The adoption of multiple certification standards: Perceived performance implications of quality, environmental and health & safety certifications

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Title:

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Abstract:

This study assesses the combined impact of multiple certifications (i.e., ISO 9001, ISO 14001, OHSAS 18001) on perceived performance dimensions related to quality, environmental and occupational health and safety. Using survey data collected from 59 Irish manufacturing plants in 2014 we employed MANCOVA and regression analysis to test our proposed hypothesis. The results suggest that companies that are simultaneously ISO 9001, ISO 14001 and OHSAS 18001 certified are significantly better performers with regard to environmental and occupational health and safety compared to companies without multiple certifications. However, from a perceived quality performance perspective having these multiple certifications doesn't seem to be an effective performance improvement tool.

Keywords:

Certification, ISO 9001, ISO 14001, OHSAS 18001, perceived performance

1. Introduction

Over the last decade, there has been an unprecedented increase in companies seeking external process certification of various types. For example, the popularity of ISO 9001, a quality management certification, has been globally implemented to a significant extent (Lo et al., 2013). However, due to increasing pressure from multiple stakeholder groups such as customers, NGOs and governments, sustainability certifications (Marshall et al., 2014) in terms of the environment (ISO 14001) and social dimensions in terms of workforce health and safety (OHSAS 18001) have also been increasingly globally diffused. However, companies seem to struggle to gain the widely promised performance benefits from these certifications.

A review of previous literature indicates that controversy exists with regards to the performance implications of these certifications (McGuire and Dilts, 2008; Lo et al., 2014; Su et al., 2015). Some authors have highlighted that these inconsistences are due to the exclusion of contingency factors that may impact on the efficacy of certifications (Lo et al., 2013). An important nuance that is mostly absent in previous research is investigating the relationships between the quality, environmental and safety dimensions (Pekovic, 2015) and the combined impact of multiple certifications on performance (Fan et al., 2014). Organizations follow different paths when it comes to adopt multiple certifications (Salomone, 2008; Karapetrovic and Casadesus, 2009; Abad et al., 2014), and this process entails various challenges related to the duplication of managerial tasks and procedures that can create unintended negative effects on subsequent performance.

It should be noted that this study does not look directly at integrated management systems (IMS). However, by looking at the presence of multiple certifications, the results should

provide an indication of the perceived operational performance implications of having multiple certifications.

This study investigates the scenario where companies have multiple certifications and whether these certifications might affect each other and thus their effectiveness in terms of the perceived performance outcomes. The main research objective of this paper is to examine the combined effects of ISO 9001, ISO 14001 and OHSAS 18001 certifications on perceived quality, environmental and occupational health and safety performance. Subsequently, this research seeks to explore the following research question: *Do multiple certifications (i.e., ISO 9001, ISO 14001 and OHSAS 18001) impact on perceived operational performance (i.e., perceived quality, environmental and occupational health & safety performance)?* Multiple certifications refer to companies adopting more than one of the following management systems: ISO 9001, ISO 14001 and OHSAS 18001. Subsequently, this research question explores the combined implication of these certifications on perceived performance to explore whether they complement or suppress the performance benefit of one another.

Thus, we make several contributions to the existing operations management literature on certifications and provide guidance to managers considering and evaluating a company's certification efforts. We explore the combined impact of ISO 9001, ISO 14001 and OHSAS 18001 on performance and its managerial implications. Furthermore, we provide managers with empirical evidence, suggesting that organisations need to consider a coherent approach to managing meta-standards (such as ISO 9001, ISO 14001 and OSHAS 18001), particularly with regard to their effect on environmental and occupational health and safety performance.

2. Literature review

ISO 9001, ISO 14001 and OHSAS 18001 belong to the three most widely applied certifications in the manufacturing industry. Of these certifications, ISO 9001 is the most established and widely implemented standard, with over one million certifications in 2013, whilst around 300,000 firms are registered to the ISO 14001 standard for the same period (The ISO survey of certifications, 2013). In comparison, the uptake of OHSAS 18001 is still relatively low with only around 56,000 certifications in 2007 (OHSAS Project Group, 2011). However, it is becoming increasingly important, with a growth rate of 37% between 2003 and 2009 (OHSAS Project Group, 2011). In addition, OHSAS 18001 forms the basis for the new ISO 45001 standard on occupational health and safety, with an anticipated publication date in late 2016.

The primary goal of these certifications is to achieve plant-level process compliance (Gray et al., 2015). However, companies have sought these external process certifications for various other reasons such as reputation, financial performance improvements or competitive advantage (Darnall, 2006; Delmas, 2001; De Jong et al., 2014; Wiengarten et al., 2013). Process certifications such as those studied in this research (i.e., ISO 9001, ISO 14001, OHSAS 18001) are externally assessed and verified by third parties to provide customers and other stakeholders with an objective assessment of a company's efforts in terms of quality, environmental and occupational health & safety standardization and performance.

2.1. Introducing ISO 9001, ISO 14001 and OHSAS 18001 certifications and their performance implications

Previous research has extensively explored the financial performance benefits of ISO 9001 certification (e.g., Corbett et al., 2005; Simmons and White, 1999; Sharma, 2005; Dunu and Ayokanmbi 2008). Studies have identified the links between ISO 9001 certification and abnormal returns on various financial measures such as stock price (Corbett et al., 2005; Levine and Toffel, 2010; Sharma, 2005). Corbett et al. (2005) identified that three years after their first ISO 9001 certification, firms experience significant abnormal performance improvements. Benner and Veloso (2008) highlight two possible sources of financial performance improvement stemming from the ISO 9000 certification family. First, performance improvement is expected to arise from enhanced operational efficiency that translates directly into cost reductions (Naveh and Erez, 2006; Terlaak and King, 2006). A second expected source of performance improvement from adopting ISO 9001 arises from increases in revenues as ISO 9001 certified firms are able to access new markets or customers (e.g., Terziovski et al., 1997; Corbett et al., 2005; Terlaak and King, 2006; Sroufe and Curkovic, 2008; Singh et al., 2011; Ismyrlis and Moschidis, 2015). Furthermore, King and Lenox (2001) find that adopting ISO 9001 leads to a reduction of waste generation and chemical emissions. Naveh and Erez (2006) conclude that ISO 9001 adoption results in an increase in worker productivity and workers' attention to detail but hinders innovativeness. Lafuente et al. (2010), on the other hand, in a study of Spanish manufacturing firms find that ISO 9001 certification and ownership structure positively influence performance, but this impact diminishes in firms where ownership is highly concentrated.

However, there are also several other studies that could not detect any performance improvement through ISO 9001 implementation (e.g., Docking and Dowen, 1999; Lima et

al., 2000; Singles et al., 2001; Morris, 2006; Ilkay and Aslan, 2012). Docking and Dowen (1999) identify that small firms in the U.S. experienced positive stock market reaction to their announcements of first ISO 9000 certification, but that larger firms' stock price did not respond. In addition, Morris (2006) studies the financial performance of U.S. firms in the electronics industry and could not detect any superior financial performance for companies that gained certifications from the ISO 9000 family compared with non-certified companies.

This current study assesses the impact of ISO 9001 certification on its primary performance objective in the form of quality performance (Gray et al., 2015). McAdam and McKeown (1999) state that the main benefit of a successful implementation of ISO 9001 practices and procedures is in eliminating errors and thus produce cost savings in terms of reducing rework and scrap. However, surprisingly, not many studies empirically explored this relationship between ISO 9001 adoption and quality performance. An exception, Gray et al. (2015), identify that quality-related process compliance performance actually decreases through time after adopting certifications from the ISO 9000 series. They concluded that these negative findings were due to managerial difficulties as a result of continual improvement of certification-related performance over time. McAdam and McKeown (1999) conducted a survey in small sized businesses and identified that most companies reported improving quality as a primary reasons for pursuing certifications from the ISO 9000 series.

It should be noted that ISO 9001 does not certify the quality of the end good or service, but rather that processes follow certain quality standards, which might ultimately improve performance outcomes (Marde, 2015).

The ISO 14001 standard is designed for companies to identify and establish the importance of their environmental impact. Through ISO 14001 companies implement operational controls to manage environmental concerns that are aimed at improving the

efficient use of natural resources (ISO, 2009). According to Boiral (2011) ISO 9001 and 14001, have similar compliance procedures and are based on the same ideology. Su et al. (2015) highlighted that both standards, developed by the International Organization for Standardization, share the same requirements for document and operations control, management policy, training, auditing, monitoring and evaluation. Similar to the quality management standard ISO 9001, ISO 14001 does not guarantee a particular organization's optimum environmental performance level but rather describes standardised processes to achieve a company's own environmental objectives (Melnyk et al., 2003). In addition, one of the main drivers of ISO 14001 certification is the pre-existence of being already ISO 9001 certified (Vastag, 2004).

Environmental management systems (EMS) such as ISO 14001 have been extensively studied in the literature. However, whilst the specific first order performance implication of ISO 9001 on quality performance have been largely ignored in the literature, research on ISO 14001 and environmental performance implications seems to have attracted considerably more interest. Previous research on ISO 14001 has shown some level of inconsistency in terms of performance implications (Link and Naveh, 2006). For example Melnyk et al. (2003) assessed the impact of having a formal but uncertified EMS compared to having a formal, certified system (i.e., ISO 14001). They identified that the perceived performance benefits are highest when companies have a certified EMS compared to a non-certified EMS. Curkovic and Sroufe (2011) conducted cases studies in the U.S. auto industry and found mixed results in terms of the impact of ISO 14001 certification on supply chain sustainability. Furthermore, Boiral and Henri (2012) surveyed Canadian manufacturing firms and found that ISO 14001 is related to superior environmental performance. Other studies have used secondary data to assess the impact of the ISO 14000 certification series on performance

(Castka and Corbett, 2013). For example Barla (2007) assessed pulp and paper plants in Quebec, Canada and could not detect any performance benefits in terms of reductions in several emission types. Furthermore, Paulraj and de Jong (2011) studied the effect of ISO 14001 certification announcement on stock performance using secondary data. They identified that in the short-term ISO 14001 certification announcement has a negative impact on stock performance and that shareholder wealth is reduced.

OHSAS 18001 is a formal external certification in the realm of occupational health and safety management systems (OHSMS). Lo et al. (2014) have highlighted that OHSAS 18001 could affect performance differently than ISO 9001 and ISO 14001. According to Lo et al. (2014, pg. 269), *"ISO 9001 and 14001 certifications were often driven by customer demand to create management systems where little previously existed. However, most firms have an OHSMS and many have been actively managing safety for decades, both because of their values and because safety regulation has existed in the United States since the 1930s"*. Thus, ISO 9001 benefits customers whilst ISO 14001 is directed at resource efficiencies, but a business case for OHSAS 18001 is generally lacking (Pagell et al., 2014; Lo et al., 2014).

As with ISO 9001 and ISO 14001, drivers for implementing OHSAS 18001 come from multiple stakeholders such as customer or employee demands (Law et al., 2006). However, existing research has not placed much emphasis on the performance implications of OHSAS 18001 certification (Castka and Corbett, 2013). Robson et al. (2007) who conducted a systematic review of the OHSMS literature concluded that the body of evidence was insufficient to make recommendations in support of OHSMSs or against them. In a more recent study, Haight et al. (2014) highlighted that measuring the effectiveness and impact of occupational health and safety management systems such as OHSAS 18001, is difficult and that reliable information is largely missing in the literature. However, Abad et al. (2013), in a

study of OHSAS 18001 certification in Spanish firms found that performance improvements followed the adoption of the safety standard. These positive results are also supported by Lo et al. (2014) who studied the impact of OHSAS 18001 on operating performance. Utilizing a U.S. panel dataset, they assessed the impact of OHSAS 18001 on safety performance, sales growth, labour productivity and ROA. They identified that certification leads to significant increases in abnormal performance on safety, sales growth, labor productivity, and profitability and that these benefits increase as complexity and coupling increase. Other studies have found some contradictory results. Fan and Lo (2012) studied the impact of OHSAS 18001 on financial performance in the US textile industry. Utilizing secondary data, they identified that whilst OHSAS 18001 has a positive impact on company's sales performance it has a negative impact on the company's return-on-assets performance.

2.2. Performance implications of multiple certifications

The reviewed studies corroborate that ISO 9001, ISO 14001, and OHSAS 18001 lead to performance improvements in terms of quality, environmental and occupational health and safety performance measures. However, since companies are likely to have multiple certifications to fulfil their stakeholders' demands it is important to analyse their combined impact on performance (Vastag, 2004). Conde et al. (2012) investigated the presence of multiple ISO certifications in the agri-food sector and their impact on performance. They found that organisational performance increased as the number of certifications increased. Similarly, Goedhuys and Sleuwaegen (2013) in a large study of manufacturing firms in fifty-nine countries, concluded that organisations with multiple ISO certifications had both improvements in productivity and sales performance. On the other hand, Lo et al. (2011)

identified that there was no relationship between the number of ISO certifications obtained and the financial performance of a firm, in their study of the Chinese electronics sector.

Scholars have also acknowledged some disadvantages related to these formal certifications (Naveh and Marcus, 2005). Some have argued that the burdensome bureaucracy of the certification process can outweigh its benefits from a company's perspective (McGuire and Dilts, 2008). Wilkinson and Dale (2002) highlighted that whilst there are compatibilities between the three standards they are likely to result in very different firm level sub-cultures that may harm their performance benefits.

The relationship between these three dimensions are also related to the trade-off debate with regard to operations strategy (Singh et al., 2014). This trade-off discussion in the operations management literature could also occur in terms of the performance implications of formal certifications, since the dimensions may not be compatible. For example, putting an increased emphasis on quality could result in increased pressure on the workforce and lead to role overload and stress (McLain, 1995). Such negative outcomes have been linked to occupational accidents (Barling et al., 2003). Furthermore, placing more emphasis on quality may result in higher internal rejects and scrappage volumes, which subsequently could decrease the environmental performance dimension.

A review of the IMS literature reveals that combining multiple certifications can, under certain conditions (i.e., integration), lead to significant performance benefits. Abad et al. (2014) for example identified that the more firms make an effort to integrate their multiple certifications (ISO 9001, ISO 14001, OHSAS 18001) the higher the prospective performance benefits. However, Salomone (2008) reported that to gain significant performance benefits obstacles such as the lack of competent human resources or lack of information need to be tackled.

The three dimensions of quality, environmental and health and safety have come to be viewed as pillars of operational excellence and should be compatible. However, Fan et al. (2014) concluded that these statements are purely theoretical, given the limited data analysis and requires further empirical investigation. Whilst arguments for both sides are acknowledged the more recent literature justifies the following hypothesis:

H1: Multiple process certifications (i.e., ISO 9001, ISO 14001, & OHSAS 18001 certification) are complementary and thus increase the positive impact on perceived performance (i.e., quality, environmental, occupational health & safety).

3. Method

3.1. Sampling and data collection

To test the combined impact of multiple certifications on perceived performance, data was collected through a survey in Ireland. The level of analysis was the manufacturing plant and the respondents were plant managers. These key informants had the comprehensive knowledge related to the management and operations of the plant and they were advised to supplement this with input from other functions, where appropriate. The majority of the data was collected electronically via email. Other methods were used as well, such as telephone, mail and face-to-face interviews. Table 1 provides an overview of the dataset in terms of industry sector. The data was collected at the end of 2014 and early 2015. The manufacturing plants were selected within the industry classification codes of SIC 27 and SIC 38 employing twenty or more people. In terms of size, the majority of companies were medium sized with 20 companies having between 101 and 250 employees and 11 companies between 251 and 500. In addition, there were 17 smaller companies (between 25 and 100 employees). The

sample also included relatively large firms with 11 companies having more then 500 employees. Table 2 provides an overview of the certification frequencies in the sample.

---Insert Table 1 about here---

The size of the population was established from a number of databases, including Kompass Ireland, the Industrial Development Authority and Enterprise Ireland. Given the SIC codes, 500 companies were identified and the response rate of just over 12% is satisfactory and in alignment with recent survey research in the operations management domain.

---Insert Table 2 about here---

3.2. Measures

Perceived operations performance was measured across the selected dimensions of quality, environmental and health and safety performance (Shin et al., 2000; Rosenzweig and Roth, 2004; Pagell et al., 2014). Respondents were prompted to indicate their plant's performance relative to their major competitors. The scale ranged from one to seven where one means far worse, four means similar and seven far better (see Table 3 & Appendix A).

Perceived quality performance was measured with the same scale using two items with regards to product performance and product conformance to customer specifications (Yang et al., 2013).

Perceived environmental performance was measured through prompting the respondents to indicate the extent to which their plant has performed from an environmental perspective during the past two years. The scale ranged from one to seven where one means not at all, four means to some extent seven to a great extent. Four items are used to represent the environmental performance dimension (see Table 3 & Appendix A). Respondents were asked

questions with regards to energy usage, water usage, waste and emissions in their facilities (Hackert et al., 2014)

Perceived occupational health and safety performance was measured through the same scale as used for the environmental dimension. Again four items were used to represent this performance dimension, which are also listed in Table 3 and Appendix A. Respondents were asked questions with regards to the number of occupational-related accident, number of occupational-related injuries, occupational-related ill health and occupational-related insurance claims at their facilities (Fernandez-Muniz et al., 2014).

Certification was measured through binary questions prompting the respondents to indicate *"Has your plant obtained any of the following certifications?"* (ISO 9001, ISO 14001, OHSAS 18001). In addition, the results were controlled for company size through number of employees. All latent variables are listed in Table 3 and the questions for these variables are presented in Appendix A.

3.3. Construct validation

Exploratory factor analysis (EFA) was conducted to validate our measures and to confirm the proposed factor structure (using SPSS 20 for this and subsequent analyses). EFA was conducted instead of confirmatory factor analysis (CFA) because of our relatively small sample size. Various scholars have called for having at least 100 (e.g., Kline, 1979) or 150 (Hutcheson and Sofroniou, 1999) cases to conduct CFA. Thus, it is acknowledged that the measures are established since our data collection effort was part of a wider study (i.e., Global Manufacturing Research Group survey). However the specific factor structure that is used in this study remains to be explored. Subsequently, we conducted principle axis factoring along with varimax rotation. The EFA model converged in a three-factor solution in

terms of perceived quality, environmental and occupational health & safety performance.

The results presented in Table 3 indicate relatively high factor loadings with the lowest value of .603. This can be interpreted as an initial indicator of the validity of our identified factor structure (Nunnally, 1978). Furthermore, no cross-loadings were detected in our solution. The initial eigenvalue for the perceived quality performance factor was 5.074 (percentage of variance = 50.74; cumulative = 50.74%), the perceived environmental performance factor 1.679 (percentage of variance = 16.795; cumulative = 67.53%) and for the perceived occupational health & safety performance factor 1.408 (percentage of variance = 14.08; cumulative = 81.62%), resulting in a cumulative percentage of the initial values of 81.62 %. The cumulative parentage of the rotation sums of squared loadings resulted in 73.57%, providing additional support for construct validity.

Furthermore, we calculated the *Kaiser-Meyer-Olkin* measure of sampling adequacy (KMO) (Kaiser, 1970). Results yielded a KMO of .756, which is above the cut-off point of .050 indicating that the sample is factorable (Kaiser, 1974; Hutcheson and Sofroniou, 1999). Additionally, we conducted *Bartlett's* test of sphericity, which examines whether the correlation matrix is different from an identity matrix (Field, 2014). The results indicate that the *Bartlett* test is significant at .000, which indicates that the correlation between the analysed variables does not bias our findings.

---Insert Table 3 about here---

Finally, Cronbach's alpha (α) has been used to test for reliability. The Cronbach's alpha values listed in Table 3 are all above the commonly accepted level of .7, which indicates that

reliability is satisfactory. Based on the above analyses, the validity and reliability of our scales were established.

Table 4 presents the Pearson correlation between the composite score of our explored factor structure. The mean composite scores were calculated for the three dependent performance variables and subsequently used to test the hypothesis. Furthermore, the mean and standard deviation of the composite variables and firm size are presented in Table 4.

---Insert Table 4 about here---

Common method bias was tested through conducting the Harman's one-factor test (Podsakoff et al., 2003). Thus, all items were loaded on a non-specified factor in an un-rotated factor structure. The first factor accounts for 50.74% of variance, and the other items load on different factors. Therefore, it can be speculated that common method variance does not pose a problem for our data.

4. Results

To test our hypothesis a one-way multivariate analysis of covariance (MANCOVA) was conducted. The dependent variables were perceived performance (i.e., quality, environmental, and social), the fixed factors were the certification bundles and the covariate was company size (i.e., number of employees).

However, within our limited sample we did not have any cases of being simultaneously ISO 9001 and OHSAS 18001 certified and being ISO 14001 and OHSAS 18001 certified. Thus, the analysis only considered the two identified certification combinations in the sample (i.e., ISO 9001 & ISO 14001; ISO 9001 & ISO 14001 & OHSAS 18001).

Table 5 provides an overview of the mean (including the mean perceived performance difference in relation to non-certified firms for that specific bundle) and standard deviations

of the two possible certification combinations with regard to three perceived performance indicators.

---Insert Table 5 about here---

The results in Table 5 indicate that with regard to perceived quality performance, having multiple certifications does not influence performance. The univariate results in Table 6 provide further evidence to indicate that this effect is non-significant when multiple certifications are present (p=230; p=.624). In addition, the univariate tests for perceived environmental performance and occupational health and safety show no improvements in performance in the presence of ISO 9001 (p=.616) and ISO 14001 (p=.138) certifications.

In terms of perceived environmental performance, the results indicate that a combination of all three standards has a positive outcome on perceived environmental performance, (p=.016). However, the presence of all three certifications leads to a significant improvement in perceived occupational health and safety performance (p=.007). These results indicate that having triple certification is beneficial for perceived environmental and occupational health and safety performance.

---Insert Table 6 about here---

To verify and validate the results of the MANCOVA analyses we also conducted ordinary least square regression analysis. Specifically, we ran three models representing the three dependent variables, with size as a control variable. The independent variables were the two certification combinations (1) ISO 9001 & ISO 14001 and (2) ISO 9001, ISO 14001 & ISO 18001. The results somewhat confirm our previous findings using MANCOVAs (see

Appendix B). Having obtained all three certifications seems be provide companies with the highest performance benefits in terms of environmental and occupational health and safety performance.

5. Discussion

The main research objective of this paper was to examine the combined effects of ISO 9001, ISO 14001 and OHSAS 18001 certifications on perceived quality, environmental and occupational health and safety performance. Although previous studies investigated the individual effects, there is little research on the combined impact of multiple certifications (Fan et al., 2014). This study contributes to advancing the knowledge in the operations management field, by taking a holistic approach to assess the effect of these certification standards on perceived performance.

The literature review has highlighted the lack of studies on the effects of multiple certifications on operational performance. Due to the limited sample size, the current study investigated the combined effect of ISO 9001, ISO 14001 and OHSAS on performance in the following combinations: ISO 9001 & ISO 14001 and ISO 9001 & ISO 14001 & OHSAS 18001. The results only indicated support for the positive effects of triple accreditation (ISO 9001 & ISO 14001 & OHSAS 18001) on perceived environmental and occupational health and safety performance. The results showed no support for any trade-off between the certification bundles investigated. However, with regard to perceived environmental and occupational health and safety performance, there was support for a spillover effect when all three certifications were present.

In terms of the spillover effect the results appear to extend the findings of other researchers. For example, Levine and Toffel (2010) showed how health and safety and

operations systems, such as quality certification, are complementary by linking ISO 9001 certification to improvements in safety. Similarly, Lo et al. (2014) found that firms with OHSAS 18001 improve safety and operational outcomes, such as waste reduction and quality improvements, both important elements of ISO 9001 and ISO 14001.

Another reason that might explain the spillover effect is that OHSAS 18001 and ISO 14001 requires a much wider stakeholder base relative to ISO 9001. The ISO 9000 standard family tends to focus on customers and satisfying their requirements. Consequently, organisations may be opportunistically using certifications to increase sales, rather than to improve quality performance (Abraham et al., 2000). The other two standards, on the other hand, need to consider the influence of stakeholders from customers to society at large. Given the higher level of scrutiny that this entails, the implication is that this leads to improved performance in terms of environment and occupational health and safety (Castka and Balzarova, 2008).

A further explanation to explain the positive outcome for the perceived environmental and occupational health and safety performance, could be provided by the control and feedback mechanisms to be found in OHSAS 18001 and ISO 14001 relative to ISO 9001. In terms of quality, such mechanisms tend to be focused on the external market and therefore customers can directly make a judgement on the quality of products. With respect to occupational health and safety and the environment, these tend to have much more intangible effects. As outlined by Terlack (2002), it is difficult for external stakeholders to determine whether the performance of ISO 14001 certified firms is greater than those that are not certified. Similarly, health and safety performance tends to be less transparent when compared to measuring quality performance. Subsequently, there is a need for firms to more carefully

explain the performance benefits of environmental and occupational health and safety, particularly to their external stakeholder groups.

From a management perspective the results suggest that organisations need to consider a more coherent approach to managing meta-standards (such as ISO 9001, ISO 14000 and OSHAS 18001), particularly with regard to their effect on environmental and occupational health and safety performance. Such an approach to managing organisational systems would help in achieving the right balance between providing a safe working environment and operational outcomes related to quality and the environment. In addition, even though the results would appear to suggest that there is no performance benefit for firms from having ISO 9001 certification, having in place quality management processes and practices should make it easier to implement other standards, such as, ISO 14001 and OSHAS 18001, as they require similar infrastructure and knowledge requirements (Curkovic et al., 2000).

There are a number of limitations with the current study. Firstly, it was country specific and focused on Ireland. Future work should extend the research to other jurisdictions. Whilst the analysed certifications in this paper follow common global approaches and requirements, countries may have different laws that impact on the certification process and performance. Secondly, the limited sample size meant that this study not look at all permutations of the three certifications that were investigated. Thirdly, related to the small sample size it was not feasible to test for the possible confounding implications of industry on our results. However, we do solely include manufacturing firms in our sample. Fourthly, the results highlighted the benefits of organisations having multiple standards on performance. Future research should consider the implications of having integrated management systems in place and how such a complementary approach affects performance. The possible interaction effects between these multiple certifications might significantly alter firm performance. Finally, the study

considered three meta-standards, future work could look at other certification programmes, such as ISO 26000 on social responsibility. It is also important to acknowledge that industry experts are expecting that OHSAS 18001 will be phased out soon and might be replaced by a ISO standard (ISO 45001).

6. Conclusion

In recent years, firms have implemented quality (ISO 9001), environmental (14001) and occupational health and safety (OHSAS 18001) management standards, in order to remain competitive and meet their stakeholders' objectives. However, implementing multiple certifications has proved challenging and the findings from the literature appear mixed (Wilkinson and Dale, 2002). The current study has tried to provide some guidance with regard to the relationship between perceived performance and the three standards outlined above. However, managing two or more different systems can be challenging. Not only due to the need to be proficient across the different areas of quality, environment and safety, but also in dealing with the different stakeholders who may have conflicting interests. Ultimately it is about achieving the right balance between operations objectives, such as time, cost and quality and the multiple standards in which firms have to operate.

Appendix A. Survey items

Operations Performance							
Perceived Quality Performance							
Please Indicate your plant's performance compared to your major competitor(s)?							
	1= Far worse	2	3	4= Similar	5	6	7= Far better
Product performance							
Product conformance to customer specifications							
Perceived Environmental Performance							
During the past two years, please indicate the extent to which your plant has performed from an environmental perspective:							
	1= Not at all	2	3	4= Some extent	5	6	7= Great extent
We have reduced energy use in our facilities							
We have reduced water use in our facilities							
We have reduced waste at our facilities							
We have reduced emissions at of our facilities							
Perceived Occupational Health & Safety Performance							
During the past two years, please indicate the extent to which your plant has performed from a health and safety perspective:							
	1= Not at all	2	3	4= Some extent	5	6	7= Great extent
We have reduced the number of occupational-related accidents at our facilities							
We have reduced the number of occupational-related injuries at our facilities							
We have reduced occupational-related ill health at our facilities							
We have reduced the number of occupational-related insurance claims at our facilities							
Certification							
Has your plant obtained any of the following certifications? (Y/N)							
ISO 9001							
ISO 14001							
OHSAS 18001							
Company Size							
Approximately how many employees work at the plant in total?							

Appendix B. Additional robustness checks

Perceived Quality Performance Regression Model R^2=.049		
Independent Variable	**Std. Coefficent B**	**Sig.**
Size	-.111	.408
ISO 9001 & ISO 14001	-.164	.238
ISO 9001, ISO 14001 & OHSAS 18001	-.141	.312

Perceived Environmental Performance Regression Model R^2=.149		
Independent Variable	**Std. Coefficent B**	**Sig.**
Size	.153	.228
ISO 9001 & ISO 14001	.132	.309
ISO 9001, ISO 14001 & OHSAS 18001	.350	.009

Perceived Occupational Health & Safety Performance Regression Model R^2=.217		
Independent Variable	**Std. Coefficent B**	**Sig.**
Size	.184	.131
ISO 9001 & ISO 14001	.299	.019
ISO 9001, ISO 14001 & OHSAS 18001	.374	.004

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Table 1. Industry distribution

Industry	**Frequency**
Food & kindred products	8
Apparel and other finished products made from fabrics and similar materials	1
Chemicals and allied products	3
Rubber and miscellaneous plastics products	7
Primary metal industries	4
Fabricated metal products, except machinery and transportation equipment	7
Industrial and commercial machinery and computer equipment	4
Electronic and other electrical equipment and components, except computer equipment	8
Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks	2
Manufacture of motor vehicles, trailers and semi-trailers	2
Manufacture of other transport equipment	3
Stone, clay, glass, and concrete products	2
Miscellaneous manufacturing industries	8
Total	*59*

Table 2. Certification frequencies

Single Certifications	**Frequency**
ISO 9001	46
ISO 14001	26
OHSAS 18001	19
Multiple Certification	
ISO 9001 & ISO 14001	7
ISO 9001 & OHSAS 18001	0
ISO 14001 & OHSAS 18001	0
ISO 9001 & ISO 14001 & OHSAS 18001	19

Table 3. Construct measurement items

Items	**Mean**	**Std. Dev.**	**Factor Loading**	***Alpha Values***
Perceived Quality Performance				.719
Product performance	5.38	.993	.603	
Product conformance to customer specifications	5.47	.995	.923	
Perceived Environmental Performance				.886
We have reduced energy use in our facilities	4.58	1.344	.784	
We have reduced water use in our facilities	4.22	1.791	.802	
We have reduced waste at our facilities	4.90	1.423	.750	
We have reduced emissions at of our facilities	4.29	1.630	.783	

Perceived Occupational Health and Safety Performance				.953
We have reduced the number of occupational-related accidents at our facilities	4.98	1.239	.844	
We have reduced the number of occupational-related injuries at our facilities	5.08	1.222	.928	
We have reduced occupational-related ill health at our facilities	4.88	1.301	.870	
We have reduced the number of occupational-related insurance claims at our facilities	4.85	1.257	.831	

Table 4. Correlations

Variables	Mean/ Frequency	Std. Dev.	(1)	(2)	(3)	(4)	(5)	(6)
Perceived Quality Performance (1)	5.42	.852	1					
Perceived Environmental Performance (2)	4.58	1.344	.011	1				
Perceived Occupational Health & Safety Performance (3)	4.94	1.174	-.080	.530**	1			
ISO 9001 Certification (4)	/ 46	---	-.486**	-.005	.186	1		
ISO 14001 Certification (5)	/ 26	---	-.194	.331*	.422**	.448**	1	
OHSAS 18001 Certification (6)	/ 19	---	-.116	.328*	.312*	.346**	.772**	1
Size (7)	337.76	434.49	.129	-.110	.022	.006	-.164	-.363**

**. Correlation is significant at the 0.01 level
*. Correlation is significant at the 0.05 level (2-tailed, Pearson Correlation).

Table 5. Means and standard deviations of certification bundles

Perceived Quality Performance		
Certification bundles	Mean Performance (Performance Differences)	Std. Deviation
ISO 9001 & ISO 14001	5.04 (-.430)	.748
ISO 9001 & ISO 14001 & OHSAS 18001	5.34 (-.128)	.886
Perceived Environmental Performance		

Certification bundles	Mean Performance (Performance Differences)	Std. Deviation
ISO 9001 & ISO 14001	4.83 (.285)	1.489
ISO 9001 & ISO 14001 & OHSAS 18001	5.24 (.968)	1.047
Perceived Occupational Health & Safety Performance		
Certification bundles	Mean Performance (Performance Differences)	Std. Deviation
ISO 9001 & ISO 14001	5.59 (.733)	1.174
ISO 9001 & ISO 14001 & OHSAS 18001	5.59 (.948)	1.005

Table 6. Univariate between-subjects test statistics of certification bundles

Perceived performance dimension Initiative/program	Significance	Observed Power (alpha)
Perceived Quality Performance		
ISO 9001 & ISO 14001	.230	.223
ISO 9001 & ISO 14001 & OHSAS 18001	.624	.077
Perceived Environmental Performance		
ISO 9001 & ISO 14001	.616	.079
ISO 9001 & ISO 14001 & OHSAS 18001	.016	.689
Perceived Occupational Health & Safety Performance		
ISO 9001 & ISO 14001	.138	.315
ISO 9001 & ISO 14001 & OHSAS 18001	.007	.791