
The Effects of ISO Certification on Organization Workmanship Performance

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The use of ISO 9001 certification to improve workmanship on construction projects is a research area that is presently receiving attention due to the competitive demand for quality projects and infrastructure in the market. There is limited information, however, regarding the extent of the relationship between ISO 9001 certification and workmanship performance. Also, the impacts of the systemic factors on workmanship need to be considered. As a result, this study is aimed at addressing these issues. This study investigates the effects of ISO 9001 certification on organization workmanship performance using the construction industry as a case study. A questionnaire survey was used to identify factors that contribute to poor workmanship on construction projects. The study also compared workmanship performance between ISO certified organizations and non-ISO-certified organizations. It was found that ISO 9001 certified organizations performed better in workmanship performance compared to non-ISO 9001 certified organizations. As a result, a correlation relationship was established among the improvement of workmanship factors, ISO 9001 certifications, and workmanship performance.

Key words: construction, management, organization, performance, quality, workmanship

INTRODUCTION

The most important aspect of a quality project is the workmanship; unfortunately, poor quality workmanship can destroy projects already put in place. Presently, there has been a gradual but noticeable paradigm shift in the quality field. Increasingly, organizations are now beginning to realize that the only way to understand how an organization operates, and thus improve its workmanship performance, is by implementing a quality management system (QMS) (Nanda 2005). Due to this shift in management style and quality profession, the task of achieving an ISO 9001-certified QMS is viewed fundamentally as the establishment of the necessary infrastructure to manage and continuously improve an organization's processes. Poor workmanship is attributed to either one or a combination of the following factors: inappropriate use of a component or materials, use of a material adjacent to or in combination with another that adversely affects it, and lack of knowledge by the designer regarding the potential deterioration of a material and poor design (Carillon 2001). According to Ahmad (2002), cited by Chong (2006), factors that contribute to the poor quality of construction workmanship are no proper monitoring of projects, poor quality of materials used, and lack of proper site supervision due to inconsistent supervision. In the researcher's opinion, a lack of proper monitoring of quality performance and standards will affect the workmanship produced. Abdul-Aziz and Al-Atiq (1999) performed evaluations on ISO 9000 standards in Saudi Arabia using 15 construction contractors. The findings revealed

that the majority of contractors believe ISO 9000 standards are applicable to the construction industry, beneficial to their companies, and bring about improvement in their operations. Furthermore, Pheng (1993) worked on workmanship and the relevance of quality assurance as a management process for achieving quality standards in the construction industry. Pheng emphasized that skills alone are insufficient to produce the workmanship desired if there has been a lack of care in exercising the skills. Therefore, workmanship is a function of both skills and care; to a large extent, lack of care results in shoddy workmanship.

The implementation of the ISO 9001 standard QMS can help to improve an organization's processes, quality performance, and workmanship, and it addresses all internal and external factors that can impact quality workmanship (ISO 2009a). In order to improve the workmanship factors' problems, the work processes, and the delivery of quality products, the International Organization for Standardization (ISO) was formed in 1947 to promote the development of standardization, promote the practice and adoption of the quality management system, facilitate the international exchange of goods and services, and foster cooperation among intellectual, technological, and economic activities (Janet 1995). There is a need, however, to have proper procedures and an effective QMS in place to attain ISO 9001 quality certification and ensure that projects are monitored effectively, which will lead to quality workmanship. Studies undertaken in the past showed that poor construction workmanship occurs due to human factors rather than technical factors. Human factors are responsible for defects during construction/management and work procedures, whereas technical factors are responsible for defective materials, design problems, and natural disasters (Anrekwu and Okpala 1998). These studies indicate the possibility of achieving substantial performance in workmanship improvement through ISO certification in any organization, but the extent is not known.

The early stages of empirical research on an ISO-certified QMS created instruments capable of measuring QMS practices and performance (Saraph, Benson, and Schroeder 1989; Abdel-razek and Refaat

1998). Using these facts, several research studies have examined the link between ISO-certified QMS practices and performance. Scholars have investigated both the direct and indirect effects of ISO QMS on performance. A large body of literature highlights the positive implications of QMS practices on performance (Flynn, Schroeder, and Sakakibara 1995; Abdel-razek and Refaat 1998; Choi and Eboch 1998; Das et al. 2000; Ahire and Dreyfus 2000). This study delves into the research that links ISO certification and workmanship performance to investigate the extent of the impact of ISO certification on workmanship performance through the improvement of workmanship factors. Specifically, the analysis established in this paper contributes toward answering the following research questions: To what extent does ISO certification help to improve workmanship performance? How can ISO 9001 certification help organizations improve workmanship performance? Why is ISO 9001 certification important to an organization? How does the organization with ISO 9001 certification perform compared to an organization without ISO 9001 certification, with reference to workmanship performance. This paper answers these questions by using data from a questionnaire survey conducted on poor workmanship factors.

Empirical Studies Linking ISO Certification and Workmanship Performance

The roles played by quality and systemic factors in an organization provide the need for ISO certification and better workmanship performance. Quality is rapidly becoming an important discriminating factor as price has been traditionally (Harris and McCaffer 1993). However, the construction industry, manufacturing industry, and other notable industries are still characterized by poor quality. Numerous studies have been carried out that have quantified the cost of quality in manufacturing, design, and construction (BRE 1982), defined the factors affecting quality (Nair 2006; Fletcher and Scivyer 1988; Griffith 1990), and developed and explained QMSs (Jay 2003; Hughes

and Williams 1992; ISO 2009c). Many of the findings of a study carried out in the UK in 1982 (BRE 1982) allocated the blame for poor quality to factors very similar to those identified in another study done in 1987 (Abdel-razek and Refaat 1998). Aspects such as the following are highlighted in the two studies: inadequate information, poor communication, poor management, poor care in workmanship, and lack of site supervision. Furthermore, Sidney (1995) indicated that improper procedures or carelessness during construction operations led to poor quality of workmanship. On what can be used to improve identified factors, Bibby, Austin, and Bouchlaghem (2003) identified possible improvement mechanisms as: a structured and explicit design process, improved design planning, integrated design and construction, information flow management, understanding/predicting impact of design changes, and a knowledge database. Moreover, the ISO 9001 international standard is a very important guiding tool being used to address the problem of poor workmanship being experienced all over the world on construction projects (ISO 2009c). ISO standards exist to support all aspects of conformity assessment and facilitate the implementation of the QMS at all stages in construction projects (ISO 2009b). Despite usefulness in improving workmanship, the extent of the relationship between ISO 9001 certification and workmanship performance is still with limited information. The serious research efforts and rigorous attempts to measure both quality management practices and their effects on quality outcomes began with Krafcik (1988) and Saraph et al. (1989). Later, others like Nair (2006) and Black and Porter (1996), to name a few, extended the development of validated measures to capture quality management practices and performance. This provided a basis for several research studies published since 1995 and examine the link between QM practices and firm performance. A review of literature indicated that the studies differed in terms of conceptualizing QM practices and firm performance. Nair (2006) indicated that QM practice was regarded as a multi-dimensional construct. Other views can be found in (Flynn, Schroeder, and Sakakibara 1995; Powell 1995; Adam et al. 1997; Grandzol and Gershon 1997; Ahire

and O'Shaughnessy 1998; Nair 2006), while others conceptualized it as a single construct (Hendricks and Singhal 1996; Douglas and Judge 2001).

In general, research studies argued a direct relationship between QM practices and performance. Along with the direct link, as shown in these papers, several research studies have highlighted the presence of contextual variables in the relationship between QM practices and performance. Studies such as Wilson and Collier (2000) and Sousa and Voss (2002) highlight the role of organizational context on the link between quality management practices and performance. The contextual variables considered include managerial knowledge, corporate support for quality, external quality requirements, and product complexity (Benson, Saraph, and Schroeder 1991), organizational uncertainty (Reed et al. 1996), and manufacturing strategy (Sousa and Voss 2001). This study focuses on the generally accepted direct associations between ISO certification and workmanship performance, and tests their validity based on the data obtained from empirical studies and published journals. The following hypotheses examine the relationship between ISO certification and workmanship performance:

- ISO certification in an organization is substantially correlated with workmanship performance.
- Organization workmanship performances and improvement in poor workmanship factors are substantially correlated.
- The correlation between workmanship performance and improvement of poor workmanship factors is influenced by ISO certification.

This study intends to consider the systemic aspect of workmanship by considering workmanship performance of construction projects through factors that contribute to poor workmanship. Therefore, the aim of this paper is to determine the extent by which ISO certification can improve organizational workmanship performance through the improvement of poor workmanship factors. In view of this aim and scope, a questionnaire survey was used to identify factors that contribute to poor workmanship on construction projects. Also, this study compared workmanship performance between ISO 9001 certified organization and

non-ISO 9001 certified organization in order to show the extent by which ISO 9001 certification can impact an organizational workmanship performance.

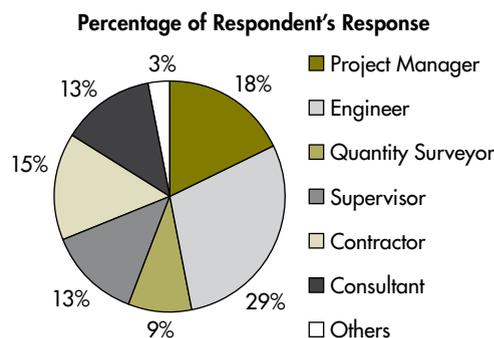
METHODOLOGY

The method adopted for this research is a questionnaire survey, and the qualifying questions used in this research survey were derived from the literature. The review of the literature revealed that parameters such as poor communication, poor documentation, poor supervision, poor system/methodology of work, poor performance of workers, poor management, and poor planning have previously been explored as probable causes of poor workmanship in an organization (Chong 2006; Abdul-Rahman 1996; BRE 1982; Abdel-rezek and Refaat 1998). Management of the design process has become increasingly complex as a result of workmanship factors (Bibby, Austin, and Bouchlaghem 2003; BRE 1982; Abdel-razek and Refaat 1998). Refaat (1998) blames poor quality on inadequate information, poor communication, and lack of site supervision, while Sidney (1995) indicated that improper procedures or carelessness during construction operations led to poor quality of workmanship. Studies undertaken in the past showed that poor construction workmanship occurs due to human factors rather than technical factors, whereas technical factors are responsible for defective materials, design problems, and natural disasters (George 1990; Anrekwu and Okpala 1998). The survey involved the administration of questionnaires using construction industry professionals as a case study for other industries. Out of the 100 questionnaires sent out, only 55 were returned, resulting in a 55 percent response rate. The questionnaire was administered through personal consultation, contact, Internet exchange of information, visitation to some of the respondent's organization, and phone calls for proper follow up. Most of the respondents who returned the questionnaires had between five to 10 years of experience in the construction industry.

SURVEY DATA ANALYSIS

Figure 1 shows the breakdown of the respondents into classes of professionals. The figure shows that the

Figure 1 Breakdowns of respondents into classes of professionals.



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respondents who returned the questionnaires were mostly engineers (29 percent) and project managers (18 percent). The response rate in this study is quite satisfactory, with a total rate of return of 55 percent.

Analysis of Data Regarding Factors That Contribute to Poor Workmanship

The analysis of the questionnaire data was categorized into seven sections of factors that are considered to contribute to poor construction workmanship as described in the questionnaire. Under factors that contribute to poor construction workmanship, the data collected were entered into the Statistical Package for the Social Science (SPSS) software (Research Consultation 2009a), where analysis of variance (ANOVA) was used to compare respondents' agreement levels and test the research hypothesis in order to show the correlation among factors contributing to poor construction workmanship, ISO certification (QMS), and workmanship performance. Researchers use this technique to compare the perception of three or more groups (Xiao and Proverbs 2002; Low and Chuan 2006; Ogunlana and Toor 2008). In this analysis, it is assumed that the ISO standard is in strong agreement with the research hypothesis, which indicates that the improvement of factors that contribute to poor construction workmanship through ISO certification can bring about an improvement in workmanship performance. It is also assumed that ISO certification can improve factors that contribute to poor construction

workmanship on construction projects. Hence, these ISO standard assumptions in correlation to the research hypothesis were tested. Also, the test hypothesis assumes that the means of the groups are not equal, while the null hypothesis assumes that the means of all of the groups are equal. These assumptions were used to test the significance between the groups.

Responses on poor communication

The responses to poor communication in Appendix 1 show that poor communication is one of the factors affecting the quality of workmanship. In Appendix 1, the ISO project manager, engineer, supervisor, contractor, consultant, and quantity surveyor have high levels of agreement on this factor. In their responses, they are 50 percent strongly agree and 50 percent agree with the “poor communication” factor. Specifically, ISO engineers, supervisors, consultants, and quantity surveyors 100 percent agree with the factor. In general, ISO respondents made a compelling case with their high levels of agreement. This shows their high levels of agreement to ISO standard assumptions and requirements, which necessitates high levels of improvement in the organization’s workmanship performance as a result of ISO certification. It appears that the response from most of the non-ISO respondents was less favorable to this view. The non-ISO project managers, engineers, supervisors, contractors, consultants, and quantity surveyors indicate low levels of agreement in their opinions. Consequently, the non-ISO respondents’ agreement level is relatively low when compared with ISO respondents’ agreement level. This also suggests that the non-ISO respondents’ agreement level to ISO standard assumptions and requirements for workmanship performance improvement is low. Hence, the organization workmanship performances and improvement of workmanship factors are substantially correlated.

Responses on poor documentation

In Appendix 2, under “poor documentation,” the ISO project manager, supervisor, contractor, consultant, and quantity surveyor show high levels of agreement. ISO quantity surveyors and consultants 100 percent strongly agree, while ISO engineers, contractors, and project managers 50 percent strongly agree and 50 percent

agree with “poor documentation” as a contributing factor. These facts show their strong position on this factor and also suggest their high levels of agreement to ISO standard assumptions and quality requirements. The non-ISO respondents have low levels of agreement, as most of them 100 percent disagree with this factor, as shown under the non-ISO project manager, engineer, supervisor, contractor, and consultant with higher levels of disagreement. This shows that the correlation between workmanship performance and improvement of workmanship factors is influenced by ISO certification. Also, it shows that ISO certification in this organization is substantially correlated with workmanship performance. This indicates that the organization’s workmanship performance and improvement in workmanship factors are substantially correlated.

Percentage of responses on poor supervision

In Appendix 3, under “poor supervision,” the ISO project manager, engineer, supervisor, contractor, consultant, and quantity surveyor show high levels of agreement. The ISO project managers 100 percent agree, while ISO engineers, supervisors, contractors, consultants, and quantity surveyors 100 percent sometimes agree with “poor supervision” as a factor contributing to poor workmanship. Furthermore, their views are in high levels of agreement with ISO standard assumptions and quality requirements, which indicate the existence of an ISO-certified QMS in the organization. This suggests high levels of improvement in the ISO organization’s workmanship performance. On the other hand, the non-ISO respondents show low levels of agreement, with the highest levels of disagreement coming from supervisors, contractors, and consultants. The non-ISO supervisor is 40 percent totally disagree and 60 percent disagrees, the non-ISO contractor 16.7 percent totally disagrees and 83.3 percent disagrees, while the non-ISO consultant 33.3 percent totally disagrees and 66.7 percent disagrees on “poor supervision.” These opinions confirm their low levels of agreement to ISO standard assumptions and quality requirements. This suggests that the direct correlation between workmanship performance and improvement of workmanship factors is influenced by ISO certification. Also, it shows

that ISO certification in this organization is substantially correlated with workmanship performance and improvement in workmanship factors.

Responses on poor system/methodology

In Appendix 4, under “poor system/methodology,” the ISO respondents indicate low levels of agreement, with the lowest levels of agreement and highest levels of disagreement coming from the ISO engineer, project manager, and quantity surveyor. They 100 percent disagree with poor system/methodology as a contributing factor. Despite this unimpressive performance, ISO respondents still show some levels of agreement in their opinions in support of non-ISO respondents’ position, as indicated in supervisor 50 percent sometimes agree, contractor 50 percent sometimes agree, and consultant 100 percent sometimes agree. This confirms their relatively low levels of agreement to ISO standard assumptions, quality requirements, and low improvement on this workmanship factor. Moreover, the non-ISO respondents have high levels of agreement due to the agreement level from the supervisor, contractor, and consultant. In the view of these respondents, non-ISO supervisors 80 percent strongly agree and 20 percent agree, contractors 83.3 percent strongly agree and 16.7 percent agree, while consultants 83.3 percent strongly agree and 16.7 percent agree, which suggests that in their perspectives, “poor system/methodology” contributes to poor construction workmanship. This shows that the correlation between workmanship performance and improvement of workmanship factors is influenced by ISO certification. Also, it shows that ISO certification in this organization is substantially correlated with workmanship performance and improvement in workmanship factors.

Responses on poor performance of workers

In Appendix 5, under “poor performance of workers,” the ISO respondents show high levels of agreement with their responses, which suggest that in their perspectives “poor performance of workers” is one of the factors contributing to poor construction workmanship. The ISO project managers and ISO quantity surveyors 100 percent strongly agree with this position, while ISO engineers and consultants 100 percent agree with the

poor performance of worker. This view is also in agreement with ISO standard assumptions and ISO quality requirements, which actually suggest the existence of ISO-certified QMS and improvement in the ISO organization’s workmanship performance. Non-ISO respondents indicate high levels of disagreement in their opinions as shown under non-ISO project manager, engineer, supervisor, contractor, and consultant with 100 percent disagree. Besides, these respondents also show low levels of agreement in their opinions, with the non-ISO quantity surveyor at 50 percent agree and 50 percent sometimes agree with the ISO respondent’s view. This actually confirmed their high levels of disagreement with ISO standard assumptions and quality requirements. It further suggests the presence of lower workmanship performance in this organization and that the correlation between workmanship performance and improvement of workmanship factors is influenced by ISO certification. In addition, it shows that ISO certification in this organization is substantially correlated with workmanship performance and improvement in workmanship factors.

Responses on poor management

In Appendix 6, under “poor management,” the ISO respondents indicate high levels of agreement in their opinions. The ISO project managers, engineers, consultants, and quantity surveyors 100 percent strongly agree that “poor management” contributes to poor workmanship. Also, ISO supervisors and contractors 50 percent strongly agree and 50 percent agree with this view. This indicates their high levels of agreement to ISO standard assumptions and ISO quality requirements. However, the non-ISO respondents have low levels of agreement. These non-ISO respondents 100 percent disagree, which suggests that in the perspectives of these respondents, “poor management” does not contribute to poor workmanship on construction projects. This also suggests their low levels of agreement to ISO standard assumptions and quality requirements. This brings about lower workmanship performance in the non-ISO organization, and it further suggests that the correlation between workmanship performance and improvement of workmanship factors is influenced by ISO certification.

Responses on poor performance planning

In Appendix 7, under “poor planning,” the ISO respondents indicate low levels of agreement, with the lowest level of agreement coming from consultants. ISO respondents indicate high levels of disagreement on “poor planning,” as shown in Appendix 7 with project managers, engineers, supervisors, contracts, consultants, and quantity surveyors 100 percent disagreeing with this factor. This suggests that poor planning is not considered as a contributing factor by ISO respondents. This further shows their relatively low levels of agreement to ISO standard assumptions and quality requirements. As a result, the respondents’ opinions suggest lower workmanship performance and improvement under this factor. However, the non-ISO respondents have high levels of agreement due to the agreement level of supervisors, contractors, and consultants. This suggests that they are in high levels of agreement with ISO standard assumptions and quality requirements. Also, it shows that ISO certification in this organization is substantially correlated with workmanship performance and improvement in workmanship factors.

Analysis of Variance (ANOVA) Test

This test was undertaken to the significant differences between the mean of the groups of construction professionals, and also to confirm the research hypotheses in order to achieve the research aim. The test hypothesis assumes that the means of the groups are not equal, while the null hypothesis assumes that the means of all of the groups are equal, which is in agreement with the research hypothesis and null hypothesis stated earlier. The alpha value for level of significance is 0.05. In Table 1, the degree of freedom between the groups is 1, while the degree of freedom within the groups is 52. The significance between groups for all of the factors tested was below the significance level of 0.05. Also, the observed values of F are greater than the F critical value of 4.00 from the F critical table.

Considering these facts, the null hypothesis assumption is rejected. Therefore, there is sufficient evidence to conclude that the means between the groups are

not equal and this indicates a significant difference between the groups. Based on this test, the research hypotheses, which indicated that ISO certification in an organization is substantially correlated with workmanship performance, organization workmanship performances, and improvement in poor workmanship factors are substantially correlated and that the correlation between workmanship performance and improvement of poor workmanship factors is influenced by ISO certification, are therefore proved. However, further analysis is required to determine the exact reason for the significant difference among the groups. This is done through an independent sample test.

Independent Sample Test

To further test the variability of respondent means between the groups, an independent sample t-test was conducted for the samples. An independent sample t-test is used to see if the means are different from each other, especially in this case where the means are from different individuals who are independent of each other.

The critical value is 0.05. In Table 2, the p value for poor documentation, poor supervision, poor performance of workers, and poor management is higher than the critical value of 0.05. Hence, the assumption of equal variance has been met. It is therefore concluded that there is no difference between respondent means. This actually justified the high levels of agreement and improvement of workmanship performance recorded in ISO-certified organizations under these factors. Furthermore, the p-value for poor communication, poor system/methodology, and poor planning is less than the critical value of 0.05. This means that the assumption of equal variance is not met and that the obtained differences in respondents’ means are likely to have occurred based on random sampling. It is concluded that there is a difference between the variances in the respondents’ means under these factors. This will suggest that respondents under these factors are not assessing accurately and they are mostly from non-ISO certified organizations. It can also be a result of a low level of ISO standard awareness or noncompliance to ISO standard quality requirements.

Table 1 ANOVA test for significance.

		Sum of squares	df	Mean square	F	Sig.
TOTAL_PC	Between groups	130.113	1	130.113	27.571	.000
	Within groups	240.679	51	4.719		
	Total	370.792	52			
TOTAL_PD	Between groups	719.724	1	719.724	82.958	.000
	Within groups	442.465	51	8.676		
	Total	1162.189	52			
TOTAL_PS	Between groups	864.232	1	864.232	30.167	.000
	Within groups	1461.051	51	28.648		
	Total	2325.283	52			
TOTAL_PM	Between groups	268.134	1	268.134	12.430	.001
	Within groups	1100.167	51	21.572		
	Total	1368.302	52			
TOTAL_PP	Between groups	706.985	1	706.985	111.183	.000
	Within groups	324.298	51	6.359		
	Total	1031.283	52			
TOTAL_PW	Between groups	2507.837	1	2507.837	332.669	.000
	Within groups	384.465	51	7.539		
	Total	2892.302	52			
TOTAL_PN	Between groups	219.774	1	219.774	16.613	.000
	Within groups	674.679	51	13.229		
	Total	894.453	52			

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DISCUSSION

According to the analysis, it was revealed that respondents from the ISO organizations indicated high levels of agreement and improvement in workmanship performance under poor communication, poor documentation, poor supervision, poor performance of workers, and poor management, while the non-ISO organization recorded high levels of agreement and improvement in workmanship performance under poor system/methodology and poor planning. This suggests that ISO certification can improve workmanship performance substantially as shown from ISO organization performance, that the organization

workmanship performances and improvement in workmanship factors are substantially correlated, and that the correlation between workmanship performance and improvement of poor workmanship factors was influenced by ISO certification. This is because ISO organization respondents are in high agreement with ISO standard assumptions and ISO standard quality requirements. These findings are quite comparable to the findings found in (Chong 2006; Abdel-razek 1998). According to (ISO 2009a), the purpose of the standard is to promote process of designing, improve workmanship quality, implementing, improving quality management system within an organization and enhance performance. Also,

Table 2 Independent sample test results.

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
TOTAL_PC	Equal variances assumed	8.219	.006	5.019	46	.000	3.9000	.77707	2.33583	5.46417
	Equal variances not assumed			8.259	41.948	.000	3.9000	.47219	2.94705	4.85295
TOTAL_PD	Equal variances assumed	.039	.845	22.961	46	.000	10.4474	.45501	9.53148	11.36325
	Equal variances not assumed			23.407	14.484	.000	10.4474	.44634	9.49305	11.40168
TOTAL_PS	Equal variances assumed	.031	.862	14.785	46	.000	12.2316	.82730	10.56632	13.89684
	Equal variances not assumed			14.190	13.428	.000	12.2316	.86199	10.37539	14.08777
TOTAL_PM	Equal variances assumed	6.382	.015	-3.763	46	.000	-6.2684	1.66598	-9.62187	-2.91497
	Equal variances not assumed			-4.807	21.628	.000	-6.2684	1.30408	-8.97562	-3.56122
TOTAL_PP	Equal variances assumed	1.556	.219	20.634	46	.000	10.1684	.49281	9.17645	11.16040
	Equal variances not assumed			17.189	11.663	.000	10.1684	.59156	8.87538	11.46146
TOTAL_PW	Equal variances assumed	3.057	.087	17.301	46	.000	17.4737	1.00998	15.44069	19.50667
	Equal variances not assumed			19.732	17.223	.000	17.4737	.88555	15.60718	19.34019
TOTAL_PN	Equal variances assumed	11.391	.002	-5.016	46	.000	-5.9158	1.17947	-8.28994	-3.54164
	Equal variances not assumed			-8.643	45.252	.000	-5.9158	.68446	-7.29414	-4.53744

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Hoang et al. (2008) identified an ISO certification technique that comprises quality control, continual improvement, quality assurance, and total quality management as a major management technique to improve workmanship performance. The research conducted by Xiande et al. (2004) indicated that the

type of quality system adopted by an organization is highly associated with organizational contextual factors, as proved in this present research. Xiande et al. (2004) further showed that there exists a relationship among quality management practices, organizational context, and business performance.

Furthermore, the analysis indicated that ISO certification could be used in an organization to improve workmanship performance through an improvement in workmanship factors. Going by the numbers of workmanship performance improvement recorded by the ISO organization in this analysis, it can be established that the organization workmanship performances and improvement in workmanship factors through ISO certification are substantially correlated. Abdel-razek and Refaat (1998) reported that improvement in the aspects of work specified in these workmanship factors should make it possible progressively to improve construction workmanship quality. In general, it can be established that ISO-certified organizations performed better in workmanship performance and improvement in workmanship factors when compared with non-ISO certified organizations. These findings are comparable to the findings found in (Chong 2006; Abdel-razek and Refaat 1998). According to Refaat (1998), an ISO-certified QMS brings about quality improvement in an organization through improved employee performance, financial standards, increased awareness, improved quality control and assurance systems, improved training methods, improved research and development, increased employee participation, and improved documentation, communication, and information systems. Finally, the analysis has indicated that ISO certification is an important workmanship improvement technique for an organization (Jay 2003; Nanda 2005). There was a direct correlation established between ISO certification, organization workmanship performance, and improvement in workmanship factors. This shows that an ISO-certified QMS can be used to improve organization competitiveness in both local and international markets. This workmanship improvement system can improve organization quality performance and eliminate all poor workmanship factors. According to Xiande, Yeungb, and Leea (2004), domestic competitive hostility has limited effects on quality management, but the impact of international competitive hostility is highly significant. International quality competition is an important contextual factor in catalyzing quality

management shifts toward a more advanced level of quality management techniques. As the international competitive hostility increases, companies tend to enhance their quality systems in terms of both infrastructure and core practices using international quality standards.

IMPLICATIONS FOR MANAGERS

The major contribution of this research to the body of knowledge and the practice of construction project management is the establishment of the extent of using ISO certification to improve workmanship performance in any organization. The study established the existence of a substantial correlation between ISO certification, workmanship performance, and improvement of workmanship factors. This workmanship improvement system through ISO certification is an effective tool to ensure effective management of construction projects, business operations, and manufacturing processes. This kind of workmanship improvement system will guide managers in identifying the nature of workmanship, defective works, and productivity problems, and finding solutions to increase the efficiency of their workforce. While the utilization of the workmanship improvement system is easily accomplished by ISO certification, the most effective results may be achieved in conjunction with experienced, skilled personnel, and the judgment of the management. Considering the competitive nature of the market and high demand for quality projects and products from consumers, governments, and corporate organizations, the system will serve as an important tool for managers to compete and remain in the market. It will enhance their organizational image, and reputation, and increase customer patronage and the quality of their work. Besides, if applied properly by managers, it will eliminate operational failures, project delays, and problems of rework, defects, and systemic factors. Furthermore, this will bring about quality workmanship on construction projects, the timely completion of projects, effective management of projects, a high level of management commitment, proper documentation of projects, improved worker's performance, adequate project

supervision, communication, and better planning. It will also eliminate the problem of excessive claims and improve the image of the organization. More importantly, improving workmanship performance with ISO certification can improve all organization activities, workmanships, and processes for improvement of products, profitability, productivity, and customer satisfaction. Therefore, this system is highly recommended for all managers.

CONCLUSIONS AND RECOMMENDATIONS

Based on the hypotheses tested, this study concluded there was a direct correlation among ISO certification, organization workmanship performance, and improvement in workmanship factors, which was very substantial. Also, the study concluded that the correlation between workmanship performance and improvement of workmanship factors was influenced by ISO certification application. There was a significant difference between the groups, and the significant difference only existed between respondents on poor planning, poor communication, and poor system/methodology due to lack of ISO certification, as most of the respondents under these three factors came from non-ISO organizations. Furthermore, the study concluded that ISO certification improved workmanship performance substantially, as confirmed by the hypotheses tested. In line with these hypotheses, substantial agreement was recorded on five factors tested compared with significant difference recorded on three factors. It was concluded that ISO 9001 certification could help organizations improve their performance by improving the poor workmanship factors in their organization with ISO certification. The hypotheses indicated that improvement in workmanship performance was recorded on five workmanship factors out of seven factors. The study further concluded that ISO 9001 certification is important to an organization because it would help to improve their workmanship performance, improve the systemic factors in their organization, and improve the organization quality substantially. Finally, it was concluded that ISO

organizations show better workmanship performance when compared to the non-ISO organizations, which was attributed to the influence of ISO certification. This research only achieves the goal of determining the extent by which ISO certification could improve workmanship performance in an organization. Based on the analysis from this research, there is still a need for further research works in some areas because of limited data, including investigation into the impacts of QMS implementation on productivity, and the effect of workmanship on productivity. There is a need to identify factors affecting the implementation of ISO QMS in construction and other notable industries in consideration of low-certified companies recorded in this study.

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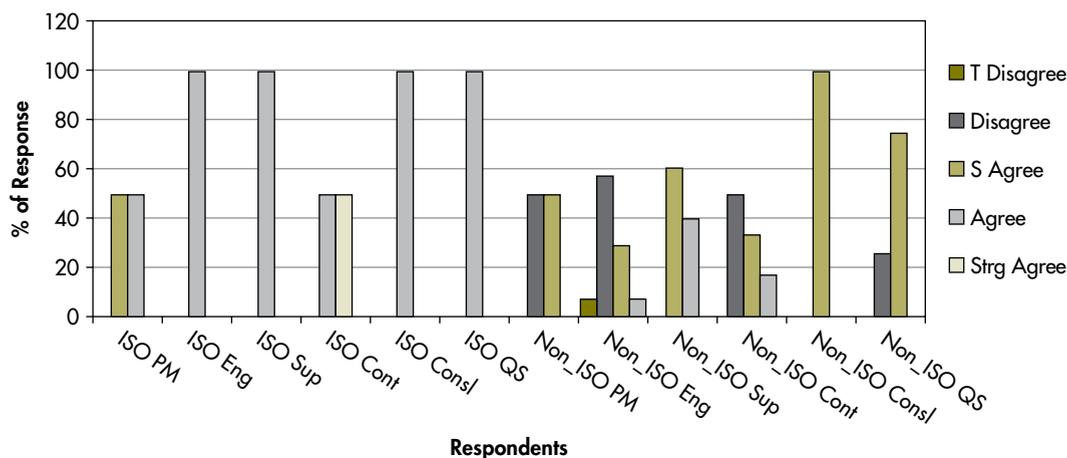
BIOGRAPHIES

Abrahams Mwasha obtained his doctorate in Wolverhampton, England, his construction management certificate at the Ardhi/Rotterdam Institute of Housing Studies, and his master's degree in civil and industrial construction in KIIKC. His research interests include sustainable construction materials and problematic soils, applications of sustainable materials in the construction industry, waste management, and renewable energy. He has published more than 20 research papers and several conference papers. He recently published a book, *The Practical Guide to Green Technology for Ground Engineering*. Mwasha was the first-prize winner of the BIZCOM social enterprise award, organized by the MERCIA Institute of Enterprise in the United Kingdom. He is also a recipient of the competitive Trinidad and Tobago Government research grant and many other research grants. Mwasha is the reviewer of many international and local journals. He is presently a lecturer in the Department of Civil and Environmental Engineering, at the University of the West Indies, Trinidad and Tobago. He can be reached at amwasha@eng.uwi.tt.

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APPENDICES

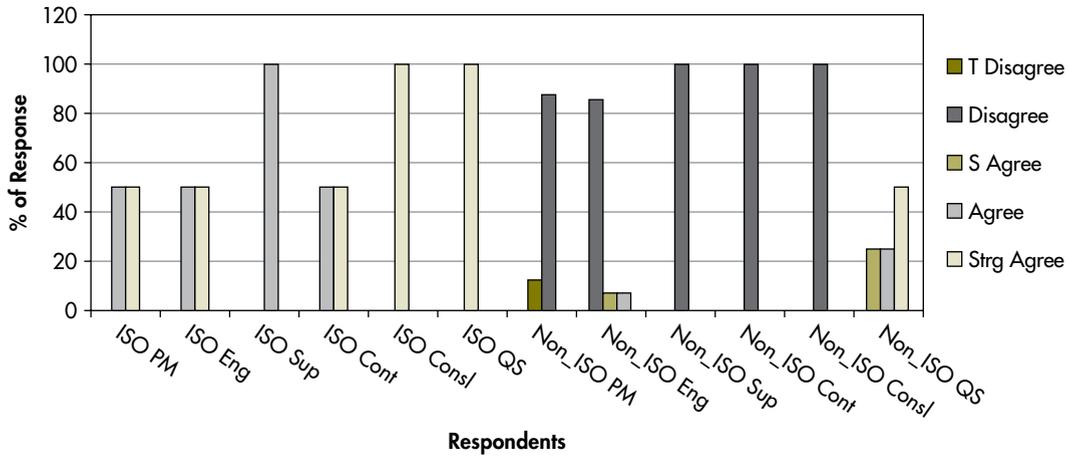
Appendix 1 Percentage of Responses on Poor Communication.



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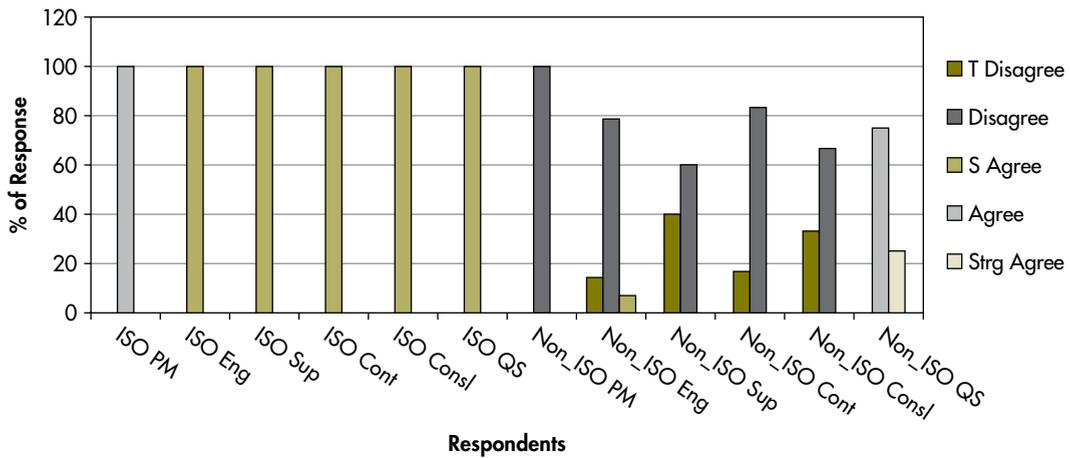
The Effects of ISO Certification on Organization Workmanship Performance

Appendix 2 Percentage of Responses on Poor Documentation.



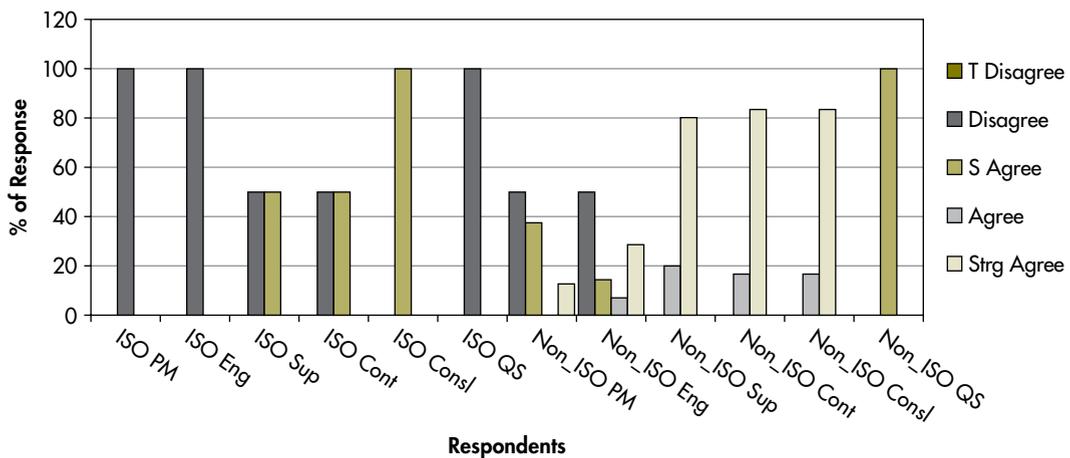
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Appendix 3 Percentage of Responses on Poor Supervision.



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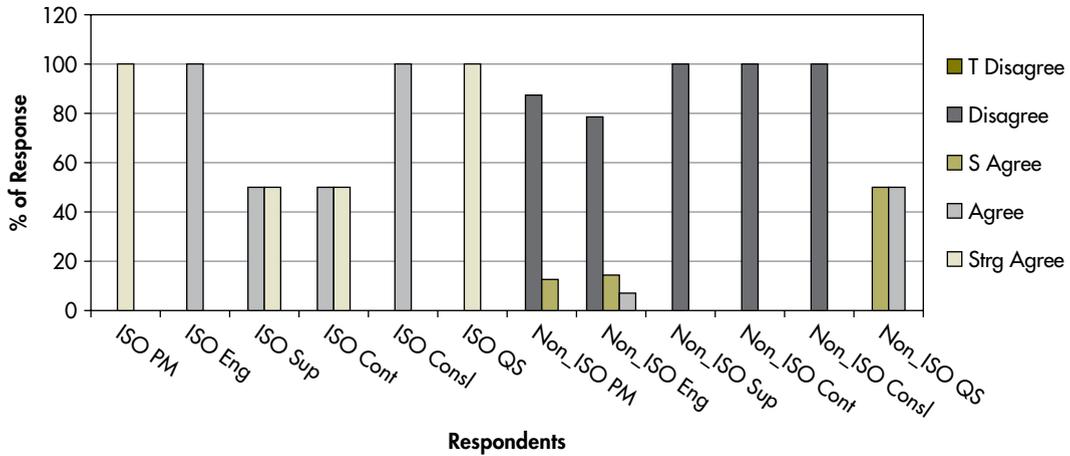
Appendix 4 Percentage of Responses on Poor System/Methodology.



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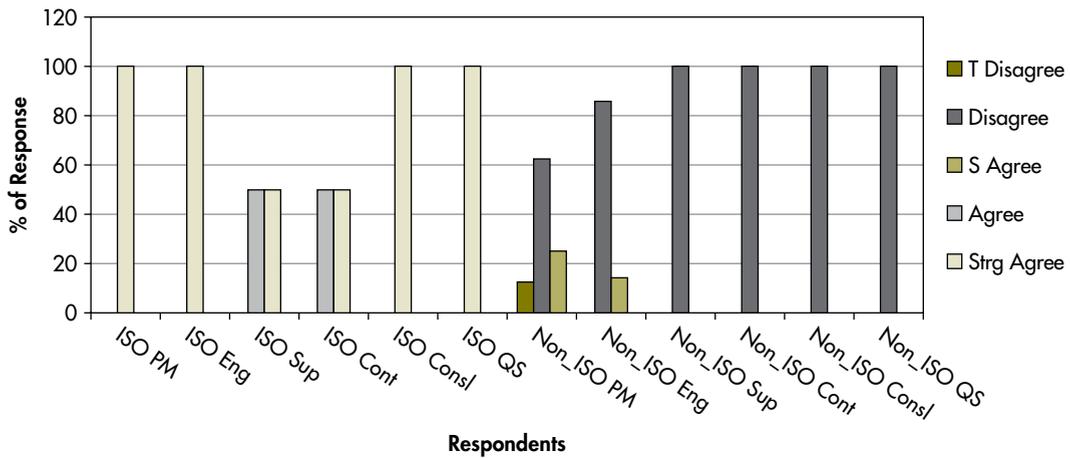
The Effects of ISO Certification on Organization Workmanship Performance

Appendix 5 Percentage of Responses on Poor Performance of worker.



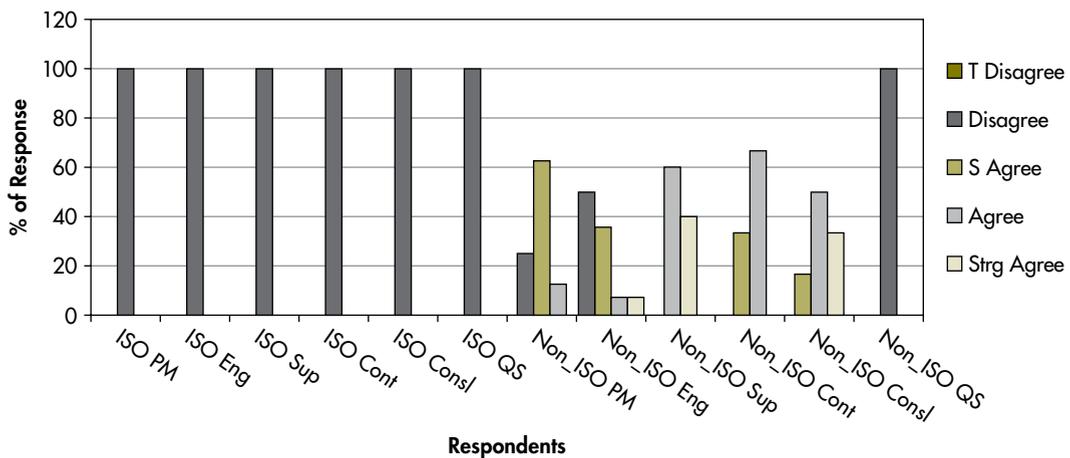
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Appendix 6 Percentage of Responses on Poor Management.



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Appendix 7 Percentage of Responses on Poor Performance Planning.



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