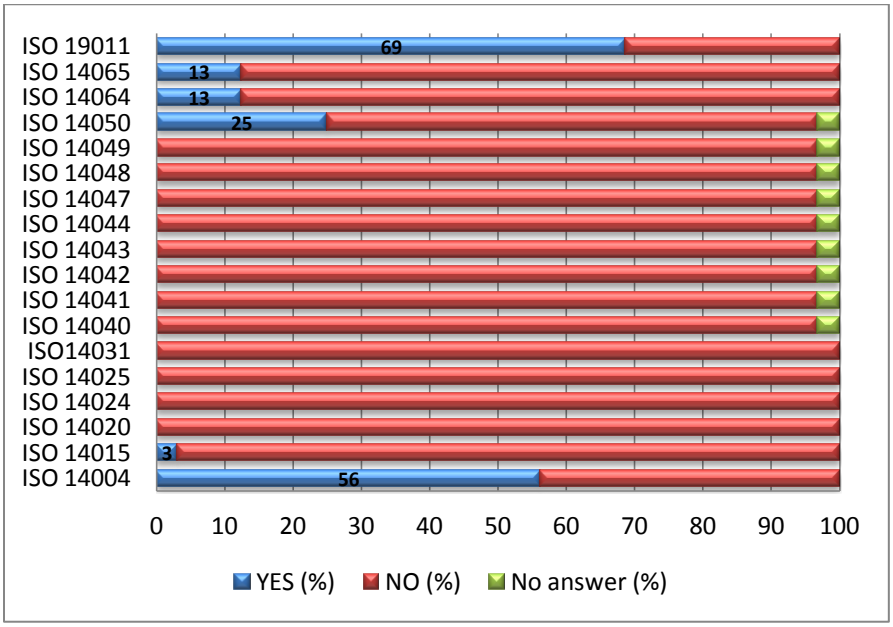


Figure 15. Environmental management guidelines usage (%)

5. Integration of standardized MSs

This part of the study discusses RQs 6-12 (see 2.4.2). As reported in Durdevic et al. (2013a), 30 out of 32 companies implemented more MSSs, in addition to ISO 14001. Specifically, 18 (56%) organizations implemented ISO 9001, 4 (13%) ISO/TS 16949, and 8 (25%) implemented OHSAS 18001 (Durdevic et al., 2013a). An additional eight organizations reported the use of other MSSs, such as CSA Z809 for sustainable forest management (Durdevic et al., 2013a). Moreover, six organizations (18.8%) reported that they used ISO 9004 as a guideline for their QMS (Durdevic et al., 2013a). For those that implemented multiple MSSs, two (6.3%) companies implemented four MSSs (ISO 14001, ISO 9001, OHSAS 18001 and ISO/TS 16946) and only one company (3%) implemented three MSSs (ISO 14001, ISO 9001 and ISO/TS 16949) (Durdevic et al., 2013a). Out of the 30 companies, ten (33%) that implemented two or more MSSs achieved full integration, 6 (20%) partial, while 14 (47%) kept their MSs separated (Durdevic et al., 2013a). It can be concluded that the majority of companies with multiple MSSs were pursuing some form of integration (53% in total). Nevertheless, compared to the previous studies, this number is relatively low. Douglas and Glen (2000), Karapetrovic and Casadesus (2009), Bernardo et al. (2009), Bernardo et al. (2010) and Khanna et al. (2010) all found integration rates to be higher than 53%.

5.1 Time for implementation (Durdevic et al., 2013a)

The respondents were asked to indicate the time to implement MSSs in their organizations (question 17, Appendix H). The results are shown in Figure 16. The mean time required to implement the first MSS was found to be between 18 and 23 months. For the second standard, 8 organizations (25%) responded that they required between 6 and 11 months for implementation. Another 8 (25%) indicated the time to implement the second standard to be between 12 and 17 months. Based on the responses received, it is clear that less time was required to implement the second standard than the first. It was further determined that the time needed for the implementation of the third and fourth MSSs was between 6 and 11 months in both cases. The findings are in line with the results reported by Karapetrovic and Casadesus (2009), who also found less time for the second standard than for the first.

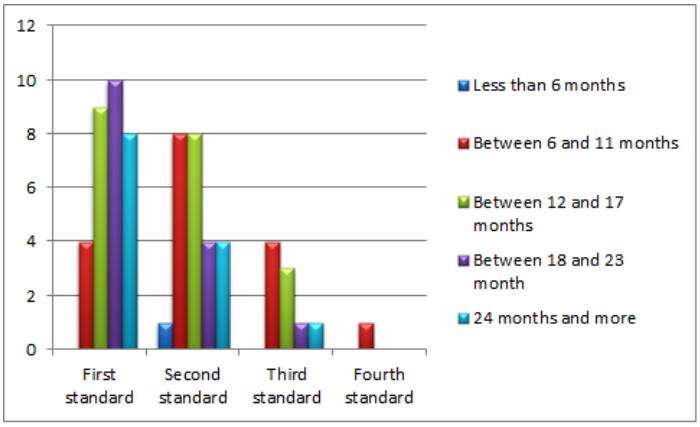


Figure 16. Time to implement MSSs by order of implementation (%)

5.2 Order of implementation (Durdevic et al., 2013a)

Figure 18 presents the responses regarding the sequence of implementation (question 16, Appendix H). As shown in Figure 13, ISO 9001 was the standard most frequently implemented first, followed by ISO 14001, and OHSAS 18001. In cases where ISO 14001 was not implemented first, it was always implemented second. These findings are broadly in line with the results found by Douglas and Glen (2000), Zeng et al. (2007), Karapetrovic and Casadesus (2009), Bernardo et al. (2010), Zeng et al. (2011) and Bernardo et al. (2012a), according to whom the most followed path for the companies was to implement a QMS according to the ISO 9001 first, then an EMS according to the ISO 14001, and then other systems, mostly OHSAS 18001 as the third one.

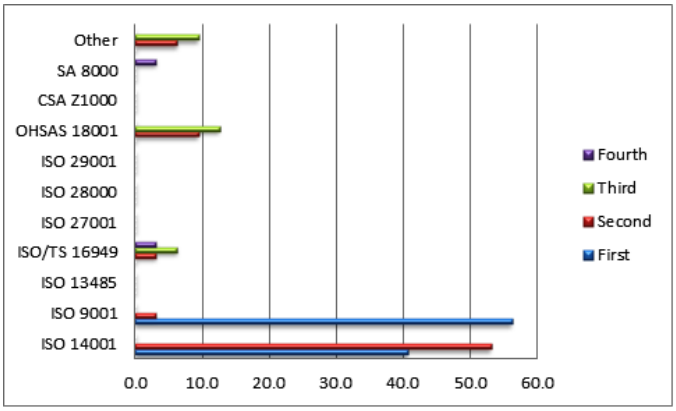


Figure 17. Order of implementation of MSSs (%)

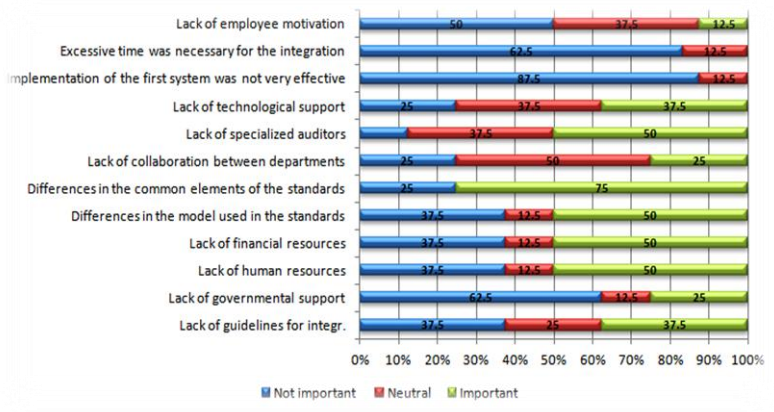
5.3 Integration difficulties

Data regarding the integration difficulties were collected from question 23 (Appendix H), using the same method as explained in 4.1. As presented in Durdevic et al. (2013b), the most significant difficulties were 'differences in the common elements of the standards' reported by 8 out of 13 organizations in total, 'differences in the models used in the standards' and 'lack of human resources', both reported by 6 out of 13 organizations in total. All other difficulties, such as the 'lack of employee motivation' and 'lack of government support' were not assigned to be important by the majority of organizations (Durdevic et al., 2013b). The presented results slightly differ from what was previously reported in Karapetrovic et al. (2006), Casadesus et al. (2007), Bernardo et al. (2012b), Simon et al. (2012a) and Simon et al. (2012b), who found those two difficulties to be the two most important by Spanish organizations. Some of the possible reasons for these results could be that Canadian employees are more open to changes than Spanish employees, thus they did not lack of their motivation and support. Regarding the government support, it can also be concluded that Canadian organizations have more support from the government than Spanish organizations. All these could be a consequence of different political systems that prevail in these two countries.

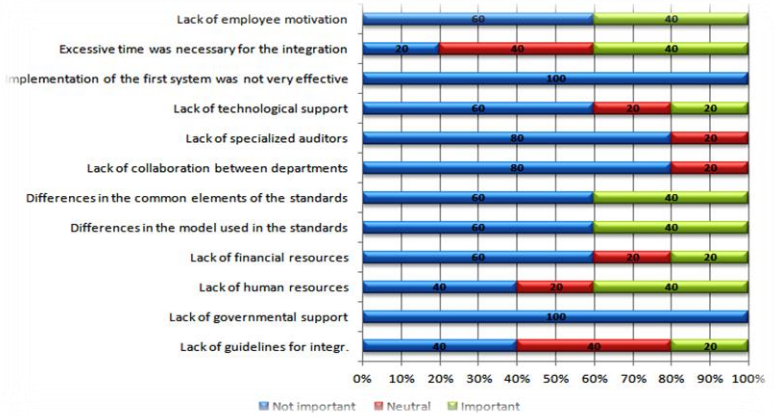
With respect to the organization size (Figure 18), it could be noticed that SMEs encounter more difficulties with the integration process than the large

organizations. ‘Differences in the common elements of the standards’ is the difficulty that shows the biggest difference between the responses of SMEs and large organizations. Six out of eight SMEs in total reported this difficulty as an ‘important’ one. On the other hand, only two out of the five large organizations assigned this difficulty as ‘important’. Other difficulties reported ‘important’ by most of the SMEs were ‘differences in the model used in the standards’, ‘lack of financial recourses’ and ‘lack of human resources’. These results differ from what (Figure 19), it could be was previously obtained by Salomone (2008), who reported that the problems associated with integration grow as an organization size increase.

With respect to the sector where organizations operate concluded that manufacturing organizations generally face more integration difficulties than ‘other’ type of organizations. The most common difficulties that were assigned as ‘important’ were ‘differences in the common elements of the standards’, ‘differences in the model used in the standards’ and ‘lack of human resources’. The reason might be the complexity of the production or products which leads to the complexity of the system and thus makes it difficult to eliminate the potential obstacles before the integration. On the other hand, other types of organization might have found a way to eliminate obstacles before integration, hence did not have to face them in the process.

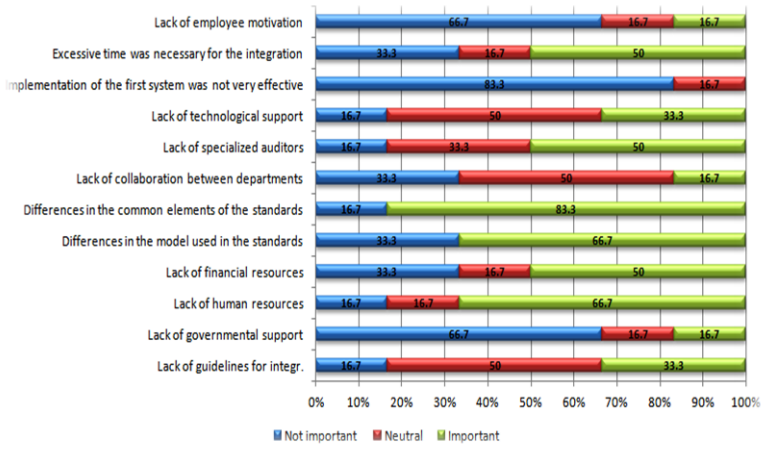


a) Small and medium

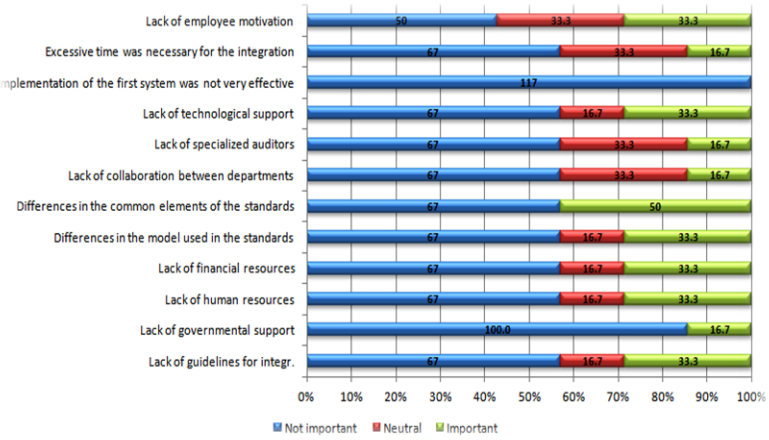


b) Large

Figure 18. Integration difficulties by organization size



a) Manufacturing



b) Other

Figure 19. Integration difficulties by industry sector

5.4 Level of integration

Three different integration aspects regarding the integration levels were offered in the questionnaire: documentation, processes and human resources (questions 20, 21 and 22, respectively, Appendix H). The same as in Karapetrovic et al. (2006), Casadesus et al. (2007) and Bernardo et al. (2009), for the first and the second aspect, data were collected by choosing a number on the following scale: 1- 'not integrated', 2- 'partially integrated' and 3- 'fully integrated', while for the third aspect, the following scale was used: 1 – 'different people for all systems', 2 – 'same people for some systems' and 3 – 'same people for all systems'.

5.4.1 Documentation

The most integrated document was the manual, fully integrated by ten and partially by one of the responding organizations (Figure 20). Procedures were fully integrated by eight of the organizations and partially by four, and instructions and records, both fully integrated by seven of organizations and partially by three of responding organizations. On the other hand, policy, objectives and targets show a lower level of integration, fully integrated in less than six (45%) organizations. These results differ from Karapetrovic et al. (2006) and Bernardo et al. (2009), who reported full integration for the policy and objectives in more than 70% of organizations. However, the results in this research provide the integration of targets, which was not included in their

studies. A possible reason for a lower level of integration of the policy and objectives in Canada versus Spain could be that integration in Canada was introduced later than it was in Spain. Therefore, Canadian organizations were focusing more on the integration of some other parts of their MSs, such as procedures, instructions and processes and they left the policy, objectives and target to integrate at the end.

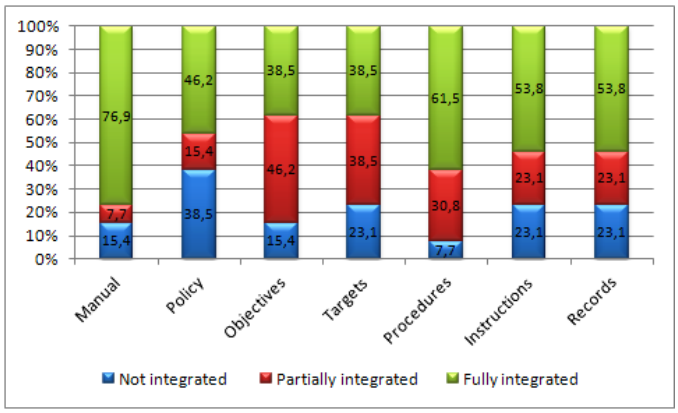
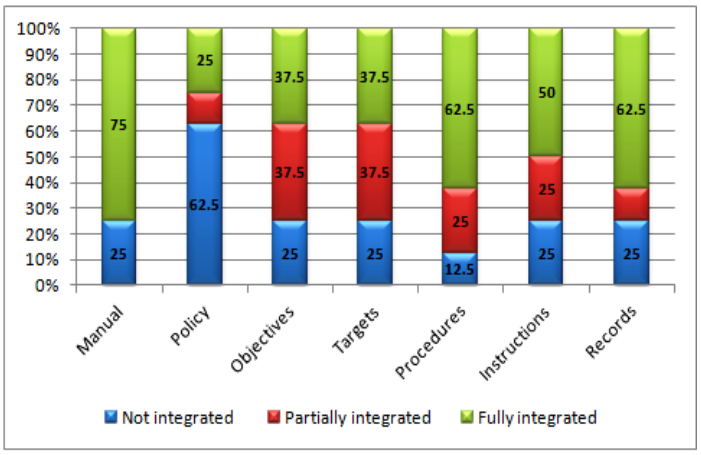


Figure 20. Integration of documentation

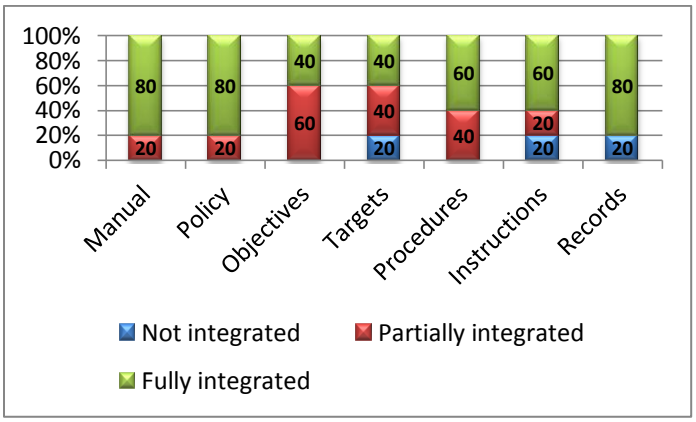
With respect to the organization size (Figure 21) there is only one item, namely 'policy', that shows differences in the responses between SMEs and large organizations. The number of large organizations that fully integrated their policy is higher than a number of SMEs. One of the reasons could be the number of employees. For large organizations, it is beneficial to integrate the policy as soon as they can, so they can manage their employees easier.

Regarding the sector where organizations operate (Figure 22), there are differences in responses regarding the integration of records, instructions and

procedures between manufacturing and the 'other' type of companies. It seems that 'other' type of companies integrated these three items more than the manufacturing organizations. In detail, six out of seven 'other' type of organizations reported 'full integration' of their records while in case of manufacturing companies that number is fairly low, only three out of six companies in total. The results are similar in the case of instruction and procedures (Figure 22). These results were expected, due to the number of manufacturing organizations that reported 'important' for the integration difficulties (see 5.3). They faced more difficulties than the 'other' type of organizations, which could have led to a lower level of integration as well.

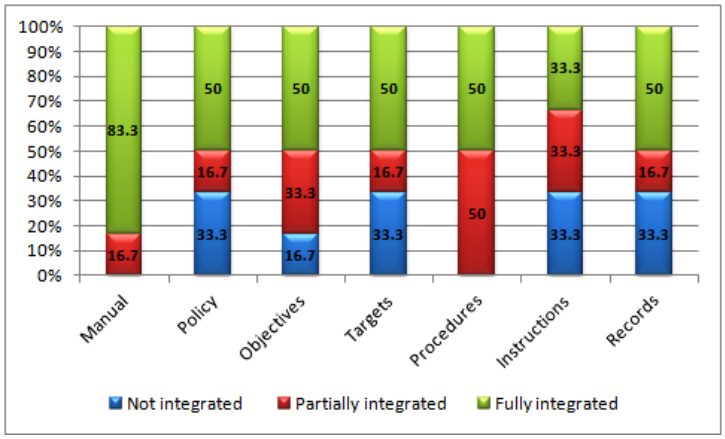


a) Small and medium

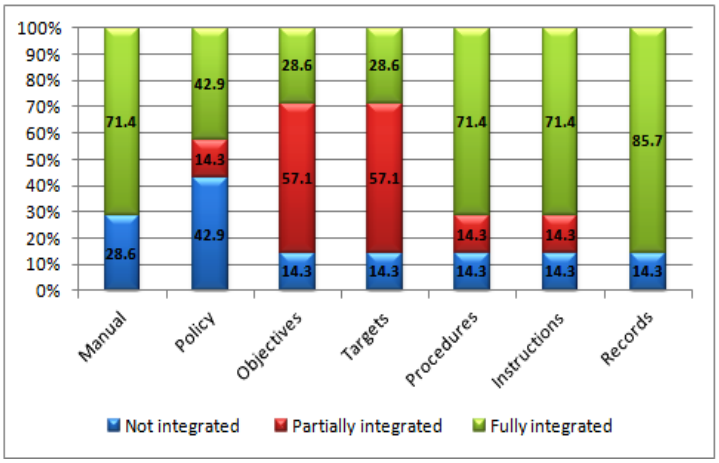


b) Large

Figure 21. Integration of documentation by organization size



a) Manufacturing



b) Other

Figure 22. Integration of documentation by industry sector

5.4.2 Processes

Most of the processes were fully integrated by the majority of responding organizations (Figure 23). The most integrated process was 'internal auditing', fully integrated by all organizations. 'Management review', 'documentation control', 'record control' and 'corrective and preventive action' were all fully integrated by 12 out of 13 organizations in total. The least integrated processes were 'determination of legal requirements' (6) and 'operational control' (7). It might be that companies prefer keeping these processes separated. The number of legal requirements could be large and trying to integrate the processes of the determination of legal requirements corresponding to different MSs could be a never ending process.

These results are also in line with the findings obtained by Karapetrovic et al. (2006) and Bernardo et al. (2009), who also reported a high integration level of organizations' processes. However, the results obtained in this paper show a slightly higher percentage than in their studies. Nevertheless, due to the fairly low sample size, the interpretation of the results should be taken with caution.

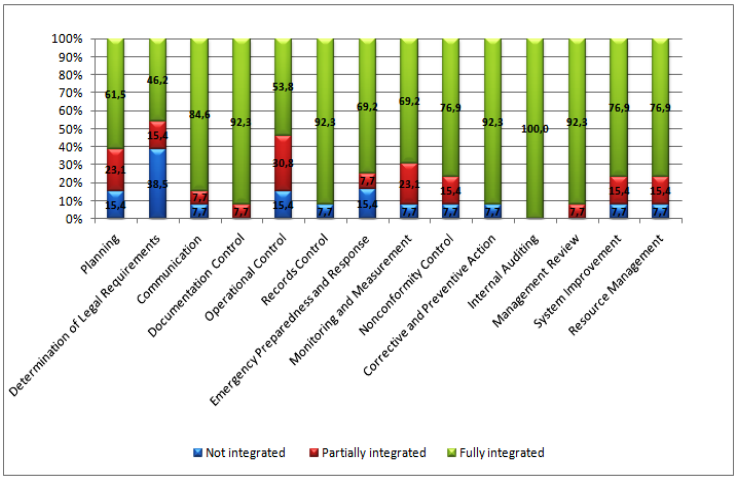
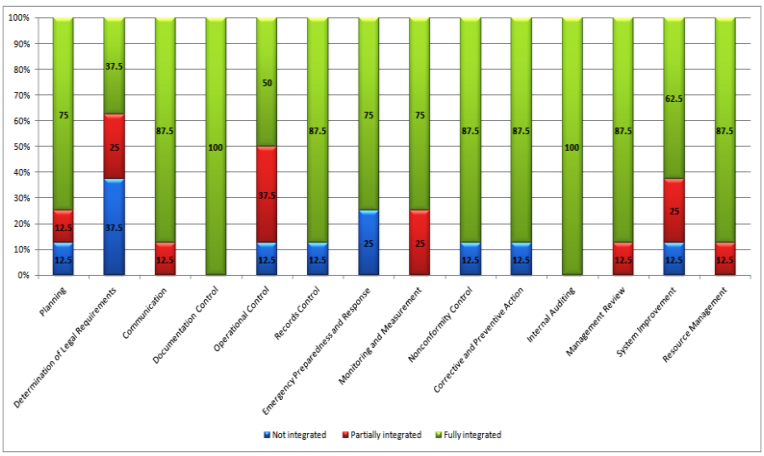
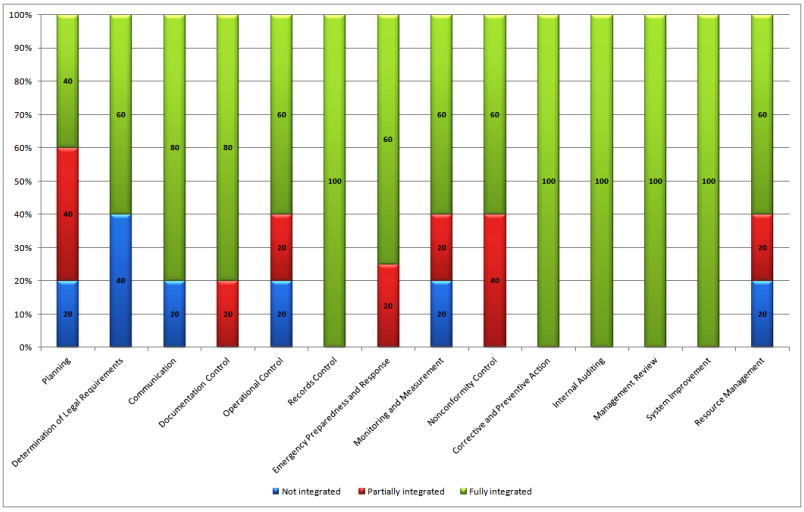


Figure 23. Integration of processes

Regarding the organization size (Figure 24), the results obtained do not show many differences in responses between SMEs and large organizations. However, processes that showed variations were 'system improvement', 'determination of legal requirements' and 'planning'. 'System improvement' was fully integrated by all five large companies (100%), while that number was lower in the case of SMEs. Five out of eight in total fully integrated that process (62.5%). It could be that improvement of MSs is more of a concern for large organizations, due to the number of employees that has to be managed. On the other hand, 'planning' was fully integrated by a larger number of SMEs. Six out of eight SMEs fully integrated 'planning' and only two out of five large organizations did the same. This result was very surprising, as one would think that larger organizations would integrate planning more than SMEs, since the MSs are more complex than in the case of SME.



a) Small and medium

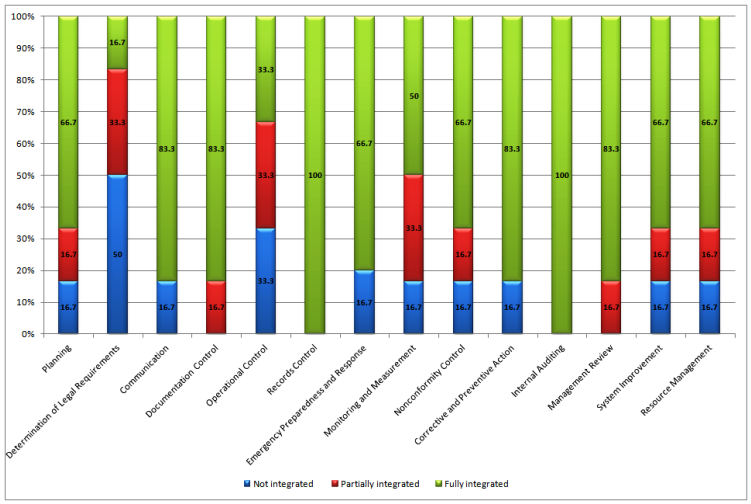


b) Large

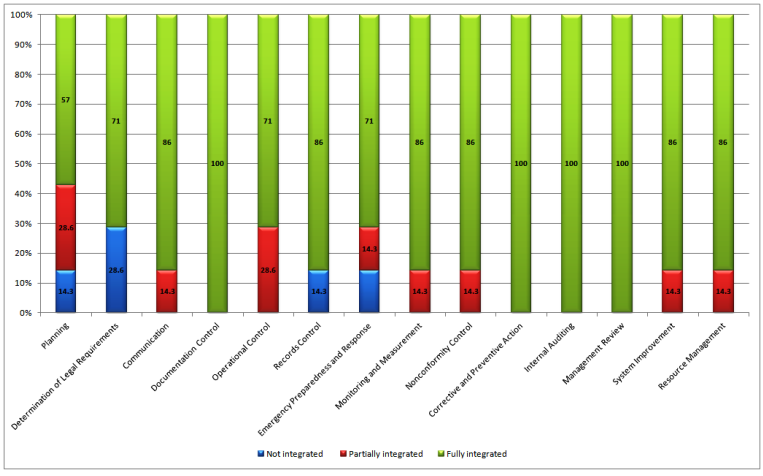
Figure 24. Integration of processes by organization size

With respect to the organizations sector (Figure 25), it could be seen that processes are fully integrated by a larger number of the 'other' type of organizations than by the manufacturing organizations. The biggest variance lies in responses regarding the full integration of 'operational control' and the 'determination of legal requirements' processes. 'Operational control' and 'determination of legal requirements' were both fully integrated by five out of

seven ‘other’ companies and only by two and one out of six manufacturing organizations, respectively. The reason could be the same as in the case of the integration of documentation (see 5.4.1). Manufacturing companies face more difficulties in integration than the ‘other’ type of companies (see 5.3).



a) Manufacturing



b) Other

Figure 25. Integration of processes by industry sector

5.4.3 Human resources

Human resources can be integrated at three hierarchical levels: the highest (top management level or managers), medium (middle level or representatives) and the lowest (floor level or inspectors) (Karapetrovic, 2002b; Beckmerhagen et al., 2003; Karapetrovic et al., 2006; Casadesus et al., 2007, Bernardo et al., 2009). The results obtained in this study show that human resources are integrated at some degree at every hierarchical level (Figure 26). Eleven organizations out of thirteen in total reported the same managers for all MSs, nine the same inspectors for all MSs, and seven organizations reported the same representatives for all MSs. These results are in line with Karapetrovic (2002b) and Beckmerhagen et al. (2003) according to whom a certain level of integration is expected for all hierarchy levels. The results also aligned with the results obtained by Karapetrovic et al. (2006) and Casadesus et al. (2007), who also reported *"same person''* for all hierarchical levels by the majority of organizations. However, the results differ from what was previously found by Bernardo et al. (2009), who reported "*different people responsible for different function-specific MSs*". It could be concluded that Canadian organizations integrate their human resources in the same manner as Spanish companies, as well as follow the most common way as proposed in theory – integrate HR at the top and at the bottom, and separate in the middle (Renzi and Capelli, 2000; Beckmerhagen et al. 2003).

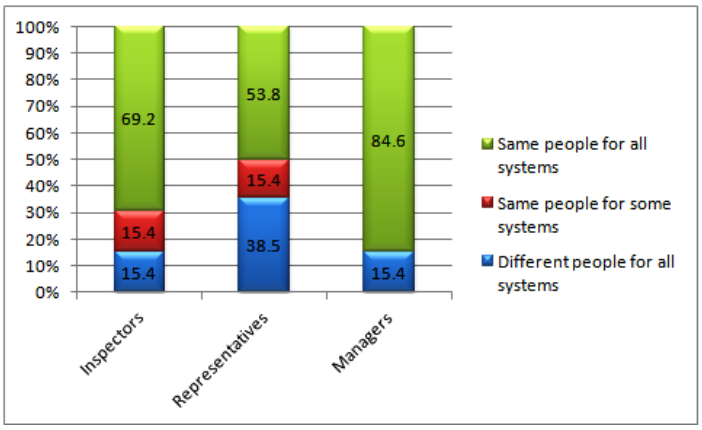
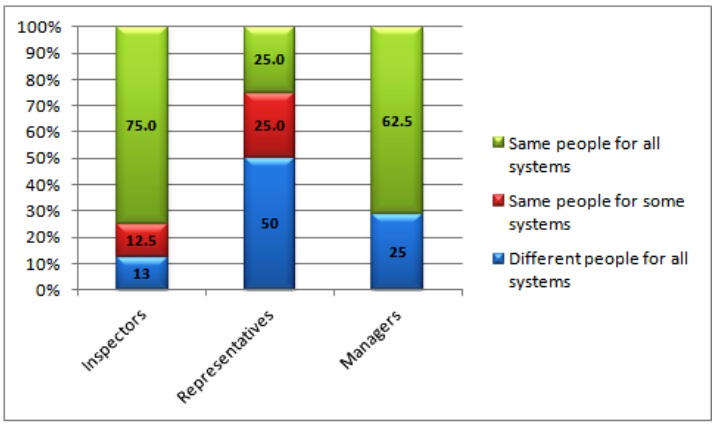
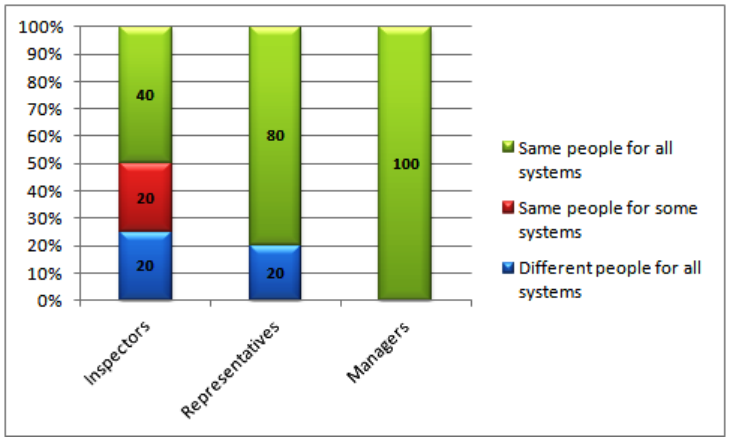


Figure 26. Integration of human resources

Regarding the organization size (Figure 27), six out of eight SMEs in total had the same inspectors for all MSs, five the same managers and only two organizations reported the same representatives for all MSs. On the other side, all five large organizations reported the same managers for all MSs, four organizations the same representatives and only two out of five organizations in total the same inspectors for all MSs. As can be seen in Figure 27, SMEs integrated more their managers and inspectors, while keeping low the integration at the middle level (representatives). Large organizations keep the lowest integration at the lowest level (inspectors). These results are very interesting, since one would expect that large organizations would integrate the lowest level the most, due to their size. The more the lowest level is integrated, the easier it is to coordinate employees, since they do not have to follow multiple guidelines, use multiple instructions and report to multiple inspectors.



a) Small and medium

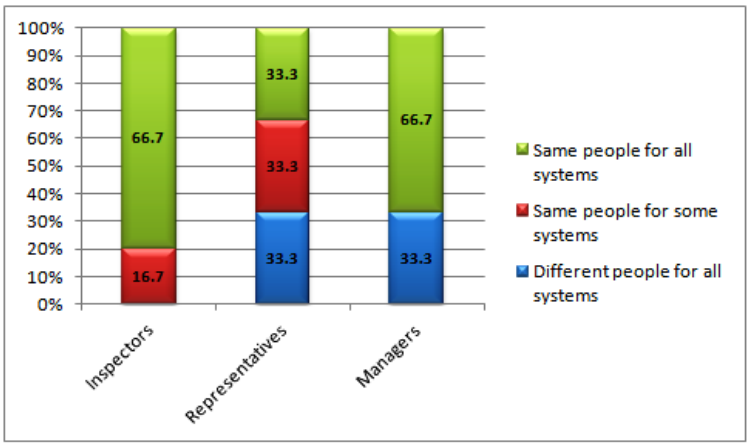


b) Large

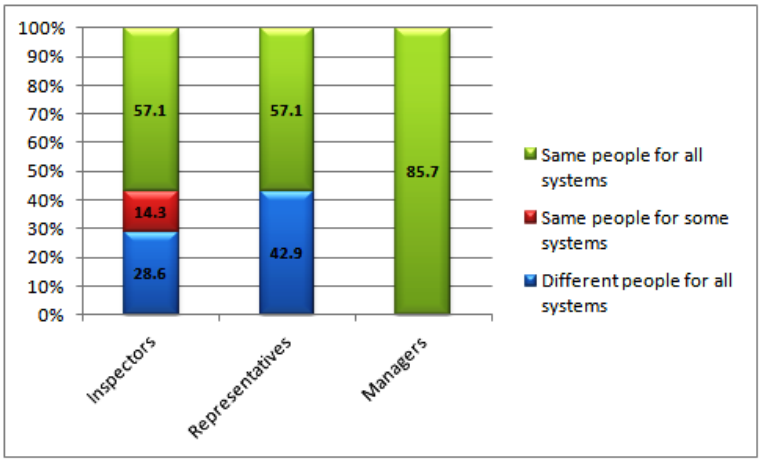
Figure 27. Integration of human resources by organization size

Figure 28 illustrates the level of integration of human resources depending on the organization sector. As can be seen from the graph, four out of six manufacturing organizations reported the same inspectors and the same managers for all MSs, while only two organizations had the same representatives for all MSs. On the other side, four out of seven 'other' organizations reported the same inspectors and the same representatives for all MSs and six

organizations had the same managers for all MSs as well. As can be seen in Figure 28, there are more 'other' companies that have the same people at the middle level. It might be that it is more difficult to integrate the middle level for manufacturing organizations. That might be due to their operations and the work they do. It could be that manufacturing is more complex than construction, fishing and service, so keeping the people separated at the middle level is a preferable option.



a) Manufacturing



b) Other

Figure 28. Integration of human resources by organization sector

5.4.4 Reasons for keeping the MSs separated

Data regarding the reasons for keeping the MSs separated were collected and classified in the same manner as for the integration difficulties (see 5.3). The following reasons were assigned to be the most significant (Durdevic et al., 2013b): 'lack of interest' reported with 4 or 5 (i.e., 'important') by seven out of nine organizations in total and 'areas/departments affected by the standards were very different' reported by five organizations. In addition, two organizations reported that registration of the original standard was required quickly and only one organization reported that it either had not known that integration was possible or that standards were too different or that it had not had adequate guidelines for integration (Durdevic et al., 2013b). The presented results are partially in line with the results obtained by Karapetrovic et al. (2006) and Casadesus et al. (2007), who also reported 'lack of interest' as one of the major reasons for keeping the MSs separated. However, they did not report the 'areas/departments affected by the standards were very different' reason to be of any importance, which in this study seems to have the second highest significance. Moreover, the results also differ from what was reported by McDonald et al. (2003) (see 2.2.5).

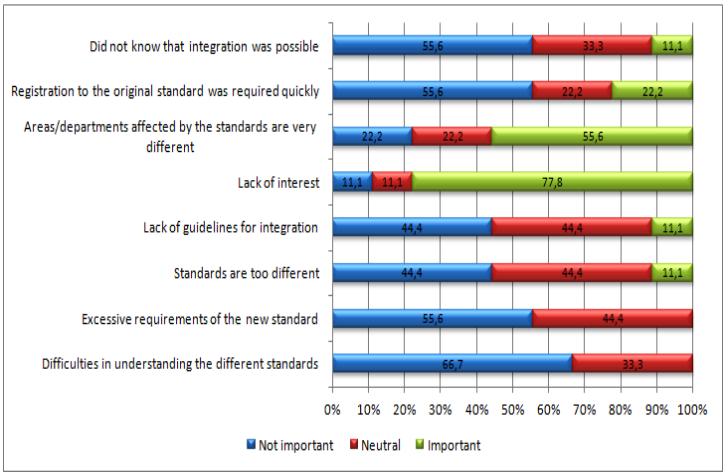
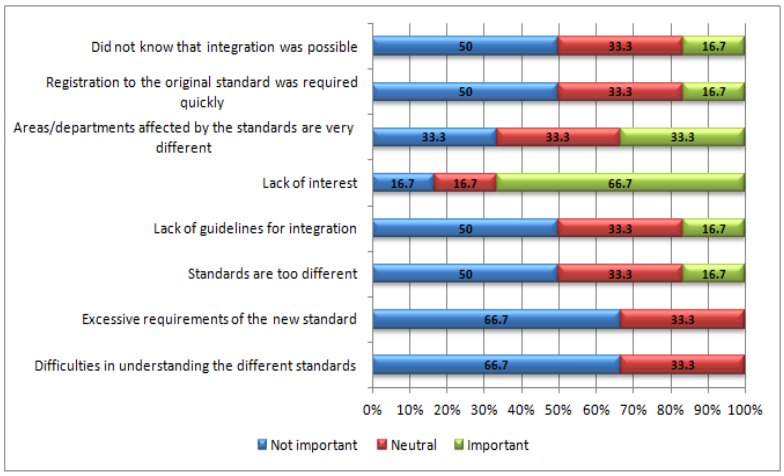
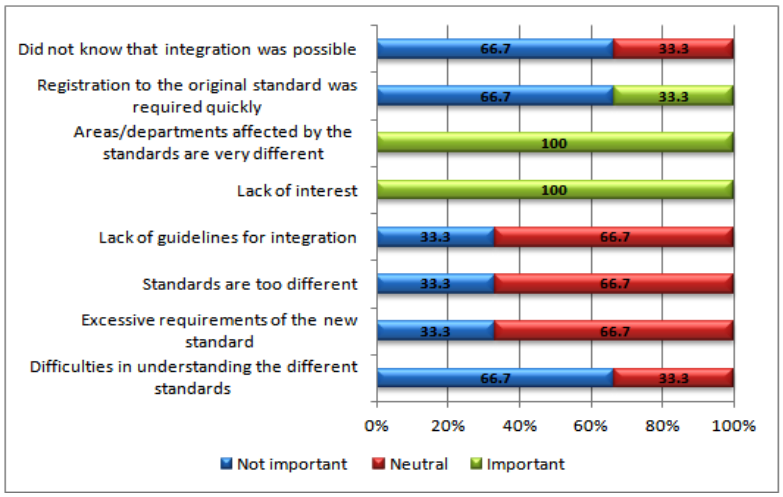


Figure 29. Reasons for keeping the MSs separated

With respect to the organization size (Figure 30), there is only one reason, namely 'areas/departments affected by the standards are very different' that showed differences in the responses between SMEs and large organizations. Specifically, all three large organizations assigned 'important' for that difficulty, while only two out of six SMEs in total did the same. It could be that SMEs, due to their size, do not have many departments, thus they do not find that difficulty to be as important as large organizations. On the other side, large organizations have more departments, hence the integration can be a harder to do.



a) Small and medium

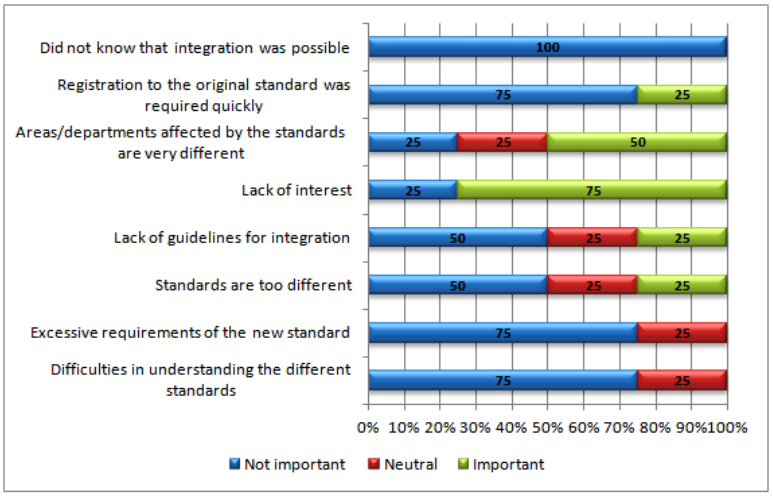


b) Large

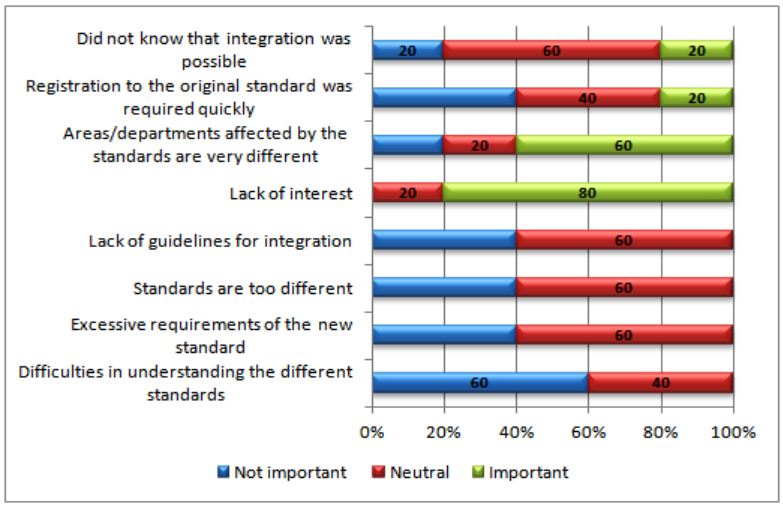
Figure 30. Reasons for keeping the MSs separated by organization size

With regard to the industry sectors (Figure 31), the responses of manufacturing and 'other' organizations were fairly similar. Both types of organizations reported 'lack of interest' as a major reason, followed by the 'areas/departments affected by the standards are very different'.

The results indicate that no matter what an organization is involved in, the reasons for keeping the MSs separated are the same.



a) Manufacturing



b) Other

Figure 31. Reasons for keeping the MSs separated by industry sector

5.4.5 Cluster analysis

The same as in Bernardo et al. (2009), 13 organizations that have reported some level of integration were classified using cluster analysis. *"There are no rules-of-thumb about the sample size necessary for cluster analysis"* (Dolnicar, 2002). However, *"Formann (1984) suggests the minimal sample size to include no less than* 2^k *cases (k = number of variables)"* (Dolnicar, 2002). In this thesis, three different variables were taken into account: documentation, processes and human resources. Therefore, $2^k = 2^3 = 8 < 13$, thus the sample size in this research can be considered as appropriate.

There is one study in the literature that did the same type of analysis as this one, namely Bernardo et al. (2009). However, Bernardo et al. (2009) did not include the human resource variable in their cluster analysis. Moreover, the sample used and the results obtained were different.

In addition, hierarchical cluster procedure was performed using the Ward's method linkage (Hair et al., 1987). The result was a two-group classification: 'class 1' and 'class 2'. Table 12 presents descriptive statistics of the obtained classes. On the left-hand side of the table are the columns of the means for the two groups identified in the Ward's method of clustering. Besides the means, the level of significance is listed, comparing the differences between the group means. All three variables, i.e. documentation, processes and human resources,

show significant importance (level of significance lower than 0.05). An interpretation of the means for the two classes shows that 'class 2' displays a higher level of integration for all three variables (2.7, 2.9 and 2.7 out of 3) than 'class 1' (1.9, 2.4, 1.8 out of 3), respectively. Therefore, organizations in 'class 2' may be labeled as organizations with high integration, while organizations in 'class 1' as organizations with low integration. 'Class 1' contains six organizations, among which four were SMEs and two were large organizations. 'Class 2' contains seven organizations, four SMEs and three large. Therefore, both classes have more SMEs than large organizations. With respect to the operation sectors, in 'class 1', there are three organizations involved in manufacturing and another three are 'other' type of organizations. 'Class 2' contains three manufacturing and four 'other' types of companies. Both classes have almost the same number of manufacturing and 'other' types of organizations, which makes them easier to compare.

Out of the six organizations in 'class 1', two had ISO 14001 and ISO 9001, two had ISO 14001 and OHSAS 18001, one had ISO 14001, ISO 9001 and OHSAS 18001, and the last one had ISO 14001, ISO 9001 and other standards (SFI ("*Sustainable Forestry Initiative*"), FCS ("*Forest Stewardship Council*") and PEFC ("*Program for the Endorsement of Forest Certification*")).

Out of the seven companies in 'class 2', one company had ISO 9001, two had ISO 9001 and OHSAS 18001, one had ISO 9001 and ISO 20000 (for information technology) and the now withdrawn ISO 9003, and one organization had CSA Z809. Out of the two remaining organizations, one reported an *"internal company system"* in addition to ISO 14001, and another one had only ISO 14001.

	Means		
Variable	***Class 1***	***Class 2***	***Level of significance***
Documentation	1.9	2.7	0.001
Processes	2.4	2.9	0.006
Human Resources	1.8	2.7	0.001

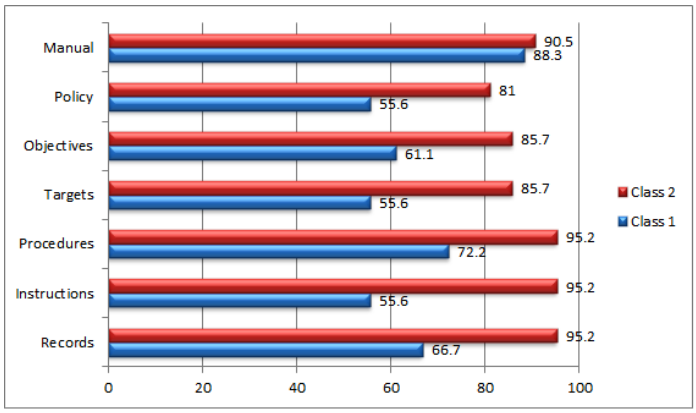
Table 12. Two- group cluster solution (adopted by Hair et al., 1987)

Organizations grouped in 'class 2' (Figure 32) demonstrate extremely high level of integration of all three aspects, i.e. documentation, processes and human resources. In detail, procedures, instructions and records were fully integrated by six and partially by one out of seven organizations in total. The manual was also fully integrated by six and not integrated by only one organization. The objectives and targets were both fully integrated by four and partially by three organizations. The least integrated item was the policy. The reason for this result could be, as was already mentioned in 5.4.1, that organizations want to leave the policy at the end. Therefore, they integrate all other aspects first and then they sum up the work by integrating the policy. This assumption could be verified in

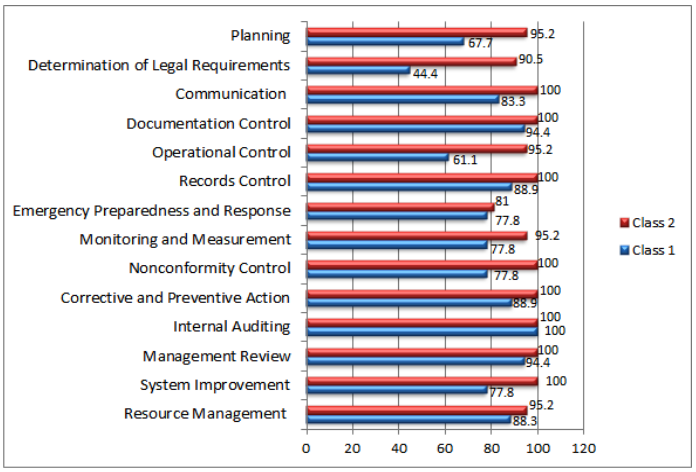
the future by asking the same question again and seeing the difference in responses. In addition, almost all processes were fully integrated by all seven organizations, i.e. communication, document control, records control, nonconformity control, corrective and preventive actions, internal auditing, management review and system improvement. Planning, operational control, monitoring and measurement, resources management were all fully integrated by six and partially by one organization. The determination of legal requirements was fully integrated by five and partially by two organizations in total. The emergency preparedness and response was the least integrated item, fully integrated by five and not integrated by two organizations. With respect to human resources, five organizations reported the same representatives and inspectors for all MSs and two organizations had the same representatives and inspectors for some MSs. In addition, six organizations had the same managers for all MSs and only one reported different managers for all MSs.

Organizations grouped in 'class 1' (Figure 32) display a low level of integration in all three aspects. The most integrated document was the manual, fully integrated by four and partially by one out of six organizations in total. Procedures were fully integrated by two, partially by three and not integrated by one organization. Records were fully integrated by three and not integrated by another three organizations. Objectives, policy, targets and instructions showed a very low level of integration. They were fully integrated by one or two

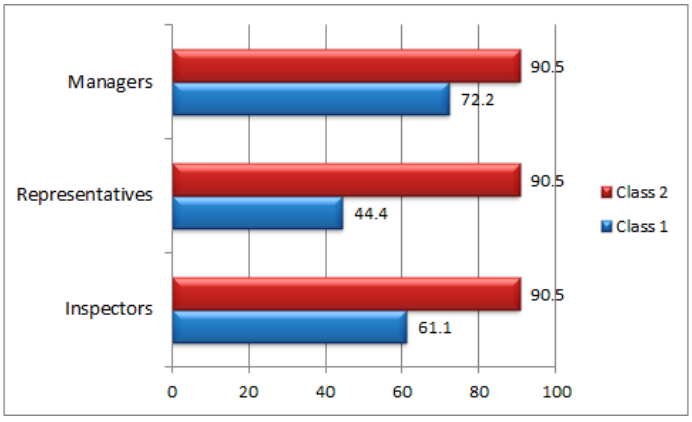
organizations only. With respect to the organizations' processes, the most integrated item was internal auditing, fully integrated by all six organizations. Document control and management review were the second most integrated items, fully integrated by five and partially by one organization. They are followed by records control and corrective and preventive actions, also fully integrated by five and not integrated by one organization. The least integrated process was the determination of legal requirements, not integrated by five and fully integrated by only one organization. Regarding the human resources, four organizations had the same managers for all MSs, three organizations had the same inspectors for all MSs and only one organization reported the same representatives for all MSs. Therefore, this class of organizations shows a very low level of integration of all three variables: documentation, processes and human resources. Out of three aspects, processes were integrated by most organizations, especially internal auditing, which was fully integrated by all organizations in the group. The results imply that, even though the organizations choose not to fully integrate all aspects in their MSs, they still integrated those aspects that make sense to them to be integrated at the moment.



a) Documentation



b) Processes



c) Human resources

Figure 32. Level of integration for 'class 1' and 'class 2'

As said at the beginning of this section, there was only one study (Bernardo et al., 2009) that did the same type of analysis. That study was conducted in Spain, one of the top five countries in the world with respect to the number of ISO 9001 and ISO 14001 certificates (ISO, 2011a). On the other side, Canada is eighth for the ISO 14001 growth (ISO, 2011a). It should be also noticed that all organizations in the Spanish sample were registered at least to the ISO 14001 and ISO 9001 standards. In this sample, organizations were certified to the ISO 14001 only at the minimum. However, out of 13 organizations in total, eight organizations had ISO 9001 as well.

In addition, the results in this thesis indicate that organizations could be classified into two classes: organizations with a low level of integration and organizations with a high level of integration. In Bernardo et al. (2009), organizations were classified in three groups: organization with an *"initial level of integration"*, organizations with a *"slightly higher level of integration"* and organizations with *"the highest level of integration".* The results might differ due to the sample size, 13 in this thesis versus 435 in their study, or the fact that the human resources variable was not included in the cluster analysis in their study. However, in Bernardo et al. (2009), not all organizations achieved full integration, the same as in this research.

6. Auditing

This sub-chapter discusses the following topics:

6.1 Frequency of ISO 14001 IEAs

6.2 Structure of ISO 14001 IAs

6.3 Purpose of ISO 14001 IEAs

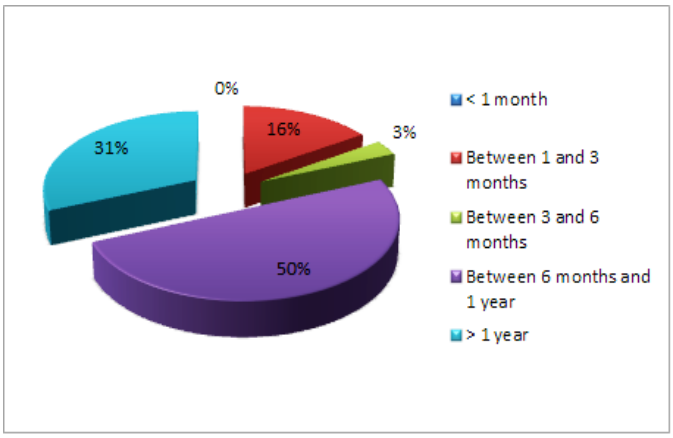
6.4. Integration of ISO 14001 IEAs with other MSSs audits

6.5. Relationship between the integration of standardized MSs and audits.

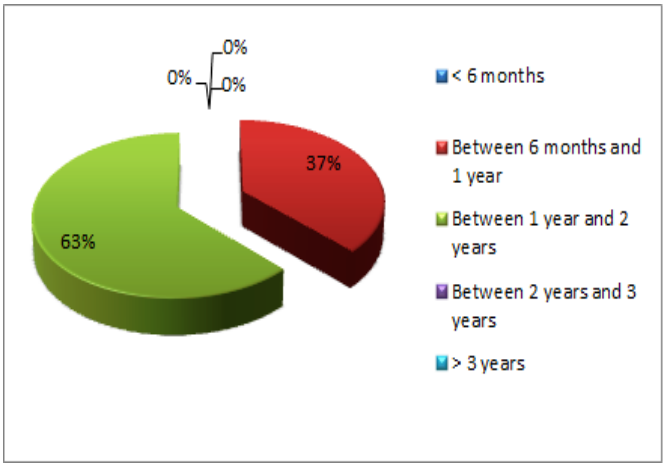
6.1 Frequency of ISO 14001 IEAs

Figure 33 illustrates how often ISO 14001 IEAs were performed. Out of 32 participating organizations, one half conducted their IAs once every six months to one year. Out of the remaining 16 organizations, five conducted their IAs once every one to three months, ten once a year or more, and only one company performed its IAs once every three to six months. EAs were performed less frequently. Twenty organizations conducted their EAs once every one to two years, and the other ten companies once every six months to one year. These results align with the results obtained by Karapetrovic et al. (2007), who found a higher frequency of internal over external auditing. The same authors also reported about 60% of organizations with the IA frequency of once every 6-12 months (Karapetrovic et al., 2007), similar to this research. However, the percentage in this study was lower (50%). This might be due to the difference in the samples. This research included only ISO 14001- registered organizations.

The organizations in Karapetrovic et al. (2006) sample were registered to both the ISO 9001 and the ISO 14001 standards. It could be assumed that organizations in Karapetrovic et al (2006) were registered against ISO 9001 for a longer time. Therefore, the experience gained from practicing 'quality audits' made the organizations faster with 'environmental audits' as well.



a) Internal audits



b) External audits

Figure 33. ISO 14001 auditing frequency

6.2 Structure of ISO 14001 IAs

There were two ways offered in the questionnaire in which an organization can organize its IAs against ISO 14001: around internal processes and around the requirements in the standard. The findings show that 19 organizations had their IAs structured around the ISO 14001 requirements, ten organizations around their internal processes, and three companies combined both methods (Figure 34). These results differ from what was previously found by Karapetrovic et al. (2006), who reported 61% of IAs *"executed process-by-process"* and 34% *"requirement-by-requirement".* Possible reasons why the majority of Canadian organizations perform their IAs following the requirements in the ISO 14001 standard might be due to the fact that this option was the older one. Even though the process approach was introduced for the first time in 2000 (Hooper, 2001), the older approach probably stayed etched for a longer time in Canadian organizations. On the other side, Karapetrovic et al. (2006) conducted their study in Spain, a country that now represents one of the top five countries in the world with the largest number of registrations to the ISO 9001 and the ISO 14001 standards (ISO, 2011a). Spanish organizations most likely try to stay up to date and maintain this position. That could be why the majority of Spanish organizations reported that execution of their IAs was performed around their internal processes.

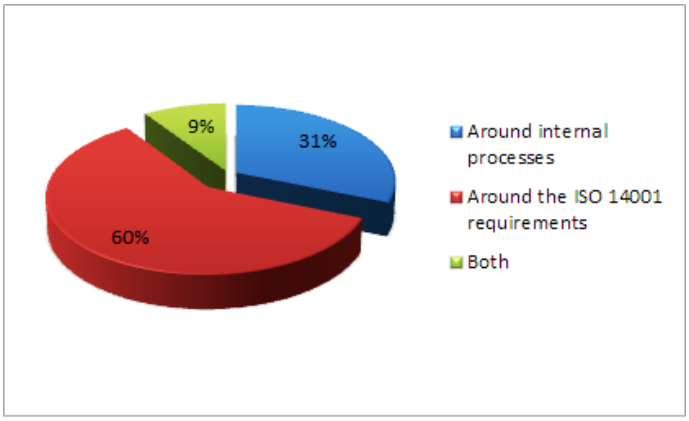


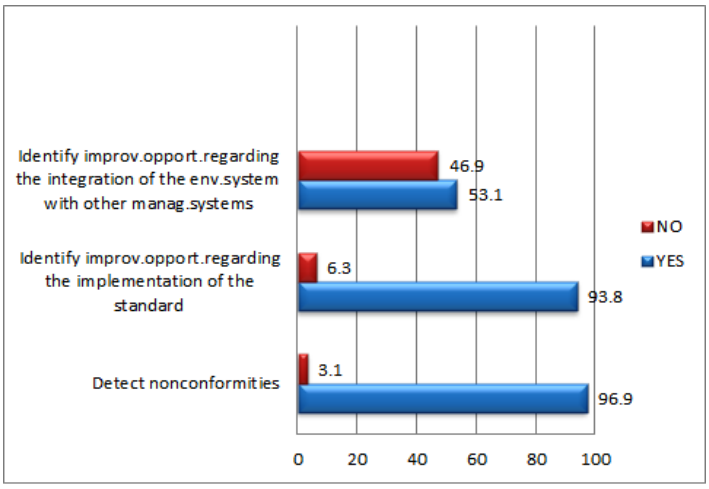
Figure 34. Structure of internal audits

6.3 Purpose of ISO 14001 audits

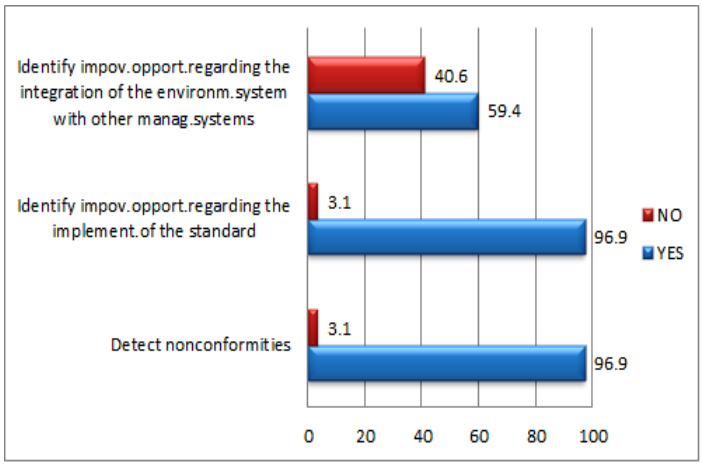
There were three reasons provided in the questionnaire for carrying out IEAs: to detect possible nonconformities, to identify opportunities regarding the implementation of the standards, and to identify opportunities regarding the integration of the EMS with the other MSs.

Figure 35 illustrates the survey results regarding the usage of ISO 14001 IEAs. In the case of IAs, 31 organizations said that IAs detect potential nonconformities, 30 that they identified improvement opportunities regarding the implementation, and 17 organizations reported that IAs also identify improvement opportunities regarding the integration. It can be seen that almost all organizations reported that IAs detect nonconformities and identify improvements regarding the implementation of the standard. However, the last audit purpose was reported by only a half of organizations. A possible reason for such a low number of companies that recognized the third purpose of audits

could be that organizations were not aware of it. Therefore, they were paying more attention to the first two audit purposes. The results were higher for EAs than for IAs (see Figure 35). A possibility for this finding could be that the registrars, unlike the organizations, were aware of all three purposes. However, the number that reported the third purpose (19) is still lower that the number reported for the first two (31 for both). Nevertheless, this situation could change with time, as organizations become more knowledgeable about the audits and their use. The results are also similar to the results obtained by Karapetrovic et al. (2006), who also reported 79% and 90% of companies for IAs and EAs, respectively, that obtained improvement opportunities for the implementation of the standards. However, the findings here show a higher number of companies regarding detecting nonconformities than was found in their study. It could be that Canadian companies face more nonconformities than Spanish organizations, thus the IEAs detect these nonconformities more as well. Another reason could be the fact that Canada was way behind Spain in implementing the ISO 14001 standard (ISO 2011a). Moreover, this study also reports findings regarding the improvement opportunities for the integration of the EMS with other MSs, which were found lacking in previous studies.



a) Internal audits



b) External audits

Figure 35. Usage of ISO 14001 audits

6.3 Internal and external audits integration

In this part of the study the integration of ISO 14001 IEAs with other MSS audits was investigated. Three different were examined in the survey: audit simultaneousness, audit plans and reports, and audit view.

Regarding the first aspect, there were three ways offered in the questionnaire for carrying out audits: at different times for different standards/systems, simultaneously for some of the standards/systems, and simultaneously for all standards/systems.

Regarding the second aspect, there were also three ways provided in the questionnaire that could be applied: separate audit plans and separate audit reports for different standards/systems, single audit plan and separate audit reports, and single audit plan and single audit report for all standards/systems.

Regarding the third aspect, the auditors can audit MSs as mutually independent, interrelated or integrated.

6.4.1 Audit simultaneousness

The majority of organizations either conducted all their audits simultaneously or at different times for all MSs (Figure 36). Specifically, 13 out of 26 organizations in total indicated simultaneous IAs and 11 indicated simultaneous EAs for all MSs, and 11 and 9 organizations kept them separated, respectively. Out of the remaining six organizations that reported simultaneous EAs only for specific MSs, one organization implied that it was done for the ISO 14001 and the ISO 9001 standards and another company for the ISO 14001 and the OHSAS 18001 standards. Out of the two organizations that reported simultaneous IAs for some MSs, one company said that it was for ISO 14001 and ISO 9001. These results are

in line with the results obtained by Karapetrovic et al. (2006), Casadesus et al. (2007) and Bernardo et al. (2010), who also reported that the majority of companies either conduct their audits in simultaneous manner for all MSs or keep them all separated. However, these authors obtained a higher percentage of companies with simultaneous IEAs (over 65%) (Casadesus et al., 2006; Karapetrovic et al., 2007; Bernardo et al., 2010). In this study, that value was 50% for IAs and 42.3% for EAs, respectively.

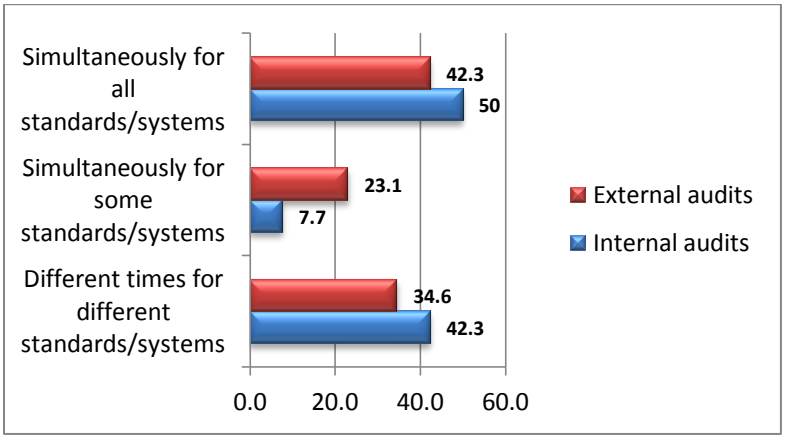


Figure 36. Audit simultaneousness

6.4.2 Audit plans and reports

Regarding the integration of audit plans and reports (Figure 37), the results do not follow the same pattern. A large majority of companies (11 for IAs and 15 for EAs) reported separate audit plans and audit reports for all MSs. These results differ from what was previously found by other authors, e.g. Wilkinson and Dale (2000), Karapetrovic et al. (2006), Casadesus et al. (2007), Bernardo et al. (2010)

and Simon et al. (2011). They all reported a single audit plan and a single audit report for the majority of their investigated companies (over 55%).

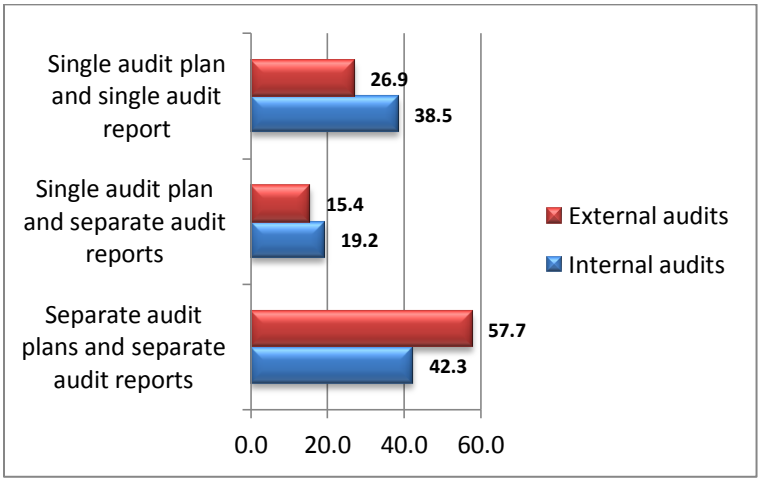


Figure 37. Audit plans and reports

6.4.3 Audit view

The results also show very low values when it comes to the audit view aspect (Figure 38). The majority of organizations reported that their MSs were internally and externally audited as independent systems (42.3% for IAs and 53.8% for EAs). Seven organizations indicated that their MSs were internally audited as an integrated system. On the other hand, only four organizations reported that their MSs were externally audited as an integrated system. These results are quite different from the results obtained by the majority of other authors (Casadesus et al., 2006; Karapetrovic et al., 2007; Bernardo et al., 2010; Simon et

al., 2011), who found a fairly high number of organizations that reported internal and external auditing of their MSs as an integrated system (over 50%).

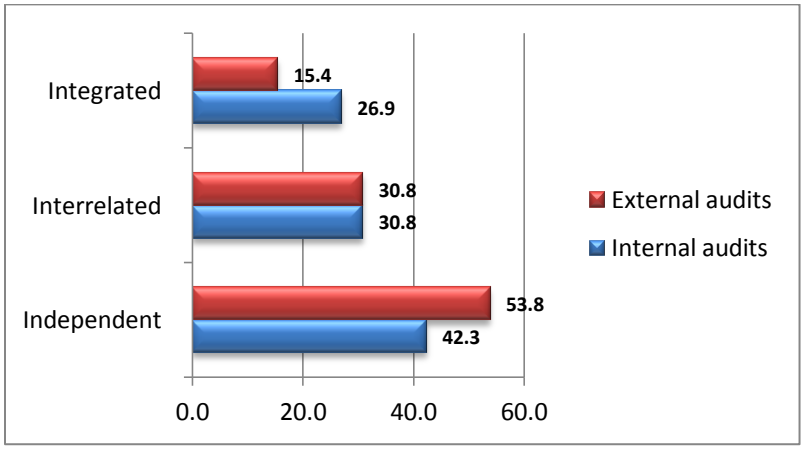


Figure 38. Audit view

6.4.4 Results summary

The results indicate a very low value of IEAs integration in Canadian organizations. It should be mentioned that organizations that were included in this part of study were the organizations that reported multiple MSs. However, not all organizations reported full or partial integration of their MSs. Therefore, a reason for low values of the integration of IEAs could be that some organizations had not integrated their MSs.

6.5 Relationship between the integration of standardized MSs and IEAs

To address the relationship between the integration of IEAs and MSs, three different levels of integration were identified first. The organizations with multiple MSs were classified into two distinct groups (see 5.4.5): 'class 1' or organizations with low integration and 'class 2' or organizations with high integration. In addition, organizations that have kept their MSs separated were placed in 'class 0' or organizations with no integration. These three groups of organizations are analyzed with respect to the level of their IEAs integration.

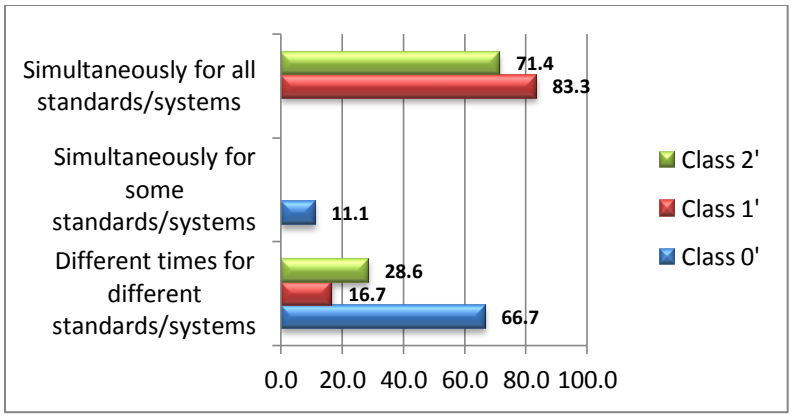
It should also be mentioned that there is only one study in literature, namely Bernardo et al. (2011), which did this type of investigation. However, the context in that study was different, since it was conducted in Spain and on organizations registered to two standards, ISO 14001 and ISO 9001. In this thesis, all organizations in the sample were registered to ISO 14001 as minimum. However, out of the thirteen organizations in total, eight reported having ISO 9001 in addition to ISO 14001 (see 5.4.5).

6.5.1 Internal audit aspects by level of standardized MSs integration

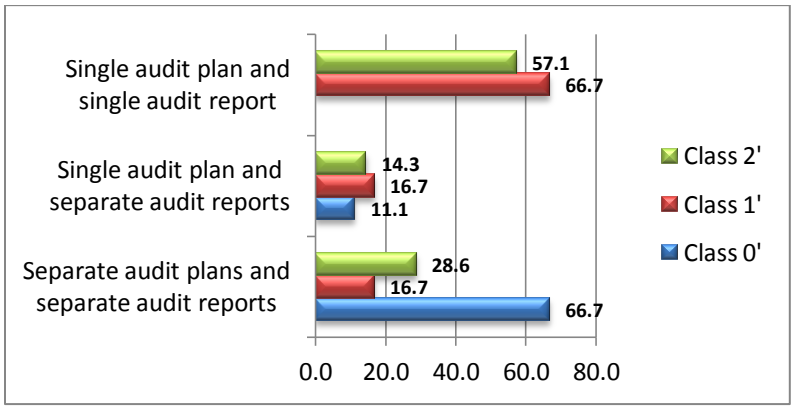
Figure 39 presents the level of three IA aspects (simultaneousness, plans and reports and view) for the three previously defined groups of organizations. Figure 39 contains three graphs, one for each IA aspect. The graphs below show that organizations in 'class 1' display the highest level of integration of all three

audit aspects. In detail, five out of six organizations in total conducted their IAs simultaneously for all implemented MSs, four have a single audit plan and a single audit report, and three organizations reported that their MSs were internally audited as an integrated system. On the other side, organizations in 'class 2' display a lower level of IAs integration (see Figure 39). These results were not expected due to the fact that organizations in 'class 1' were characterized by a low level of integration of their MSs and organizations in 'class 2' with a high level of integration. Organizations grouped in 'class 0' show the lowest integration of all three audit aspects (see Figure 39). This result is to be expected, since these organizations were characterized as organizations with no integration.

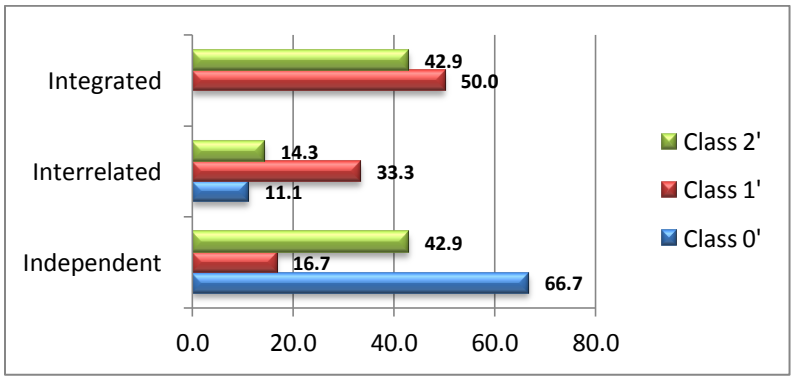
These results differ from the results reported by Bernardo et al. (2011) in Spain. They found that organizations without the integration of MSs had integrated some aspects of their IAs (Bernardo et al., 2011). They also concluded that *"organizations with a higher degree of integration of their management MSs seem to also have more integrated internal audits components"* (Bernardo et al., 2011), which is not the case in this study. Here, organizations that reported no integration also showed no integration of their IAs and organizations that showed a high level of integration of their MSs do not necessary have a high level of IA integration and vice versa.



a) Audit simultaneousness



b) Audit plans and reports



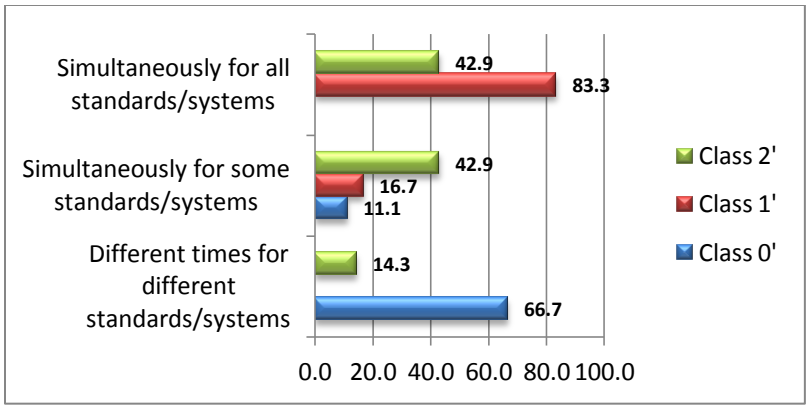
c) Audit process

Figure 39. Internal audit aspects by level of standardized MSs integration

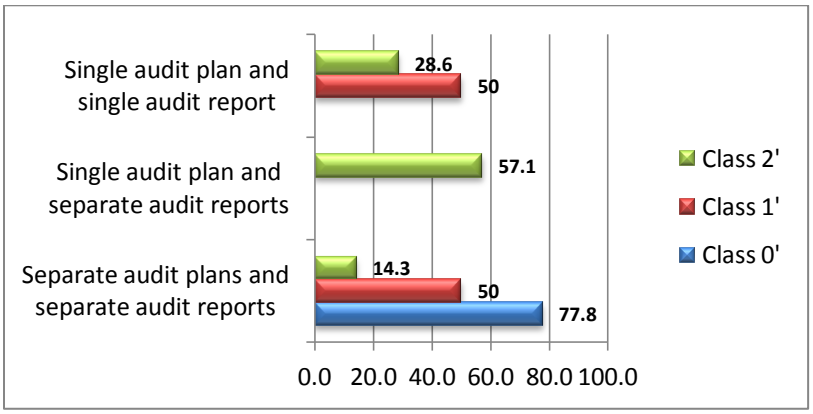
6.5.2 External audits aspects by level of standardized MSs integration

Figure 40 illustrates the level of integration of EA aspects by level of MSs integration. The results show a slightly lower level of integration of all three audit aspects than the level of IAs integration. However, organizations in 'class 1' still display the highest level of integration of EAs and organizations in 'class 0' display the lowest level. Organizations in 'class 1' reported exactly the same responses as in the case of IAs. On the other side, organizations in 'class 2' show a lower level of integration than the organizations in 'class 1'. In detail, three out of seven organizations reported simultaneous EAs for all systems, two reported a single audit plan and a single audit report and no organizations indicated that their MSs were audited as an integrated system. MSs were usually audited as interrelated or independent systems. Regarding the organizations in 'class 0', there is only one organization that reported simultaneous EAs for specific MSs.

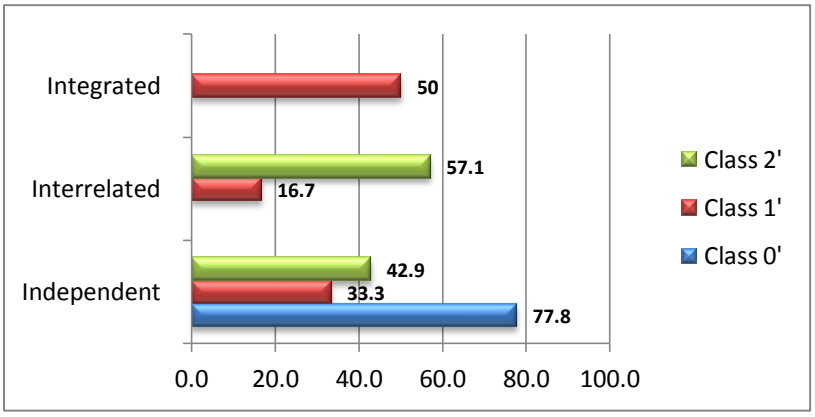
These results are not in agreement with the results found by Bernardo et al. (2011), who reported that a higher level of MSs leads to a higher level of integration of EAs as well.



a) Audit simultaneousness



b) Audit plans and reports



c) Audit process

Figure 40. External audit aspects by level of standardized MSs integration

6.5.3 Results summary

There are two interesting points that could be made from the results obtained. First, organizations that reported no integration of their MSs also report no integration of their IEAs and that point makes perfect sense. However, what was surprising is that organizations that reported a high level of integration of the MSs reported a low level of integration of their IEAs. On the other hand, organizations that indicated a low level of integration of their MSs, reported a high level of integration of their IEAs. The results were unexpected, since one would think that the more integrated the MSs are, the more IEAs would be integrated as well (Bernardo et al., 2011).

7. Conclusions

This study presents the findings of the empirical survey conducted in 2011 in Canada on ISO 14001-registered organizations. Three registrars were used to identify the target organizations. Seventeen research questions were identified and discussed. The survey data were analyzed using DA, EFA, RA, CA and SEM. The following paragraphs present conclusions, contributions and future considerations with respect to the three topics discussed in the thesis: ISO 14001 implementation, integration of standardized MSs, and auditing.

7.1 ISO 14001 implementation

The first conclusion that could be made is that ISO 14001 motives and benefits have not been investigated Canada in the last five years or so. Furthermore, there were no studies that applied SEM for analyzing the relationship between the motives and benefits in Canada.

The results showed that the most important motives for the ISO 14001 implementation reported by Canadian organizations are: 'improvement in environmental performance', 'improvement of image and social impact' and 'provision of competitive advantage'. 'Improvement in environmental performance' as a major motivation factor for the ISO 14001 implementation differs from what was reported in most of the research found in the existing literature (Georgiadou and Tsiotras, 1998; Poksinska et al., 2003; Pan, 2003;

Salomone, 2008, Psomas et al., 2011). However, the results are in line with the results found by Arena et al. (2012). It can be concluded that, in the last five years or so, having better environmental performance has become a primary concern (see 4.1.1.1). The results also showed differences in responses regarding the organizations size and industry sectors, which was not previously reported in the literature.

Three most important benefits perceived from the ISO 14001 implementation were: 'increased environmental awareness', 'improved environmental performance' and 'prevention of pollution'. The findings are in line with Turk (2009) and Arena (2012), who also reported improvement of environmental awareness and performance as two of the most important ISO 14001 benefits. The results also showed the differences in responses regarding the organizations size, which was previously reported by only two studies, namely Radonjic et al. (2006) and Massoud et al. (2010). With respect to the industry sector, the benefits are in line with the motivation (4.1.1.2).

Another topic investigated in Chapter 4 was the relationship between the motives and the benefits of the ISO 14001 implementation. Four different motive factors (customer pressure, EMS improvement, integration and competitive advantage) and three different benefit factors (improving relationships with stakeholders, EMS improvement and improving employees' motivations) were extracted using EFA. The relationships were tested using SEM,

a technique that has not been previously used for the same type of study. The results showed the following relationships (see 4.1.3):

- motives related to customer pressure had a positive impact on the benefits related to improving relationships with stakeholders.
- motives related to EMS improvement had a positive impact on the benefits related to EMS improvement and benefits related to improving employees' motivation.
- motives related to integration had a positive significant impact on the benefits related to improving employees motivation.
- motives related to competitive advantage had a negative impact on the benefits related to improving relationships with stakeholders.

The main limitation of this part of the study was the fact the motives and benefits offered in the questionnaire were not the same. Therefore, it was difficult to examine the relationship between them. The motives and benefits were also different from the motives and benefits reported by other authors. This also presented a challenge while comparing the results with other studies. Another limitation was the sample size. Only 32 organizations were used in SEM, while the recommended size is over 100 (Spasojevic-Brkic, 2009). The fact that the research examines only one country could be another limitation as well, since the results cannot be generalized to other countries.

Future research should develop sets containing the same ISO 14001 motivations and benefits, and gather at least 100 organizations to test the model proposed in this research. In that case, analyzing the relationship between motivation and benefits should be easier.

7.2 Integration of standardized MSs

The first conclusion made is that a high percentage of Canadian organizations with an ISO 14001 registered EMS also have an ISO 9001 registered QMS in place. In addition, ISO 9001 was found to be the most common starting point for implementing MSSs. This was despite the fact that the participants were selected specifically due to their implementation of ISO 14001. ISO 14001 and OHSAS 18001 were found to be the second and third most common starting points, respectively. These findings align with what was previously reported in the studies of Spanish companies (Karapetrovic and Casadesus, 2009; Bernardo et al., 2010). The study also highlighted that the time required to implement the first MSS by far exceeded the time required to implement the second, third, and fourth. These findings are also aligned with the literature (Karapetrovic and Casadesus, 2009), and indicate that organizations may benefit from the organizational learning and the establishment of infrastructure that accompany the implementation of its first MSS (Karapetrovic and Casadesus, 2009). Of the participating organizations that implemented more than one MSS, the majority were found to be pursuing some form of an IMS.

The research also examined the difficulties that ISO 14001-registered Canadian organizations face during the integration process and the reasons for keeping the standardized MSs separated. Differences in responses regarding the organizations' size and industry sectors were discussed as well. This presents a contribution to the literature, since these were not previously investigated. The companies that have integrated their standardized MSs usually face difficulties related to the differences in the models used in the standards, differences in the common elements of the standards and the lack of human resources. On the other hand, companies that have not integrated their MSs usually cite the 'the lack of interest' to be the most important reason for that decision. These findings constitute a contribution by highlighting the difficulties that were reported the most by Canadian organizations. Moreover, being aware of the reasons that companies assign to be 'important' for not proceeding with the integration, other organizations could address the issues early in the integration process. The 'lack of interest' as an example, could be mitigated by attending seminars on the purpose and benefits of the integration, as well as having adequate training and up to date information.

Another topic discussed in this chapter was related to the level of integration of MSs. The main motive for this part of the research was the fact that information about the integration levels in Canadian organizations has not been found in the current literature. Differences in responses regarding the organizations' size and industry sectors were presented as well. These differences have not been

previously found in the literature. Moreover, this research also examined the integration of targets, which were not included in the previous studies of Karapetrovic et al. (2006) and Bernardo et al. (2009).

There are some limitations of the research presented in Chapter 5. First, it is important to recognize that the results may not apply to other countries. Second, the sample size was relatively small and it is possible that a larger sample would lead to some changes in the results. One of the limitations can also be the fact that the target organizations were ISO 14001- registered only. Therefore, it was difficult to directly compare the results with previous studies. However, this is one of the contributions made by the current research, specifically the examination of the extent of integration in ISO 14001-registered Canadian organizations. In addition, the research presents a valuable contribution to the MSs integration field as a whole since the integration difficulties, the reasons for keeping MSs separated and the integration levels have not been investigated in Canada before.

Future research may focus on investigating the different levels of integration of the standardized MSs achieved in Canadian organizations with respect to the time when integration has taken place in organizations. How integration time and costs influence integration levels could also be explored. Moreover, it could be examined what aspects organizations integrate first: documentation,

processes or human resources. Were they all integrated one after another? If yes, what was the order? Were some aspects integrated at the same time and which ones? This information could contribute to the analysis of integration levels and make it clear why some of the aspects were integrated less and some more.

7.3 Auditing

The first conclusion made is that Canadian organizations reported a higher frequency of their IAs than their EAs. Second, the majority of organizations reported that their IAs were structured around the ISO 14001 standards. This result differs from Karapetrovic et al. (2006) who reported IAs executed around the internal processes by the majority of organizations. It could be that Canadian organizations still have not changed their way of conducting the IAs, even though the process approach was introduced for the first time in 2000 (Hooper, 2001).

Almost all organizations reported that IEAs detect nonconformities and identify improvement regarding the implementation of ISO 14001. However, a smaller number reported that audits identify opportunities regarding the integration of the EMS with other MSs (see 6.3).

With respect to the level of IEAs integration, the results indicated a very low level of integration of all three IEA aspects: simultaneousness, plans and reports, and view. However, the level of IAs integration is higher than the level of integration of EAs.

With respect to the relationship between the integration of standardized MSs and IEAs, two conclusions may be drawn from the results: organizations that reported no integration for their MSs also reported no integration for their IEAs and organizations that reported a high level of integration of their MSs reported a low level of integration of their IEAs and vice versa (see 6.5.1 and 6.5.2).

This research presents a valuable contribution to the field of IEAs, since empirical studies on IEAs have been and still are very limited. It also presents the results regarding the topics that have not been investigated before in Canada, such as the frequency of IEAs, the structure of IAs, the main purpose of IEAs and the integration of IEAs. Finally, it explored the relationship between the integration of MSs and IEAs, which was only examined in Bernardo et al. (2011).

Future research could develop the same investigation but covering a larger sample size, since the sample size in this part of the research was a major limitation. Longitudinal examination of the integration of IEAs could be done as well, to see if responses would change in time.

Bibliography

Arena, M., Azzone, G. and Platti, M. (2012), "Motivations and Benefits in the Italian Metal Industry", *International Journal of Engineering Business Management,* Vol. 4 No. 41, pp. 1-8.

Asif, M., Bruijn, E.J., Fisscher O.A.M., Searcy and Steenhuis H.J. (2009), "Process embedded design of integrated management systems", *International Journal of Quality and Reliability Management,* Vol. 26 No. 3, pp.261-282.

Asif, M., Fisscher O.A.M., Bruijn, E.J. and Pagell, M. (2010), "An examination of strategies employed for the integration of management systems", *The TQM Journal,* Vol. 22 No. 6, pp. 648-669.

Azzone, G., Bianchi, R. and Noci, G. (1997), "Implementing Environmental Certification in Italy: Managerial and Competitive Implications for Firms", *Eco-Management and Auditing,* Vol. 4, pp. 98-108.

Beckmerhagen, I., Berg, H., Karapetrovic, S. and Willborn, W. (2003), "Integration of management systems: focus on safety in the nuclear industry", *International Journal of Quality & Reliability Management,* Vol. 20 No. 2, pp. 210-228.

Bernardo, M., Casadesus, M., Karapetrovic, S. And Heras, I. (2009), "How integrated are environmental, quality and other standardized management systems? An empirical study", *Journal of Cleaner Production,* Vol. 17, pp. 742-750.

Bernardo, M., Casadesus, M., Karapetrovic, S. and Heras, I. (2010), "An empirical study on the integration of management system audits", *Journal of Cleaner Production,* Vol. 18, pp. 486-495.

Bernardo, M., Casadesus, M., Karapetrovic, S. and Heras I. (2011), "Relationships between the integration audits and management systems. An empirical study", *The TQM Journal,* Vol. 23 No. 6, pp. 659-672.

Bernardo, M., Casadesus, M., Karapetrovic, S. and Heras I. (2012a), "Integration of standardized management systems: does the implementation order matter?", *International Journal of Operations & Production Management",* Vol. 32 No 3, pp. 291-307.

Bernardo, M., Casadesus, M., Karapetrovic, S. And Heras, I. (2012b), "Do difficulties influence management system integration levels?", *Journal of Cleaner Production,* Vol. 21, pp. 23-33.

Boiral, O. and Sala, J.M. (1998), "Environmental Management: Should Industry Adopt ISO 14001", *Business Horizons,* January-February, pp. 57-64.

Casadesus, M. and Karapetrovic, S. (2005), "An Empirical Study of the Benefits and Costs of ISO 9001: 2000 Compared to ISO 9001/2/3: 1994", *Total Quality Management*, Vol. 16 No. 1, pp. 105-120.

Casadesus, M., Heras, I. and Karapetrovic, S. (2007), *The 9000 with the 9000: an analysis of the impact of the ISO 9000 standard in Catalonia*, Product, Process and Production Engineering Group – University of Girona, Spain.

Casadesus, M., Karapetrovic, S. and Heras, I. (2011), “Synergies in standardized management systems: some empirical evidence”, *The TQM Journal,* Vol. 23 No. 1, pp. 73-86.

Chan, E.S.W. and Wong, S.C.K. (2006), “Motivations for ISO 14001 in the hotel industry”, *Tourism Management,* Vol. 27, pp. 481-492.

Chavan, M. (2005), “An appraisal of environmental management systems. A competitive advantage for small businesses”, *Management of Environmental Quality: An International Journal,* Vol. 16 No. 5, pp. 444-463.

Christensen, P. and Rasmussen, B.D. (1998), “Implementation of Environmental Management in the Danish Printing House Industry”, *Eco-Management and Auditing,* Vol. 5, pp. 88-94.

Cronbach L.J. (1951),”Coefficient alpha and the internal structure of tests”, *Psychometrika,* Vol. 16 No. 3, pp. 297-334.

Dolnicar S. (2002), “A Review of Unquestioned Standards in Using Cluster Analysis for Data-Driven Market Segmentation”, CD Conference Proceedings of the Australian and New Zealand Marketing Academy Conference (ANZMAC 2002), Deakin University, Melbourne.

Douglas, A. and Glen, D. (2000), “Integrated management systems in small and medium enterprises”, *Total Quality Management,* Vol. 11 No 4/5&6, pp. 686-690.

Durdevic, T., Searcy, C. and Karapetrovic, S. (2013a), "The Role of ISO 14001 in Sustainable Enterprise Excellence", proceedings of the 5th European Conference on Intellectual Capital, Bilbao, Spain, Vol. 1, pp. 99-107.

Durdevic, T., Karapetrovic, S. and Searcy, C. (2013b), "An investigation of the integration of standardized management systems in Canada", proceedings of the 17th ICIT conference, Sydney, Australia, paper# 3-4K.

Fisher, M.R. (2003), "Applying ISO 14001 as a business tool for campus sustainability. A case study from New Zealand", *International Journal of Sustainability in Higher Education,* Vol. 4 No. 2, pp. 138-150.

Fortunski, B. (2008), "Does the environmental management standard ISO 14001 stimulate sustainable development. An example from the energy sector in Poland", *Management of Environmental Quality: An international Journal,* Vol. 19 No. 2, pp. 204-212.

Fresner, J. (2004), "Introduction. Small and medium size enterprise and experience with environmental management", *Journal of Cleaner Production,* Vol. 12, pp. 545-547.

Fresner, J. and Engelhardt, G. (2004), "Experience with integrated management systems for two small companies in Austria", *Journal of Cleaner Production,* Vol. 12, pp. 623-631.

Georgiadou, M. and Tsiotras, G. (1998), "Environmental management systems: a new challenge for Greek industry", *International Journal of Quality & Reliability Management,* Vol. 15 No. 3, pp. 286-302.

Goh, E.A., Zailan,i S. and Wahid, N.A. (2006), "A study of the impact of environmental management system (EMS) certification towards firm's performance in Malaysia", *Management of Environmental Quality: An International Journal,* Vol. 17 No. 1, pp. 73-93.

Gonzalez-Benito, J. and Gonzalez-Benito, J. O. (2005), "An analysis of the relationship between environmental motivations and ISO 14001 certification", *British Journal of Management,* Vol. 16, pp. 133-148.

Griffith, A. and Bhutto, K. (2008), "Improving environmental performance through integrated management system (IMS) in the UK", *Management of Environmental Quality: An international Journal,* Vol. 19 No.5, pp. 565-578.

Griffith, A. and Bhutto, K. (2009), "Better environmental performance. A framework for integrated management systems (IMS)", *Management of Environmental Quality: An international Journal,* Vol. 20 No. 5, pp. 566-580.

Hair, J.F., Anderson, R.E. and Tatham, R.L. (1987), *Multivariate Data Analysis with Readings,* 2nd ed., Macmillan Publishing Company, a division of Macmillan Inc., USA.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black W.C. (1998), *Multivariate Data Analysis,* 5th ed., Prentice-Hall International, Inc., USA.

Hayduk, L.A. (1987), *Structural Equation Modeling with LISREL. Essentials and Advances,* The Johns Hopkins University Press, Baltimore.

Hayduk, L.A. (1996), *LISREL Issues, Debates, and Strategies,* The Johns Hopkins University Press, Baltimore.

Hayduk, L.A. and Littvay, L. (2012), “Should researches use single indicators, best indicators, or multiple indicators in structural equation models?”, *BMC Medical Research Methodology,* 12:159, available at http://www.biomedcentral.com/1471-2288/12/159 (date of visit: 02/25/2013).

Hillary, R. (2004), “Environmental management system and the smaller enterprise”, *Journal of Cleaner Production,* Vol. 12, pp. 561-569.

Holt, D. (1998), “The perceived benefits of an environmental management standard”, *Business Process Management Journal,* Vol. 4 No. 3, pp. 204-213.

Hooper, D., Coughlan, J. and Mullen, M.R. (2008), “Structural Equation Modeling: Guidelines for Determining Model Fit”, *Electronic Journal of Business Research Methods,* Vol. 6 No.1, pp. 53-60.

Hooper, J. (2001), “The Process Approach to QMS in ISO 9001 and ISO 9004”, *Quality Progress*, http://asq.org/quality-progress/2001/12/standards-outlook/the-process-approach-to-qms-in-iso-9001-and.html (date of visit: 09/03/2013).

ISO (2004), ISO 14001, *International Standard: Environmental Management Systems – Requirements with Guidance for Use*, International Organization for Standardization, Geneva, Switzerland.

ISO (2005), *ISO 9000, International Standard: Quality Management Systems – Fundamentals and Vocabulary*, International Organization for Standardization, Geneva, Switzerland.

ISO (2008), *The Integrated Use of Management System Standards,* International Organization for Standardization, Geneva, Switzerland.

ISO (2008a*), ISO 9001, International Standard: Quality Management Systems – Requirements,* International Organization for Standardization, Geneva, Switzerland.

ISO (2011), *ISO 19011, International Standard: Guidelines for Auditing Management Systems*, International Organization for Standardization, Geneva, Switzerland.

ISO (2011a), ISO Survey, http://www.iso.org/iso/home/standards/certification/iso-survey.htm (date of visit: 09/11/2013)

Jabbour, C.J.C., Santos, A.C.F. and Nagano, S.M. (2008), "Environmental management system and human resource practices: is there link between them in four Brazilian companies?", *Journal of Cleaner Production,* Vol. 16, pp. 1922-1925.

Jiang, R. J. and Bansal, P. (2003), "Seeing the Need for ISO 14001", *Journal of Management Studies,* Vol. 40 No. 04, pp. 1047-1067.

Jones, R.R., Pryde, M. and Cresser, M. (2005), "An evaluation of current environmental management systems as indicators of environmental performance", *Management of Environmental Quality: An International Journal,* Vol. 16 No. 3, pp. 211-219.

Joreskog, K. and Sorbom, D. (1996), *Lisrel 8: User's Reference Guide,* Uppsala University, Scientific Software International Inc., USA.

Jorgensen, T.H, Remmen, A. and Mellado, D.M. (2006), "Integrated management system – three different levels of integration", *Journal of Cleaner Production,* Vol. 14 No. 8, pp. 713-722.

Jorgensen, T. (2008), "Towards more sustainable management systems: through life cycle management and integration", *Journal of Cleaner Production,* Vol. 16 No. 10, pp. 713-722.

Kaiser, H.F. (1960), "The application of electronic computers to factor analysis", *Educational and Psychological Measurement,* Vol. 20 No. 1, pp. 141-151.

Karapetrovic, S. (2002a), "On the concept of a universal audit of quality and environmental management systems", *Corporate Social Responsibility and Environmental Management,* Vol. 9 No. 3, pp.147-156.

Karapetrovic, S. (2002b), "Strategies for the integration of management systems and standards", *The TQM Magazine,* Vol. 14 No. 1, pp. 61-67.

Karapetrovic, S. (2003), "Musings on integrated management systems", *Measuring Business Excellence,* Vol. 7 No. 1, pp. 4-13.

Karapetrovic S, Casadesus, M. (2009), "Implementing environmental with other standardizes management systems: Scope, sequence, time and integration", *Journal of Cleaner Production,* Vol.17 No. 5, pp 533-40.

Karapetrovic, S., Casadesus, M. and Heras, I. (2006), *Dynamics and integration of standardized management systems. An empirical study,* Documenta Universitaria, Girona, Spain.

Karapetrovic, S., Casadesus, M. and Heras I. (2010), "What happened to the ISO 9000 lustre? An eight-year study", *Total Quality Management*, Vol. 21 No. 3, pp. 245-267.

Karapetrovic, S. and Jonker, J. (2003), "Integration of standardized management systems: searching for a recipe and ingredients", *Total Quality Management and Business Excellence*, Vol. 14 No. 4, pp. 451-459.

Karapetrovic, S. and Willborn, W. (1998a), "Integration of quality and environmental management systems", *The TQM Magazine,* Vol. 10 No. 3 pp. 204-213.

Karapetrovic, S. and Willborn, W. (1998b), "Integrated audit of management systems", *International Journal of Quality & Reliability Management,* Vol. 15 No.7, pp.694-711.

Karapetrovic, S. and Willborn, W. (1998c), "The system's view for clarification of quality vocabulary", *International Journal of Quality & Reliability Management,* Vol. 15 No. 1, pp. 99-120.

Karapetrovic, S. and Willborn, W. (2000), "Generic audit of management systems: fundamentals", *Managerial Auditing Journal,* Vol. 15 No. 6, pp. 279-294.

Karapetrovic, S. and Willborn, W. (2001), “Audit system: Concept and practices”, *Total Quality Management,* Vol. 12 No. 1, pp. 13-28.

Khanna, H.K., Laroiya, S.C. and Sharma, D.D. (2010), “Integrated management systems in Indian manufacturing organizations”, *The TQM Journal,* Vol. 22 No. 6, pp. 670-686.

Kraus, J. and Grosskopf, J. (2008), “Auditing integrated management systems: considerations and practice tips”, *Environmental Quality Management,* Vol. 18 No. 2, pp. 7-16.

Labodova, A. (2004), “Implementing integrated management systems using a risk analysis based approach”, *Journal of Cleaner Production,* Vol. 12, pp. 571-580.

Lawrence, L., Andrews, D., Ralph, B. and France, C. (2002), “Identifying and assessing environmental impacts: investing ISO 14001 approaches”, *The TQM Magazine,* Vol. 14, No. 1, pp. 43-50.

Liyin, S., Hong, Y. and Griffith, A. (2006), “Improving environmental performance by means of empowerment of contractors”, *Management of Environmental Quality: An International Journal,* Vol. 17 No. 3, pp. 242-257.

Lopez-Fresno, P. (2010), “Implementation of an integrated management system in an airline: a case study”, *The TQM Journal,* Vol. 22 No.6, pp. 629-647.

Maps of World (2013), “Top Ten Countries with Highest Quality of Life”, http://www.mapsofworld.com/world-top-ten/world-top-ten-quality-of-life-map.html (date of visit: 09/10/2013).

Marimon, F., Casadesus, M. and Heras, I. (2006), "ISO 9000 an ISO 14000 standards: an international diffusion model", *International Journal of Operations & Production Management,* Vol. 26 No. 2, pp. 141-165.

Marimon, F., Heras, I., and Casadesus, M. (2009), "ISO 9000 and ISO 14000 standards: A projection model for the decline phase", *Total Quality management,* Vol. 20 No. 1, pp. 1-21.

Massoud, M.A., Fayad, R., Fadel, M.E. and Kamleh, R. (2010), "Drivers, barriers and incentives to implement environmental management system in the food industry: A case of Lebanon", *Journal of Cleaner Production,* Vol. 18, pp. 200-209.

Matias, J. and Coelho, D. (2002), "The integration of the standards systems of quality management, environmental management and occupational health and safety management", *International Journal of Production Research,* Vol. 40 No. 15, pp. 3857-3866.

McDonald, M., Moris, T. and Philips, A. (2003), "Management system integration: can it be done?", *Quality Progress*, Vol. 36, No. 1, pp. 67-74.

Mohammed, M. (2000), "The ISO 14001 EMS Implementation Process and Its Implication: A Case Study of Central Japan", *Environmental Management,* Vol. 25 No. 2, pp. 177-188.

Nga, J.K.H. (2009), "The influence of ISO 14001 on firm performance", *Social Responsibility Journal,* Vol. 5 No. 3, pp. 408-422.

Nunnallyn, J. C. (1978). *Psychometric theory,* New York: McGraw-Hill.

Pan, J.N. (2003), “A comparative study on motivation for and experience with ISO 9000 and ISO 14000 certification among Far Eastern countries”, *Industrial Management & Data Systems,* 103/8, pp. 564-578.

Petroni, A. (2000), “The analysis of customer-satisfaction – related elements of ISO 14001 implementation: evidence from the food machinery industry”, *Eco-Management and Auditing,* Vol. 7, pp. 1-10.

Pojasek, R. (2006), “Is your integrated management system really integrated?”, *Environmental Quality Management,* Vol. 16 No 2, pp. 89-97.

Poksinska, B., Dahlgaard, J.J. and Eklund, J.A.E. (2003), “Implementing ISO 14001 in Sweden: motives, benefits and comparisons with ISO 9000”, *International Journal of Quality & Realibility Management,* Vol.20 No.5, pp. 585-606.

Proto, M. and Supino, S. (2000), “Ecomanagement quality systems: ISO 14000. The state of the art in Italy”, *Total Quality Management,* Vol. 11 No 4/5&6, pp. 767-772.

Psomas, E.L., Fotopoulos, C.V. and Kafetzopoulos, D.P. (2011), “Motives, difficulties and benefits in implementing the ISO 14001 Environmental Management System”, *Management of Environmental Quality: An international Journal,* Vol. 22, No.4, pp. 505-521.

Radonjic, G. and Tominc, P. (2006), “The impact and significance of ISO 14001 certification on the adoption of new technologies. The case of Slovenia”, *Management of Environmental Quality: An International Journal,* Vol. 17, No. 6, pp. 707-727.

Renzi, M.F. and Cappelli, L. (2000), “Integration between ISO 9000 and ISO 14000: opportunities and limits”, *Total Quality Management,* Vol. 11 No 4/5&6, pp. 849-856.

Rezaee, Z. and Elam, R. (2000), “Emerging ISO 14000 environmental standards: a step-by-step implementation guide”, *Managerial Auditing Journal,* Vol. 15 No 1/2, pp. 60-67.

Rodriguez, S.L. (2009), “Environmental engagement, organizational capability and firm performance”, *Corporate Governance,* Vol. 9 No. 4, pp, 400-408.

Salomone, R. (2008), “Integrated management systems: experience in Italian organizations”, *Journal of Cleaner Production,* Vol. 16, pp. 1786-1806.

Searcy, C., Morali, O., Karapetrovic, S., Wichuk, K., McCartney, D., McLeod, S. and Fraser, D. (2012), “Challenges in implementing a functional ISO 14001 environmental management system”, Vol. 29 No. 7, pp. 779-796.

Sebhatu, P.S. and Enquist, B. (2007), “ISO 14001 as a driving force for sustainable development and value creation”, *The TQM Magazine*, Vol. 19 No. 5, pp. 468-482.

Silva, G.C.S. and Medeiros, D.D. (2004), “Environmental management in Brazilian companies”, *Management of Environmental Quality: An International Journal,* Vol. 15 No. 4, pp. 380-388.

Simon, A., Bernardo, M., Karapetrovic, S. and Casadesus, M. (2011), “Integration of standardized environmental and quality management systems audits”, *Journal of Cleaner Production,* Vol. 19, pp. 2057-2065.

Simon, A., Karapetrovic, S. and Casadesus, M. (2012a), “Evolution of Integrated Management Systems in Spanish firms”, *Journal of Cleaner Production,* Vol. 23, pp. 8-19.

Simon, A., Karapetrovic, S. and Casadesus, M. (2012b), “Difficulties and benefits of integrated management systems”, *Industrial Management & Data Systems,* Vol. 112 No. 5, pp. 828-846.

Spasojevic-Brkic, V.K. (2009), *Kontigentna teorija I menadzment kvalitetom,* Masinski fakultet Univerziteta u Beogradu, Beograd.

Strachan, P.A., Sinclair, I.M. and Lal, D. (2003), “Managing ISO 14001 implementation in the United Kingdom Continental Shelf (UKCS)”, *Corporate Social Responsibility and Environmental Management,* Vol. 10, pp. 50-63.

Turk, M.A. (2009), “ISO 14001 environmental management system in construction: An examination of its application in Turkey”, *Total Quality Management,* Vol. 20 No. 7, pp. 713-733.

To, W.M., Lee, P.K.C, and Yu, B.T.W. (2012), “Benefits of implementing management system standards. A case study of certified companies in the Pearl River Delta, China”, *The TQM Journal,* Vol. 24 No. 1, pp. 17-28.

Watson, M. and Emery, R.T.A. (2004), “Law, economics and the environment. A comparative study o environmental management systems”, *Managerial Auditing Journal,* Vol. 19 No. 6, pp. 760-773.

Wilkinson, G. and Dale, B.G. (1999a), “Integrated management systems: an examination of the concept and theory”, *The TQM Magazine,* Vol. 11 No. 2, pp. 95-104.

Wilkinson, G. and Dale, B.G. (1999b), “Models of management systems standards: a review of the integration issues”, *International Journal of Management Review,* Vol.1 No. 3, pp. 279-298.

Wilkinson, G. and Dale, B.G. (1999c), “Integration of quality, environmental and health and safety management systems: an examination of the key issues”, *Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture,* Vol. 213 No. 3, pp. 275-283.

Wilkinson, G. and dale, B.G. (2000), “Management system standards: the key integration issues”, *Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture,* Vol. 214, No. ?, pp. 771-780.

Wilmshurst, D.T. and Frost, R.G. (1997), “Environmental Management: Evidence of an Australian corporate response”, *Eco-Management and Auditing,* Vol. 4, pp. 127-134.

Winter, J.C.F., Dodou, D. and Wieringa, P.A. (2009), “Exploratory Factor Analysis With Small Sample Size”, *Multivariate Behavioral Research,* Vol. 44, pp. 147-181.

Zeng, S.X., Jonathan, J.S. and Lou, G.X. (2007), “A synergetic model for implementing an integrated management system: an empirical study in China”, *Journal of Cleaner Production,* Vol. 15, pp. 1760-1767.

Zeng, S.X., Xie, X.M., Tam, C.M. and Shen, L.Y. (2011), "An empirical examination of benefits from implementing integrated management systems (IMS)", *Total Quality Management",* Vol. 22 No. 2, pp. 173-186.

Zutshi, A. and Sohal, A.S. (2004), "Adoption and maintenance of environmental management systems: critical success factors", *Management of Environmental Quality: An International Journal,* Vol. 15 No.4, pp. 399-419.

Zutshi, A. and Sohal, A.S. (2005a), "Integrated management system. The experience of three Australian organizations", *Journal of Manufacturing Technology Management,* Vol. 16 No. 2, pp. 211-232.

Zutshi, A. and Sohal, A.S. (2005b), "A framework for environmental management system adoption and maintenance: an Australian perspective", *Management of Environmental Quality: An International Journal,* Vol. 16 No. 5, pp. 464-475.

Appendix A. Additional information regarding the ISO 14001 EMS

An EMS can be defined as *a part of the overall MS that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policy"* (Sebhatu and Enquist, 2007; Fortunski, 2008).

According to Rezaee and Elam (2000) and Jabbour et al. (2008), an EMS is the most useful tool for achieving continuous environmental performance, and a way for management to deal with aspects that impact the environment. It is a tool that provides an organization with "*goodwill, credibility, reduced liability risk, increased productivity, competitive advantage, cost savings and ultimately, profitability"* (Proto and Supino, 2000).

ISO 14000 environmental series of standards present the work of a world recognized international standards organization, 'International Organization for Standardization' (Watson and Emery, 2004), and they are divided into seven categories (ISO, 1998; Rezaee and Elam, 2000): environmental management systems, environmental auditing, environmental performance evaluation, environmental labeling, life-cycle assessment, environmental aspects in product standards, and, terms and definitions.

According to Fisher (2003) and Fortunski (2008), the two most important standards and the basis for creating an EMS according to ISO 14000 standards are (Fisher, 2003; Fortunski, 2008): ISO 14001 – "*guidelines and requirements for application*", and ISO 14004 – *"general guidelines on principles, systems and supporting techniques"*.

ISO 14001 presents the world most recognized framework for managing organizations' environmental impacts (Rezaee and Elam, 2000; Ann et al., 2006). The standard is designed to introduce environmental improvement into every aspect of a company's operations and offers an organized approach to manage environmental issues (Ann et al., 2006). However, ISO 14001 does not provide an organization with a tool how to understand and measure its environmental impacts, neither the options for preventing them (Azzone et al., 1997). Also, it does not guarantee that it will improve their environmental performance (Azzone et al., 1997).

There are number of techniques and models offered in the literature that could help an organization in adopting and maintaining an effective EMS. For instance, Zutchi et al. (2005b) proposed a framework as a tool for EMS adoption and maintenance. This framework covers three phases: *"development, certification and maintenance, and continuous improvement*". In addition, Razaee and Elam (2000) provide 15 *"step-by-step"* guidelines in implementing ISO 14001 which an

organization should follow in order to successfully adopt and maintain its EMS. Jabbour et al. (2008) proposed the model that links the phases of the EMS to human resource practices in order to attain continuous improvement of a companies' environmental performance. Petroni (2000) proposed a framework for strategic implementation of an EMS oriented to customers' satisfaction. Lawrence et al. (2002) suggested two approaches in identifying and assessing environmental aspects which are important factor for successful implementation of the ISO 14001 EMS: *"mass balance/multi-criteria"* and *"assessment and environmental audit".* Zutshi and Sohal (2004) believed that if organizations addressed a certain number of *"critical success factors*", during the adoption and maintenance of their EMS, as well as the guidelines provided by ISO 14000 series, they would have a successful EMS implementation, where by "successful" mean *"smoother, faster, effective and sustainable"* in nature. In addition, Searcy et al. (2012) recommended improvements of ISO 14001in seven different areas, namely "*definitions, purpose of the EMS, environmental policy, public reporting, monitoring and measurement, management review and other minor changes related to compliance, establishing baseline performance, risk and linking ISO 14001 with sustainability"*. They believed that these improvements would make the standard easier for understanding, therefore easier for adopting, as well as maintaining the effectiveness of the system.

Appendix B. ISO 14001 motivation

The following paragraphs chronologically illustrate the major findings regarding the motivation for implementing the ISO 14001 EMS with respect to the country where the studies were conducted.

Wilmshurst and Frost (1997) interviewed 95 CEOs in Australia and found out that the most important drivers for the ISO 14001 implementation were "*legal obligation"* followed by "*the need to meet due diligence requirements",* "*community concerns with operations"* and "*shareholder and investor concerns".* These findings are in line with Liyin et al. (2006*)* who after reviewing the existing literature also concluded that the ISO 14001 implementation is mainly driven by "*external impetus such as legal enforcement incentive programs from government".*

Georgiadou and Tsiotras (1998) examined five Greek companies. They grouped implementation motives into three categories: "*market factors"*, "*economic and financial factors"*, and "*business factors"*. According to their findings, implementation of ISO 14001 is considered to be significant for the organizations success with the most important factors being "*improving image, reducing cost, improving quality and showing care for the environment*". The same year, Christensen and Rasmussen (1998) developed a research with 12 organizations

in Denmark. According to their findings, there are two important motives that drive organizations in adopting ISO 14001: "*positive environmental attitude"* (being able to market the company in the future as a "*green company*") and "*strategic consideration"* ("*strategy of complying with future requirements from different stakeholder groups, customer demands, requirements of authorities, rising green taxes")* while customer demand did not seem to be one of the important drivers for ISO 14001 implementation. Boiral and Sala (1998) conducted a study in *"about a dozen"* Canadian organizations and reported three major reasons why Canadian companies implement the ISO 14001 EMS: "*the intrinsic worth of the management system proposed by the standard"* (rigor, follow-up, effectiveness), "*better control of human behavior"*, and "*socioeconomic spinoffs generated by implementing new standard"* (active approach to customers' future requirements). The third reason seems to be similar to the "*strategic consideration"* from the study by Christensen and Rasmussen (1998).

Wilkinson and Dale (1999c) investigated five English organizations. They reported that the main reasons for introducing an EMS were "*satisfying customer requirements, reducing costs and increasing environmental legislation"*.

Mohammed (2000) conducted a case study on 14001 certified companies in Central Japan and found the following motives for adopting ISO 14001: "*improving the environmental aspects inside the firms", "enchasing the employees' environmental awareness and environmental capacity-building", "enhancing the firms' image among public",* and "*improving the management system of the environment inside the firms".*

Four studies were found in 2003. One out of four in total was conducted in Canada, namely, Jiang and Bansal (2003). They examined 16 pulp and paper companies in Canada and discovered that "*task visibility" ("the extent to which a particular firm task is easily observable or attracts the attention of the public"*), and "*environmental impact opacity" ("difficulty with which the environmental impact of a firm's task can be measured and understood by external stakeholders")* were instrumental in pushing firms towards the ISO 14001 certification. They also reported that "*market demand, institutional pressures and management control*" pushed firms towards the implementation of an EMS. Poksinska et al. (2003) carried out a study in Sweden and reported that the main motivation were "*enhance corporate image", "improve market share", "satisfy customers' environmental expectations"* and *"meet the requirements set by the communities and authorities".* Pan (2003) examined organizations in Japan, Taiwan, Korea and Hong Kong and reported "*external pressure", "improvement of corporate image" and "public relations and others"* as major reasons for the

implementation of ISO 14001. In addition, Strachan et al. (2003) reported that organizations usually implement the ISO 14001 EMS so they can ensure they have "*an appropriate and effective management system in place*".

Hillary (2004) reviewed the literature and identified "*top 5 stakeholders*" that drive companies towards implementation: "*customers, local government, local community regulators and employees".* On the other hand, Silva and Medeiros (2004) and Zutshi and Sohal (2004) conducted empirical studies. Silva and Medeiros (2004) investigated 37 Brazilian organizations and showed that the most important reason for EMS adoption is that *"it helps an organization pay attention to its regulatory responsibilities and provides a means for addressing non-regulated environmental aspects"*. Zutshi and Sohal (2004) investigated 286 organizations in Australia and New Zealand and reported two most important critical success factors: "*top management commitment"* and "*learning and training".*

Two years later Chan and Wong (2006) conducted a research on 164 hotels in China, from which 10.6% were certified against ISO 14001 and, 17.4% were considering certification in closer future. They found that the most important motives were *"corporate governance"* and *"legislation".* In 2008, Salomone (2008) investigated 103 Italian companies and discovered that the most significant motives were "*enhanced image"* and "*continual improvement".*

Turk (2009) analyzed 68 companies in Turkey and found that the most significant motives for adopting the ISO 14001 EMS were *"having an easy access into international markets, desire to develop their EMS and desire to change".* In addition, Rodriguez (2009) conducted a study in Spain on 195 manufacturing companies and reported two main groups for adoption of *"green commitments":* "*ecological concerns"* and "*market reasons"*.

Massoud et al. (2010) investigated 121 food industries in Lebanon and reported that food companies implement ISO 14001 because they want to *"follow the international food industry trend, improve their environmental performance, enchase company image and reduce operational costs"*.

Psomas et al. (2011) investigated 53 organizations in Greece and obtained that the most significant motive for implementing ISO 14001 was "*environmentally-friendly policy"*, while "*gaining a competitive advantage"* and "*social requirement"* were the motives of middle and lowest level, respectively.

Finally, Arena et al. (2012) carried out an examination on 120 ISO 14001 registered Italian metal organizations. The most important motives that they found out were "*improvement of environmental performance", "improvement of corporate image"* and "*improvement in the relationship with regulators"*.

Appendix C. ISO 14001 benefits

The next paragraphs chronologically present the findings of the above mentioned authors with respect to the country where the studies were conducted.

Christensen and Rasmussen (1998) reported the following benefits: *"attracting new customers, marketing advantage, increase in sales, more control of the organization, enhancing a general view and knowledge about production, creating more openness between management and employees, reduction of the number of subcontractors and commitment of top management*".

Mohammed (2000) conducted a case study in the Central of Japan on ISO 14001 certified organizations and identified the following ISO 14001 benefits: "*reduction of paper purchases, electrical consumption, chemical and toxic materials use, fuel consumption, water waste and environmental accidents*". The same year, Petroni (2000) also conducted a case study on large manufacturing companies that have recently implemented ISO 14001 and found that customer satisfaction is recognized to be a major benefit for implementing and developing an EMS according to ISO 14001. Moreover, the benefits were grouped into three categories: "*product-related", "image and reputation", and "the assurance of compliance with regulations"*.

Strachan et al. (2003) reported that "*external recognition and enhanced business reputation"* were primary benefits that companies perceived from adopting ISO 14001. Pan (2003) reported the following benefits: "*improved competitive edge, improved corporate image and public relations and others".* According to him, organizations can be classified into three groups: companies with best, better and the worst implementation benefits (Pan, 2003). In addition, Poksinska et al. (2003) reported "*improvement of corporate image, improvement internal procedures, improvement of relations with authorities and communities"* as the most important ISO 14001 benefits.

Hillary (2004) reviewed the existing literature and reported that the most cited benefits by organizations were *"internal (organizational, financial and, people benefits)"* and *"external (commercial, environmental and, communication benefits)"*.

Chavan et al. (2005) carried out a case study on one small business in Australia and reported that the company obtained ten per cent cost reduction after applying ISO 14001.

Radonjic et al. (2006) conducted a research in Slovenia and reported benefits as follows: "*reduction in energy consumption, assuring higher safety for workers, reduction in emission to water, reduction of air emission"*. They also reported that over 60% of responded firms consider the ISO 14001 certification as a very useful tool with respect to technology adoption and development of

"environmental conscious products" (Radonjic et al., 2006). In addition, Goh et al. (2006) in their study on 45 ISO 14001 certified organizations in Malaysia found that the most important benefits were "*enhancing the reputation of the company*, *improving the company's chance of selling product internationally, waste reduction, increase customer satisfaction* and *improving the company's competitive position",* while "*reducing costs and improving quality"* were not addressed as significant ones.

Nga (2009) conducted a comparative study in Malaysia between ISO 14001 certified and ISO 14001 non-certified companies. The obtained results implied that the companies that have adopted the standard have higher average return on equity compared to the companies that have not (Nga, 2009). This study implies that ISO 14001 may bring certain benefits in terms of cost reduction through production efficiency which contradict the previous study of Gos et al. (2006) who reported that "*reducing cost"* was not a significant ISO 14001 benefit.

Griffith and Bhutto (2008) and Griffith and Bhutto (2009) reported that the most important benefits were "*lower environmental costs, better environmental performance, reduced environmental risk, improved reputation and green credentials, reducing energy in use, minimizing external pollution and environmental damage, reduced embodied energy and resource depletion and, minimizing internal pollution and hazards to health*". In addition Turk (2009)

reported "*improvement of the environmental awareness of company, improvement of the standardization in environmental management, decreasing the environmental impacts, providing sustainable development in environment* and, *enhances company's image"*.

Psomas et al. (2011) identified four benefits factors: 1) "*improved a company's position in the market"*, 2) "*transition from conventional to sustainable practices"*, 3) "*improved relationship with society due to better environmental performance"* and 4) "*improved waste processing",* with the last one being the most important benefit derived from the ISO 14001 implementation.

Finally, Arena et al. (2012) examined Italian metal organizations and found out that the ISO 14001 benefits closely align with the ISO 14001 motives and they include "*improvement of environmental performance", "improvement of corporate image"* and *"improvement in the relationship with regulators"*.

Appendix D. Introduction to integration

The rapid growth and existence of multiple MSSs that organizations can or have already implemented, and the ongoing importance of being placed on them, have led many organizations to investigate wheatear or not is possible to integrate standardized MSs into an IMS (Bernardo et al., 2010; Poksinska et, al., 2003). Integration was seen as the only way to deal and benefit from increasing development of different standardized MSs (Lopez-Fresno, 2010).

Integration could be defined as a process of putting together different function-specific MSs into a single and more effective IMS (Beckmerhagen et al., 2003). According to Karapetrovic and Willborn (1998a) and Douglas and Glan (2000), the integration of the MSs results when two or more MSs are linked that the independence of one or both systems is lost. Since most of the standards are drafted to be compatible with each other, and duplication of MSSs "*must be avoided*" (Boiral and Sala, 1998), the integration is seen as a solution (Jorgensen et al., 2006) and a natural path for an organization (Boiral and Sala, 1998).

Integration is also seen as a "*symbol for success*" (Zeng et al., 2007) and a part of the "*organization's portfolio"* (Wilkinson and Dale, 1999a; Wilkinson and Dale, 1999c; Wilkinson and Dale, 2000). According to Karapetrovic and Jonker, (2003) and Salomone (2008), integration is an opportunity to exploit the advantages it can bring. It is "*a unique process that requires a little extra effort, but offers*

many benefits and wide range of advantages" (Khanna et al., 2010). However, top management commitment and support are required for the successful integration (Wilkinson and Dale, 1999c).

Even though there is no *"one right*" and "*one size fits all*" IMS (McDonald et al., 2003; Asif et al., 2009), there are number of studies that propose frameworks and approaches to help companies in integration. For example, Griffith and Bhutto, (2009) proposed a framework for implementation of an IMS to encourage better performance. This framework facilitates horizontal integration and contains five phases: "*organizational mapping*, *statement of vision, policy and objectives*, *commitment to IMS*, *structure (to ensure homogenous and consistent application across functions and through the organization),* and *evolution (to ensure continuous improvement)"* (Griffith and Bhutto, 2009).

In addition, Labodova (2004) proposed a theoretical model for IMS implementation, which combines risk analysis and the PDCA (Plan-Do-Check-Act) approach. Asif et al. (2009) suggested a *"process base design*" of IMS or *"PEDIMS approach"*, which is based on PDCA approach and designed to *"implant*" an IMS in the operational activities of an organization. There are four stages in this approach: *"designing core processes", "operational or process performance excellence", "integration in strategy and operations",* and *"certification"*. Lopez-Fresno (2010) proposed a model based on a system approach for design and

implementation of an IMS using the five following steps: *"analysis of the current situation to identify the starting point", "definition of the scope of the integration", "interrelation of requirements matrix", "identification of the processes and interrelationship matrix linking processes and requirements",* and *"design of the model*". Karapetrovic (2002a) proposed a *"two-pronged approach*" for integration. The first prong considered a creation of *"Generic Management System Standard or GMSS*" ("*universal system*" guideline) to support the integration, while second approach presented "*Generic Audit Standard or GASS*", for an integrated audit system. In addition, the author suggested three strategies for development of generic guidelines for integration:*"Core GMSS/GASS",* which would involve the common standards' elements identification; providing a set of core elements in a guideline form; and the function-specific requirements would be used in their current form, *"Integrated GMSS/GASS",* which would, in addition to previous list of common elements, incorporate quality, environmental and other appropriate modules, and *"Roadmad GMSS/GASS",* which would provide a procedure for the actual integration of MSs and audits with the explanation about the systems difference. The final goal of this integration is: *"one system, one standard*" (Karapetrovic, 2002a).

Zeng et al. (2007) proposed *"a multi-synergic*" model for effective implementing an IMS by including three levels of synergy: strategic, organizational and cultural, and, documentation. According to them, "*synergy is beneficial and helps to*

ensure continuous improvement of the organization and management system" (Zeng et al., 2007).

Karapetrovic and Jonker (2003), identify the *"ingredients*" that are necessary for the establishment of an IMS in an organization. These "ingredients" present the common elements of function-specific management system standards that are harmonized under the generic IMS framework.

In addition, Searcy et al. (2012) provide the recommendations for the successful process of integration and they include: establishment of an integration team, starting with the common elements of the systems while treating specific parts differently where necessary and, incorporating integration issues into training.

Appendix E. Integration motivation

Why do organizations spend money and time on integration of their MSs? The number of different motives and reasons has been reported in the existing literature.

Wilkinson and Dale (2000) identified "*building on the successful QMS, securing further improvements, reduction in costs and control, and desire for common documentation*" as major motivates for IMS.

McDonald et al. (2003) reported several reasons, such as "*customer requirements, trade barriers, insurance cost reduction, higher return on investment, right thing to do, smart thing to do, and manufacturing and operating cost reductions"*.

Fresher and Engelhardt (2004) in the case study of two small Australian companies observe that, *"improving the products*" and "*working together*" with the customers and suppliers, were the two key motives that drive companies towards integration.

Zutshi and Sohal (2005a) in their examination of Chinese organizations identified *"better use of resources, cost savings, and remaining competitive in the market"* to be the most significant integration motives.

In addition, Salomone (2008) reported *"markets, human resources and continual improvement"* to be the major integration motives.

Khanna et al. (2010) classified motives into: *"internal",* which includes motives related to the goal of achieving organizational improvement, and *"external",* related to the *"customer pressures, image building, marketing issues, improvement of market share, and the regulation policies of the government"*.

Finally, Casadesus et al. (2011) identified several drivers for implementing the second standard between organizations: "*improving image and social impact, improving the company's competitive position, improving efficiency and control, reducing problems and accidents, customer pressure, and synergies among management systems"*.

Appendix F. Integration benefits

"*In order to reap the benefits of an IMS, the misalignment between function-specific systems must be reduced to a minimum*" (Karapetrovic and Jonker, 2004). Having an IMS would bring greater benefits than the sum of the "*partial benefits"* of the independent managed systems (Matias and Coelho, 2002). However, which specific benefits an organization will see mostly depend on the organization itself, its culture and its business that need to be taken into consideration during the integration process (McDonald et al., 2003). In addition, Asif et al. (2010) recognized that perceiving the benefits would also depend on the integration motivation, i.e. whether the motivations for the integration are *"internal needs assessment"* or *"external pressure".* Zeng et al. (2011) identified that companies with related experience, such as managing some other standard before, would achieve better IMS implementation which would lead to better IMS benefits as well. In their study on 66 Chinese organizations, they recognized the following benefits perceived from the integration: *"decrease paper work, decrease management cost, decrease complexity of internal management, simplify certification process, and facilitate continuous improvement"* (Zeng et al., 2011).

Karapetrovic and Willborn (1998a) reported the benefits of an IMS as follows: "*the establishment of an integrated and optimal management system from the start, comprehensive involvement of all stakeholders, reduced use resources,*

harmonization and unified problem solving, improved cost effectiveness, and increased flexibility for including other systems".

Wilkinson and Dale (1999c) identified two major benefits from the integration: *"reduction in the documentation*" and "*reduction in auditing fees related to certification"*. Additionally, Wilkinson and Dale (2000) reported the following integration benefits: "*simplified management, further business opportunities, administration and audit cost savings, integration of employees into the business, improved control and management through common approach, and performance improvement*".

Douglas and Glen (2000) reported next benefits to be the most significant ones: "*multi-function auditors, less paperwork, fewer procedures, easier to manage systems, increased effectiveness, reduced costs, better communication between staff, and improved image with customers*".

In addition, McDonald et al. (2003) reported several integration benefits: "*simplified system, optimized resources, improved organizational performance, integrated business strategy, and establishment of a common framework for continual improvement*".

Beckmerhagen et al. (2003) identified that integration brings number of advantages, such as *"simplification of standards and requirements of management systems, reduction of auditing and registration costs, integrated*

audits, implementation costs reduction, harmonization of the documentation, alignment of objectives, processes and resources, reduction in paperwork, elimination of duplication, and improved system effectiveness and efficiency".

Fresher and Engelhardt (2004) in their case of two small Australian companies identified more specific benefits such as *"reduced water consumption, reduction of the use of chemicals and reduction of gas consumption, which all lead to the cost reduction".*

Zutshi and Sohal (2005a) studied 104 companies in China and reported *"enhanced strategic planning, improvements in resource utilization (reduction in duplication of processes and procedures and time spent in the documentation reviews), holistic view (higher level of management control, easy addressing people related issues), acceptance and understanding among employees, integrated training programs (save time and money), enhanced communication, dollar savings and positive market image, audits and housekeeping (reduction in number of internal and external audits)"* as the most important benefits.

Jorgensen et al. (2006) reported the integration advantages as follows: *"more focus on interrelations, synergies between systems, objectives and targets are established, coordinated and balanced, organization and responsibilities are defined in one place".*

Griffith and Bhuto (2008) identified three key groups of benefits: *"economic (reduced risk of environmental penalties, reduced costs of remediation activities, reduced costs of resources and waste material)", "organizational (improved opportunities, improved market place, improved relationships, improved internal operations)",* and "*environmental (reduced impact on natural environment, reduced impact on natural resources, reduced impact on communities)".*

According to Salomone (2008), the most outstanding benefits are: "*optimization/unification of audits, both internal and external, reduction in the documentation and saving time, money and labour*". Renzi and Cappelli (2000) also reported "*cost reduction, homogeneity in management, and decreasing in documentation*" as main benefits perceived from having an IMS.

Khanna et al. (2010), in their study in India, reported *"reduction in duplication of policies, procedures and work instructors, reduced costs, higher transparency, time savings, synergy between MS, improved image, reduction in number of audit days, improved communication, improved competitiveness, and help in adopting new technologies"* as the most significant benefits that companies perceived from the integration.

Lopez-Fresno (2010) identified that the most important benefits are "*improvement in strategic planning, achievement of a holistic view, better decision making, better efficiency of resources utilization, enhanced*

communication, improved people motivation, stronger customer orientation, achievement of cultural change, and enhanced positive corporate image".

Casedusus et al. (2011) identified five benefits that have statistical difference between the organizations with two standards, namely ISO 9001 and ISO 14001, and the organizations having ISO 9001 only: "*market share, customer satisfaction, health and safety at work, decreasing leading time, and meeting the delivery date".*

To et al. (2012) recognized 3 key groups of integration benefits: *"improvement of corporate performance, quality performance and marketing performance".*

Simon et al. (2012a), in their over-time examination, reported *"task simplification, increasing of organizational efficiency, better use of the internal and external audits, and improvement of the firm's image"* as the major benefits perceived from integration.

Finally, Simon et al. (2012b) identified four groups of benefits: "*internal cohesion benefits", "benefits related to better use o the systems", "organizational strategic benefits",* and *"system performance benefits".*

Appendix G. Integration difficulties

The following lines chronologically present the findings regarding integration difficulties.

Karapetrovic and Willborn (1998a) in their theoretical study identified the following difficulties that may encounter during the process of integration: *"different customers and stakeholders", "inadequate harmonized standards", "inter-functional conflicts"* and *"different operational management methods"*.

Wilkinson and Dale (2000) reported culture differences and complexity of the MSs to be the most significant difficulties that hinder integration. Other less important are the lack of support, need for adequate training and doubts about IMS ownership (Wilkinson and Dale, 2000).

Beckmerhagen et al. (2003) identified *"organizational and communication difficulties, perceptions of differences in standards requirements, problems in the alignment of management objectives, processes and resources differing interested parties, fears and perceptions of downsizing*" as main obstacles that companies face during integration.

Zutshi and Sohal (2005) identified *"people attitude, lack of strategic planning, lack of expertise and use of consultants, continually changing regulations and*

guidelines, reporting of results and time-delays in organizations" to be the most important challenges in Chinese organizations

Zeng et al. (2007) classified integration difficulties into two groups: *"internal factors",* which includes human resources, organizational structure, company culture, and understanding and perception and *"external factors",* which includes technical guidance, certification bodies, stakeholder and customers and institutional environment.

Salomone (2008) identified the risk of not attributing the right level of importance to each QMS, EMS and OHSAS and organizing an IMS to be one of the most important integration difficulties.

Asif et al. (2009) reviewed the literature and classified the difficulties into: *"different nature of individual systems, employees' resistance, lack of resources, and lack of strategy for integration."*

Griffith and Bhutto (2009) reported "*employee resistance to organizational change"* and "*the need to capture hearts and minds to secure support for system implementation"* as two major challenges organizations faced during integration.

Bernardo et al. (2012b) reported that, for the companies with two and three standards, the most important difficulties were *"differences between the models*

underpinning the standards" and *"lack of support from government"*. In addition, *"lack of human resources"* and *"lack of employees' motivation"* were identified as 'important' by almost a third of the respondents (Bernardo et al., 2012b). The authors had also classified integration difficulties into three groups: *"internal", "external"* and *"difficulties with the standards"* (Bernardo et al., 2012b).

Simon et al. (2012a) in their over-time examination (from 2006 to 2010) found out that in 2006, the most significant difficulties were "*lack of human resources, lack of technological support, lack of administration support and lack of specialized consultants"*, while in 2010 were "*lack of human resources, lack of employee motivation, lack of department collaboration and lack of specialized consultants"*.

Finally, Simon et al. (2012b) in their examination of 76 companies in Spain, defined four dimensions of difficulties: *"lack of resources for integration", "difficulties with standards implementation and clarification", "organizational internal difficulties", and difficulties related to the people working with the standards".*

Appendix H. The questionnaire

This questionnaire contains 32 questions organized into 6 sections. Completion of the questionnaire will require approximately 30 minutes. Please complete all questions.

Section 1 - ISO 14001 Implementation

Please answer all of the questions below. Indicate your response by circling the most applicable answer (circle one only).

1. How long did it take your organization to implement ISO 14001?

    a. Less than 6 months
    b. Between 6 and 11 months
    c. Between 12 and 17 months
    d. Between 18 and 23 months
    e. 24 months or more

2. How much did it cost your organization to implement ISO 14001 (in total, in Canadian dollars)?

    a. Less than $25,000
    b. $25,000 - $49,999
    c. $50,000 - $74,999
    d. $75,000 - $99,999
    e. $100,000 or more

3. How much does it cost your organization to maintain ISO 14001 (annually, in Canadian dollars)?

    a. Less than $25,000
    b. $25,000 - $49,999
    c. $50,000 - $74,999
    d. $75,000 - $99,999
    e. $100,000 or more

4. Does your organization use the following guidelines as a part of its environmental management system? Please circle the applicable answer.

EMS Guidelines	ISO 14004	Yes	No
Environmental Assessment	ISO 14015	Yes	No
Environmental Labels	ISO 14020	Yes	No
	ISO 14024	Yes	No
	ISO 14025	Yes	No
Environmental Performance Evaluation	ISO 14031	Yes	No
Life Cycle Assessment	ISO 14040	Yes	No
	ISO 14041	Yes	No
	ISO 14042	Yes	No
	ISO 14043	Yes	No
	ISO 14044	Yes	No
	ISO 14047	Yes	No
	ISO 14048	Yes	No
	ISO 14049	Yes	No
EMS Vocabulary	ISO 14050	Yes	No
Greenhouse Gas Emissions	ISO 14064	Yes	No
	ISO 14065	Yes	No
Auditing	ISO 19011	Yes	No

5. Please rate the importance of the motivation for implementing ISO 14001 in your organization. Please assign the ratings using this scale:

   1 = very unimportant

   2 = somewhat unimportant

   3 = neutral

   4 = somewhat important

   5 = very important

Improvement in environmental performance	1	2	3	4	5
Improvement of image and social impact	1	2	3	4	5
Customer pressures	1	2	3	4	5
Government pressures	1	2	3	4	5
Other stakeholder pressures	1	2	3	4	5
Improvement in efficiency and control	1	2	3	4	5
Decreasing problems and accidents	1	2	3	4	5
Provision of competitive advantage	1	2	3	4	5
Natural continuation of a previous standard	1	2	3	4	5
Synergies among management systems	1	2	3	4	5
Others	1	2	3	4	5

Section 2 - ISO 14001 Audits

Please answer all of the questions below. Indicate your response by circling the most applicable answer.

6. How frequently does your organization conduct internal audits against ISO 14001?

    a. Less than one month
    b. One month to less than three months
    c. Three months to less than six months
    d. Six months to less than one year
    e. One year or more

7. How frequently is your organization audited externally against ISO 14001?

    a. Less than six months
    b. Six months to less than a year
    c. One year to less than two years
    d. Two years to less than three years
    e. Three years or more

8. How does your organization structure its internal audits against ISO 14001?

    a. Audits are structured around internal processes
    b. Audits are structured around the requirements in the ISO 14001 standard
    c. Other

9. In your organization, internal audits against ISO 14001:
    (Please circle the applicable answers for all three items)

Detect nonconformities	Yes	No
Identify improvement opportunities regarding:		
the implementation of the standard	Yes	No
the integration of the environmental system with other management systems	Yes	No

10. In your organization, external audits of your organization against ISO 14001:
    (Please circle the applicable answer for all three items)

Detect nonconformities	Yes	No
Identify improvement opportunities regarding:		
the implementation of the standard	Yes	No
the integration of the environmental system with other management systems	Yes	No

Section 3 – ISO 14001 Benefits

Please answer the question below. Please follow the instructions provided in the question.

11. Please rate the benefits your organization has received from the implementation of ISO 14001. Please assign the ratings using the following scale:

    1 = ISO 14001 negatively affected the item in question

    2 = ISO 14001 made no difference

    3 = ISO 14001 positively affected the item in question

Prevention of pollution	1	2	3
Improved legal compliance	1	2	3
Improved environmental performance	1	2	3
Increased environmental awareness	1	2	3
Improved public image	1	2	3
Reduced risk	1	2	3
Reduced costs	1	2	3
Improved relations with stakeholders	1	2	3
Improved employee motivation	1	2	3
Increased customer satisfaction	1	2	3
Increased market opportunities	1	2	3
Improved emergency preparedness and response	1	2	3
Other	1	2	3

Section 4 – Other Management Systems and Integration

Please answer all of the questions below. Please follow the instructions provided in each question.

12. Is your organization registered to the following standards? Please circle the applicable answer.

ISO Quality Management System Standards	ISO 9001	Yes	No
	ISO 13485	Yes	No
	ISO/TS 16949	Yes	No
	ISO/TS 29001	Yes	No
Other ISO Standards	ISO 22000	Yes	No
	ISO 27001	Yes	No
	ISO 28000	Yes	No

13. Does your organization use the following guidelines as a part of its quality management systems? Please circle the applicable answer.

ISO 9004	Yes	No
ISO 10001	Yes	No
ISO 10002	Yes	No
ISO 10003	Yes	No
ISO 10006	Yes	No
ISO 10012	Yes	No

14. Does your organization use any of the following management systems standards? Please circle the applicable answer.

OHSAS 18001	Yes	No
CSA Z1000	Yes	No
SA 8000	Yes	No
Other (please write in):	Yes	No

15. Please indicate the priority your organization gives to the following actions (from "1" indicating the highest priority to "4" indicating the lowest):

Add new management system standards (for example, OHSAS 18001, SA 8000, ISO 27001, ISO 28000, …)	
Add new supporting standards / guidelines for specific areas or system components (for example, ISO 14031, ISO 14020, ISO 14064, ISO 10002, …)	
Add new improvement standards / excellence models (for example, ISO 14004, ISO 9004, Canadian Framework for Business Excellence, …)	
Do not add any new standards / guidelines / excellence models	

16. Please indicate the order of implementation for the management system standards in your organization (first, second, third, fourth, fifth, etc.).

_____ ISO 14001

_____ ISO 9001

_____ ISO 13485

_____ ISO/TS 16949

_____ ISO 27001

_____ ISO 28000

_____ ISO 29001

_____ OHSAS 18001

_____ CSA Z1000

_____ SA 8000

_____ Other

17. Please indicate the time to implement management system standards in your organization by order of implementation. Please assign the ratings using this scale:

1 = Less than 6 months

2 = Between 6 and 11 months

3 = Between 12 and 17 months

4 = Between 18 and 23 months

5 = 24 months or more

First standard:	1	2	3	4	5
Second standard (if applicable):	1	2	3	4	5
Third standard(if applicable):	1	2	3	4	5
Fourth standard (if applicable):	1	2	3	4	5
Fifth standard (if applicable):	1	2	3	4	5
Sixth standard (if applicable):	1	2	3	4	5

18. Once you had implemented the first management system based on a standard, what were the principal reasons for implementing other systems in your organization? Please assign the ratings using this scale:

    1 = very unimportant

    2 = somewhat unimportant

    3 = neutral

    4 = somewhat important

    5 = very important

Improvement of image and social impact	1	2	3	4	5
Customer pressures	1	2	3	4	5
Government pressures	1	2	3	4	5
Improvement in efficiency and control	1	2	3	4	5
Decreasing problems and accidents	1	2	3	4	5
Provision of competitive advantage	1	2	3	4	5
Natural continuation of the previous standard	1	2	3	4	5
Synergies among management systems	1	2	3	4	5
Others	1	2	3	4	5

19. Of the management system standards implemented in your organization, which ones were integrated into a single management system?

    a. None
    b. Only the following (please write in): _____
    c. All

Please Note: If your organization has partially or completely integrated your ISO 14001 environmental management system with one or more other systems, please answer Questions 20 – 23. Otherwise, please go to Question 24.

20. If your organization has partially or completely integrated ISO 14001 with one or more of the systems, please indicate the extent to which the following management system documentation has been integrated. Please assign the ratings using this scale:

    1 = not integrated

    2 = partially integrated (a single document was created from various separate documents by adding them together, one after the other)

    3 = fully integrated (documents were integrated into a single, newly revised, document)

Manual	1	2	3
Policy	1	2	3
Objectives	1	2	3
Targets	1	2	3
Procedures	1	2	3
Instructions	1	2	3
Records	1	2	3
Other	1	2	3

21. If your organization has partially or completely integrated ISO 14001 with one or more of the systems, please indicate the extent to which the following management system processes have been integrated. Please assign the ratings using this scale:
    1 = not integrated

    2 = partially integrated (only some elements of the process have been integrated)

    3 = fully integrated (a single, integrated process exists for all standards / systems)

Planning	1	2	3
Determination of Legal Requirements	1	2	3
Communication	1	2	3
Documentation Control	1	2	3
Operational Control	1	2	3
Records Control	1	2	3
Emergency Preparedness and Response	1	2	3
Monitoring and Measurement	1	2	3
Nonconformity Control	1	2	3
Corrective and Preventive Action	1	2	3
Internal Auditing	1	2	3
Management Review	1	2	3
System Improvement	1	2	3
Resource Management	1	2	3
Other	1	2	3

22. If your organization has partially or completely integrated ISO 14001 with one or more of the systems, please indicate the extent to which the following management system responsibilities have been integrated. Please assign the ratings using this scale:

    1 = different individuals for different systems / standards

    2 = same individuals for the following systems / standards only: _____

    3 = same individuals for all systems / standards

Inspectors	1	2	3
Representatives	1	2	3
Managers	1	2	3

23. If your organization has partially or completely integrated ISO 14001 with one or more of the systems, please indicate the importance of the main difficulties encountered in the integration process. Please assign the ratings using this scale:

    1 = very unimportant

    2 = somewhat unimportant

    3 = neutral

    4 = somewhat important

    5 = very important

Lack of guidelines for integration (books, articles, standards…)	1	2	3	4	5
Lack of governmental support	1	2	3	4	5
Lack of human resources	1	2	3	4	5
Lack of financial resources	1	2	3	4	5
Differences in the models used in the standards (PDCA, process, …)	1	2	3	4	5
Differences in the common elements of the standards (audits, policy, …)	1	2	3	4	5
Lack of collaboration between departments	1	2	3	4	5
Lack of specialized auditors	1	2	3	4	5
Lack of technological support	1	2	3	4	5
Implementation of the first system was not very effective	1	2	3	4	5
Excessive time was necessary for the integration	1	2	3	4	5
Lack of employee motivation	1	2	3	4	5
Other	1	2	3	4	5

24. Please answer all of the following questions regarding internal and external management system audits in your organization. Circle one answer for internal audits and one answer for external audits. If your organization does not have multiple management systems, please leave this question blank.

	Internal Audits			External Audits		
The audits are conducted: 1. At different times for different standards / systems. 2. Simultaneously for the following standards / systems: _____ 3. Simultaneously for all standards / systems.	1	2	3	1	2	3
The audits use: 1. Separate audit plans and separate audit reports for different standards / systems. 2. Single audit plan and separate audit reports. 3. Single audit plan and single audit report for all standards / systems.	1	2	3	1	2	3
The auditors audit management systems as mutually: 1. Independent. 2. Interrelated. 3. Integrated.	1	2	3	1	2	3

25. If your organization has not integrated ISO 14001 with any other management system standards, please indicate the importance of the following reasons for not integrating the standards. Please assign the ratings using this scale:

1 = very unimportant

2 = somewhat unimportant

3 = neutral

4 = somewhat important

5 = very important

Difficulties in understanding the different standards	1	2	3	4	5
Excessive requirements of the new standards	1	2	3	4	5
Standards are too different	1	2	3	4	5
Lack of guidelines (books, articles, standards…) for integration	1	2	3	4	5
Lack of interest	1	2	3	4	5
Areas / departments affected by the standards are very different	1	2	3	4	5
Registration to the original standard was required quickly	1	2	3	4	5
Did not know that integration was possible	1	2	3	4	5
Other	1	2	3	4	5

Section 5 – Sustainability Guidelines

26. Does your organization use any of the following sustainability guidelines?

Global Reporting Initiative	Yes	No
Global Compact	Yes	No
AA 1000	Yes	No

27. Please indicate the order of implementation for the sustainability guidelines in your organization relative to ISO 14001 (first, second, third, fourth).

_____ ISO 14001

_____ Global Reporting Initiative

_____ Global Compact

_____ AA 1000

28. Please rate the importance of the motivation for implementing sustainability guidelines. Please assign the ratings using this scale:

1 = very unimportant

2 = somewhat unimportant

3 = neutral

4 = somewhat important

5 = very important

Improvement of image and social impact	1	2	3	4	5
Customer pressures	1	2	3	4	5
Government pressures	1	2	3	4	5
Other stakeholder pressures	1	2	3	4	5
Improvement in efficiency and control	1	2	3	4	5
Decreasing problems and accidents	1	2	3	4	5
Provision of competitive advantage	1	2	3	4	5
Natural continuation of the previous standard	1	2	3	4	5
Synergies among management systems	1	2	3	4	5
Others	1	2	3	4	5

Section 6 – Organization Profile

Please answer all of the questions below. Indicate your response by circling the most applicable answer (circle one only).

29. What is your role within the organization?

a. Environmental Manager
b. Quality Manager
c. General Manager
d. Other

30. What is the total number of employees in your organization?

    a. Less than 100
    b. Between 100 and 500
    c. Between 501 and 1000
    d. More than 1000

31. What is the primary economic sector that your organization operates in?

    a. Agriculture, Forestry, Fishing and Hunting
    b. Mining and Oil and Gas Extraction
    c. Utilities
    d. Construction
    e. Manufacturing
    f. Wholesale Trade
    g. Retail Trade
    h. Transportation and Warehousing
    i. Information and Cultural Industries
    j. Finance and Insurance
    k. Real Estate and Rental and Leasing
    l. Professional, Scientific and Technical Services
    m. Management of Companies and Enterprises
    n. Administrative and Support, Waste Management and Remediation Services
    o. Educational Services
    p. Health Care and Social Assistance
    q. Arts, Entertainment and Recreation
    r. Accommodation and Food Services
    s. Other Services - except Public Administration
    t. Public Administration

32. What is the primary destination of the goods and/or services produced by your organization?

    a. End-user
    b. Another company
    c. Both the end-user and another company

Appendix I. Destination of goods/services

The last question asked in the section 6 was related to the internal/external customers of organizations goods/services (Figure I1). Seventeen organizations indicated that their immediate customer is another company, while only seven had "end-users" as customers. Eight organizations had both. These results are similar to the results obtained by Karapetrovic et al., 2006; Casadesus et al., 2007 and, Karapetrovic and Casadesus (2009) for the case in Spain. They have also obtained over 50% of respondents indicating "another company" as their immediate customer.

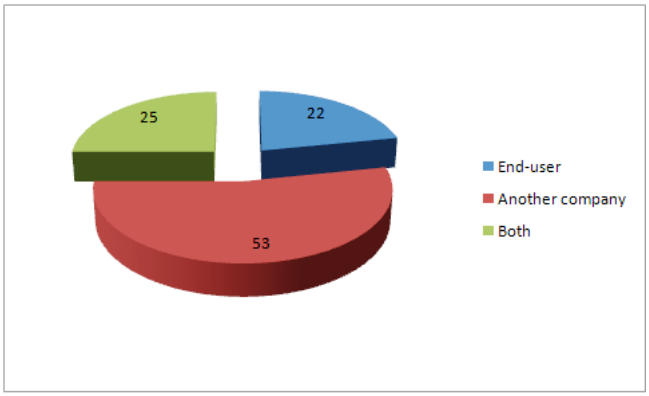


Figure I1. Customers (%) (Karapetrovic et al., 2006)

Appendix J Structural Equation Modeling (SEM)

Structural Equation Modeling is a multivariate technique that examines directions and intensity of direct and indirect influences between the constructs in a model (Spasojevic –Brkic, 2009). These constructs, which can also be called concepts or latent variables, may be classified into two categories: exogenous and endogenous (Hayduk, 1987). If a concept is directly caused or influenced by any of the other concepts, it is called endogenous (dependent variable) (Hayduk, 1987). On the other hand, if a concept always acts as a "cause" and never as an "effect", it is called exogenous (predictor or independent variable) (Hayduk, 1987). The main advantages of SEM are that includes measurement error (Spasojevic-Brkic, 2009) and gives us a possibility to examine multiply relationships between the concepts (variables). If a variable acts as a dependent variable in one relationship, the same variable can become and act as an independent variable in another relationship. The main disadvantage of this technique is that requires larger sample size. Smaller sample sizes are possible but the results from such estimation have to be interpreted with a caution.

The SEM consists of two components (Hayduk, 1987; Zeng et al., 2011):

1) the measurement model, which links the concepts with their observed indicators and, 2) structural model, which defines causal and direct effects between the concepts.

The measurement model can be expressed by the following two equations (Hayduk 1987; HaZeng et al., 2011):

$$x = \Lambda_x \xi + \delta$$

$$y = \Lambda_y \eta + \varepsilon$$

The first equation links the exogenous concepts to the exogenous indicators (observed variables) while, second links endogenous concepts with exogenous indicators (Hayduk, 1987). x presents observed exogenous indicators, y are endogenous indicators, λ_x shows the relationships of the exogenous indicators and exogenous concepts, λ_y describes the relationships of the endogenous indicators and endogenous concepts, δ is the error variable for the exogenous concepts and, ε is the error variable for the endogenous concepts (Hayduk, 1987; Zeng et al., 2011).

The structural model is described by the following equation (Hayduk, 1987; Zeng et al., 2011):

$$\eta = B\eta + \Gamma\xi + \zeta$$

where η presents endogenous concepts, ξ is exogenous concept, B shows the relationships of the endogenous concepts, Γ denotes the impact of exogenous concepts on endogenous concepts and, ζ is an error variable for the structural model.

There are number of guidelines and fit indexes or indicators for determining a model fit of a proposed model (Spasojevic-Brkic, 2009; Hooper et al., 2008;

Hayduk, 1987; Joreskog and Sorbom, 1996). However, existence of a large number of indicators does not mean that a researcher should satisfy all of them in order to say that a model that he/she proposed should be accepted. On the contrary, these indicators exist in a large number in order to give researchers more chance for "proving" a proposed model. For instance, Hooper et al. (2008) by referencing Hu and Bentler (1999), present a table of a "Two-Index" Strategy with the combinations of different two indicators depending of the values obtained in the analysis. These authors recommend that a research should only present two "good" indicators instead of presenting a batch of them without any significant importance.

In this thesis, the following indicators with the presented acceptance criteria (Table 1) have been used (Hooper et al, 2008; Spasojevic – Brkic, 2009, Joreskog and Sorbom, 1996):

Fit Index (indicator)	Acceptance criteria
Chi-Square χ^2	Low value relative to degrees of freedom an insignificant p-value (p>0.05)
RMSEA (Root Mean Square Error Approximation)	Values less than 0.07
GFI (Goodness of Fit Index)	Values greater than 0.90
RMR (Root Mean Square Residual)	Good models have small RMR
SRMR (Standardized RMR)	Values less than 0.08
NFI (Normed Fit Index)	Values greater than 0.95
CFI (Comparative Fit Index)	Values greater than 0.95

Table 13. Fit indexes and acceptance criteria