AUDIT PROCESS QUALITY, ITS KEY DRIVERS AND THE CLIENT'S COMPETITIVE OUTCOMES IN VOLUNTARY INDUSTRY STANDARD AUDITS:

AN EMPIRICAL STUDY OF ISO 9001 AND ISO 14001 CERTIFIED ORGANIZATIONS

(Spine title: Audit Process Quality, Its Key Drivers and Outcomes)

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ABSTRACT

Voluntary industry standards have increased in popularity due to globalization and pressures imposed by a wide variety of stakeholders. However, there have been growing concerns with the credibility of voluntary industry standards. For instance, the performance implication of prominent standards, such as ISO 9001 and ISO 14001, are at the center of the debate. Primarily focusing on the client, the organization who pursues the ISO certification, previous studies pay little attention to the auditor, the knowledgeable professional in the certification process. To address the missing link, this study focuses on how the audit process quality is assessed, the effect of the auditor's knowledge-based resources on the audit process quality, and the effect of the audit process quality on the client's competitive outcomes and client satisfaction.

Building on extant literature, this study hypothesizes that audit process quality is a multistage, multidimensional construct. I further hypothesize that the auditor's knowledge-based resources are positively related to audit process quality; and audit process quality is positively related to the client's competitive outcomes and client satisfaction.

The developed hypotheses are tested using Structural Equation Modeling (SEM) based on the data collected from 204 managers at ISO certified plants in Canada and U.S. Two approaches are used to test potential non-response bias: compare early and late responses in the planned survey; conduct a one-page follow-up survey after the planned survey, then compare the responses collected from the planned survey and those collected from the follow-up survey for non-respondents. No significant difference is found. Construct validity is supported by reliability assessment and factor analysis results.

The results reveal that audit process quality is multistage: stage-one audit process quality associated with the first readiness review stage; stage-two audit process quality associated with the second on-site certification audit stage. While stage-one audit process quality is assessed by efficiency measures related to time and cost, stage-two audit process quality is multidimensional, reflecting the auditor's reliability, responsiveness, assurance, empathy and efficiency perceived by the client. I found that communication is positively related to stage-one process quality while the auditor's human capital and structural capital are not significant factors. Surprisingly, cooperation is negatively related to stage-one audit process quality. Human capital, communication and cooperation are found to be positively related to stage-two audit process quality. Stage-two audit process quality is found to be positively related to the client's competitive outcomes and client satisfaction while stage-one audit process quality has no direct effects.

Keywords: Knowledge-based Resources, Audit Process Quality, the Client's Competitive Outcomes, Client Satisfaction, Structural Equation Modeling, Survey

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

1.1 The Diffusion of Voluntary Industry Standards

While regulatory standards have been served as the primary means to monitor and control firms' behavior, voluntary industry standards have started to gain momentum due to globalization and pressures imposed by a wide variety of stakeholders (Christmann and Taylor, 2006). In global markets, buying firms and consumers need to obtain credible information to ensure that they purchase quality products or services from responsible suppliers which operate under different national government regulations. There is increasing awareness among government agencies, NGOs, environmental activists and local communities on the environmental impact of economic activities of business organizations (Poksinska et al., 2003). By providing a potential governance mechanism for firm self-regulation in the global economy, voluntary industry standards can reduce the buying firm's costs for supplier selection and monitoring, thereby effectively addressing stakeholder concerns.

Numerous voluntary industry standards have been developed by international, regional or national standard organizations. Many of these industry standards have gained international recognition. Business organizations worldwide have increasingly adopted prominent standards, such as ISO 9001 and ISO 14001. The number of ISO 9001 certification have surged dramatically, increasing from 44,388 in 2001 to 897,866 by 2006, as shown in Figure 1-1. The number of ISO 14001 certifications have more than tripled during the past six years, rising from 36,464 in 2001 to 129,199 by the end of 2006, as shown in Figure 1-2 (ISO Survey, 2006).

Figure 1-1: Number of ISO 9001 Certificates from 2001 to 2006

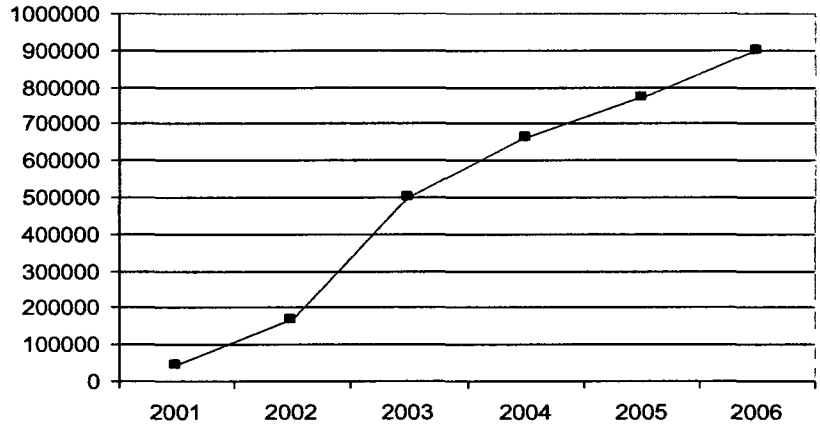
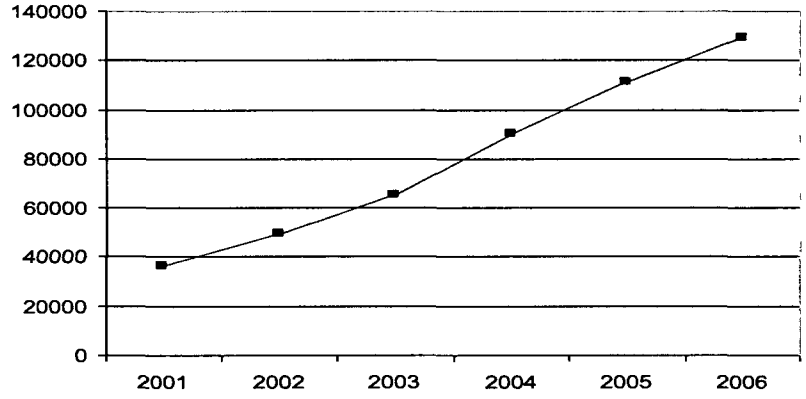


Figure 1-2: Number of ISO 14001 Certificates from 2001 to 2006



1.2 Benefits and Concerns with the Effectiveness of ISO Certification

The acclaimed benefits of ISO management system certification include improved operational efficiency, economic benefits and strategic advantages. Some certified companies reported that their operational efficiency has increased due to the process streamlining, lead time reduction and product quality improvement (Sroufe, 2003). Economic benefits resulting from ISO certification involve cost savings, international market access and enhanced financing opportunities (Briggs, 2006). More importantly, the strategic advantages gained from ISO certification help to attract more organizations to "the ISO club." Reported benefits include improved competitive positioning, enhanced

company reputation, and enhanced corporate image among stakeholders, such as the regulators, customers and the public (Berthelot et al., 2003).

Despite all the applause and enthusiasm towards ISO certification, many studies of the performance outcomes of certified organizations question the credibility of the certification. Some researchers found there is no significant performance difference between ISO certified firms and non-certified firms (Andrews et al., 2003; Vastag and Melnyk, 2002). In the case of ISO 14001, ISO certification and implementation costs outweigh the cost savings resulted from the EMS (Andrews et al., 2003).

1.3 The Missing Link of Audit Process Quality

Compliance with voluntary industry standards are typically verified through a certification audit (King et al., 2005). For instance, the ISO standard audit is conducted independently by the ISO certification or registration bodies. The auditor and the client who pursue the certification are the two principal players in the audit process. Each party has a role to enact when they interact during the audit process (Cahill and Woollard, 1997). Therefore, factors related to both parties will contribute to the client's competitive outcomes. However, previous research has primarily focused on the role of the client. The role of the auditor, the knowledgeable professional in relation to the client's competitive outcomes remains unclear.

The credibility of ISO certification depends on not only the efforts of the client but also the quality audit conducted by the auditor (Ammenberg et al., 2000). Without substantive implementation of the standards in the client, ISO certification tends to only create a "paper management system" that focuses on a bureaucratic exercise. "Daily practices remain somewhat decoupled from the prescriptions of the ISO standards."

(Morrison et al., 2000; Boiral, 2007). From the auditor's perspective, the question becomes how is the audit process quality evaluated and what can the auditor do to deliver high quality service in the audit process in order to help the client achieve beneficial outcomes?

In this study, ISO 9001 and ISO 14001 certification audit are considered representative of the audits for voluntary industry standards, because they are the most adopted and internationally recognized standards, and because their audit processes are typical among voluntary standards audits in terms of the key players and the audit process. The audit process for ISO certification is briefly introduced in the following section.

1.4 The Process of ISO Management System Audit

An *audit* is a systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled (ISO 19011 auditing guidelines, 2002). A close look at the ISO management system certification process shows that the audit plays a pivotal role in delivering effective and credible certification. Although it undertakes the task of standard development, ISO does not issue certificates to other organizations. The *International Accreditation Forum (IAF)*, an international association of Conformity Assessment Accreditation Bodies, ensures the competence of accreditation bodies functioning in individual countries, and establishes *mutual recognition arrangements (MRA)* among different countries. According to the governance mechanism, *national accreditation bodies* audited by IAF, are in charge of accrediting and approving an organization as competent to carry out ISO management system certification. These accredited

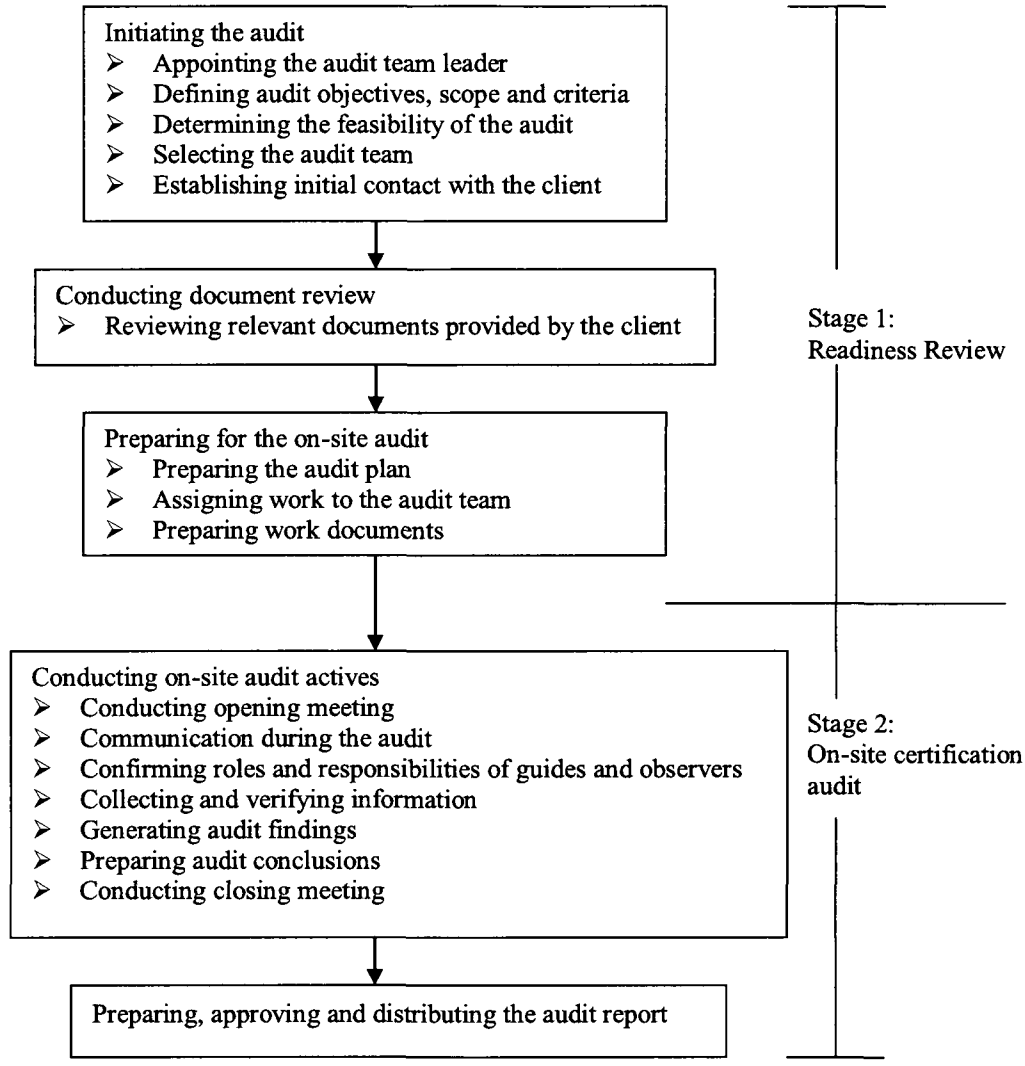
organizations, named *certification or registration bodies*, grant written assurance of the management system which conforms to ISO standard requirements based on audit reports resulted from auditing *the clients*, who are pursuing ISO certification. In the certification process, the client is responsible for the design, development and implementation of the management system according to the ISO standards. In the hierarchy of ISO certification, only the auditors in the certification bodies have direct contacts and interactions with the clients. Therefore, the quality of the audit service, to a great extent, is determined by the knowledge and skills of the auditor and the relationship between the auditors and their clients fostered through the service encounter (Chase, 1981).

To explore the means to improve the quality of the audit service, this research focuses on the behaviors of the auditors and the clients when they meet and interact through the ISO audit process. In practice, the ISO audit is typically conducted by a two-stage approach: stage one, the readiness review stage, which assesses the existence and completion of the documentation, and stage two, the on-site certification audit, which assesses the overall conformance to the standards. The major activities involved in the two stages (ISO 19011:2002) are illustrated in Figure 1-3.

1.5 Research Focus, Objectives and Research Questions

This study focuses on identifying the key attributes of the audit process quality associated with voluntary industry standards. More importantly, the goal is to explore the key drivers for audit process quality and the influence of audit process quality on the client's competitive outcomes and client satisfaction. Audit practices for the popular voluntary standards of ISO 9001 and ISO 14001 were chosen as the business settings for this study. This study should provide important implications for the auditor.

Figure 1-3: ISO Management System Certification Process: Two-Stage Approach



The quality of the audit service, termed as *audit process quality*, has received extensive attention in accounting research. However, in this study, the subject of interest is the quality of management system audit, which is different from the quality of financial audit studied in the accounting literature. The term "audit process quality" will be used in reference to ISO management system audit process quality, rather than financial audit process quality, throughout the remainder of this study.

The needs for assessing and improving audit process quality become increasingly important as the international popularity of ISO standards continues to grow. On one hand, the auditor relies on high quality audits to win more business form current and potential clients. On the other hand, the organization pursuing ISO certification needs to make decisions on selecting auditors or repurchasing the service based on audit process quality. More importantly, stakeholders who are influenced by the output of the certified management system need to gain confidence on the certification based on the audit process quality. Accreditation bodies need to assess audit process quality in order to maintain the credibility of the certification.

Despite the needs for assessing the audit process quality, research on the subject is rather sparse. Such drawbacks can be attributed to a number of challenges posed on measuring audit process quality. First, for the client, the quality of the management system audit, one type of credence-based service, is costly and difficult to evaluate even after purchase and consumption (Darby and Karni, 1973; Nelson, 1970). Second, the client may lack the technical expertise or the means to make a reliable assessment on the audit process quality (Darby and Karni, 1973). Third, the client's competitive outcomes are ambiguous because ISO standards focus on the process and system rather than the performance outcome (Affisco et al., 1997). After being certified, the outcomes of the audit may take a long time to be realized and verified (Sharma and Patterson, 1999).

When assessing the effectiveness of adopting a voluntary industry standard, audit process quality appears to be an important factor that is frequently overlooked. In the case of adopting ISO 9001 or ISO 14001 standards, previous studies have provided rich insights on the motivations for adopting the standards (Delmas, 2001; Melnyk et al.,

2003; Jiang and Bansal, 2003), the amount of resources that are necessary to successfully implement the standard (Douglas and Judge, 2001; Hendricks and Singhal, 2001), and the effect of the standard adoption on the organization's performance (Anderson et al., 1999; Corbett et al., 2005; Morris, 2006). The research attention on the resources associated with the auditor, the other critical player of the certification process, has been limited. This limitation may contribute to the controversy raised from the performance implications of the ISO certification.

The ISO management system audit is a professional service characterized by a high degree of client contact. As shown in the audit process in Figure 1-3, the service encounter through the on-site certification audit plays an important role in improving audit process quality. The service quality perceived by the clients is primarily dependent upon the interaction (e.g., "the moment of truth") between the service provider and the service receiver in the service encounter (Chase et al., 1998; Roth and Menor, 2003). Research on the auditor's knowledge-based resources of may shed light on the effective means of improving audit process quality, which may in turn influence the outcome of the ISO certification audit.

When examining the performance implication of ISO standard certification, previous research has assessed financial performance, operational performance and environmental performance (ISO 14001) (Corbett et al., 2005; Andrews, 2003). Client satisfaction as part of the result of the certification has not been examined. It seems that the satisfaction of the client is not as important as the outcome of the certification audit, as the effectiveness of the certification is primarily dependent on the financial or operational benefits from the certification. However, client satisfaction means a great

deal to the auditor who must win over future clients in today's competitive business environment. Investigating the effect of audit process quality on client satisfaction can provide managerial insights to the auditor.

The auditor's knowledge-based resources fit nicely in the intellectual capital framework developed by Stewart (2001), which describes that a company's intellectual capital consists of three elements: human capital (knowledge and skills of people), structural capital (processes, documents, methodologies, software and other knowledge artifacts) and client relationship. The link between the knowledge-based resources of the auditor and the audit process quality, as well as the effect of audit process quality on the client's competitive outcomes and client satisfaction will be assessed on the grounds of knowledge-based view theory (KBV). Specifically, the human capital, the structural capital and the client relationship of the auditor were proposed to affect the audit process quality. It is further proposed that the audit process quality has positive effect on the client's competitive outcome and client satisfaction.

Credible certification can be viewed by the buying firm as a reliable indicator for high quality performance or excellent environmental performance. This study investigates how to enhance the credibility of ISO certification through high quality audit service. Specifically, this study attempts to investigate the following research questions:

1) How is audit process quality assessed for a voluntary standard?

2) Does the client's perception of the knowledge-based resources of the auditor affect audit process quality?

3) Does the audit process quality influence the client's competitive outcomes?

4) Does the audit process quality influence client satisfaction?

1.6 Dissertation Overview

The purpose of this dissertation research is to investigate the effect of the knowledge-based resources of the auditor on the audit process quality, and the effect of the audit process quality on the client's competitive outcomes and client satisfaction.

The audit process quality construct is viewed as being multistage and multidimensional. The multistage audit process quality includes stage-one audit process quality associated with the readiness review stage, and stage-two audit process quality associated with the on-site certification stage during the ISO certification process. While stage-one audit process quality is measured by manifest variables, stage-two audit process quality is developed to be a multidimensional second-order factor, reflecting first-order factors including reliability, responsiveness, assurance, empathy and efficiency as perceived by the client. It is proposed that stage-one audit process quality will positively influence stage-two audit process quality.

Based on the literature review and the preliminary study, a conceptual model was developed, linking the auditor's knowledge-based resources to the audit process quality. In addition, the audit process quality was proposed to positively influence the client's competitive outcomes and client satisfaction. Built on the intellectual capital framework in Stewart (2001), four components of the auditor's knowledge-based resources include human capital, structural capital, communication and cooperation between the auditor and the client to reflect client capital. Knowledge-based view (KBV) theory is introduced as the theoretical foundation for developing the structural relationships between knowledge-based resources, audit process quality, the client's competitive outcomes and client satisfaction. The hypothesized relationships are tested using structural modeling

based on data collected from 204 ISO 9001 and ISO 14001 certified plants in Canada and U.S.

There are four principal findings.

1) The audit process quality is a multistage multidimensional construct. To adequately assess the service quality of ISO certification audit, the quality features related to stage-one readiness review and stage-two on-site certification audit should be examined. Since the stage-two audit requires intensive service encounter, the audit process quality of this stage involves both perceptual and technical quality measures: reliability, responsiveness, assurance, empathy and efficiency. The stage-one audit has positive influence on stage-two audit process quality.

2) The relationship between the auditor's knowledge-based resources and the audit process quality yielded mixed results. Human capital, which represents the knowledge, skills and competence of the auditor does not have a significant impact on stage-one audit process quality, but appears to be a significant resource for delivering a high quality audit service in stage two, with the on-site certification audit. Surprisingly, structural capital was not found to be a significant resource for the audit process quality associated with each stage of the audit. As part of the client relationship, communication was found to be significantly related to both stage-one and stage-two audit process quality. Interestingly, cooperation was found to be negatively related to stage-one audit process quality, while being positively related to stage-two audit process quality.

3) Stage-two audit process quality was found to be positively related to the client's competitive outcomes. However, stage-one audit process quality is not significantly related to the client's competitive outcomes.

4) Stage-two audit process quality was found to be positively related to client satisfaction. However, stage-one audit process quality is not significantly related to client satisfaction.

This dissertation contains seven chapters. The research motivation, the purpose of the research and the research questions are introduced in chapter one. In chapter two, the literature is reviewed, and key constructs are defined and discussed based on the review of relevant literature. The need for the research is identified in relation to the development of a conceptual framework which identifies the key drivers for quality service encounters. In chapter three, the hypotheses are developed. The auditor's knowledge-based resources are proposed as the key drivers for the audit process quality. The audit process quality is proposed to influence the client's competitive outcomes and client satisfaction. The research methodology is presented in chapter four. Description of the survey results, data examination, and construct validation are reported in chapter five. The hypothesis testing results and a discussion of the theoretical and managerial implications related to the research findings are summarized in chapter six. The dissertation concludes with the contributions and limitations of the study in chapter seven.

CHAPTER 2: LITERATURE REVIEW

2.1 Chapter Preview

Relevant literature will be reviewed in this chapter. ISO 9001- and ISO 14001-certification are considered to represent the typical business context for a voluntary industry standard audit because they are the most adopted and recognized voluntary standards worldwide.

This dissertation research focuses on the factors related to the auditor in the certification process. Specifically, the interests center on how audit process quality is evaluated, the impact of the auditor's knowledge-based resources on audit process quality and how audit process quality contributes to the client's competitive outcomes and client satisfaction. Accordingly, the following literature review will focus on audit process quality, knowledge-based resources and the client's competitive outcomes and client satisfaction, shown as the highlighted areas in Figure 2-1.

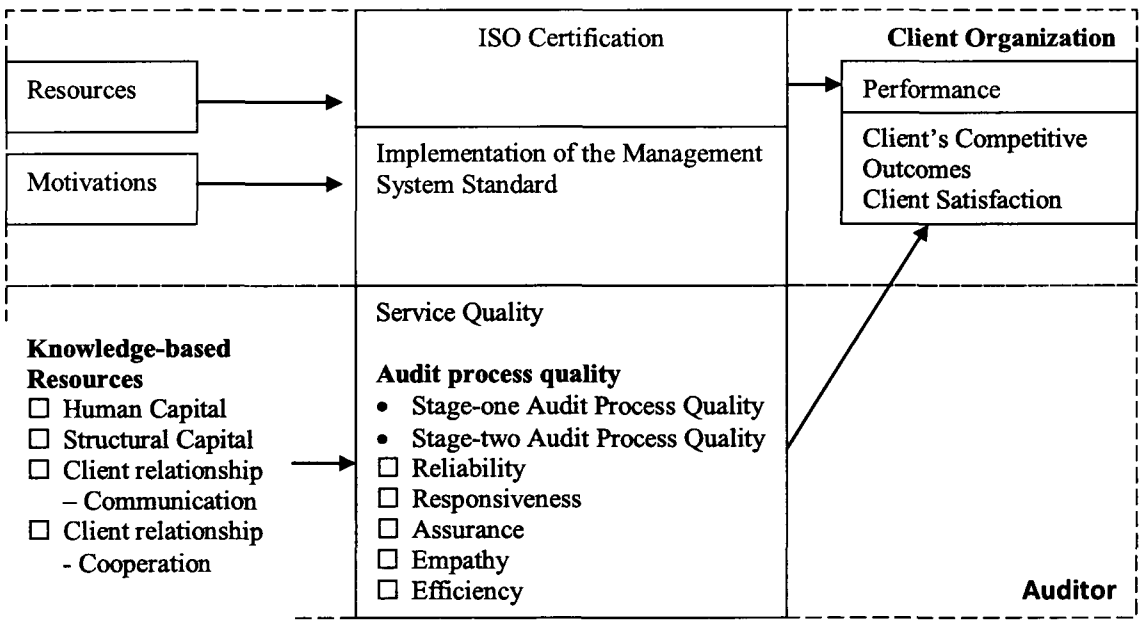
An ISO management system audit can be viewed as one type of professional service. Although there is a lack of research in this area, audit process quality can find its roots in service quality research; therefore, review of the audit process quality literature starts with a review of the service quality literature, followed by a closer look at professional service quality and financial audit. The components of audit process quality will be established and developed based on these foundations.

Due to the knowledge-intensive nature of the ISO certification process, the knowledge-based view (KBV) theory appears to be a solid theoretical ground for identifying the knowledge-based resources that influence audit process quality.

Moreover, the knowledge-based resources of the auditor can be classified based on Stewart's (2003) framework; therefore, review of the knowledge-based resource literature begins with a review of the KBV theory and Stewart's intellectual capital framework. After this review, research on the human capital, structural capital and client relationship involved in the ISO certification process is examined.

The third part of the review focuses on the client's competitive outcomes and client satisfaction. The client's competitive outcomes are the center of attention for both the client and the auditor: client satisfaction is critical to the auditor's business success. Survey research on performance after ISO certification, case studies on the benefits of the certification and research on customer satisfaction are reviewed.

Figure 2-1: Focus of the Literature Review



2.2 Audit process quality

The ISO management system audit can be classified as one type of service in Schmenner's (1986) framework, in which services are divided into four groups: service factory, service shop, mass service and professional service, based on labor intensity and

customer contact/the degree of customization. Labor intensity is defined as the ratio of labor costs incurred to the value of the plant and equipment, while customer contact/customization indicates the degree to which the customer interacts with the service process and the degree to which the service is customized to the customer's needs (Schmenner, 1986).

The audit service is a highly labor-intensive service business in the sense that it involves relatively little plant and equipment cost, but considerable labor time on behalf of the auditor: during the on-site certification audit process, the prominent method of acquiring audit evidence is through interviews and communication with shop floor workers and the middle and top management (Davies and Webber, 1998). Due to the uniqueness of the industry in which the client organization specializes in and its various management systems, it is imperative that the audit service is highly customized to the client's needs. In sum, the high labor intensity and interaction between the auditor and the client signify that audit service is a professional service which is provided by qualified professionals with a substantial fund of specific knowledge (Gummesson, 1978); therefore, previous research on service quality can shed light on the investigation of audit process quality.

Most of the existing research on audit process quality focuses on the quality of financial audits, which is different from the subject of interest in this research: ISO management system audits. Although both type of audits obtain audit evidence and evaluate it objectively to determine the extent to which the audit criteria are fulfilled, management system audits differ from financial audits in terms of their tasks, objectives, nature of audit evidence, evidence collecting method and the audit governance

mechanism (Carcello et al., 1992; Frances 2004; Russell 2006). The detailed differences between management system audits and financial audits are shown in Table 2-1.

Financial auditing is the process by which a competent and independent individual accumulates and evaluates evidence concerning financial statements prepared by a specific economic entity, for the purpose of determining and reporting upon the degree of correspondence between the quantifiable financial information and the established accounting criteria (Lemon et al., 1997). In contrast to the voluntary nature of ISO management system audits, financial audits are highly regulated and controlled by Generally Accepted Auditing Standards (GAAS). While financial auditors deal with quantifiable information, a management system auditor has to collect and verify large amounts of information that may not be quantified; for instance, the auditor needs to verify that the quality assurance program has been developed and implemented in conformance with the prescribed ISO 9001 standards. As a result, the assessment of financial audit process quality may not apply to the evaluation of management system audits; however, as one type of professional service, the investigation of management system audit process quality can be rooted in professional service quality and the extensive research studies on service quality in general.

2.2.1 Service Quality

Definitions of service quality focus on meeting customers' needs and requirements and how well the service delivered matches customers' expectations (Lewis and Booms, 1983). Service quality has been shown to promote customer loyalty and retention (Imrie et al., 2000), which is important to any service provider. Previous research on service

Table 2-1: Differences between ISO Management System Audit and Financial Audit

	ISO Management System Audit	Financial Audit
Task	To determine whether the client's management system conforms with the ISO management system standards	To determine the association between the auditee's financial statement and generally accepted accounting criteria
Objectives	Customized to the client's (auditee) needs; e.g. to meet requirements for certification to ISO standards; to meet regulatory or contractual requirements; to improve the client's management system performance	To prevent and detect fraud To protect the investors
Certification Requirements for auditors	Not mandatory e.g. Certified Environmental Management System Auditor (Canada) Pass a supplementary exam administered by Canadian Environmental Certification Approvals Board (CECAB); Meet the education, experience, and training requirements prescribed by CECAB;	Mandatory e.g. CPA (U.S.) Pass Uniform Certified Public Accountant Examination; Meet other requirements imposed by state laws
Audit Evidence	Internal (within the client) May not be quantifiable	Internal (within the client) External (e.g. confirmation of accounts receivable with debtors) Quantifiable
Internal (the client) knowledge & expertise regarding the audit	Few quality or environmental experts in the client	Lots of accountants in the client
Evidence Collection Method	Focus on interview, on-site visit and observation	Focus on document review
Frequency	One time for certification audit Surveillance audit three years after the certification audit	Annually
Audit Governance mechanism	Voluntary No central authorities The auditor holds no liability	Well-regulated Controlled by central authorities The auditor holds liability for malpractice
Ambiguity regarding defining good practice	Difficult to detect Quality and outcomes of the audit are difficult to measure or may take very long time to be realized.	Easy to detect The revealing of the financial problems faced by the client (such as filing for bankruptcy) shows as an evidence that the auditor failed to detect false or missing information in the financial statement of the client.

quality in regards to audit has primarily focused on financial audit, rather than ISO management system audit.

A number of studies have focused on the attributes or dimensions of service quality (Cronin and Taylor, 1992; Grönroos, 1982; Parasuraman et al., 1985, 1988): these studies generally agree that service quality is a multi-dimensional or multi-attribute construct. Influential studies on the attributes of service quality have been summarized in Table 2-2. Grönroos (1982) notes that the quality of a service as perceived by customers has two dimensions: the outcome dimension, concerning quality of results, and the process dimension, concerning quality of process. While the quality of results is associated with the results that customers want, quality of process relates to the process customers have to put themselves through to achieve the expected results (Lehtinen and Lehtinen, 1982; Baker and Lamb, 1993).

The attributes of service quality can also be classified into technical quality versus functional quality, based on whether the service provided meets service specifications and customer expectations (Maddox, 1981; Teas, 1993). What the customer is actually left with after the service, termed as technical service, is a necessary — but not always sufficient — condition to achieve customer satisfaction and overall service quality. Functional service, which involves how services are received by customers in relation to various personnel, resources and activities of the service provider during the service delivery, is another determining factor in achieving overall service excellence (Kettinger and Lee, 1994).

Table 2-2: Attributes of Service Quality

References	Aspects of Service Quality	Definition
(Gronroos, 1982, 1990; Lehtinen and Lehtinen, 1982; Baker and Lamb, 1993)	quality of results	the ability of the service provider to deliver the results customers want time after time, without unpleasant surprise
	quality of process	concerned with everything that has to be done to obtain the results customers want
(Maddox, 1981; Teas 1994; Kettinger and Lee, 1994)	technical quality	what the customer is actually left with after the service is delivered
	functional quality	corresponds with the expressive performance of the service and how service are received by customers in relation to various personnel, resources and activities of the service provider
(Lehtinen and Lehtinen, 1991)	physical quality	service related to products or supports (physical instrument and environment)
	interactive quality	related to the interaction between the customer and the service provider
	corporate quality	symbolic in nature; concerns how customers and potential customers see the corporate entity, its image or profile
(Parasuraman et al., 1991; Harvey, 1998; Cronin and Taylor, 1992, 1994)	perceptual quality	It's in the eyes of beholders; determined by customer perceptions: empathy, responsiveness, assurance etc.
	technical quality	whether the service provided adheres to specifications, standards
(Darby and Karni, 1973;Nelson 1974; Beattie 1982; Maute and Forrester 1991)	search quality	aspects of the product or service that customers can evaluate before making the purchasing
	experience quality	attributes that can be evaluated only after the consumption
	credence quality	attributes that can only be evaluated after extensive product or service usage or can never be verified by the average consumer, not even after purchase and consumption

Viewing service quality from operational and strategic perspectives, Lehtinen and Lehtinen (1991) make a distinction between physical quality, interactive quality and corporate quality. On the operational level, originating in the physical elements of service, physical quality is related to physical products, instruments and the environment needed in a service production process. Interactive quality relates to the interaction and communication between the customer and the service provider. On the strategic level, corporate quality concerns the long-term development of the service provider: it relates to

how customers and potential customers perceive the corporate entity (i.e. its image or profile) (Lehtinen and Lehtinen, 1991). Functional service, which involves how services are received by customers in relation to various personnel, resources, and activities of the service provider during the service delivery, is another determining factor for achieving overall service excellence (Kettinger and Lee, 1994).

Due to the highly intangible nature of service, the perceptual and objective attributes become complementary in assessing the quality of service. Perceptual quality is in the eye of the beholder (customers), and is thus determined by customer perceptions. Research on the conceptualization of service quality has its roots in expectancy disconfirmation theory: many early marketing researchers adopted this theory as the foundation for measuring service quality (Grönroos 1982, 1984; Parasuraman et al., 1985, 1988). SERVQUAL, one of the influential service quality models created by Parasuraman, Zeithaml, and Berry (1985, 1988), measured service quality using the expectancy disconfirmation framework on five dimensions: tangibles, responsiveness, reliability, assurance and empathy. The detailed definitions of each service quality dimension are listed in Table 2-3.

Table 2-3: Service Quality Dimensions (Parasuraman et al., 1985, 1988)

Reliability	the ability to perform service as promised, both dependably and accurately
Responsiveness	willingness to help customers promptly
Assurance	knowledge and courtesy of employees, as well as their ability to convey trust
Empathy	caring and individualized attention
Tangibles	the appearance of physical facilities, equipment, and personnel, as well as other factors affecting the senses such as noise and temperature

The SERVQUAL model has come under extensive criticism because of the difficulty in replicating its dimensions (Babakus and Boller 1992; Cronin and Taylor

1992); in addition, Cronin and Taylor (1992) maintain that expectations are not necessary in the measurement of service quality, thus conceptualizing their own model (called SERVPERF) using customers' perceptions. Complementary to the perceptual quality, objective quality assesses whether the service provided adheres to specifications and technical standards (Harvey, 1998). This aspect of service quality is similar to the technical quality previously discussed.

The information economic theory of search, experience and credence qualities (Darby and Karni, 1973; Nelson, 1974) proposes that attributes can be of three types: search attributes, which refer to qualities that can be evaluated prior to purchase; experience attributes that can be evaluated only after consumption; credence attributes that can only be evaluated after extensive product usage, if at all (Darby and Karni, 1973; Maute and Forrester, 1991). Thus, search, experience and credence qualities reflect the level of ease in evaluating attributes at different points in the consumer's decision process (Darby and Karni, 1973; Maute and Forrester, 1991).

Compared to search and experience qualities, credence attributes are costly or difficult to evaluate even after purchase and consumption (Darby and Karni, 1973; Nelson, 1970) and have a higher level of predictive value than search and experience attributes (Becker, 2000); for example, these attributes may include the degree of service professionalism, level of care or extent of knowledge possessed by the service provider (Brush and Artz, 1999). As the long-term consequences of credence attributes are only known in the course of time (Brush and Artz, 1999), the customer's ability to evaluate credence attributes increases with the accumulation of experience, primarily because product familiarity results in increased customer expertise (Alba and Hutchinson, 1987;

Beattie and Fearnley, 1995). As a result of experience, experts possess knowledge that can be used to evaluate these more complex attributes, though credence attributes may never be fully evaluable (Johnson and Russo, 1981).

In this study, the perceptual versus technical quality framework is adopted to classify the attributes of audit process quality due to the following considerations: on one hand, audit process quality perceived by the client is the focus of interest for the auditor; on the other hand, technical audit process quality reflected by management system performance is a central concern of the client organization.

2.2.2 Professional Service Quality

Professional services are commonly portrayed as a subcategory within the service industry: they represent the most intangible services, where service production involves extensive customer contact and a high degree of individual judgment on the part of the service provider (Lovelock, 1983; Schmenner, 1986; Clemes et al., 2000; Verma, 2000). Professional services are commonly associated with characteristics such as specialist knowledge (competence), autonomy (independence), self-regulation and a high degree of customer participation and customization (Hill and Neeley, 1988; Hausman, 2003).

A professional's qualifications are often based on education, experience and special skills, whereas knowledge is often concentrated within a narrow area. Knowledge refers to "an intellectual discipline capable of formulation on theory . . . requiring a good educational background and testing by examinations" (Wilson, 1972). Some standard of intellectual training is an essential element of professional competence (Haywood-Farmer and Stuart, 1988).

Independence, a critical facet of the code of ethics, is centrally connected to professional service, which regulates the service provider's line of action. Officially written or loosely established through tradition, a code of ethics is one of the prominent characteristics of professional service (Greenwood, 1957; Bloom, 1984). Self-regulation in professional service is often administered through professional association. Formed by the professionals themselves, these associations typically certify the practitioners, supervise them and set ethical rules (Maanen and Barley, 1984). Professional association represents the members of the profession, particularly those in private practice, and assumes the responsibilities of safeguarding and developing its expertise and standards (Wilson, 1972).

A high degree of customer participation is another commonly-accepted characteristic of professional services (Larsson and Bowen, 1989; Hausman, 2003). Customer participation is often defined in the literature as the input provided by the client for the service production and/or delivery; customers contribute the required "raw material" to the work flow of the service organization (Mills et al., 1983).

Due to its unique characteristics, professional service is considered a credence-dominant service by economists (Bloom, 1984). Assessing professional service quality is difficult and complex, even after consumption (Gummesson, 1978). It is often difficult for the client to evaluate the professional service quality that they receive for three reasons: firstly, the technical outcome of a professional service is not immediately detectable in many situations (Sharma and Patterson, 1999); secondly, the client may not have the knowledge and expertise to assess the technical outcome of a professional

service (Stewart et al., 1998); thirdly, due to performance ambiguity, the client may not be able to evaluate the outcome of a professional service (Powpaka, 1996).

2.2.3 Stage-One Audit Process Quality

In the stage-one readiness review, the auditors conduct a preliminary assessment; for instance, in ISO 9001 audits, the assessment involves reviewing the auditee's quality documentation, which includes the quality manual and other supporting materials (ISO 19001 Auditing Guideline). This evaluation determines if the auditee's quality documentation satisfies the prescribed standards. If the auditors believe that something is missing, or an ISO 9001 element is not addressed, the auditor informs the auditee and waits until the item has been addressed before conducting the on-site certification audit.

Due to time constraint and resource limitation in stage-one, the clients expect the auditor to complete the document review as early as possible and with the proposed budget. Additionally, the client's readiness for the next stage of audit relies on the thoroughness of the document review: namely, the auditor needs to ensure that the client's management system documents, records and supporting materials are thoroughly reviewed. This process ensures that no important document is missing when the client is examined under the ISO standards. The readiness review process can be viewed as a project with the aim of completing the entire project using the minimum time span and budget (Patterson, 1973).

Preliminary study (described in detail in Chapter Four methodology) conducted with the auditors and clients further reveals that stage once was generally viewed as the pre-audit stage, focusing on the document review with limited interactions between the auditor and the client. Stage-one audit approximately accounts for 10% of the total ISO

certification audit cost according to the interviewed industry experts. Generally, total cost of certification includes application fee, audit fee, special audit fee (if needed), registration fee and ssurveillance fee. Application fee may range from $500 to $3000 depending on the size the scope of the client's operation. Stage-one audit is usually covered by the application fee. Because of the limited auditor-client interaction and the technical nature of stage-one audit, it is evaluated based on efficiency measures.

2.2.4 Stage-Two Audit Process Quality

2.2.4.1 Perceptual Quality

Rooted in service quality studies, perceptual quality of the audit involves the attributes that can only be ascertained after the audit service delivery process. Perceptual audit process quality reflects reliability, responsiveness, assurance and empathy (Zeithaml et al., 1990) perceived by the client. It should be noted that tangibles, one dimension of service quality presented in the SERVQUAL model (Parasuraman et al., 1985, 1988) are not included in the audit experience quality: this is because tangibles, which include the appearance of physical facilities, equipment and personnel, as well as other factors affecting the senses such as noise and temperature, are not considered an important factor in audit service delivery, which is characterized by intensive on-site visits, observations and interviews within the client organization (Gray, 2000).

Reliability

Due to the professional nature of audit service, the client relies primarily on the audit plan developed by the auditor (Watson and Mackey, 2003), which specifies the timeline of the audit process and activities being performed during each aspect of the timeline. The on-site certification audit requires extensive interactions with various levels

of personnel within the client organization and is viewed as an intrusive occurrence from the client's standpoint (Rezaee and Elam, 2000); therefore, reliability, defined as the ability of the auditor to perform the promised service accurately and in a timely fashion, becomes crucial to the client organization.

Responsiveness

It is considered typical of professional services that clients are not clear about their own needs with respect to the service that they provide (Stewart et al., 1998; Thakor and Kumar, 2000). When it comes to the ISO management system audit, many client organizations do not possess sufficient knowledge related either to the management system or to the audit process (Tucker and Kasper, 1998); consequently, the client expects responsive action from the auditor if any problems associated with the certification audit arise. In this study, responsiveness reflects the willingness of the auditor to assist clients and provide prompt service.

Assurance

The client organization has assurance in the service quality when the service provider is knowledgeable, courteous and conveys trust (Parasuraman et al., 1985, 1988). As it relates to the audit service, assurance is defined as the auditor's ability to convey trust and confidence to the client organization. Due to the fact that through the audit process the client organization is required to provide confidential business information associated with each aspect of the management system under audit (Hillary, 1998), it is essential that the auditor ensure the confidentiality of the obtained audit evidence and gain the client's trust.

Empathy

One important issue challenging the auditor today is how to add value to the client when providing the audit service (Christmann and Taylor, 2006). From a broader perspective, buying firms can lower their search and monitoring costs associated with supplier selection and evaluation with the assistance of an ISO certification audit (King et al., 2005; Terlaak and King, 2006). In terms of the client organization, the ISO certification audit may encourage them to establish and improve their effective quality management system or promote environmental purchasing (Yap, 2000); therefore, empathy, defined as the degree to which the auditor provides individual care and value-added service to meet the client's needs, is considered an important facet of audit experience quality.

2.2.4.2 Technical Quality

As suggested by the service quality literature (Harvey, 1998), technical quality of the audit refers to the attributes related to the technical outcomes that can be assessed objectively by the client. The stage-two on-site certification audit involves conducting on-site audit activities such as facilitating the opening meeting, as well as collecting and verifying information through observations and interviews. In the second stage, the top management of the client organization needs to be actively involved in goal-setting, design and implementation, as well as allocating resources towards the ISO standard implementation and certification (Rodgers et al., 1993; Zutshi and Sohal, 2004). This stage of the audit can also be considered as a project with the objective of completing all the tasks with the minimum time and budget.

2.3 Knowledge-based Resources of the Auditor

2.3.1 Knowledge-based View Theory (KBV)

According to KBV theory, knowledge can serve as a resource for developing sustainable competitive advantage (Kogut and Zander 1993, 1995; Winter 1987), and can be transferred across organizations (Grant and Baden-Fuller, 1995). In general, knowledge is defined as justified true belief (Nonaka, 1994). To a business organization in particular, knowledge consists of the beliefs that guide organizational action (Chakravarthy et al., 2003). Knowledge can be classified into explicit knowledge versus tacit knowledge. There are a number of distinctions between explicit and tacit knowledge (Polanyi 1966): while explicit or codified knowledge can be exchanged relatively easily or acquired through market transactions, tacit or implicit knowledge is much more individual or organizational-specific and cannot be as easily exchanged. While explicit knowledge can be codified, capitalized and subsequently exchanged or acquired through market transactions, tacit knowledge cannot be codified, capitalized or easily exchanged in the market. The capabilities generated by tacit knowledge enable an organization to sustain a cumulative strategic change (Nonaka 1991, 1994).

Because tacit knowledge is difficult to imitate or substitute and is relatively immobile, it can constitute the basis of sustained competitive advantage. In business organization, tacit knowledge is viewed as the knowledge-based resources that contain human capital, structural capital and client relationship(Menor et al, 2007; Subramaniam and Youndt, 2005). Human capital builds upon the tacit knowledge accumulated and manifested in the skills and expertise of the work force. Structural capital represents the codified knowledge in the manufacturing process and the information system of the organization. Client relationship contains the knowledge embedded within, available

through and utilized by interactions among individuals and their networks of interrelationships (Subramaniam and Youndt, 2005).

As it relates to operations strategy, manufacturing decisions can be categorized into two categories: the structure of the manufacturing process such as technology process, plant capacity and location, and the infrastructure of the manufacturing process such as the quality management system, inventory management, work force management and organizational design (Hill, 2000; Swink et al., 2005). Structure of the manufacturing process refers to the operational decisions related to the design of the manufacturing process, while the infrastructure of the manufacturing process refers to the operational decisions related to the planning and control systems of the operation (Reid and Sanders, 2005). The combination of the structure and the infrastructure of the manufacturing process affects a firm's ability to support its competitive priorities such as cost, quality, delivery and flexibility (Ward et al., 1994).

In terms of ISO certification audit, the primary work force of the auditing firm accumulates the tacit knowledge and expertise through education, working experience and training; meanwhile, the quality management system ensures the audit is planned, executed and completed in accordance to the audit guideline prescribed by ISO. Normally, a quality control department headed by an experienced senior auditor takes charge of monitoring the conduct of the auditor or the designated audit team in the audit process, examining the quality of the audit report and seeking the client's feedback on the audit service.

Knowledge can be transferred through socialization, externalization, combination and internalization (Nonaka, 1994). Socialization is the process of sharing experiences

and thereby creating tacit knowledge such as shared mental models and technical skills: the process requires interactions between individuals. Externalization is the process of articulating tacit knowledge into explicit concepts: this can be seen as a process of concept creation and is often triggered by dialogue and collective reflection. Combination is the process of systematizing concepts and combining different bodies of explicit knowledge: new knowledge may be created through reconfiguration of existing information by sorting, categorizing and combining explicit knowledge. Internalization is the process of embodying explicit knowledge into tacit knowledge (Nonaka, 1994). Concerning the ISO certification audit, the knowledge transfer between the auditor and the client occurs through service encounter in the audit process, when both parties communicate and cooperate with each other to fulfill the audit tasks.

2.3.2 Knowledge-based Resources

Management system audit is considered a "high-knowledge" industry sector because a majority of its workforce are knowledge workers such as professional auditors. Beck (1998) defines knowledge workers as "professionals, senior management and technical, engineering and scientific staff; in other words, the people in the organization who are paid to think." Organizations that have over 40 per cent knowledge workers are considered to be in the high-knowledge sector (Beck, 1998). This sector relies primarily on intangible assets to compete in the business environment.

Generally, the intangible assets of a "high-knowledge" organization consist of three essential components: human capital, structural capital and customer capital (Stewart, 1999; 2001). Human capital is embedded in the knowledge, talent and skills of the people. Structural capital includes intellectual property, methodologies, software,

documents and other knowledge artifacts. Customer capital builds on the relationship with the client (Stewart, 2001).

2.3.2.1 Human Capital

Based on the Stewart's (1999; 2001) framework, the human capital of the auditor is considered to comprise the knowledge, skills and expertise of the auditors employed by the auditor. The auditor's knowledge, often referred to as auditor competence, is defined as the auditor's expertise and skills required for conducting the audit (Carcello et al., 1992). Education, work experience, training and audit experience related to the industry in which the client organization resides can assure the client that the auditor possesses the knowledge and skills necessary for a high quality audit (Schroeder et al., 1986). Audit professionals are approached by potential clients to obtain benefits from the knowledge and skills that the clients cannot easily learn (Conchar, 1998). Information related to auditor knowledge is documented in the auditor's profile, usually available at the accreditation organization's website (if the auditor is accredited).

2.3.2.2 Structural Capital

Building on Stewart's framework and the operations strategy literature, the structural capital of the auditing firm refers to the audit service process and the information system used by the auditing firm. Because the essential elements of the ISO audit are carried out during the on-site certification audit at the client's facility, the facilities of the auditing firm are considered a trivial factor in delivering high quality audit service (Ismail et al., 2006). Importantly, the efficiency of the audit service process — which involves planning and scheduling the audit, designating the auditor or audit

team, preparing work documents and collecting and verifying information — depends to a great extent on the information system used by the auditing firm (Russell, 2003).

2.3.2.3 Client Relationship

Central to the concept of customer capital is the knowledge embedded in the relationships built between the service provider and the client (Stewart, 2001). In alignment with such understanding, the auditor's client relationship is defined as the knowledge embedded in the interactions between the auditors and their clients. From an operational perspective, these interactions are viewed as service encounters during the audit process.

Service encounter is central to the process of an ISO certification audit. Roth and Menor (2003) define 'service encounter' as the client contact points at which the clients meet and interact with the service provider. The outcome of service quality is derived from the interactive process through service encounters: in other words, the "moments of truth" (Chase et al., 1998; Svensson, 2006). As a result, studies on service encounters should take into account the perspectives of parties involved in the human interaction (Czepiel, 1990).

Despite the interactive nature of the service encounter, previous research on the subject has primarily focused on the perspective of the client (the service receiver) and how to meet the client's needs (Svensson, 2006). Numerous studies investigate client contact, which refers to the physical presence of the client in the service system during the service delivery (Chase, 1978; Grove and Fisk, 1983; Bowen, 1990). Substantial attention has been given to client involvement, defined as the degree of client involvement in the creation of the service (Lovelock, 1983; Schmenner, 1986). Client

involvement reflects the level of interaction that the client has with the service system, and the level to which a client can actually affect the service delivery process (Lovelock, 1983; Silpakit and Fisk, 1986). The other party of the pair, the service provider, has received sparse attention in service encounter research.

The missing link of the role of the service provider uundermines a comprehensive understanding of service encounter, particularly in the case of a professional service such as ISO management system audit. In addition to the clients' participation and cooperation, the role of the professional auditors in delivering credible certification service is fundamental. Given that most managers at client organizations are novices in regard to ISO standards, through the audit process they rely heavily on the experienced auditors who hold specific knowledge and skills in this area (Meyer et al., 2006).

To attain a comprehensive understanding of the service encounter during the ISO audit and its impact on audit process quality, this research attempts to study how the auditor can improve the communication and cooperation with their clients to enhance audit process quality.

Client Relationship — Communication

Communication is defined as the information exchange effort made between the auditor and the client (Chen & Paulraj, 2004; Krause & Ellram, 1997). In the buyer-supplier relationship literature, inter-organizational communication is operationalized in terms of the extent to which the firm and its key suppliers (a) share critical, sensitive information related to operational and strategic issues, (b) exchange such information frequently, informally and/or in a timely manner, (c) maintain frequent face-to-face meetings, and (d) closely monitor and stay abreast of events or changes that may affect

both parties (Krause and Ellram, 1997; Carr and Pearson, 1999). Findings on inter-organizational communication can provide foundations for the conceptualization and operationalization of the audit service encounter.

The auditor's communication efforts appear to be crucial in every stage of the ISO certification audit process. Throughout the audit process, the auditor needs to make sure the client is informed about the audit plan, activities associated with each stage and any problems related to the management system being audited (Sutton, 1993; Ammenberg et al., 2001). Particularly in the on-site certification stage, frequent interviews and informal conversation with staff and management in the client organization are instrumental in acquiring audit evidence (Kraus and Platkus, 2007). Any changes related to the audit plan or audit execution, as well as any problems discovered during the audit process, must be communicated to the client in a timely manner to minimize the risk posed to the client organization (Rezaee and Elam, 2000).

Client Relationship – Cooperation

Cannon and Perreault (1999) define cooperation as the expectations that the two exchanging parties have concerning working together to achieve mutual and individual goals jointly. This definition demonstrates that instead of one party striving to accommodate another party's needs, both parties accept the notion that they must work together to be successful (Cannon and Perreault, 1999). Research has shown that cooperation contains two essential dimensions: flexibility, the degree to which both parties are willing to adjust their own behavior to accommodate the needs of the other, and shared problem solving, which refers to the degree to which the parties share responsibility for maintaining the relationship and for problems that arise as time goes on

(Heide and Miner, 1992). Adapting the previous research, cooperation is defined in this study as the extent to which the auditor and the client are willing to adjust their own behavior to accommodate the needs of each other and work together to solve problems.

Balancing between customizing to the client's needs and maintaining profession integrity poses a great challenge to ISO auditors (Christmann and Taylor, 2006). To compete successfully in the market, the auditor needs to be flexible in response to the client's requests for modifying the audit plan and the activities involved in the process; for instance, the date of the on-site visit can be made earlier than planned or postponed if requested by the client, due to reasons such as manufacturing schedule conflicts or government regulation requirements (King and Lenox, 2000). To ensure audit process quality, however, the auditor should not reduce the total amount of on-site audit hours even if this is demanded by the client. An alternative way to meet the client's demand is to increase the size of the audit team on site. Should any unexpected situation or disagreement arise during the audit process, the auditor must be willing to work with the client to deal with the problem and bridge the divergence (Davies and Webber, 1998).

2.4 The Client's Competitive Outcomes

Audit process quality, as one type of credence-based services, is the difficult to verify because it often lacks physical evidence of the service process (Bebko, 2000), or because customers do not have a clear expectation of the service (e.g. in the case of really new services). Moreover, customers may often not have well-defined expectations of the credence service because they lack the expertise to identify and describe their own needs and demands (Brush and Artz, 1999).

ISO management system standards focus on conformance and continuous improvement rather on the performance (Briggs, 2006), which makes the evaluation of management system performance improvement after the certification difficult to evaluate. Nevertheless, performance improvement is a significant indicator for high quality audit service. The certified organizations can expect better marketing outcomes or operations outcomes than their competitors.

Specifically, a successful QMS audit can increase operating efficiency by implementing the established QMS procedures and mechanisms (Florida and Davison, 2001), and facilitating the delivery of high quality products/services to the buying firm. The buying firm may reduce the frequency of quality monitoring if they perceive the certification credible. An effective EMS audit is expected to improve the organization's public image and environmental performance such as waste reduction and reduction of the toxic chemical release (Teece et al., 1997).

2.5 Client Satisfaction

Customer satisfaction is the result of the accumulated experience of a customer's purchase and consumption experiences (Andreassen and Lindestad, 1998). Peter and Olsen (1994) argue that the degree of satisfaction is dependent on the extent of disconfirmation and the consumer's level of involvement with the product and service delivery process. Fornell (1992) found that satisfied customers tends to maintain their consumption pattern and will consume similar products or services. Customer's past satisfaction affects their decisions to have a continuing relationship with the service provider (Crosby et al., 1990). In present research, client satisfaction is reflected by the

repurchase intention of the client and the client's overall satisfaction with the audit process and outcome.

CHAPTER THREE: HYPOTHESIS DEVELOPMENT

3.1 Chapter Preview

In this chapter, a conceptual framework is developed to fulfill the research objectives and address the research questions based on the review of academic and practitioner literature. KBV theory provides the theoretical ground for the conceptual framework development. Because KBV theory contends that knowledge-based resources are instrumental to achieve competitive advantage and superior performance (Grant, 1996), it is hypothesized that the auditor's knowledge-based resources as reflected by its human capital, structural capital and client relationship are positively related to audit process quality. It is further proposed that audit process quality is positively related to the outcomes of the audit and client satisfaction.

The proposed generic model, which links knowledge-based resources, audit process quality, the outcomes of the audit and client satisfaction, is shown in Figure 3-1, followed by Figure 3-2, which depicts the hypothesized conceptual model in detail. In the hypothesized model, audit process quality is proposed to consist of stage-one and stage-two audit process quality. Focusing on document review, a stage-one audit does not involve many interactions between the auditor and the client: the process resembles routine project management. Time and cost factors therefore become the determinants of stage-one audit process quality; in contrast, stage-two certification audit process quality, featuring intensive auditor-client interactions, is characterized not only by technical qualities such as time and cost, but also perceptual qualities such as reliability, responsiveness, assurance and empathy.

Knowledge-based resources contain human capital, structural capital and client relationship (communication and cooperation between the auditor and the client). It is hypothesized that each knowledge-based resource will positively influence both stage-one and stage-two audit process quality. The conceptual model shown in Figure 3-2 is illustrated based on the impact of human capital on audit process quality. In the following subsections, the linkages among the knowledge-based resources, audit process quality and the outcome of the ISO audit are developed and hypothesized.

Figure 3-1: The Proposed Generic Model

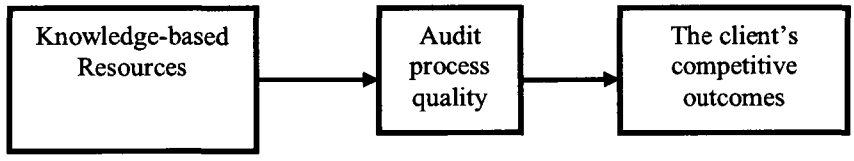
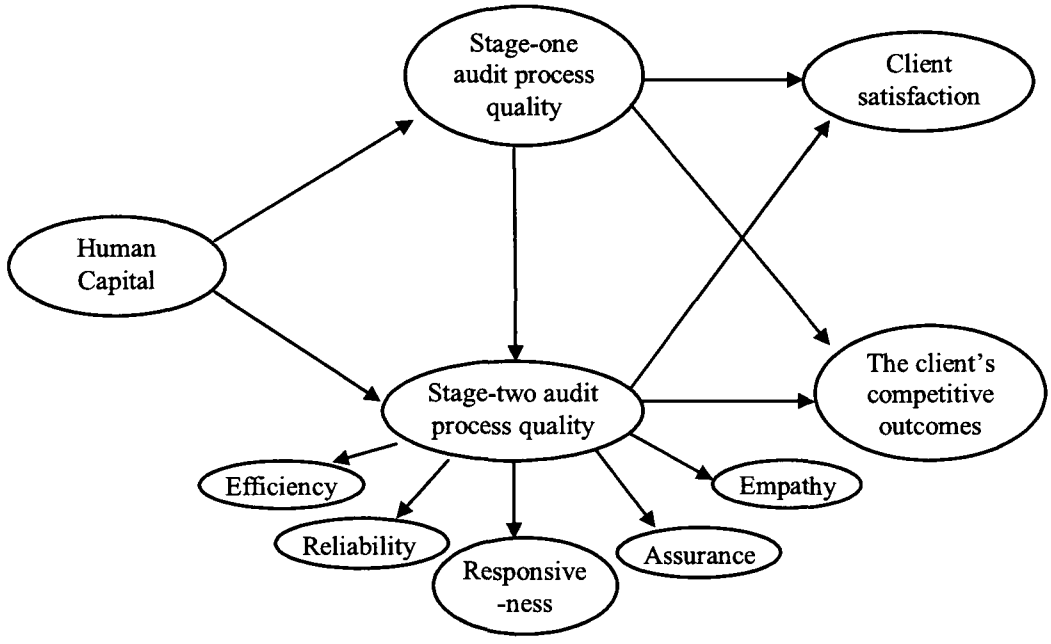


Figure 3-2: The Hypothesized Conceptual Model (Illustration based on the impact of human capital on audit process quality)



3.2 Dimensions of Audit Process Quality

The literature review reveals that the components of audit process quality have not been empirically studied to date. A close examination of the process and characteristics of the ISO certification audit suggests that audit process quality is a multi-stage and multi-dimensional construct.

The ISO certification audit is typically carried out using a two-stage approach: stage-one, readiness review and stage-two, on-site certification audit (ISO 19001 Auditing Guidelines). Stage one focuses on document review: it involves an examination of whether the client organization's documentation adequately fulfills the requirements of ISO standards, helps to identify the key risks of the business, analyzes related regulatory aspects and assesses compliance. This stage resembles a routine project; therefore, the service quality of the stage-one audit can be evaluated using the measurements for project performance (Tushman and Katz, 1980; Moor and Beelde, 2005). Stage two involves intensive interactions between the client and auditor as the auditor needs to collect audit evidence on the site of the client organization (Davies and Webber, 1998). Both the technical and perceptual aspects of quality characteristics need to be assessed in order to adequately reflect the efficiency of the activities carried out in the stage-two audit and the service quality perceived by the client. The audit process quality should be assessed according to different stages of the audit process: the formal hypothesis is stated as follows:

H1: The audit process quality is a multi-stage construct, consisting of stage-one audit process quality and stage-two audit process quality.

Research has established that service quality is a multi-dimensional construct

(Parasuraman et al., 1991; Berry et al., 1991). When intensive interactions between the service provider and the client are involved in the service process, assessing both the perceptual and technical aspects is instrumental in adequately evaluating service quality (Harvey, 1998).

The perceptual aspects of service quality generally incorporate reliability, responsiveness, assurance, empathy and tangibles (Parasuraman et al., 1991; Berry et al., 1991; Cronin and Taylor, 1992). For the on-site certification audit, the audit activities mostly occur on the site of the client organization. The physical appearance of the auditor, therefore, is not considered an important dimension in evaluating audit process quality. The technical aspects of audit process quality assess the efficiency of the stage-two audit activities from a project perspective. The formal hypothesis concerning the multi-dimensionality of the stage-two audit process quality is stated as follows:

H2: Stage-two audit process quality is a multi-dimensional construct, reflecting

a) reliability
b) responsiveness
c)assurance
d) empathy
e)efficiency

In the ISO certification process, the goal of the stage-one audit is to prepare the client organization for the stage-two on-site certification audit (Hillary, 1998). In stage one, the auditor reviews all the relevant documentation and examines whether the documentation conforms to the requirements of the standard; in essence, the first stage of the audit makes sure the client organization conforms to the ISO standard "on paper," while the stage two audit assesses if the conformance can be verified in

reality. A high quality audit conducted in stage one helps the client to be well-prepared for the next stage of certification audit in a timely and cost-efficient way, which is more likely to enhance the auditor's reliability, responsiveness, assurance and empathy perceived by the client. Therefore, it is hypothesized that the stage-one audit process quality is positively related to the stage-two audit process quality. The formal hypothesis is stated as follows:

H3: Stage-one audit process quality is positively related to stage-two audit process quality.

3.3 Knowledge-based Resources and Audit Process Quality

According to the KBV theory, knowledge-based resources are the main determinants of a firm's competitive advantage and superior performance (Decarolis and Deeds, 1999). As part of a firm's knowledge-based resources, infrastructural and structural capital contributes to the competitive advantage of the firm, which may be reflected by high quality audit service.

KBV theory states that tacit knowledge can be converted to explicit knowledge through the externalization process of articulating the tacit knowledge into explicit concepts (Nonaka, 1994). The process is often triggered by conversations and collective reflection, which serve as the primary means of communication between the auditor and the client in an ISO certification audit (Epstein and Roy, 2001). To enhance audit process quality, it is imperative to bridge the knowledge gap between the auditors and the clients: the need for the conversion of tacit knowledge maintained separately by the auditors and their clients to the explicit knowledge shared by both parties motivates both the auditors and their clients to enhance their efforts in communication and cooperation.

Research in financial audits and management audits suggests that knowledge factors, such as the auditor's knowledge, the client's commitment to standard implementation and the expectation gap may affect the communication efforts made by the auditors and their clients (Carcello and Nagy 2004; Beeler, 1999).

3.3.1 The Impact of Human Capital on Audit Process Quality

Human capital is characterized by the skills, knowledge and expertise of employees (Schultz, 1971; Stewart 2001). ISO auditors armed with education, industry experience and training possess special knowledge and expertise which provides them with competence to perform the audit tasks (O'Leary, 2003). The auditor's knowledge and expertise are valuable, rare, cannot be codified and are thereby considered tacit (Nonaka, 1991). Key to a high quality ISO audit, auditor knowledge is an invaluable resource which is controlled by auditing organizations (O'Leary, 2003): this resource can be protected from imitation by knowledge barriers, which are subtle and difficult to attain and understand (Lippman & Rumelt, 1982).

Many well-recognized auditor registration organizations assert that the auditor's knowledge is the essential element for delivering a high quality audit; an example of this is IRCA (International Register of Certified Auditors), the largest auditor registration organization worldwide. To be registered as an auditor, IRCA requires that the applicant spend at least 30 days auditing, at least 20 days of which must be spent performing on-site certification audits, as opposed to off-site document reviews and planning. This time must include at least two audits during which a decision on the acceptability of a management system has to be made, excluding routine surveillance audits. To qualify as a Certified Quality Auditor (CQA) registered by the American Society of Quality (ASQ),

the applicant must have eight years of work experience in the body of knowledge related to the audit service, such as quality related methods and techniques.

De Beelde (2002) finds that auditors with industry specialization are likely to develop knowledge and skills specifically adapted to the industry, thus being able to deliver reliable services as perceived by their clients. Karapetrovic and Willborn (2000) contend that the auditor's ability to apply relevant knowledge and skills in planning, conducting and reporting on specific audit tasks in accordance with prescribed auditing principles is key to meet the client's expectations of achieving reliable and responsive audit service which maintains confidence with their business information. In addition to technical knowledge and skills, familiarity with the client's organizational culture is vital for the auditor to provide a satisfactory audit service experience (Hunt, 1997). Familiarity with the prevailing language, customs, attitudes and the system in which the client organization operates tends to enhance the client's perceptions of service quality (Hunt, 1997). Due to their substantial understanding of the importance of tacit knowledge held by the client organization, the auditors are highly motivated to attain the knowledge through effective communication with their clients; therefore, it is proposed that the human capital of the auditor is positively related to audit process quality.

H4a: Human capital of the auditor is positively related to stage-one audit process quality.

H4b: Human capital of the auditor is positively related to stage-two audit process quality.

3.3.2 The Impact of Structural Capital on Audit Process Quality

As to the auditor, structural capital involves codified knowledge of state-of-the-art service processes and superior information systems (Subramaniam and Youndt, 2005). In the readiness review stage (stage-one audit), an auditor operating under an efficient service process can initiate the audit, conduct document review and prepare for the on-site audit in a timely manner (Don, 1996). Initiating the audit requires numerous tasks such as defining audit objectives, scope and criteria, determining the feasibility of the audit and assembling the audit team. Conducting document review involves reviewing relevant documents provided by the client. The on-site audit preparation involves preparing the audit plan, assigning work to the audit team and preparing work documents.

Audit practices have often been introduced into organizational contexts where they have not previously existed, or have existed in an informal or undeveloped manner (Power, 1997): this notion is applicable to ISO management system auditing. While some of the client organizations that pursue ISO certification via the certification body have experiences in corporate internal quality audit or environmental audit for the purpose of management system control, some of the clients have never entered this field (Arter, 2000). Both situations may result in a lengthy document review process or generate significant costs associated with document preparation. An efficient audit process and advanced information system can expedite and simplify tasks required in the readiness review stage.

In the process of an on-site audit (stage-two audit), the team can interview anybody at the facility, from managers to line workers, to assess whether facility personnel understand ISO 14001's procedural and paper documentation requirements. The length of external audits can range from a few weeks to several months, depending on the size of

the facility and the paperwork documentation requirements. Few will deny that certification audits disrupt a facility's normal business; after all, "outsiders" are in to check on the facility's performance (Warming-Rasmussen and Jensen, 1998). Due to the time demands and other costs that audits impose on the facility, an efficient audit service process and advanced information system provided by the auditor may not only significantly improve the reliability, responsiveness, assurance and empathy experienced during the audit, but also enhance time performance and cost reduction.

H5a: The structural capital of the auditor is positively related to stage-one audit process quality.

H5b: The structural capital of the auditor is positively related to stage-two audit process quality.

3.3.3 The Impact of Communication on Audit Process Quality

As one element of knowledge-based resources, client relationship represents the knowledge embedded within, available through and utilized by interactions among individuals and their networks of interrelationships (Subramaniam and Youndt, 2005). Because service encounters depict what happens when the auditor and the client interact, it can be viewed as an indicator of the client relationship of the audit firm.

Research has shown that service quality depends directly and most immediately on the management and monitoring of individual service encounters (Shostack, 1987; Solomon et al., 1985). The management of service encounters is nested with broader managerial issues of organizational structure, strategy and culture that can also influence service delivery and ultimately client perceptions of service quality (Bowen and

Schneider, 1988). In many cases, service encounters are viewed from the client's standpoint (Bitner et al., 1990).

Service quality is viewed as the client's perception of service excellence: it is therefore the client's perception that rates the service quality of an entity (Parasuraman et al., 1985). Such a notion, however, is not adequate for evaluating audit process quality because the client may not possess the specific knowledge and skills necessary for the evaluation. Auditors, armed with the specific knowledge and skill sets, are therefore on a more solid ground to influence service encounters, which in turn affects audit experience quality.

Previous research on service quality affirms the importance of service encounters and the dyadic interaction between the client and the service provider in the assessment of service quality (Parasuraman et al., 1988; Surprenant and Solomon, 1987). Close examination of the scale items for the five service quality dimensions identified by Parasuraman et al. (1988) (tangibles, reliability, responsiveness, assurance and empathy) reveals that a majority of all the items relate directly to the human interaction element of service encounter.

A "no surprise" approach is central to delivering reliable and responsive audit service, as perceived by the client (Wealleans, 2005). During the audit, the auditor should periodically communicate the progress of the audit activities and any concerns to the client in a timely manner. Evidence collected during the audit that suggests an immediate and significant risk related to quality and environment should be reported without delay to the client (Hutchins, 1997). As the audit proceeds, if the available audit evidence indicates that the audit objectives are unattainable, the auditor should report the reasons

to the client so that the client can take appropriate action such as modification of the audit plan, or making changes to the audit objective (Rezaee and Elam, 2000). Mohr and Spekman (1994) find that inter-organizational communication contributes to establishing trust between trading partners; therefore, communication efforts made by the auditor help to build trust with the client organization.

The auditor's communication efforts may also foster professional integrity, the technical attribute of audit experience quality. By actively communicating to the client any problems and risks detected in the on-site certification audit process, the auditor expects the client to pay attention to the problems and take corrective actions accordingly (Cahill and Michelin, 1996). The auditor's communication efforts assist the auditor in conveying the message that any problems detected in the audit process, even those that may lead to non-conformity, will not be ignored; therefore, professional integrity may be reinforced by the auditor's communication efforts.

As an interactive process, the role of the client in an ISO management system audit is as vital as the auditor. Without the client's communication efforts, it is impossible to achieve high quality audit service. If the clients communicate with the auditor whenever they have concerns over the audit plan, audit activities to be undertaken, the progress of the audit or any problems encountered during the audit, the informed auditor will be able to address these concerns in a timely manner (Hutchins, 1997), enabling the auditor to provide reliable and responsive service to the client. Moreover, sharing sensitive information related to quality or environment will help the auditor provide value-added service customized to the client's needs (i.e., identifying improvement opportunities for the client) (Russell, 2006), which will enhance the empathy dimension of the audit

experience quality. The following hypotheses (H6a and H6b) link the client's communication efforts to audit experience quality perceived by the client.

For the client organization, knowledge attained through communication in the service encounter can serve as a valuable resource for enhancing capabilities such as organizational skills, functional competencies of articulating goals, making choices, gathering information, measuring progress and improving management system performance (Florida and Davidson, 2001; Teece et al., 1997). The enhanced capabilities may result in the time performance and cost reduction of the audit project; therefore, it is hypothesized that communication, as one aspect of the auditor's client relationship, is positively related to technical audit process quality.

H6a: Communication is positively related to stage-one audit process quality.

H6b: Communication is positively related to stage-two audit process quality.

3.3.4 The Impact of Cooperation on Audit Process Quality

As another important facet of service encounters in ISO certification audits, cooperation between the auditors and their clients can be viewed as the two patterns of knowledge transfer processes: socialization and combination (Nonaka, 1994). Cooperation focuses on both parties' willingness to accommodate each other's needs and joint problem solving (Heide and Miner, 1992; Cannon and Perreault, 1999).

From the auditor's perspective, the tacit knowledge gained through education, experience and special training provides an effective means for the auditor to detect the client organization's needs (Wealleans, 2005). Accommodation to the clients' needs and joint problem solving results in sharing experience with the clients, which makes the auditor empathize with the clients and incorporate their needs (Nonaka, 1991). In the ISO

audit, cooperation can also be viewed as the knowledge transfer process 'combination.' The auditor's accommodation of the client's needs and joint problem solving with the client can be considered as the process of combining, categorizing and recontextualizing the knowledge held by the auditors and their clients. When the auditors can effectively identify the needs and the problems of the client organization based on their knowledge, they are more likely to provide accommodations to these needs and solutions to the problems; therefore, it is hypothesized that the auditor's client relationship— namely, cooperation — is positively related to audit process quality.

Rooted in the conceptualization of cooperation between the buying firm and the supplier (Heide and Miner, 1992, Cannon and Perreault, 1999), the auditor's cooperation efforts stress the auditor's willingness to adjust their own behavior to accommodate the needs of the client and solve problems jointly with the client. The client perceives the audit service as reliable and responsive if the auditor is flexible in response to their requests on modifying the audit plan in terms of dates, time, duration of meetings, schedule of interviews and on-site observation (O'Leary and Stewart, 2007). The auditor appears to be trustworthy and caring, from the client's perspective, if he or she is willing to work with the client to resolve any diverging opinions concerning the audit evidence or the audit findings and conclusions (Wealleans, 2005).

Auditors will require access to a variety of information in order to effectively carry out their investigation: a large proportion of this information is attained by the aid of the client (Hutchins, 1997). Case studies show that the client's flexibility in accommodating the audit plan proposed by the auditor helps the execution of scheduled audit activities run smoothly (Robinson and Clegg, 1998), and therefore provides support for the auditor

to deliver service within the established time frame. The access to relevant information via the client's cooperation makes it possible for the auditor to respond promptly to the problems raised during the audit process (Williamson et al., 1996). The client's willingness to solve problems jointly with the auditor is beneficial to the establishment of mutual trust (Ammenberg et al., 2000).

Walson and Emery (2004) argue that there is growing evidence that many ISO environmental auditors are willing to approve EMS without conducting an effective investigation. If the top management of an organization just wants a green badge on the wall without substantial implementation of the prescribed EMS standards, there are certification bodies out there that will do that; in such cases, the professional integrity of the auditor is compromised under the pressure posed by the client (Herrbach, 2005). When the auditor reduces the audit hours required for collecting sufficient audit evidence to accommodate the client's demand, or when the auditor cannot insist on his or her opinions on audit findings and conclusions under the pressure exerted by the client, professional integrity is greatly undermined; however, this study asserts that cooperation between the auditors and their clients can promote professional integrity through making efforts such as joint problem solving. For instance, through working with the client, options such as assigning more auditors to the ISO certification audit for the purpose of maintaining the total hours required by the audit plan can be adopted to withhold professional integrity.

Viewed as a knowledge creation process (Nonaka and Takeuchi, 1995), cooperation in the certification audit can help the client organization attain knowledge from the professional auditors. Because the knowledge learned through cooperation is

valuable, rare and inimitable (Barney, 1991; Garvin, 1993), it can serve as an intangible strategic resource for enhancement of management system capabilities in the client organization (Winter 1987; Quinn 1992), which may lead to superior quality or environmental performance. Therefore, it is hypothesized that:

H7a: Cooperation is positively related to stage- one audit process quality.

H7b: Cooperation is positively related to stage-two audit process quality.

3.4 Audit Process Quality and the Client's Competitive Outcomes

ISO management system certification indicates that an organization has a well-documented and consistent management system in place, but does not guarantee performance improvement (Albuquerque et al., 2007); however, performance improvement outweighs the internal process control in the eyes of the certified organization's stakeholders. In the case of ISO 14001, buying firms practicing green purchasing expect to reduce supplier selection and evaluation costs through EMS certification (King et al., 2005). Environmentally-conscious clients therefore rely on ISO14001 certification to assess whether the supplier's environmental performance meets their green purchasing criteria. Improved environmental performance leads to enhanced corporate image, compliance with environmental regulations and increased business opportunities (Rao, 2002); therefore, it is hypothesized that:

H8a: Stage-one audit process quality is positively related to the client's competitive outcomes.

H8b: Stage-two audit process quality is positively related to the client's competitive outcomes.

3.5 Audit Process Quality and Client Satisfaction

ISO management system auditing has proved to be a useful tool to evolve from maintaining regulatory compliance to a position of improved productivity and enhanced competitive advantage, inspiring innovation in the certified organization (Geffen and Rothenberg, 2000). Many organizations that pursue ISO certification expect to achieve not only internal objectives but also external objectives; for instance, an internal objective of achieving ISO 14001 certification is to provide assurance to management that the organization is in control of its organizational processes and activities having an impact on the environment. External objectives include providing assurance of environmental performance improvement to external stakeholders, and achieving compliance with environmental regulations (Tucker and Kasper, 1998). The client will be satisfied with the overall audit service if both internal and external objectives are achieved.

Extensive research in marketing literature supports that perceived audit process quality has a positive impact on client satisfaction (Cronin and Taylor, 1992; Taylor and Baker, 1994): "A summary of cognitive and affective reaction to a service incident or sometimes to a long-term service relationship" (Oliver, 1980). Adapted from service quality literature, the perceptual attributes of audit process quality are also expected to positively affect client satisfaction. It is hypothesized that:

H9a: Stage-one audit process quality is positively related to client satisfaction.

H9b: Stage-two audit process quality is positively related to client satisfaction.

CHAPTER FOUR: METHODOLOGY

4.1 Chapter Preview

The purpose of this chapter is to provide a description of why an empirical methodology was selected and how the research design was developed. Specifically, the rationale of choosing survey-based research is stated, followed by an overview of the research methodology employed in this study. The research design, sampling and development of the survey instrument, together with the data collection procedure are described in sequence.

4.2 Use of Empirical Survey Research Method

Empirical research, using data collected from field-based observations rather than mathematical modeling, simulation and laboratory settings (Flynn et al., 1990) was considered appropriate for the present study. In analytical mathematical research methods, such as mathematical modeling and simulation, models are typically built using formal logic and tested using artificially-derived data (Wacker, 1998). The external validity is not strongly supported, as the initial settings and the artificially-derived data may not adequately represent the actual decision-making conditions. An advantage of the modeling method is that it finds the optimal solution, which is not the objective of the present study. Given that research in the area of voluntary audit service is in its emerging stage, information derived from field-based empirical research can provide systematic knowledge of the actual practice in the audit service operation and can be used for research problem identification, theory building and verification.

Numerous case studies have been conducted to reveal the benefits and problems associated with the audit service process (Robinson and Gould, 2000; Godshall, 2000; Ni and Karapetrovic, 2003). However, descriptive in nature, these case studies are not quantitatively oriented, lack precisely defined variables, and involve observations and analysis on a particular setting which results in limited generalizability of the research (Malhotra and Grover, 1998).

Survey research was chosen as the research methodology for the present study because compared to case studies, surveys have the advantage of identifying commonalities and patterns, particularly for generalizing to performance outcomes.

Specifically, survey-based methodology was considered appropriate for two reasons: firstly, the present study focuses on the behavior of auditors and their clients interacting through the audit service encounter, which links to the audit process quality perceived by the clients and the outcomes of the audit. Perceptual measures were used to assess key constructs involved in the study, such as the service encounter and audit process quality. The subject of interest in this study calls for the use of a survey-based method, which is an effective means for attaining information related to latent behavioral variables that may not be directly observable (Boyer and Swink, 2008). Secondly, one key variable of the present study, the client's competitive outcomes service, is often not measured by client organizations either because it cannot be measured in a cost-effective manner, or because the client lacks resources and knowledge for such an undertaking. By seeking opinions from the individuals who are directly involved in the audit process, the survey-based method makes it possible to assess the client's competitive outcomes via perceptual measures.

4.3 Overview of the Methodology

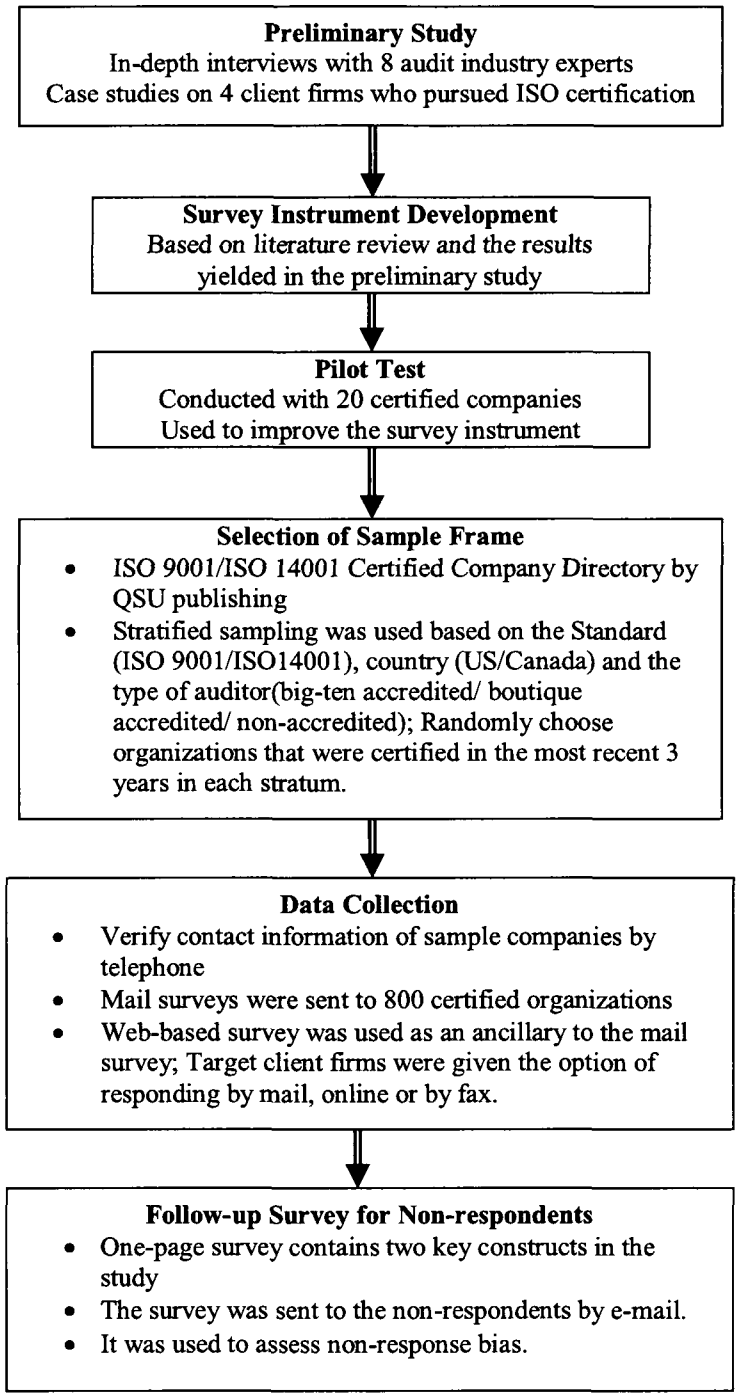
The research objective is to access the knowledge-based resources of the audit firm for high-quality services, as well as the linkage between audit process quality and the outcome of ISO auditing. The views of the client organizations were sought to empirically test the proposed conceptual model. A preliminary study was conducted through eight in-depth interviews with audit industry experts to gain their insights on issues related to the service encounter and audit process quality. The survey instruments were developed based on literature review and the results of the preliminary study. A pre-test was conducted to refine the survey instrument. A mail survey was used to collect data from the client organizations. A web-based survey was also used as an ancillary method in order to provide convenience to the target respondents, thereby enhancing the response rate. The research design is shown in Figure 4-1, and described in detail in the following subsections.

4.4 Unit of Analysis and Target Population

4.4.1 Unit of Analysis

The study concentrates on audit process quality, its key drivers and outcomes in voluntary industry standards auditing. The audit processes of ISO 9001 and ISO 14001certification were considered to represent the typical voluntary industry standard auditing. Such a decision was made because ISO 9001 QMS and ISO 14001 EMS certifications are not only the most recognized voluntary industry standards worldwide, but are the most adopted standards among the ISO management system families (ISO Survey 2007).

Figure 4-1: Overview of the Research Design



Due to the voluntary nature of the standards, there are three ways of achieving ISO standard compliance: firstly, an organization can declare its compliance with ISO standards through the internal self-audit. Secondly, an organization can get ISO-certified

through the audits conducted by its client organization, which is called a second-party audit; for instance, a parts supplier can get ISO-certified by auditors sent by the original equipment manufacturer (OEM) client. Thirdly, an organization can seek ISO certification through an independent third-party audit firm. Third-party audit is often considered the most credible because the auditors are not involved in the business of the client organization, and thus can provide impartial opinions in the audit report; however, there are divergent opinions on what contributes to the service quality of the third-party audit and how it affects the credibility of the certification.

The objective of this research is to investigate the factors that contribute to high quality audit service, which may lead to credible certification for a voluntary industry standard. Aside from the knowledge factors embedded in the audit firm, other influencing factors are rooted in the intensive interactions between the audit firm and the client organization; therefore, among the various types of audit available, the third-party audit process is considered the unit of analysis.

4.4.2 Target Population

4.4.2.1 Target Population Identification

The target population includes all the client organizations that comply with voluntary industry standards through third-party auditing. Due to a budget constraint and the difficulty in locating an available list of the general population worldwide, it was decided to conduct the research based on the target population which includes all the U.S. and Canadian companies that have received ISO 9001/14001 certification by third-party auditing firms. According to ISO Survey 2007, as of December 2007, there were 43,654 organizations in Canada and the United States that were ISO 9001-certified and 6,528

organizations were ISO 14001-certified. The certified organizations operate in a wide variety of industrial sectors; thus, the choice of the special population can ensure the variety of the sampling.

From 2001 to 2007, the annual growth rate of the total number of ISO 9001 and ISO 14001 certifications was 65 per cent on average. Companies which were ISO certified after January 2007 were chosen for this survey due to their more recent experience, making the respondent more likely to have fresh memory and respond. Because ISO releases its survey on the number of certifications in 2007 at the end of 2008, there is no statistics report available for the number of companies which were newly certified from January 2007 to May 2009, when the survey started; however, given the number of certifications in 2007 and the annual growth rate of certification, it was estimated that the population of the recently certified companies (January 2007 to May 2009) was adequate for the sampling.

In practice, top management and the personnel responsible for the management system certification program designated by the client organization are the most knowledgeable, as they are actively involved in the audit process. Therefore, top management and the designated personnel were chosen as the primary target informants for this study.

4.4.2.2 Target Population Characteristics

Because ISO 9001 and ISO 14001 are voluntary standards, the certified organization may be audited by an accredited certification body, or have received the certification from a non-accredited audit firm. There are national accreditation bodies which oversee the accreditation of ISO auditors and audit firms despite the voluntary

nature of the ISO standards audit. The industry is operated under two levels of the certification scheme: the individual level (the auditor) and the organizational level (the audit firm).

Accreditation Bodies in Canada and the United States

Canada: Standards Council of Canada (SCC)

As the national accreditation body, the Standards Council of Canada (SCC) oversees accreditation for ISO management system certification bodies. The SCC ensures that the accredited organization has met the international standards for management system certification bodies and is able to competently assess and certify management systems.

Canada: Canadian Environmental Certification Approval Board (CECAB)

CECAB, established by Environmental Careers Organization (ECO Canada) in 1997, oversees the administration of the environmental auditing certification program in Canada. The organization manages the EMS auditor application process, reviews the applicants' qualifications, administers the certification exam and grants EMS certification if the applicants fulfill the prescribed requirements.

U.S.: Registrar Accreditation Board & Quality Society of Australasia (RABQSA)

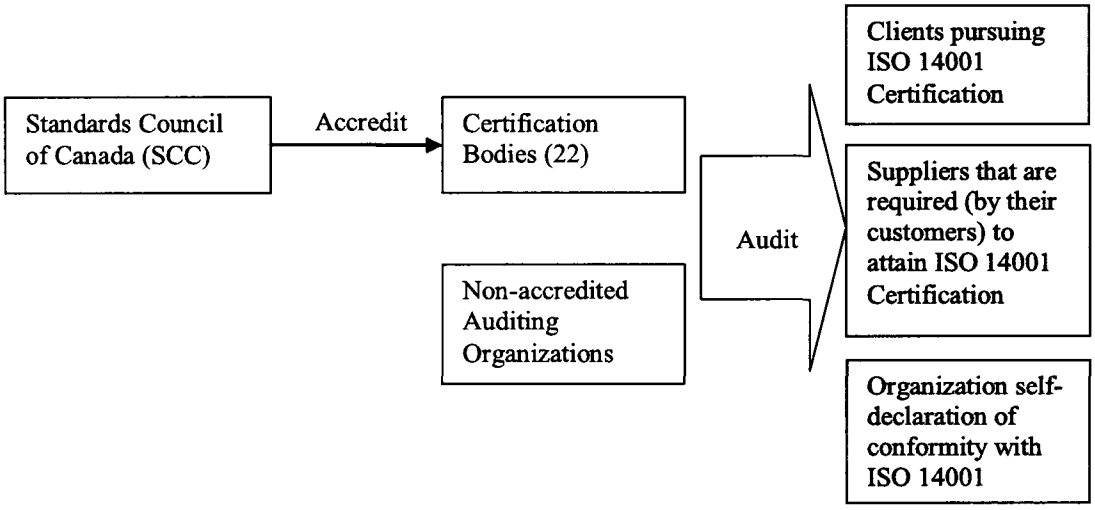
Formed in 2005 from the merger of the Registrar Accreditation Board (the U.S. national accreditation body for management systems) and the Quality Society of Australasia (joint accreditation for management systems for Australia and New Zealand), RABQSA designs, develops and delivers auditor training and certification on the ISO management system. Operating internationally, RABQSA certification has the most recognized credentials for QMS and EMS auditors in the United States and Canada.

U.S.: The ANSI-ASQ National Accreditation Board (ANAB)

The ANAB, established on January 1, 2005, is the U.S. national accreditation body for ISO management system standards. Previously, the accreditation activities of ANAB were operated by the ANSI-RAB National Accreditation Program under a partnership agreement. ANAB is a member of the International Accreditation Forum (IAF) and a signatory of the IAF multilateral cooperative arrangements for QMS and EMS. While the certification scheme for individuals provides professional recognition for ISO auditors, the organizational-level accreditation scheme offers accreditations to auditing organizations that meet the international standards of management system certification bodies.

In Canada, the national accreditation body SCC is responsible for granting accreditations to qualified ISO auditing organizations (certification bodies). In the United States, the accreditation task is fulfilled by ANAB. To ensure that the audit conducted by certification bodies conforms to the prescribed audit principles and procedures, the national accreditation bodies routinely check the documentation of specific certification audits performed by the certification body, or randomly select an ongoing audit project to perform a witness audit. Commonly used to monitor the audit process, the witness audit is conducted by an experienced lead auditor assigned by the accreditation body. The accreditation scheme for ISO 14001 certification bodies in Canada is shown in Figure 4-2 as an example.

Figure 4-2: The Accreditation Scheme for ISO 14001 Certification Body in Canada



Accreditation for ISO auditing organizations is not mandatory. ISO certification can be issued by accredited certification bodies or non-accredited audit firms. Another phenomenon signifying the voluntary nature of the ISO audit industry is that even the accredited certification bodies do not require their full-time auditors or contractor auditors to be certified; for instance, SGS Systems & Services Certification Canada Inc., a certification body accredited by the SCC assigns both full-time employees and contractors to conduct ISO audits. SGS encourages their auditors to obtain accreditation, but accreditation is not mandatory within the firm.

4.5 Sampling

4.5.1 Selection of the Sample Frame

The sample frame was selected to minimize bias and adequately capture the characteristics of the target population (Henry, 1990). Because the adoption, registration and publication of ISO standards are voluntary, no government agencies or organizations maintain a directory of the certified organizations. Finding a comprehensive ISO certified

company directory has been a challenging task. I found that Quality System Update QSU Publishing maintains a relatively comprehensive database of ISO certified companies.

The Global Quality Exchange (GQEX) Researcher Subscription was purchased from QSU Publishing Company as the sample frame for the study. This annual subscription includes a worldwide directory database of ISO 9001- and ISO 14001-certified companies worldwide. The information in the directory is collected from two sources: one is the auditing firm that reports its client information to the directory, and the other is the certified organization that chooses to be listed in the directory in order to publicize, communicate and promote their certification to their stakeholders, such as clients, business partners or the general public. The database was updated quarterly, adding newly-certified company information. Available information included the certified company's name, address, telephone and fax numbers, standard under which the company site is registered, name of the certification body which performed the audit, scope of the company's registration and the effective date of registration and certificate number.

The disadvantage of using the directory is that it may result in self-selection bias. Organizations that are not listed in the directory will be excluded from the study. Over 21,000 ISO 9001-certified organizations and over 3,800 ISO 14001-certified Canadian and US organizations are listed in the directories. Based on the numbers released by the ISO 2007 survey, approximately 50% of the certified organizations are not listed in the directory. These certified organizations were not listed in the directory due to several reasons: firstly, there are budgetary constraints — companies may not want to pay the service charge for being listed. Secondly, companies may prefer to publicize their ISO

certification through other media, such as newspaper advertisements or on their own company website. Thirdly, companies may simply not be aware of the existence of the directory. One way to test the self-selection bias is to find and survey the ISO certified companies which are not listed, then compare their responses to those listed in the directory. Because there was a lack of resources for getting the contact information of the non-listed companies, the self-selection bias test was not performed. It is possible that there are factors related to the non-listed companies which may influence the results of the study.

Operating in a wide variety of industrial sectors, these organizations are certified by either accredited audit firms or non-accredited audit firms. Among the organizations that are certified by accredited audit firms, some are certified by the "big ten" audit firms, while others are certified by small boutique-type audit firms. The sample frame includes companies certified by accredited "big-ten," and accredited boutique-type audit firms, as well as non-accredited audit firms; therefore, this can be viewed as an adequate representation of the target population. In the directories maintained by QSU publishing, the "big ten" largest certification bodies were ranked by their number of client organizations. The list of the "big-ten" audit firms is shown in Table 4-1.

4.5.2 Sample Size Estimation

One of the key issues in research design is to determine the necessary sample size to achieve adequate statistical power for the planned hypothesis testing. The conceptual framework developed in Chapter Three will be examined using structural equation modeling (SEM). The rationale of using SEM will be explained in Chapter Five.

Table 4-1 The "Big-Ten" Certification Bodies

Rank	Certification Bodies
1	BSI Management Systems
2	UL DQS
3	Perry Johnson Registrars Inc.
4	Quality Management Institute - SAI Global
5	United Registrar of Systems Ltd
6	Bureau Veritas Group
7	NSF International
8	SGS Systems & Services Certification
9	DNV Certification, Inc.
10	Intertek Systems Certification

For SEM, the reliability of the parameter estimates, model fit and statistical power are significantly affected by sample size (Shah and Goldstein, 2006). Research has shown that small sample sizes are generally characterized by parameter estimates with low reliability, greater bias in χ^2 and RMSEA fit statistics and greater uncertainty in future replication (Jackson, 2003).

A number of approaches have been recommended to determine the adequate sample size for SEM. A simple rule of thumb method suggests establishing a minimum of 200 observations (Bentler and Chou, 1987). Another option is to have a certain number of observations per manifest variable (MV) (Bollen, 1989). There are ten latent variables (LVs) involved in the structural modeling analysis. If each LV has three MVs (Hair et al., 2009), each MV will need five observations, the estimated sample size would be 150 ($10 \times 3 \times 5 = 150$). If each MV needs 10 observations, the estimated sample size is 300 ($10 \times 3 \times 10 = 300$). MacCallum et al. (1996) suggested a third approach by conducting a prior power analysis to determine the adequate sample size. The sample size can be estimated based on the degree of freedom and desired power, assuming $\alpha = 0.05$, root mean square

error of approximation RMSEA = 0.08. Based on the hypothesized model, it was estimated that 30 MVs will be involved in this study. Therefore, the degree of freedom would be 30(30+1)/2-30 = 435. Using the formula provided by MacCallum et al., (1996), a power of 0.08 for a test of close fit can be achieved with a sample size of 53. The indication is that adequate power can be achieved with moderate sample size when the degree of freedom is high. However, the same level of sample size may not necessarily be adequate for precise parameter estimates (MacCallum et al., 1996).

Given the sample size estimation using the three methods, I consider a minimum of 200 the adequate sample size for the present study. It falls into the range of the second estimation approach (100, 300). When comparing the moderate sample size estimate the third approach, using sample size of 200 can provide more reliable parameter estimates, overall model fit and achieve higher statistical power (Hair et al., 2009). The typical survey response rate in operations management research range from 18% to 32% (Frohlich, 2002), it was expected to achieve 25% response rate for this study. Various approaches recommended by Frohlich (2002) were used to maximize the response rate. Potential respondents were contacted directly to verify the accuracy of the mailing list. Pre-notice letters were sent to generate early interest, followed by multiple waves of mailing of the survey package. A copy of the research reports was offered to the respondents. Phone calls and emails were used to follow up with the non-respondents. Pre-paid postage, web survey and toll free fax number were provided for the convenience of returning the completed survey. With these response rate enhancing strategies, the twenty-five-percent response rate was considered achievable. Therefore, survey

questionnaires need to be sent to 800 certified organizations to obtain 200 responses approximately for the 25% response rate.

4.5.3 Stratified Sampling

Stratified sampling involves grouping the study population into strata and selecting a random sample within each stratum. Stratified sampling is often used to ensure proportional representation for each stratum, decrease the sampling variability, or to yield a sufficient number of a subpopulation in the sample for reliable analysis (Henry, 1990). It can be done proportionally or disproportionally. Proportional stratification results from using the same sampling fraction in each stratum, while disproportionally stratified sampling involves using different sampling fractions in different strata.

Proportional stratification was used to divide the sample into two groups: ISO 9001 certified organizations and ISO 14001 certified organizations. Each group accounts for 50% of the sampling frame. Since auditors must follow the same auditing guidelines for ISO 9001 and ISO 14001, it was expected that the audit processes would be similar for both standard certifications. Therefore, the same proportion was used for each stratum to achieve equal representation of each standard.

According to the ISO survey 2007, among all the ISO 9001 certified organizations in the US and Canada, about 75% operate in US, 25% operate in Canada. Simply using random sampling may result in the over- or under- representation of the Canadian certified organizations in relation to the US certified organizations. Based on the numbers of the organizations that get ISO certified in U.S. and Canada, I decided to select 75% of the samples in U.S. and 25% in Canada. Therefore, among the total of 800 sample

organizations, 600 were drawn from the list of US companies, and 200 were drawn from the list of Canadian companies.

Moreover, the type of the auditor was used to further divide the certified organizations into three strata. The certified organizations may be audited by three types of auditors: big-ten accredited, boutique accredited and non-accredited. Based on the literature review and the interviews with the industry experts, this variable was predicted to be an important indicator of audit process quality. Therefore, it was important to proportionally represent these three groups: organizations certified by a big-ten certification body, organizations certified by a boutique certification body, organizations certified by a non-accredited auditor. Based on the data available in the directory, the sampling fractions for the organizations certified by big-ten accredited, boutique accredited, non-accredited auditors were approximately 50%, 20% and 30%, respectively. A breakdown of the stratified sample is shown in Table 4-2.

Table 4-2 Stratified Sampling

Country	Standards	Big-ten Accredited	Boutique Accredited	Non-accredited	Total
US	ISO 9001	150	60	90	300
	ISO 14001	150	60	90	300
Canada	ISO 9001	50	20	30	100
	ISO 14001	50	20	30	100
Total		400	160	240	800

4.5.4 Sampling to Enhance Response Rate

The sampling procedure was designed and executed to improve the response rate. Because target organizations were recently certified, they were more likely to be interested in this study and likely to respond to the questionnaire. Organizations that were certified after January 2007 were randomly selected from each stratum. According to a

recent survey, while the time to obtain ISO 9001 certification ranges from eight months to 1.5 years, it takes most companies approximately 12 months to two years to get ISO 14001-certified (Babakri et al., 2003). Respondents are expected to have a fresh memory of their experience with the certification audit in the past three years.

It is possible that some of the companies had undergone the certification audit two years ago: the respondents of these companies can be reminded of their past experience due to the surveillance audits after the certification. According to ISO 9001/14001 auditing guidelines, surveillance audits are needed every six months after the certification to assure ongoing conformity, to determine whether the certified management system remains effective and to encourage continual improvement. Surveillance audits are carried out by the same audit firm that conducted the certification audit; therefore, the respondents in the client companies can refresh their memories of the certification audit conducted by the audit firm.

The directory is updated quarterly; therefore, it is possible to get updated information of the target companies which were recently certified in terms of their contact names, mailing address and telephone number. Aside from surveying the most recently certified companies, I attempted to boost the response rate by providing a research summary, offering incentives and controlling for the industries. Since there is a general interest in benchmarking company performance among certified companies, offers to provide research summaries can help to enable the target organizations to compare their firm to their benchmark. Book incentives were also offered to encourage the informants to respond. Informants who replied were entered into a drawing: five

winners received the business bestseller, *The Toyota Way, 14 Management Principles from the World's Greatest Manufacturer* by Jeffery Liker.

To rule out threats to valid inference, I attempted to control the industry sector when selecting the samples. Five industries were selected: transportation equipment manufacturing (336), electrical and optical equipment (334), machinery manufacturing (333), plastics and rubber products manufacturing (326) and chemicals, chemical products and fiber (325). Within the selected industry sectors, due to highly-demanding clients and stringent government regulations, ISO certification is critical to the organizations' business success. Actively involved in the certification process and having extensive experience with certification, respondents of these organizations are knowledgeable of the certification process and will be able to provide valuable responses to the survey; in addition, the selected industries primarily involve line and continuous flow manufacturing processes with a high degree of complexity. The complex manufacturing processes make the certification audit a challenging task, and require intensive service encounters between the auditor and the client; therefore, the respondents that attained rich experiences during the audit process were capable of providing insightful views to the study.

4.6 Preliminary Study

A preliminary study featuring interviews with ISO 9001 QMS and ISO 14001 EMS auditors was conducted to gain insights from experienced professionals regarding the knowledge-based resources for high-quality audit service, audit process quality and the outcomes of the ISO audit. Eight lead auditors specializing in QMS and EMS auditing in

Canada were chosen as the interviewees due to their proficient expertise and extensive working experience in ISO management system auditing.

In-depth interviews with eight lead auditors from audit firms in Canada were conducted to gain a comprehensive understanding of the ISO management system audit practices including the auditing process, problems related to the service encounter between the auditor and the client and the characteristics of a high quality audit. Initial contact with 20 Canadian lead auditors (LAs) listed in the CECAB roster for certified EMS and RABQSA-certified QMS LAs was made by mailing a contact letter (see Appendix 1). All of the auditors work in the same geographic vicinity as the researcher: this made arranging in-depth interviews convenient. All of the 20 auditors work for certification bodies accredited by SCC in the Greater Toronto Area (GTA). The targeted LAs, personally accredited by CECAB and RABQSA, were expected to possess ample knowledge, skills and audit experience, and therefore could provide valuable insights for the present study.

Follow-up emails were sent to the auditors one week after the contact letters were mailed. Of the 20 auditors initially contacted, eight responded to the interview inquiry either by email or telephone. Five face-to-face interviews and three telephone interviews were arranged at the convenience and preference of the auditors. The interview protocol (see Appendix 4-2) was sent to the auditors one week before the interview was conducted.

Four client organizations were contacted to capture the clients' opinions of the ISO certification audit process. The purpose of the interviews was to understand the client's perspective of the interactions within the certification process, audit process quality

during the two-stage certification audit and the kind of audit outcomes that are critical to the client firm. The contact letter to the client organizations and the interview protocols are shown in Appendix 4-3 and 4-4, respectively.

4.7 Survey Instrument Development

Key constructs involved in the conceptual model were operationalized based on the literature review and expert opinions sought from the preliminary field studies. Measurement scales were designed to capture the clients' perceptions on the auditing firms' knowledge-based resources for the audit, audit process quality, client's competitive outcomes and client satisfaction. Table 4-3 shows the source of scales that were used to measure the key constructs in the present study and the number of corresponding survey questions.

4.7.1 Audit Process Quality

4.7.1.1 Stage-One Audit Process Quality

In the readiness review stage of the audit process, a number of activities take place. These activities include the selection of the facilities to be audited, scheduling of audits, selection of the audit team, development of the audit plan and a review of the relevant documentation provided by the client. In the case of ISO 14001, the auditor needs to review the client organization's EMS documentation to examine whether the level of documentation detail is sufficient to describe the core elements of the EMS and provide direction on where to obtain more detailed information on the operation of specific parts of the EMS (Canadian Standards Association, 2004). The primary objective of the readiness review stage is to make sure the client organization's documentation is

prepared according to the requirements prescribed by ISO standards (Moor and Beelde, 2005).

Table 4-3: Sources for Items Used to Measure the Constructs

	Construct	Source of Scale	Survey Questions
Audit Process Quality	Stage-One Audit Process Quality	Developed specifically for this study based on Tushman and Katz (1980), Hass (2006), and Moor and Beelde (2005).	B1a, B1b, B1c, B1d
	Stage-Two Audit Process Quality	Viewed as a second-order latent variable. Measured by first-order factors	not directly measured
	Efficiency	Developed specifically for this study based on Tushman and Katz (1980), Tukel and Rom (1998), and Rondinelli and Vastag (2000).	B2a, B2b, B2c, B2d, B2e
	Reliability	Adapted from Parasuraman et al. (1994), Watson and Mackey (2005)	B2f, B2g, B2h, B2i
	Responsiveness	Adapted from Parasuraman et al. (1991), Sutton (1993), Bettie and Fearnley (1995)	B2j, B2k, B2l, B2m
	Assurance	Adapted from Parasuraman et al. (1991), Berry et al. (1991)	B2n, B2o, B2p, B2p
	Empathy	Adapted from Berry et al., (1991), Christmann and Taylor (2006)	B2r, B2s, B2t, B2u, B2v
Knowledge_ based Resources	Human Capital	Modified from Snell and Dean (1992), Jayaram et al. (1999) and Karapetrovic and Willborn (2001).	A1f, A1g, A1h, A1i
	Structural Capital	Developed specifically for this study based on Hill (2000), Hayes and Wheelwright (1984)	A2a, A2b, A2c, A2d, A2e, A2f
	Communication	Modified from Carr and Pearson (1999), Mohr and Sohi (1995), Rezaee and Elam (2000) and Sutton (1993)	A3a, A3b, A3c, A3d, A3e, A3f, A3g, A3h
	Cooperation	Modified from Heide and Miner (1992), Cannon and Perreault (1999), Christmann and Taylor (2006) and King and Lenox(2000)	A3i, A3j, A3k
Outcome and Satisfaction	the client's competitive outcomes	Adapted from Flynn et al. (1994), Poksinska et al. (2003), Anderson et al. (1999)	E1a, E1b, E1c, E1d, E1e, E1f
	Client Satisfaction	Cronin et al. (2000), Hays and Hill (2006)	C1a, C1b, C1c, C1d, C1e, C1f

With an objective and limited resources, the stage-one audit can be viewed as a project. The cost and work progress in this stage is critical for the client organization which expects to move into the next on-site visit stage quickly and smoothly. Four items

were used to measure stage-one audit process quality. Three items were adapted from Tushman and Katz (1980) and Hass (2006) to reflect the cost and time factor associated with the stage-one audit. The client was asked to assess the extent to which the document review was conducted in a timely manner, whether the stage-one audit activities were conducted and completed according to the audit plan and if the cost met the budget. The fourth item was modified from Moor and Beelde (2005) to assess the extent to which the client was ready and well-prepared for the stage-two on-site certification audit.

4.7.1.2 Stage-Two Audit Process Quality

Stage-Two Perceptual Audit process quality

Similar to client-focused service quality (Parasuraman et al., 1985), audit experience quality is primarily viewed from the perspective of the client. The perceptual items of audit process quality are developed by adapting and modifying the service quality measures (reliability, responsiveness, assurance and empathy) with the intention of capturing measures of ISO management system audit service.

Reliability reflects the auditor's ability to provide timely and accurate performance of the promised service. Reliability measures developed by Parasuraman et al. (1994) were modified to capture the characteristics desired by the client during the ISO management system audit (Watson and Mackey, 2005). The modified four items reflect the extent to which the auditor delivers the promised services within a certain time frame, the extent to which the auditor is technically competent to perform the audit task, the extent to which the auditor's activities are consistent with the audit plan and the extent to which the client could count on the auditor to achieve the overall objective of the audit.

The items for *responsiveness* were developed with the intention of representing the very essence of the attribute's definition: the willingness of the auditor to assist the client and provide prompt service. A modified version of items for responsiveness (Parasuraman et al., 1991), geared to the needs of the client in audit service (Sutton, 1993; Beattie and Fearnley, 1995), was used for the present study. The four items for responsiveness assessed the extent to which the auditor responded to the client's requests: addressing their ongoing concerns, adjusting the schedule, informing them of non-conformance and issuing audit reports.

The measures for *assurance,* the auditor's ability to instill a feeling of confidence and security in clients, were adapted from Parasuraman et al. (1988, 1991) and Berry et al., (1991). The four items for assurance included the extent to which the client perceived that the auditor built trust, ensured confidence, had the best interest of the client in heart and added value to the client organization during the audit process.

Marketing researchers define *empathy* in terms of the service provider's sensitivity to meet the client's unique needs based on the client's best interest (Berry et al., 1991). In the ISO audit service, the client's perception of empathy depends on the degree to which the auditor provides individual care and value-added services to meet the client's needs (Christmann and Taylor, 2006). Five items were developed to embody the empathy perceived by the client. Adapted from Christmann and Taylor (2006), the first item measures the degree to which the audit activities were arranged at times convenient to the client. The second item asked the client the degree to which he or she perceived the opportunity for improvement proposed by the auditor might help them improve the management system capabilities within their organization. The other three items were

modified (Berry et al., 1991) to assess the auditor's attitude towards the client in terms of friendliness, professionalism and easiness.

Stage-Two Technical Audit process quality

Although difficult to measure, *technical audit process quality* represented by time performance and cost reduction is commonly desired by the client, who is dedicating substantial resources to the pursuit of ISO certification (Rondinelli and Vastag, 2000). Items for stage-two technical audit process quality were adapted from project management literature (Hui et al., 2008; Tukel and Rom, 1998). The time performance is measured by the extent to which the audit is completed as soon as possible and the extent to which the audit activities are carried out according to the audit plan. The cost factor is measured by the extent to which the cost reduction associated with the stage-two on-site certification audit and the extent to which the cost of the stage-two audit meets the budget of the client.

4.7.2 Knowledge-based Resources

The knowledge-based resources are captured with four constructs, representing four key areas: human capital, structural capital, communication and cooperation. The source of the scale items for each construct, whether the items were newly developed for this study, adapted or modified from previous studies or selected verbatim from earlier studies, are reported in sections 4.7.1.1 through 4.7.1.4.

4.7.2.1 Human Capital

Viewed as the "software" of an organization, human capital comprises the organizational controls, procedures and systems of the company, and the knowledge, experience and skills of the people involved (Hill, 1989). Following auditing guidelines,

the audit firms for ISO standards adopt similar procedures and control systems: they rely primarily on the auditors' knowledge and skills to deliver high quality audit service. To reflect the significance of human elements in the ISO audit, the items for human capital focused on the knowledge, skills and experience of the auditor.

Four items for human capital were developed based on Snell and Dean (1992), Jayaram et al. (1999) and Karapetrovic and Willborn (2001). Snell and Dean (1992) note that organizations can increase their generic human capital by hiring employees with high levels of education and expertise from the external labor market while focusing on internal training activities to develop firm-specific human capital. Jayaram et al. (1999) establish employee training as a critical factor of managing human resources for superior manufacturing performance. Building on these notions, two items were developed to assess the expertise and training of the auditor. Concerning the competence of the auditor, a third item was adapted from the case study by Karapetrovic and Willborn (2001), where auditor competence was considered a crucial factor for carrying out a value-added audit. The fourth item measures the extent to which the auditor has working experience related to the client organization's industry. This item was developed based on the preliminary study in which two managers at client organizations were interviewed, noting that the audit process would have run more smoothly and efficiently if the auditor had industry-related experience.

4.7.2.2 Structural Capital

Viewed as the "hardware" of an organization, the structural capital of the manufacturing process includes facilities, manufacturing technologies and information systems (Hill, 2000; Hayes and Wheelwright, 1984). In the present research context, the

audit firm specializes in a professional audit service. Contacts with the client occur mostly through telephone calls and emails. The on-site certification audit is conducted at the client's facilities; therefore, the audit service process and advanced information systems are critical indicators of the auditing firm's structural capital.

Six items were developed to measure the structural capital construct. In reference to Hill (2000) and Hayes and Wheelwright's (1984) definitions of structural capital, four items were developed to assess the design of the audit process, the audit plan, the development of audit protocol,and the information technology used in the audit. Two items that concern the style and format of the audit report were added based on the preliminary study.

4.7.2.3 Client Relationship - Communication

One aspect of client relationship, the auditor's communication effort as perceived by the client was operationalized based on research on inter-organizational communication (Krause and Ellram, 1997; Carr and Pearson, 1999). Items used in previous research were modified to capture the distinctive characteristics of auditor-client interactions during the ISO audit process.

Eight items were developed to measure the communication construct. The first three items intended to reflect the timeliness of the communication (Mohr and Sohi, 1995); case studies on ISO audit were also consulted (Rezaee and Elam, 2000; Sutton, 1993). The clients were asked to assess the extent to which they were informed in a timely manner about activities to be undertaken according to the audit plan, the progress of the audit and any problems encountered and if there was evidence collected during the audit which indicated an immediate and significant risk related to quality or

environmental issues. Two items were modified from Carr and Pearson (1999) to reflect the clarity of the communication: the clients were asked to assess the extent to which they understood their role and responsibilities in the audit process. Two items were adapted from Mohr and Sohi (1995) to reflect the thoroughness and usefulness of communication during the audit. The last item was added to reflect the overall effectiveness of communication during the audit.

4.7.2.4 Client relationship - Cooperation

The conceptual definition of cooperation centers on one party's flexibility to accommodate the other party's needs, along with joint problem solving between the two organizations (Heide and Miner, 1992; Cannon and Perreault, 1999). This definition provides the foundation for the items measuring the auditor's cooperation as perceived by the client. Taking the auditors' cooperation efforts observed in studies on ISO audit into account (Christmann and Taylor, 2006; King and Lenox, 2000), three items were developed to measure cooperation: the clients were asked to what extent the auditors were flexible in response to requests to modify the audit plan (e.g., dates, time, duration of the meeting, interviews and on-site observation); the extent to which the auditors would rather work out new arrangements rather than hold the client to the original plan when an unexpected situation arises; the extent to which the auditor would work with the clients to resolve any diverging opinions concerning the audit evidence and/or findings.

4.7.3 Client's Competitive Outcomes

Clients have diverse reasons for pursuing ISO certification; these motivating reasons can be used as proxies for the outcomes of the audit. The client invests significant organizational resources to get certified in order to achieve certain outcomes. Previous

studies show that internal factors such as quality improvements and external factors such as client requirements, regulation pressures and export considerations (Flynn et al., 1994; Anderson et al., 1999) are primary drivers for firms that pursue ISO 9001 QMS certification.

Specifically, items used for QMS performance were developed based on research that investigates the benefits of implementing ISO 9001. These acclaimed benefits include operational efficiency, such as lower defect rates, reduced costs of quality, higher productivity and on-time delivery (Flynn et al., 1994; Elmuti and Kathawala, 1997), as well as quality performance in terms of reductions associated with waste from processing, defective products at final inspection and hours spent reprocessing defective goods with respect to total production hours (Romano, 2000).

Four items used for EMS performance were developed based on the clients' motivating factors for pursuing ISO 14001 certification: client demands, internal environmental improvement, corporate image improvement and regulation pressure were found to be the primary drivers (Corbett and Kirsch, 2001; King and Lenox, 2001). These primary drivers were considered appropriate proxies for the outcome of ISO 14001 environmental management system audit.

Despite wide recognition within the audit industry of the need to satisfy clients, the perspectives of the "real" clients are often neglected (Elliott, 1995). Studies on the drivers of pursuing ISO management system certification have revealed that the "real" clients for the QMS certification are the downstream clients of the client (the auditee) (Poksinska et al., 2003); meanwhile, the "real" clients for the EMS certification involve the environmental regulators, general public, local communities and environmental groups

who are exposed to the effects of the client organization's environmental footprints (Sharma, 2000; Melnyk et al., 2003).

Although it is difficult to capture the view of the "real" clients, items for stakeholder confidence were developed in an attempt to reflect the interest of the clients. Because more and more buying firms rely on ISO certification to reduce supplier selection and monitoring costs (Anderson et al., 1999), the first item reflects the buying firm's confidence in the client by measuring the degree to which the client organization's business opportunities increase after certification. In relation to the ISO 9001 QMS, an appropriate proxy for stakeholder confidence is that the buying firm reduces its frequency of quality evaluations and monitoring after its supplier is certified.

4.7.4 Client Satisfaction

To measure the degree to which the client is satisfied with the audit service, three items for client satisfaction were developed based on the satisfaction measures used in Cronin et al. (2000) and Hays and Hill (2006). The clients were asked how likely they are to purchase audit service from the auditor again, how likely they are to recommend the auditor's service to a peer organization and their overall satisfaction with the audit service. Industry experts interviewed in the preliminary study also contend that repurchase intention, recommendation to peers and overall satisfaction are prominent signals for client satisfaction.

4.6.5 Summary of Survey Instrument

Once developed, the survey instrument was reviewed by two professors of operations management; modifications were made to the questions, the format and the structure of the survey based on the feedback provided by the two professors. A

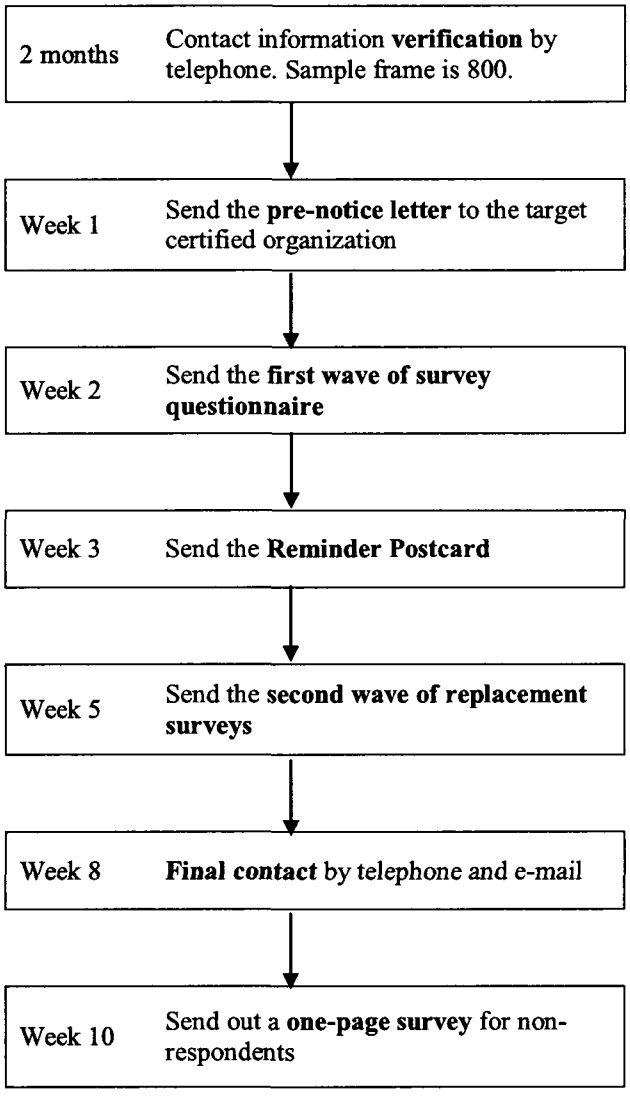
professional editor was hired to review and edit the grammar and sentence structure of the survey questions.

The revised survey instrument contained the questionnaire instructions on the cover page and seven parts of questions on the nine following pages. Part A, which contained 30 items, assessed the knowledge-based resources of the audit firm. Part B addressed the audit process quality using 26 survey questions. Part C assessed client satisfaction involving 18 items. Part D acquired the general information of the ISO audit certification. In this part, 14 items were used to inquire as to the reasons for adopting ISO standards, cost information and the level of organizational commitment devoted to ISO certification. Part E assessed the client's competitive outcomes perceived by the client using six items. Specific operational and business performance was assessed with 26 items in Part F. Facility demographic information was requested in Part G, with seven survey questions. In total, there were 127 items presented in the survey instrument. It was estimated that completing the survey would take 45 minutes to one hour.

4.8 Data Collection Procedure

A pilot test was conducted before the large-scale survey. The detailed data collection procedure through large-scale survey is shown in Figure 4-3. It took two months to verify the contact information of the sample organizations, beginning March 2009. As the timeline specifies in Figure 4-3, large-scale mailing and subsequent follow-ups were carried out from May to August 2009.

Figure 4-3: The Data Collection Procedure



4.8.1 Pilot Test

Pilot test can be used to eliminate ambiguity of the wording, improve the format and design of the survey and increase item comprehension (Prahinski et al., 2009). Before the large-scale survey, the developed survey instrument underwent a pilot test with 20 certified organizations: four of the organizations were interviewed in the preliminary

studies, and the other 16 organizations were either recommended by the auditors interviewed in the preliminary studies or contacted through the help of industry experts.

Respondents were explicitly asked to indicate any ambiguities or potential sources of error stemming from the wording or the format of the questionnaire. Input from these respondents was used to further refine and modify the survey instrument. The final versions of the survey instrument for ISO 9001- and ISO 14001-certified companies are presented in Appendices 4-6 and 4-7, respectively. The survey instrument package consisted of a cover letter to the informant, the questionnaire booklet and a participation form on a separate page.

4.8.2 Mail Survey

Survey methodology was used to empirically study the relationship between the knowledge-based resources, service encounter, audit process quality and the outcome of ISO audit. A mixed approach using a mail survey and a web-based survey were conducted to collect data.

Before the survey was mailed, a significant amount of time was invested to verify the contact information of the 800 certified companies chosen from the sample frame. The individual contacts of the sample certified organizations were reached through telephone whenever possible. In case the target informants could not be reached, or had left the company, additional phone calls were made to identify the person who is responsible for the ISO certification program and his or her contact information. Although the QSU Publishing database was updated quarterly, initial telephone verification showed that 14 of the 800 companies had stopped operating or went out of business; therefore, the 14 companies were eliminated from the sample frame and were

replaced by 14 companies that were chosen based on the sampling rules described in section 4.4. Telephone calls were made to ensure that the replacement companies' contact information was also up-to-date. After all the sample organizations' contact information was verified, the survey was implemented following the five-step procedure suggested by Dillman (2009).

Step 1: *A pre-notice email* inviting participation in the survey research was sent to the targeted respondents identified through the QSU Publishing database. In the pre-notice email, the purpose and importance of the study were discussed; it was also stressed that the response provided by the clients would be kept confidential and would be used solely for the purpose of the research.

Step 2: *The survey packages* were mailed to the 800 ISO certified companies one week after the pre-notice email. A formal invitation letter, a questionnaire booklet, a copy of the participation form and a postage-paid return envelope were included in the survey package. Besides using the return envelope, the respondents were provided with a hyperlink to the web-based survey questionnaire. The web-based survey was developed using the electronic survey platform "Ivey's Ultimate Survey Tool," provided by the Richard Ivey School of Business, University of Western Ontario (http://www.ivey.uwo.ca/survey/). The creation and administration of the survey was conducted through the World Wide Web. The survey tool provided high efficiency as the data could be explored with an Excel or SPSS format data file. The respondents could easily gain access to the survey by clicking the provided uniform resource locator (URL). To protect the respondents' security and confidentiality, a password was assigned and

included in the invitation letter. Only respondents who were invited could respond to the survey and view the survey report by entering the password.

In addition to the mail and web-based reply options, the informants could also return the completed questionnaire via fax. A toll-free fax number was set up by eFax (www.efax.com) specifically for this research. All of the faxed responses were sent directly to the researcher's email account.

Because the survey was conducted in the United States and Canada, it was translated into French so that the certified organizations operating in Quebec, a predominantly French-speaking province in Canada, could be included in the study. The French version of the survey can be found in Appendix 4-8.

Step 3: *A reminder postcard* (Appendices 4-9 and 4-10) was mailed to the target certified organizations one week after the initial mailing. In the postcard, the researcher's appreciation to those who responded to the survey is expressed along with a courteous reminder to those who had not yet responded to the survey. The hyperlink and password for the web-based survey was included.

Step 4: *A replacement questionnaire* was mailed to the target certified organizations two weeks after the reminder postcards were sent. A follow-up letter was attached with the replacement questionnaire indicating that the informant's completed questionnaire had not yet been received. The follow-up letter intended to encourage the informants to respond by conveying that other firms had responded to the survey. Three options for returning the completed survey (mail, Internet or fax) were highlighted.

Step 5: Telephone and email communication were used for the final contact with the informants four weeks after the mailing of the replacement questionnaire. Thank-you

letters were sent to those who had responded to the survey. Telephone and email follow-ups intended to emphasize the importance of responding to the study, and encourage the informants who had not yet responded to reply in a timely manner. Follow-up telephone calls were made to the respondents regarding any missing data in their responses in order to obtain the data.

4.8.3 Web-based Survey as an Ancillary Method

The web-based survey, one form of electronic survey method, has become increasingly attractive to researchers due to its many advantages, such as cost savings (Weible and Wallace, 1998), a low proportion of missing data (Klassen and Jacobs, 2001) and efficiency and data accuracy due to automatic data entry (Boyer et al., 2002); however, concern over the low response rate of web-based surveys, compared to traditional mail surveys (Klassen and Jacobs, 2001; Tse, 1998), has hindered the widespread application of this technique.

Web-based survey was selected as an ancillary method for this study for the following reasons. Firstly, research has shown that, with a careful design and implementation, the web-based survey can yield a comparable response rate to the traditional mail survey (Boyer et al., 2002). It is possible to increase response rate if the web-based survey is facilitated with an email notification, and is executed according to Dillman's follow-up strategy used with mail survey (Dillman, 2000). Secondly, the web-based survey may be very effective to collect data from respondents who have access to the Internet and email on daily basis (Klassen and Jacobs, 2001). The preliminary study conducted with the ISO auditors and the client organizations supported using a web-based survey. The interviewed auditors and clients unanimously agreed that email was

the most utilized communication vehicle, and the Internet was readily available in the client organizations.

4.8.4 One-page Follow-up Survey for Non-respondents

After the survey collection was closed on July 31, 2009, a one-page survey (Appendix 4-11) which included two key constructs in this study — communication between the auditor and the client (A3) and audit process quality (B2) — was sent to informants who did not respond to the original survey. The purpose of this one-page follow-up survey was to assess possible non-response bias. The one-page survey was sent to the non-respondents as an attachment to an email, which stated the purpose of the study and urged the recipient to respond. The recipient could also complete the one-page survey on-line by following the web link provided in the email. The results of the follow-up survey for non-respondents are reported in Chapter Five.

CHAPTER FIVE: CONSTRUCT VALIDITY

5.1 Chapter Preview

In this chapter, the descriptive statistics of the survey will be reported, followed by the construct validation. An overview of the chapter organization is shown in Figure 5-1. In Section 5.2, the response rate and descriptive statistics of the sample will be reported, followed by the assessment for possible response bias. In Section 5.3, the survey data will be examined to prepare for statistical analysis. The development and refinement procedure for the measurement models will be described in Section 5.4: reliability analysis and confirmatory factor analysis (CFA) will be used in the measurement model refinement process. Section 5.5 will focus on assessing construct validity.

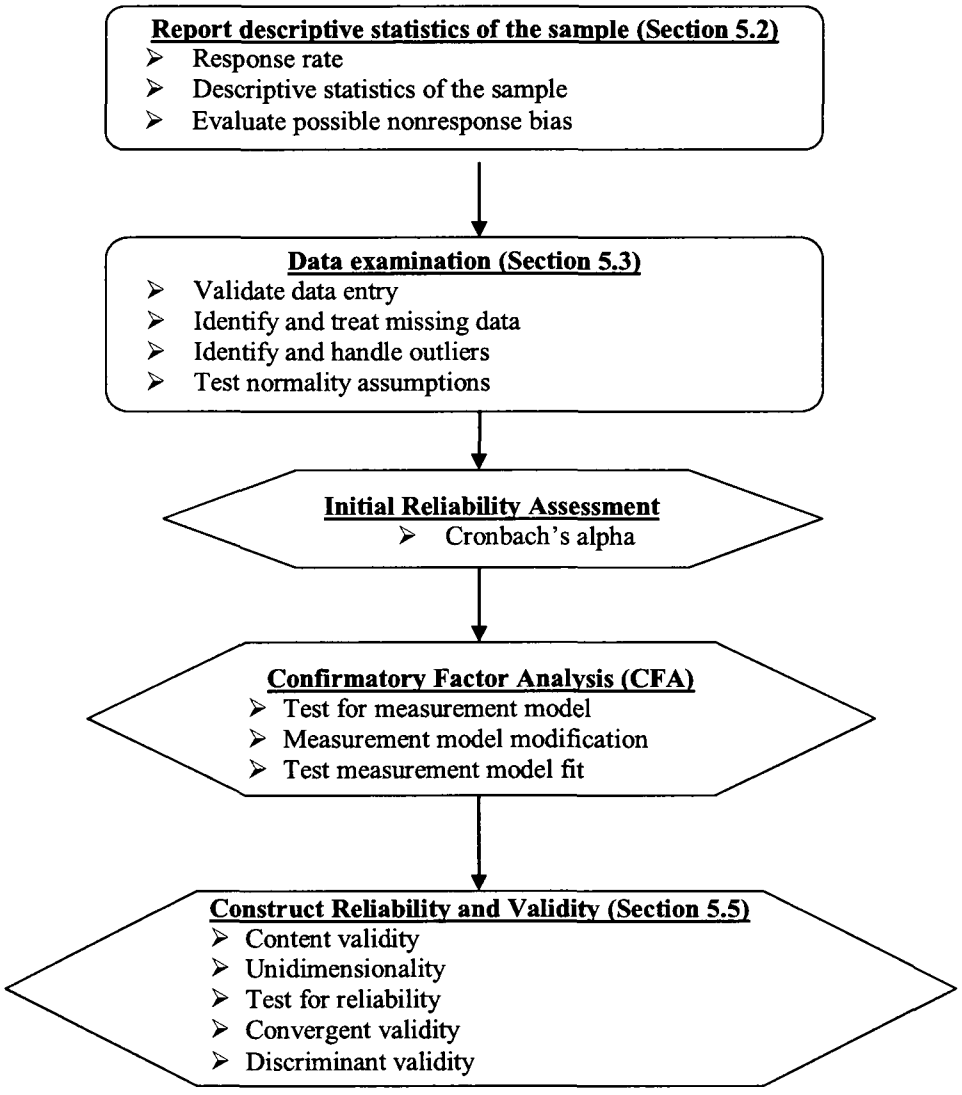
5.2 Sample Descriptive Statistics

In this section, response rate will be reported and described in detail. The descriptive statistics associated with the characteristics of the respondents and their organizations will be presented. Potential bias associated with unit and item non-response will be evaluated and discussed.

5.2.1 Response Rate

Before mailing the survey, telephone calls were used to contact the informants of the 800 target certified organizations. The purpose of telephone contact was to verify the mailing address of the certified organization and to confirm the name of the correct informant who was knowledgeable of the ISO 9001 or ISO 14001 certification

Figure 5-1: Procedures for Construct Validation



program. According to the telephone call verification, the contact information of 27 organizations was either outdated due to relocation, contact personnel changes or had errors associated with street number or postal code; the incorrect contact information was updated. Seven of these organizations could not be reached after several attempts. Further enquiry made to the parent company revealed that these organizations were closed due to

a strategic shift in corporate direction or economic troubles resulting from the events of 2008; in addition, two organizations claimed that they were not eligible for the survey because they had withdrawn from the ISO certification program due to lack of funds. Nine additional certified organizations, therefore, were randomly drawn from the sampling frame to replace the seven closed businesses and two ineligible organizations for the survey: telephone calls were also made to verify the contact information of these nine certified organizations.

After verification, the mail survey package was sent to 800 certified organizations. A cover letter, a copy of the questionnaire, a consent form and a postage paid envelope were included in the survey package. The informants were provided with three alternatives to return the completed survey: use the postage paid envelope which was included in the survey package; use the web-link and password provided in the mail to complete a web-based survey; or fax the completed survey to the researcher using the toll free fax number provided in the cover letter. Fourteen surveys were returned as "undeliverable" due to address or personnel changes. Two organizations stated that they claimed compliance with ISO standards based on internal audit rather than hiring a third-party audit firm and were, therefore, ineligible. In total, 209 surveys were completed and returned, which yielded a response rate of 26.1 per cent (209/800). Despite telephone follow-up efforts, three surveys were missing a significant amount of data related to the audit process quality variable and the outcome variable, and were excluded from the final analysis. Two responses arrived one month after the survey was closed. After excluding the five unusable questionnaires, 204 responses were actually used in the statistical analysis for testing the proposed conceptual model.

As described in Chapter Four, stratified sampling was used in this research to ensure a proportional representation of each stratum and to yield a sufficient number of sub-population organizations in the sample for reliable analysis. The variables used to form the strata were country (United States or Canada), standards (ISO9001 or ISO 14001) and the type of audit firm (accredited "big ten," accredited boutique or non-accredited). A summary of the response rate associated with each stratum is provided in Table 5-1; the response rates by standards (ISO 9001 and ISO 14001) are shown in Table 5-2.

Table 5-1 Response Rates of Each Stratum

Country	Standards	Type of Auditor	Survey Sent	Responses	Response Rate
US	ISO 9001	Big-ten Accredited	150	48	32.0%
		Boutique Accredited	60	14	23.3%
		Non-accredited	90	17	18.9%
	ISO 14001	Big-ten Accredited	150	29	19.3%
		Boutique Accredited	60	11	18.3%
		Non-accredited	90	16	17.8%
	US Total	Big-ten Accredited	300	77	25.7%
		Boutique Accredited	120	25	20.8%
		Non-accredited	180	33	18.3%
		All types	600	135	22.5%
Canada	ISO 9001	Big-ten Accredited	50	19	38.0%
		Boutique Accredited	20	8	40.0%
		Non-accredited	30	11	36.7%
	ISO 14001	Big-ten Accredited	50	23	46.0%
		Boutique Accredited	20	8	40.0%
		Non-accredited	30	5	16.7%
	Canada Total	Big-ten Accredited	100	42	42.0%
		Boutique Accredited	40	16	40.0%
		Non-accredited	60	16	26.7%
		All types	200	74	37.0%
Country Total (US + Canada)		Big-ten Accredited	400	119	29.8%
		Boutique Accredited	160	41	25.6%
		Non-accredited	240	49	20.4%
Sample Total			800	209	26.1%

Table 5-2 Response Rates by Each Standard

Standard		Survey Sent	Responses	Response Rates
ISO 9001	US	300	79	26.3%
	Canada	100	38	38.0%
	ISO 9001 Total	400	117	29.3%
ISO 14001	US	300	56	18.7%
	Canada	100	36	36.0%
	ISO 14001 Total	400	92	23.0%
	Standard Total	800	209	26.1%

While 62.7 per cent of the respondents returned the survey by mail, 32 per cent of the responses were completed online and only 5.3 per cent were returned by fax. A breakdown of the number of responses by each mode is reported in Table 5-3.

Table 5-3 Number of Responses by Each Mode of Data Collection

Mode	# of Responses	Percentage
Mail	131	62.7%
Web	67	32.0%
Fax	11	5.3%
Total	209	100.0%

5.2.2 Descriptive Statistics of the Respondents and Their Organizations

The profile of respondents of ISO 9001- and ISO 14001-certified organizations are presented in Table 5-4. Respondents held a wide variety of titles such as president, chief executive officer (CEO), operations manager, director of quality, vice president of environmental services and ISO management representative. As shown in Table 5-4, the ISO programs were managed by top management, operations, engineering, environmental health and safety (EHS) departments, designated representatives or marketing

departments. Over half of the respondents worked in the area of operations/quality management. Only 1.5 per cent of the respondents were marketing professionals.

Table 5-4 Respondent Profile

Title	Functional Area	Frequency	Percentage
President /CEO Executive Administrator General Manager VP Manufacturing Plant Manager Quality Engineer/Supervisor Director of Quality Quality Control Manager Product Manager Director of Engineering VP of Science and Technology Technical Support Manager	General Management Operations/ Quality	26 111	12.4% 53.1%
VP Engineering	Engineering	12	5.7%
Executive VP Sustainability EHS Manager	Environmental Management	40	19.2%
ISO Management Rep.	ISO Rep.	17	8.2%
Sales & Marketing Manager	Marketing	3	1.4%
Total		209	100.0%

While the minimum amount of time that the respondent held the current position was four months, the maximum working experience in the current position was 35 years. On average, the respondents have been working on their current position for 8.4 years.

The number of employees in the respondent certified organizations ranged from five to 5,200, with an average of 474 employees. As reported in Table 5-5, a majority of respondent organizations (64%) employed fewer than 500 employees. Only one percent of the surveyed organizations hired over 5,000 employees.

Table 5-5: Firm Size

number of employees	frequency	percent
<100	71	34.0
100-499	63	30.1
500-999	47	22.5
1000-1999	22	10.5
2000-4999	4	1.9
5000 above	2	1.0

As reported by the respondents, the median annual gross sales dollars of the surveyed certified organizations was between $50 million and $100 million. The number of respondent organizations within each category of annual gross sales dollars is summarized in Table 5-6. In addition, nearly 80 per cent of the respondents reported that they operated as a branch or subdivision of their parent company, which reveals that ISO certification is generally site-specific.

Table 5-6: Annual Gross Sales in 2008 Reported by Respondents

Total sales dollars in 2008	Frequency	Percent
less than $20 million	55	26.3%
$20 million to $50 million	48	23.0%
$50 million to $100 million	41	19.6%
$ 100 million to $500 million	42	20.1%
over $500 million	23	11.0%

To improve response rate, the survey targeted organizations that were recently certified (after January 2007). As shown in Table 5-7, nearly 30 per cent of the respondents reported that they were ISO-certified in 2007; the remainder was ISO-certified in 2008 or 2009.

Table 5-7: Year of Certification of the Respondents

	Frequency	Percent
2007	62	29.7
2008	108	51.7
2009	39	18.7
Total	209	100.0

5.2.3 Evaluation of Possible Nonresponse Bias

Non-response bias is one of the major sources of survey errors (Groves, 1989): it occurs when non-respondents are different from respondents in the sample frame (Dillman et al., 2009). Non-response bias could pose significant threats to the validity and reliability of the survey results (Fowler, 2009).

Minimizing the potential for non-response bias can involve significant efforts to ensure a reasonable response rate (Fowler, 2009). In this research, numerous efforts were made to achieve a reasonable response rate. People who have a particular interest in the subject matter or the research itself are more likely to return mail questionnaires than those who are less interested (Groves, 2006). During the preliminary study, it was found that organizations which recently implemented the ISO certification program were generally interested in this subject and still had fresh memory of the certification audit process; therefore, only the organizations that were certified later than January 2007 were selected in the sample. In addition, before sending out the mail survey, respondents in each target certified organization were contacted personally through phone calls to verify the mailing address and the appropriate respondent contact information.

Survey execution followed the procedure suggested by Dillman et al. (2009) to enhance the response rate. Three methods of returning the survey were provided, making it convenient for the informants to respond. Other approaches used to enhance the response rate included providing gift incentives — a bestseller business book — and a research summary. Telephone calls and emails were used during the final contacts with the informants to encourage additional responses. Before printing, the survey was professionally designed and revised based on the feedback from two academic experts and an editor. The survey was printed using booklet format and high quality paper.

Despite efforts made through survey design and execution to increase response rate, potential non-response bias needs to be addressed. Wave analysis, archival analysis and the follow-up method are the primary approaches used for non-response bias assessment in OM research (Prahinski et al., 2009). It is recommended that multiple approaches be used to fully address concerns over non-response (Prahinski et al., 2009).

In this research, two approaches were employed to assess the potential problems of non-response bias. One approach to detecting the presence of non-response bias involved comparing the early responses that were received in the first wave of the survey to the late responses that were received in the second wave (Armstrong and Overton, 1977). The second approach was to contact the non-respondents after the planned survey was closed with a follow-up survey, using a condensed one-page version of the questionnaire (Lambert and Harrington, 1990). Archival analysis, which requires using publicly-available data, was not conducted because such data could not be found.

When implementing the first approach, respondents were split into two groups based on whether the completed questionnaire was received before or after the second

wave of mailing. All completed questionnaires received before the second wave of mailing were included in the early response group, while those received after the second wave of mailing were included in the late response group. The early response group contained 118 responses, while the sample size of the late response group was 86. Twenty of 60 items were randomly selected for the key constructs involved in the study. T-tests were conducted on each item to assess if there was a significant difference between the early and late responses. The results of the t-tests are presented in Table 5-8.

To compute the t-statistics, the formula below was used.

$$t = \frac{(\overline{X}_1 - \overline{X}_2) - 0}{S_{\overline{X}_1 - \overline{X}_2}}, \text{ where } S_{\overline{X}_1 - \overline{X}_2} = \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

$S_{\overline{X}_1 - \overline{X}_2}$ $S_{\overline{X}_1 - \overline{X}_2}$ is the standard error of the difference between the two groups. S_1^2 is the standard deviation of the early response group, while S_2^2 is the standard deviation of the late response group. If the value zero is not included within the range of the 95 per cent confidence interval, the null hypothesis that there is no statistical difference is rejected. As reported in Table 5-8, none of the t-statistics was significant. The 95 per cent confidence interval associated with each t-statistic contained zero; therefore, no significant difference was found between the early and late response groups.

Table 5-8: T-test Results for Comparing Early and Late Responses

	Item Description	Early Responses X_1 (S_1) n1=118	Late Responses X_2 (S_2) n2= 86	t-Statistics	95% Confidence Interval
A1f	The auditor has substantial auditing experience.	5.814 (1.261)	5,674 (1.499)	0.719	(-0.243, 0.521)
A1h	The auditor has extensive working experience related to our industry.	6.025 (1.310)	6.081(1.087)	-0.323	(-0.397, 0.285)
A2a	The audit process was well designed by the auditor.	3.653 (1.041)	3.558 (0.965)	0.659	(-0.188, 0.377)
A2f	Advanced information technology was used in the audit process.	4.941 (1.270)	5.047 (1.371)	-0.568	(-0.473, 0.261)
A3b	We were informed about the progress of the audit in a timely manner.	4.881 (1.570)	5.149 (1.225)	1.025	(-0.097, 0.327)
A3f	We were thoroughly informed about what to expect from the audit.	4.924 (1.740)	5.128 (1.768)	-0.822	(-0.694, 0.286)
A3k	The auditor worked with us to resolve any diverging opinions concerning the audit evidence and / or findings.	4.703 (1.645)	4.477 (1.607)	0.981	(-0.229, 0.682)
B1a	The readiness review stage of the audit was conducted in a timely manner.	5.983 (0.896)	6.119 (0.743)	0.326	(-0.469, 0.202)
B1c	We were ready for the on-site visit by the time the document review was completed.	6.229 (0.685)	6.628 (0.575)	0.515	(-0.573, 0.225)
B2d	The audit report was issued soon after the on-site visit.	5.737 (1.386)	5.919 (1.330)	-0.938	(-0.562, 0.200)
B2e	The cost associated with the on-site certification audit stage met our budget.	5.390 (1.462)	5.686 (1.513)	-1.408	(-0.711, 0.119)
B2h	The auditor's activities were consist with the agreed upon audit plan.	5.525 (1.319)	5.919 (0.910)	-1.382	(-0.719, 0.236)
B2i	We could count on the auditor to achieve the overall objective of the audit project.	5.339 (0.989)	5.593 (0.8331)	-1.735	(-0.513, 0.115)
B2j	The auditor responded to our questions and concerns very quickly.	5.466 (1.122)	5.221 (1.231)	1.479	(-0.082, 0.572)
B2l	The auditor informed us immediately if there was evidence of any non-conformity.	4.305 (1.555)	4.151 (1.515)	0.706	(-0.276, 0.584)
B2o	The auditor assured confidence during the audit process.	4.475 (1.419)	4.407 (1.450)	0.333	(-0.334, 0.468)
B2r	The on-site audit activities were arranged at times convenient to our organization.	5.432 (1.330)	5.535 (1.369)	-0.538	(-0.479, 0.274)
B2v	The auditor put us at ease when he talked with us.	5.602 (0.807)	5.558 (0.791)	0.384	(-0.180, 0.267)
C1a	If we have future needs, we are likely to hire the same auditor.	5.576 (1.521)	5.512 (1.585)	-0.294	(-0.368, 0.498)
E1a	Our business opportunities increased after we were ISO certified.	5.559 (0.757)	5.593 (0.684)	0.822	(-0.598, 0.191)

Note: $\overline{X_1}$: mean value of the early responses; $\overline{X_2}$: mean value of the late responses; S_1 : standard deviation of the early responses;S_2: standard deviation of the late responses; Response scores on a scale of 1 to 7 where 1 = strongly disagree, 7 = strongly agree

When implementing the follow-up approach, a one-page survey questionnaire was sent to the 591 informants who did not respond by the scheduled closing time of the survey. The one-page questionnaire contained only 20 questions concerning two key constructs in the study: communication and audit process quality. Most people perceive time as one of the biggest costs of responding to a survey (Dillman et al., 2009): it was expected that the informants who did not respond to the planned survey were likely to respond if the questionnaire was short and easy to complete. The purpose was to collect responses from non-respondents and assess potential non-response bias. Eighty-seven responses were collected from the total 591 non-respondents, with a response rate of 14.7 per cent.

T-tests were conducted on the 11 items of question A3 and nine items of question B2 to compare the answers provided by the 204 respondents and those provided by 87 non-respondents. Table 5-9 reports the t-statistics and 95 per cent confidence intervals associated with each item. Because each confidence interval contained the value zero, the certified organizations who responded to the planned survey did not appear to be significantly different from those who did not respond to the planned survey.

5.3 Data Examination

Once the survey was completed, the survey answers were input to an Excel data file. Before proceeding to the statistical analysis, the raw data were examined to validate data entry, evaluate missing data, identify outliers and test the assumptions underlying the structural equation modeling (SEM) analysis. If not evaluated and remedied, missing data

Table 5-9: T-test Results: Respondents vs. Nonrespondents

	Item Description	Respondent Group X_1 (S_1) n1=204	non-respondent Group X_2 (S_2) n2= 87	t- statistics	95% Confidence Interval
A3a	We were informed about the activities to be undertaken in the audit plan in a timely manner.	3.752 (1.068)	3.791 (0.978)	0.552	(-0.215, 0.381)
A3b	We were informed about the process of the audit in a timely manner.	5.082 (1.450)	5.182 (1.399)	1.168	(-0.164, 0.642)
A3c	We were informed by the auditor if there is evidence collected during the audit indicates immediate and significant risk related to the quality issues in a timely manner.	5.070 (1.508)	5.082 (1.543)	-0.043	(-0.430, 0.412)
A3d	We clearly understood our roles in the audit process.	4.500 (1.877)	4.383 (1.631)	-1.058	(-0.803, 0.242)
A3e	We were thoroughly informed about what to expect from the audit.	4.131 (1.443)	4.275 (1.366)	1.205	(-0.274, 0.726)
A3f	Information exchange during the audit was useful for us to take corrective action.	5.012 (1.626)	4.912 (1.720)	-0.897	(-0.709, 0.266)
A3g	The communication between our firm and the auditor was effective.	4.918 (1.862)	5.132 (1.525)	0.347	(-0.428, 0.611)
A3h	The auditor was flexible in responding to our requests to modify the audit plan.	5.022 (1.620)	4.971 (1.683)	-0.504	(-0.507, 0.338)
A3i	When an unexpected situation arose, the auditor would rather work out new arrangements than hold us to the original plan.	5.713 (1.124)	5.748 (1.109)	-0.716	(-0.214, 0.457)
A3j	If we have future needs, we are likely to hire the same auditor.	5.339 (1.203)	5.394 (1.152)	0.614	(-0.313, 0.596)
A3k	The auditor worked with us to resolve any diverging opinions concerning the audit evidence and / or findings.	4.613 (1.619)	4.672 (1.165)	0.762	(-0.342, 0.560)
B2a	The on-site stage of the audit was conducted in a timely manner.	5.080 (1.311)	5.062 (1.308)	1.002	(-0.336, 0.106)
B2b	Audit activities during the on-site stage were conducted according to the audit plan.	4.154 (1.387)	4.285 (1.424)	0.348	(-0.317, 0.453)
B2c	Audit activities during the on-site stage were completed according to the audit plan.	4.262 (1.886)	4.501 (1.521)	-1.033	(-0.535, 0.118)
B2d	The audit report was issued soon after the on-site visit.	5.810 (1.363)	5.755 (1.201)	0.457	(-0.292, 0.468)
B2e	The cost associated with the on-site certification audit stage met our budget.	5.512 (1.487)	5.217 (1.227)	0.266	(-0.359, 0.471)
B2f	The auditor delivered services within a certain time frame as promised.	4.348 (1.762)	4.270 (1.261)	-0.642	(-0.651, 0.342)
B2g	The auditor was technically competent to perform the audit service.	5.351 (0.938)	5.604 (0.887)	0.513	(-0.194, 0.330)
B2h	The auditor's activities were consistent with the agreed upon audit plan.	5.690 (1.178)	5.337 (0.908)	0.540	(-0.238, 0.418)
B2i	We would count on the auditor to achieve the overall objective of the audit project.	5.451 (0.932)	5.278 (1.119)	1.167	(-0.106, 0.413)

Note: X1: mean value of the respondents; X2: mean value of the nonrespondents; S_1 : standard deviation of the respondents; S_2: standard deviation of the nonrespondents; Response scores on a scale of 1 to 7. 1 = strongly disagree, 7 = strongly agree

and entry errors could have negative effects on the validity of the inference which is based on the statistical analysis (Schafer and Graham, 2002). Outliers can also pose potential threats to the results if not detected and treated. Similar to most multivariate methods, factor analysis and SEM employed in testing the conceptual framework are based on the assumption that the data are distributed normally. Violation of normality can have serious effects when the sample size is relatively small (e.g. less than 50).

The following discussion describes verification of data entry, treatment of missing data, detection of outliers and the assessment of normality assumption.

5.3.1 Data Entry Verification

For the completed survey that was received by mail or fax, the responses provided on the questionnaire were input into the Excel data file; for the completed online survey, responses provided by the certified organizations were exported automatically into the Excel file. The first export of the data was done before the second wave of mailing the replacement survey. The second export of the data was done after the large-scale planned survey was closed. For the online responses, each individual response was opened and reviewed to verify the accuracy of the automatically-created Excel data files. To represent the response mode, a dummy variable was added, which differentiated whether the responses were collected by mail, web or fax (mail=1, web=2 and fax=3).

In addition, variables were coded for the country (Canada=0, United States=1), standard (ISO 9001 and ISO 14001) and type of audit firm ("big ten" accredited=1, boutique accredited=2 and non-accredited=3) to reflect the characteristics related to the stratified sampling and to prepare for the multi-group analysis in SEM. To ensure confidentiality, a numerical code was assigned to each organization rather than including

the company name in the database, analysis and report. The characteristics of the certified organization were embedded within the code; for instance, a certified organization with the code 090012005 was a Canadian facility that was ISO 9001-certified by a boutique-accredited audit firm, and its responses were the fifth completed survey received.

After the initial data entry, an independent research assistant was hired to enter the same responses received by mail, web or fax into an Excel data file. The research assistant was instructed to flag and report any discrepancies between her data entry and the initial record. In total, six data points were flagged. Errors were corrected based on the original answers provided by the respondents. SPSS software was used to test the mean (μ) and standard deviation (σ) of the data. The μ and σ values were reviewed to assess the accuracy of the data entry, and more importantly, to assess if there was sufficient variance reflected by the data. The mean and standard deviation of each item are presented in Table 5-10. No additional data entry errors were detected. A majority of the items (75 per cent) had a standard deviation greater than one (based on a seven-point Likert scale), which indicates that the collected data reflected a fair amount of variance in the opinions of the client organizations.

5.3.2 Missing Data Analysis and Treatment

5.3.2.1 Analyze Missing Data

When data are missing on certain variables, the impact can be practical and substantive (Hair et al., 2009). Practically, the sample size available for analysis can be reduced to a great extent if responses with missing data points are simply deleted from the data set. Additionally, in SPSS and Amos, factor analysis and structural equation modeling are designed to be applied on a complete data set: the software cannot be run

Table 5-10: Means and Standard Deviations of the Responses

	Construct	Items	Mean(μ)*	Standard deviation(σ)
Audit process quality	Stage-one audit process quality	B1a	6.17	0.86
		B1b	6.33	0.87
		B1c	6.40	0.67
		B1d	5.72	1.43
	Stage-two audit process quality _efficiency	B2a	5.08	1.31
		B2b	4.15	1.39
		B2c	4.26	1.89
		B2d	5.81	1.36
		B2e	5.51	1.49
	Stage-two audit process quality _reliability	B2f	4.35	1.76
		B2g	5.35	0.94
		B2h	5.69	1.18
		B2i	5.45	0.93
	Stage-two audit process quality _responsiveness	B2j	5.36	1.17
		B2k	5.04	1.41
		B2l	4.24	1.54
		B2m	4.57	1.17
	Stage-two audit process quality _assurance	B2n	5.68	1.35
		B2o	4.45	1.43
		B2p	4.53	1.46
		B2q	5.68	1.40
	Stage-two audit process quality _empathy	B2r	5.48	1.34
		B2s	5.44	1.54
		B2t	5.33	0.73
		B2u	5.27	0.78
		B2v	5.58	0.80
Knowledge-based resources	Human capital	A1f	5.75	1.36
		A1g	5.77	1.38
		A1h	6.05	1.22
		A1i	6.18	0.84
	Structural capital	A2a	3.61	1.01
		A2b	4.83	1.01
		A2c	5.83	1.41
		A2d	6.08	1.02
		A2e	5.83	1.41
		A2f	4.99	1.31
	Communication	A3a	3.75	1.07
		A3b	5.08	1.45
		A3c	5.07	1.51
		A3d	4.50	1.88
		A3e	4.13	1.44
		A3f	5.01	1.75
		A3g	4.92	1.86
		A3h	5.02	1.63
	Cooperation	A3i	5.71	1.12
		A3j	5.34	1.20
		A3k	4.61	1.63

Table 5-10 continues

construct	items	mean(μ)	standard deviation(σ)
the client's competitive outcomes	E1a	5.73	0.75
	E1b	5.60	0.92
	E1c	4.87	1.05
	E1d	5.51	1.56
	E1e	5.74	1.22
	E1f	5.03	0.86
client satisfaction	C1a	5.55	1.54
	C1b	5.62	0.87
	C1c	5.44	0.95
	C1d	6.34	0.87
	C1e	6.11	1.20
	C1f	5.77	1.44

*Response scores on a scale of 1 to 7 where 1 = strongly disagree, 7 = strongly agree

with data sets which contain missing values. Substantively, the statistical analysis results could be biased if the data set contains missing values that are not missing completely at random.

Before follow-up was made, missing data were found in 34 returned questionnaires. Telephone calls and emails were used to reach the respondents and collect the missing information; as a result, the questionnaires that contain missing data were reduced to 19, which included 11 mail responses and eight web responses. Among them, three responses (one mail response and two web responses) were missing a significant amount of data related to the audit process quality construct (reliability and empathy) and the outcome construct. These cases were excluded from further analysis because the missing data included the dependent variables (Hair et al., 2009).

For the missing value analysis, there were 47 data points missing in the remaining 16 responses: sixteen missing values were related to the facility demographic information; eleven answers were missing for question G2 (In the last 12 months, your organization represented approximately ___ % of your parent company's total annual

sales); five answers were missing for question G3 (During the last 12 months, approximately what portion of sales from your plant has been made in each of the following geographic regions? Canada, US, EU, Japan, Asia, South America, and other). Since the demographic variables were not involved in factor analysis and structural equation modeling, imputation efforts would be appropriated and therefore were not made to remedy the missing values.

Diagnostic tests were performed to detect the level of randomness of the missing data associated with the non-demographic data. Responses were formed into two groups, one with the complete data set, and the other with missing data. In this study, from the total 204 responses, the complete data set group contained 188 organizations, while the missing data group contained 16 organizations. T-tests were then performed to determine whether significant differences exist between the two groups on the variables that both groups answered: significant differences may indicate that data were not missing due to randomness (Little, 1988).

Ten items were randomly picked from the items that contained no missing values for both groups. The t-statistics and the 95 per cent confidence interval associated with each item were reported in Table 5-11. Since no significant differences were found between the complete response group and the missing data group, the missing data can be classified as missing completely at random (MCAR) (Little, 1988; Hair et al., 2009).

5.3.2.2 Treatment of Missing Data

Because the data appear to be MCAR, missing values can either be excluded from the analysis or replaced using a specific imputation approach. Simply deleting the responses with missing data can result in significant reduction in sample size, specifically

Table 5-11: Missing Data Analysis

		Item Description	Complete Response Group X_1 (S_1) n1=188	Missing Data Group X_2 (S_2) n2 = 16	t- statistics	95% Confidence Interval
1	A1f	The auditor has substantial auditing experience	5.710	5.682	0.572	(-0.235, 0.392)
2	A1h	The auditor has extensive working experience related to our industry	6.092	5.833	0.786	(-0.719, 0.268)
3	A2a	The audit process was well designed by the auditor	3.646	3.921	1.228	(-0.565, 0.112)
4	A3d	We clearly understand our roles in the audit process	4.627	4.771	-0.369	(-0.226, 0.361)
5	A3k	The auditor worked with us to resolve any diverging opinions concerning the audit evidence and / or findings	4.577	4.210	-1.002	(-0.687, 0.203)
6	A4d	We regular discussed with the auditor any differences in opinions that we had with them	4.329	4.287	0.872	(-0.412, 0.589)
7	B1c	We were ready for the on-site visit by the time the document review was completed	6.156	5.994	1.051	(-0.221, 0.612)
8	B2l	The auditor informed us immediately if there was evidence of any non-conformity	4.262	4.591	-0.996	(-0.208, 0.775)
9	B2v	The auditor put us at ease when he talked with us	5.417	5.422	0.509	(-0.297, 0.462)
10	C1a	If we have future needs, we are likely to hire the same auditor	5.622	5.279	1.278	(-0.155, 0.701)
11	C2a1	The auditor *should* help us improve our internal process	6.118	5.902	0.983	(-0.203, 0.599)
12	C2a2	The auditor *actually* helped us improve our internal process	6.024	5.811	-1.023	(-0.801, 0.198)

Note: X_1: mean value of the responses from the complete response group; X_2: mean value of responses from missing data group; S_1: standard deviation of the complete response group; S_2: standard deviation of missing data group; Response scores on a scale of 1 to 7, where 1 = strongly disagree and 7 = strongly agree.

eight per cent in this study; therefore, this approach was not adopted, as the intention was to retain as many observations as possible to achieve sufficient statistical power for the analysis.

Regression imputation was used to replace the 31 missing values. Using this method, the model was first fitted using maximum likelihood; after that, model parameters were set equal to their maximum likelihood estimates, and linear regression was used to predict the unobserved values for each result as a linear combination of the observed values for that same case. Predicted values were then entered into the Excel database for the missing values. Amos 17.0 was used for missing data imputation. By using regression imputation, the maximum possible sample size was maintained for further analysis; more importantly, predictions of missing values were based on an observation's own values on other variables. This method of imputation was appropriate when the variable with missing data had substantial correlations with the other variables (Schafer and Graham, 2002).

5.3.3 Outliers

When unusually high or low values on a variable or a combination of unique patterns are observed, it signals the possibility of outliers. Outliers can be univariate or multivariate: univariate outliers are results that have an unusual value for a single variable; multivariate outliers are results that have an unusual combination of values for a number of variables.

5.3.3.1 Detect Outliers

One way to identify univariate outliers is to convert all of the scores for a variable to standard z-scores. When the sample size is small (80 or fewer results), a result is an

outlier if its standard score is ±2.5 or beyond. When the sample size is larger than 80 results, a result is an outlier if its standard score is ±4.0 or beyond (Hair et al., 2009). Because the sample size in this research was 204, the ±4.0 threshold was followed to detect outliers. SPSS 18.0 software was used to calculate the z-score for each variable. The z-scores were then sorted in descending order to identity the scores that fell out of the threshold range. Thirty-eight scores were found to be outside the range of [-4.0, +4.0], and were therefore identified as potential outliers. Twenty-three results were highlighted as they contained potential outlier scores.

Mahalanobis' D^2 measure was used to detect potential multivariate outliers among the set of independent variables, specifically the 30 items that measured structural capital, infrastructural capital and social capital. Mahalanobis D^2 is a multi-dimensional version of a z-score: it measures the distance of a result from the centroid (multi-dimensional mean) of a distribution, given the covariance of the distribution. A result is a multivariate outlier if the probability associated with its D^2 is 0.001 or less (Hair et al., 2009). D^2 follows a chi-square distribution with degrees of freedom equal to the number of variables included in the calculation. SPSS 18.0 software was used to calculate the D^2 value and its probability for each result in the sample (n=204). To find the smallest probability value, the data set was sorted in ascending order. The probability of the D^2 for the first two results were less than 0.001 — displayed as 0.0000 and 0.0004 — which signaled that the two results have an unusual combination of values on the set of independent variables; therefore, these two results were highlighted as potential outliers.

5.3.3.2 Handle Outliers

Before deciding whether to retain or delete outliers from the analysis, the raw scores that made the results outliers should be examined (Hair et al., 2009). If the result represents a set of opinions or characteristics of the target population, it should be retained to ensure generalizability to the entire population. As to the 23 results that contained outlier scores, the original completed questionnaire was reviewed first to verify the data entry: no mistakes were found. The raw data that suggested that the result was an outlier were again examined to determine if they were truly abnormal or actually represented opinions in the target certified organizations. Since there was a lack of demonstrated proof that these results were truly distinctive, and it appeared that they reflected some of the opinions in the target population, all the data points were retained for statistical analysis.

As for the two potential outlier results identified through the multivariate assessment, the raw data were also reviewed and examined. It appeared that in the two results, the respondents rated the audit firm very low on conflict management (one dimension of social capital), but seemed otherwise satisfied with the skills, experience and infrastructure capital of the audit firm. Because the intention was to capture a wide variety of perceptions from the certified organization, it was decided to retain the two results in the sample.

5.3.4 Test the Normality Assumptions for Multivariate Analysis

Normality is the most fundamental assumption for multivariate analysis, such as factor analysis and structural equation modeling (SEM). Serious departure from normality may lead to invalid statistical results. There are two ways to test for normality: 1) graphical methods visualize the distributions of random variables or differences

between an empirical distribution and a theoretical distribution (e.g., the standard normal distribution); 2) numerical methods present summary statistics, such as skewness and kurtosis, or provide statistical tests of normality (McClave et al., 2001).

Normality of the data set was assessed by reviewing the bar-charts of the distribution pattern of each variable, using the probability-probability plot (P-P plot), skewness and kurtosis. P-P plot compares the empirical cumulative distribution function of a variable with the cumulative distribution of a normal distribution which forms a straight diagonal line: if the actual data distribution clusters around the line, it is normally distributed.

The bar-charts for each variable involved in the factor analysis and SEM did not reveal significant departure from normal distribution; in addition, the P-P plot was constructed and reviewed using SPSS 18.0 software. Sixteen variables appeared to have some degree of departure from normality, as the actual data did not closely match the straight diagonal line. Skewness is a measure of whether the peak is centered in the middle of the distribution. A z- value for skewness can be calculated using the following formula:

$$Z_{skewness} = \frac{skewness}{\sqrt{\frac{6}{N}}}$$ Where N represents sample size (204 for this study).

The recommended critical value is ±1.96, corresponding to a 0.05 error level (Hair et al., 2009). If the z-value falls outside of the (-1.96, +1.96) range, the data shape is significantly different from the normal curve in terms of skewness. Skewness and its corresponding z-score for each variable were calculated using SPSS. Nineteen items were found to deviate from normality for skewness.

Kurtosis is a measure of the extent to which data are concentrated in the peak versus the tail. Similar to skewness, a z-score can be calculated for kurtosis using the formula:

$$Z_{kurtosis} = \frac{kurtosis}{\sqrt{\frac{24}{N}}}$$

Kurtosis and its corresponding z-scores were calculated using SPSS. After comparing the kurtosis scores to the cut-off value 1.96, 13 items varied from normal distribution in terms of kurtosis.

While departure from normality was found in part of the data set, it is generally believed that detrimental effects on results tend to diminish when the sample size is 200 or larger (Hair et al., 2009). Since the sample size in this study is greater than 200, no remedy was made before proceeding to the statistical analysis.

5.4 Measurement Model Development and Refinement

Before assessing the structural relationships between the constructs, it is crucial to establish valid measurements for these constructs. Without valid measures, the conclusions drawn from the structural model analysis will also be invalid; therefore, the measurement model in this study was assessed, refined and validated prior to using SEM. As displayed in Figure 5-1, the development and refinement of the measurement model followed a systematic procedure. Each construct measurement was subject to reliability analysis. Constructs with low reliability (alpha lower than 0.70) was highlighted for special attention in the following confirmatory factor analysis (CFA). CFA was then conducted to assess which specific items may not be loading with their intended constructs. Refinement of the measurement model involves addressing problematic items based on the loadings, communalities, error residuals and theoretical considerations.

Once the refined measurement model has acceptable fit, additional assessment of validity is conducted.

5.4.1 Initial Reliability Analysis

Reliability refers to the extent to which a measuring tool provides consistent or stable results and is inversely related to the amount of random error (Carmines and Zeller, 1979). One popular method for assessing reliability is Cronbach's alpha coefficient (Pedhazur and Schmelkin, 1991). The formula for computing the alpha coefficient is as follows:

$$\alpha = \frac{N\bar{p}}{1+\bar{p}(N-1)}$$

where N = number of items and $\bar{p}$ = average inter-item correlation (off-diagonal entries in the correlation matrix). The alpha coefficient depends on the number of items in the scale as well as the correlation among items. As the number of items and correlation among items increase, alpha increases. Ranging from zero to one, α represents estimated systematic variance; generally, measurement scale with α greater than 0.70 is considered reliable (Nunnally, 1978).

Cronbach's alpha was calculated for each construct using SPSS program. As reported in Table 5-12, only two highlighted constructs: reliability and cooperation show acceptable level of reliability with alpha values greater than 0.70. Therefore, the measurement models of the constructs need to be modified and refined to achieve reliability and validity before proceeding to SEM analysis. The Cronbach's alpha-if-item-deleted was further calculated to identify problematic item. If the Cronbach's alpha was improved significantly after deleting on particular item, this item was highlighted as problematic.

Table 5-12: Initial reliability analysis

Constructs	Items	Cronbach's α
audit process quality		
stage-one audit process quality	B1a, B1b, B1c, B1d	0.515
stage-two audit process quality		
reliability	B2f, B2g, B2h, B2i	0.732
responsiveness	B2j, B2k, B2l, B2m	0.464
assurance	B2n, B2o, B2p, B2q	0.644
empathy	B2r, B2s, B2t, B2u, B2v	0.466
efficiency	B2a, B2b, B2c, B2d, B2e	0.560
the auditor's knowledge-based resources		
human capital	A1f, A1g, A1h, A1i	0.596
structural capital	A2a, A2b, A2c, A2d, A2e, A2f	0.628
communication	A3a, A3b, A3c, A3d, A3e, A3f, A3g, A3h	0.674
cooperation	A3i, A3j, A3k	0.734
the client's competitive outcomes	E1a, E1b, E1c, E1d, E1e, E1f	0.491
client satisfaction	C1a, C1b, C1c, C1d, C1e, C1f	0.516

5.4.2 Confirmatory Factor Analysis

The measurement model associates the prespecified constructs with the variables intended measure the constructs. CFA was conducted to refine the measurement model using AMOS software. When specifying the measurement models in AMOS, the measurement items were allowed to load on its intended latent construct only. The factor loadings and correlations between constructs were free for estimation. Maximum likelihood (ML) method was used to estimate the factor loadings. When assessing the latent construct, one of the factor loadings on each construct was set to 1.0 to set the scale for the construct.

The size and statistical significance ($p \leq 0.05$) of the loadings were examined to determine whether the manifest variables converge on its intended latent construct. In Amos, standardized loadings were reported to reflect the relationships in the

measurement model. Statistically significant loadings greater than 0.50 provide partial support for the validity of the measurement model (Anderson and Gerbing, 1988).

To evaluate the degree to which the estimated covariance matrix represents the observed covariance, multiple fit indices were used (Hu and Bentler, 1998). Because different fit indices were developed to reflect the various aspects of the model's ability to represent the data, and the accuracy of these indices are influenced by sample size and model complexity, multiple fit indices should be examined to provide adequate evidence of model fit.

The Chi-square (χ^2) test was used to assess the difference between the estimated and observed covariance matrices. The model can be accepted or rejected based on the χ^2 values and its p value. A relatively small χ^2 value with a p values greater than 0.05 indicates that there is no significant difference, therefore the model is acceptable (Bollen, 1989). However, χ^2 test is biased in that it tends to yield non-significant results for simple models with small sample sizes, and significant results for complex model with large sample size. Moreover, the χ^2 test only offers dichotomous decision strategy (accept or reject), providing no indications on the degree of model fit (Mulaik et al., 1989). Therefore, other goodness-of-fit measures were used to assess alternative perspectives of model fit and the degree of fit along a continuum.

Both absolute and incremental measures were used to assess model fit. The absolute fit indices directly measure the degree to which the proposed model reproduces the observed data. The incremental fit indices measure the degree of model fit improvement when comparing the proposed model to a nested based line model (Hu and Bentler, 1998). The absolute fit measures include the Chi-square test, Normed chi-square,

Goodness-of-fit index (GFI) and root mean square error of approximation (RMSEA). The Normed chi-square is the ratio of chi-square to the degree of freedom. Model fit is supported by a Normed chi-square value less than 3.0, a GFI value greater than 0.90 and an RMSEA value less than 0.08 (Hair et al., 2009). Incremental fit measures include Normed fit index (NFI), Tucker Lewis Index (TLI), Comparative fit index (CFI) and Incremental fit index (IFI or BL89). Each incremental fit measure greater than 0.90 indicates acceptable model fit (Hair et al., 2009).

5.4.2.1 Measurement Model Modification

The measurement model modification process began with a review of the CFA results including the factor loadings and error residuals of each item. An item was considered problematic if it had low correlations with other items, low loadings on its intended construct. An iterative process was employed to assess the effect of each item. A CFA was conducted and the changes in the model parameters were reviewed at each step. An item was marked as the primary candidate for elimination if the model parameters were improved significantly after dropping this item in CFA. The final decision to drop an item was based not only on its performance in factor analysis but also theoretical considerations. Each problematic item was reviewed to decide whether there were theoretical supports for elimination.

In total, 17 out of the original 60 items were deleted from the measurement models for audit process quality, knowledge-based resources, the client's competitive outcomes and client satisfaction. The common reasons that make the 17 items primary candidates for deletion are the loadings on their intended items, indicating that they do not provide sufficient explanations of the constructs. All the original items for the reliability and

cooperation constructs are retained in the measurement model. Final decisions on item elimination were based on the review of the CFA results and theoretical considerations. Details of the item deletion are reported in Table 5-13.

Table 5-13: Items Deleted in Measurement Model Modification

constructs	items	low loadings on intended items
stage-one audit process quality	B1d	×
stage-two audit process quality-efficiency	B2d	×
	B2e	×
stage-two audit process quality-reliability	All four original items were retained.	
stage-two audit process quality-responsiveness	B2k	×
stage-two audit process quality-assurance	B2q	×
stage-two audit process quality-empathy	B2r	×
	B2s	×
human capital	A1g	×
structural capital	A2a	×
	A2f	×
communication	A3a	×
	A3e	×
	A3f	×
cooperation	All three original items were retained.	
the client's competitive outcomes	E1d	×
	E1e	×
client satisfaction	C1a	×
	C1f	×

Audit process quality

For stage-one audit process quality, item B1d exhibits low loading. It also does not have adequate correlations with other items for stage-one audit process quality. Although adapted from the project management literature, item B1d, which assesses the costs associated with the stage-one readiness review stage, appear irrelevant to the evaluation of stage-one audit process quality. The results are in alignment with the preliminary studies and the survey responses for Question D2, which reveals that a majority of the

certified organizations (87 per cent) allocated less than two per cent of their annual operating costs to the ISO certification project. To the client organizations, costs are not a major concern in the certification process; therefore, item B1d was deleted from the measures for stage-one audit process quality.

When assessing stage-two audit process quality, we considered efficiency, reliability, responsiveness, assurance and empathy as major dimensions. Viewed as a project, the stage-two on-site certification audit needs to fulfill the tasks assigned in this stage while meeting the time and cost constraints. According to the CFA results, items B2d and B2e show low loadings. To capture the timeliness of conducting the on-site certification audit, item B2d measures whether the audit report was issued soon after the audit: it was developed based on the project management literature as well as the opinions expressed by the client organizations interviewed in the field study. The irrelevance of item B2d may exist because the client organization did not perceive audit reporting as interruptive, or at least as interruptive as other activities such as interviews and meetings during the on-site audit stage; for instance, interviews would interrupt the daily operations of the client organization. The timeliness of completing these activities was a major concern of the auditee. After the on-site audit, it is the auditor's responsibility to prepare and issue an audit report, which in general does not affect the client organization's daily operation; therefore, item B2d was considered an invalid measure and was deleted from the measures for efficiency. This is also in alignment with the results reflected by item D2, which indicates that cost is not a significant factor in evaluating efficiency for the stage-two audit; thus, item B2e was also deleted from the efficiency measures.

Items for reliability are intended to reflect the auditor's ability to deliver audit service as promised. Items B2f, B2g, B2h and B2i were developed based on validated measures used by Parasuraman et al. (1994) and Watson and Mackey (2005). All four items exhibit significant loadings on the reliability construct.

Items for responsiveness intend to capture the willingness of the auditor to respond to the clients' need and provide prompt service. Initial CFA results show that item B3k is problematic, as it has low loading on the responsiveness construct and low communality; it loads weakly on the empathy construct. Item B3k asked the respondents to rate the degree of the auditor's willingness to adjust their interview schedule to accommodate the client's needs. The poor performance of item B3k in CFA may result from the complexity associated with the schedule conflict between the auditor and the client. Item B3k relates to the auditor's ability to resolve the conflict and maintain professional integrity while accommodating the client's needs. Because item B3k does not provide sufficient explanation for the responsiveness construct, it was deleted from the measurement model; however, it may relate to other latent factors such as the auditor's conflict resolution abilities, which would be interesting to explore in future research.

Adapted from Parasuraman et al. (1991) and Berry et al. (1991), items for the assurance construct intend to reflect the auditor's ability to instill confidence and security in the client organization. Out of the four original items, item B2q is marked as problematic because it does not have significant loadings on the assurance construct. Item B2q asks the degree that the client perceived the audit added value to their business. Although it has been advocated that the audit should be a value-adding process to the client organization (Kraus and Platkus, 2007), the concept of value has not been clearly

defined. Clients may have different perceptions for the value added in the certification audit process. Item B2q therefore was deleted from the measures for assurance.

Adapted from Berry et al. (1991) and Christmann and Taylor (2006), items for empathy are to capture the auditor's sensitivity to meet the client's unique needs based on the client's best interest. Items B2r and B2s are marked as problematic due to low loadings on the empathy construct. Item B2r assesses the degree to which the on-site certification activities were arranged at times convenient to the client organization. It appears that item B2r has no significant loadings according to the CFA results. Because total audit time and scheduling of the ISO certification audit activities are often determined by the scope and complexity of the audit, the client organizations may not perceive item B2r as a valid measure for audit process quality. This item was therefore deleted in the scale purification process. As revealed in the preliminary study, auditors have limitations in providing the client with the opportunity for improvement: they cannot be involved in the design, development and implementation of the management system they are auditing. Due to the controversy, item B2s was considered an inappropriate measure for audit process quality, and was therefore dropped from the final analysis.

Knowledge-based Resources

Knowledge-based resources consist of four constructs: human capital, structural capital, communication and cooperation. Items for the human capital construct intend to reflect the skills and knowledge of the auditor. Item A1f concerns the auditor's work experience related to the client organization's industry sector; this item was marked as problematic because it had low loading on the human capital construct.

While industry-related work experience may increase the competence of the auditor, general knowledge and skills concerning quality management are sufficient for an auditor to conduct an ISO audit effectively. These quality-related knowledge and skills include quality terminology, quality management principles and quality control tools such as statistical process control (SPC), which can be applied in a wide variety of industry sectors. Item A1f was deleted because it does not appear to be an essential element for human capital.

Items for structural capital were intended to assess the audit service process and information system used in the audit. Item A2a assessed the degree to which the audit process was well-designed by the auditor. Item A2f assessed the level of information technology (IT) used during the audit. Items A2a and A2f had low loadings in initial CFA results. Both items were deleted from the measurement model for structural capital.

Items for communication were adapted from previous research (Carr and Pearson, 1999; Mohr and Sohi, 1995; Rezaee and Elam, 2000; Sutton, 1993). Three items were dropped for the final analysis: item A3a concerned the degree to which the client was informed of the audit activities to be undertaken in a timely manner; item A3e concerned the degree to which the client understood their responsibilities in the audit process; item A3f concerned the usefulness of the information exchange between the auditor and the client. These items were deleted because of low loadings, and low correlations with other items.

The three items for cooperation were developed to assess the auditor's flexibility to accommodate the client's needs, along with joint problem solving between the two parties. All three items have significantly high loadings on the cooperation construct.

Outcome and Client Satisfaction

The scale purification procedure was implemented for the outcome and client satisfaction constructs. The final measurement model for outcome and client satisfaction contained eight items. Four of the initial 12 items were dropped from the measurement model due to low loadings, and low correlations with other items.

5.4.2.2 Confirmatory Factor Analysis Results and Model Fit

Audit Process Quality

CFA was conducted on the audit process quality construct. First, the multiple dimensions of stage-two audit process quality were subject to CFA. Then, I assessed the measurement model for stage-one audit process quality and stage-two audit process quality using CFA.

Based on the theoretical development in Chapter three, the audit process construct was operationalized at different levels of abstraction. A higher-order CFA is appropriate when there are different lays of factors involved in the measurement model (Gorsuch, 1974). In this study, stage-two audit process quality is considered a second-order factor which reflects five first-order factors: reliability, responsiveness, assurance, empathy and efficiency.

When measuring the second-order factor, first-order factors can be modeled reflective or formative based on whether the direction of causality is from the second-order factor to the first-order factors or vice versa (Jarvis et al., 2003). I used the reflective approach because the audit process quality is based on the client's perceptions. When asked to assess stage-two audit process quality, the client generally has a general evaluation on the overall service quality. Then the client may perceive that this general

evaluation of the overall service quality reflects the auditor's reliability, responsiveness, assurance and empathy.

Following a systematic approach, a second-order CFA was conducted to refine the measurement model for stage-two audit process quality. Initial CFA assessed model fit with all the measurement items and revealed problematic items with low loadings. The problematic items were dropped one at a time to improve CFA model fit. Deletion or retention of a problematic item was based on both theoretical considerations and statistical analysis. Figure 5-2 shows the final CFA model where a second-order factor (stage-two audit process quality) reflects the five first-order factors (reliability, responsiveness, assurance, empathy and efficiency). The factor loadings of each item for the final CFA model are reported in Table 5-14.

Figure 5-2: Stage-two Audit Process Quality: Second-order CFA Model

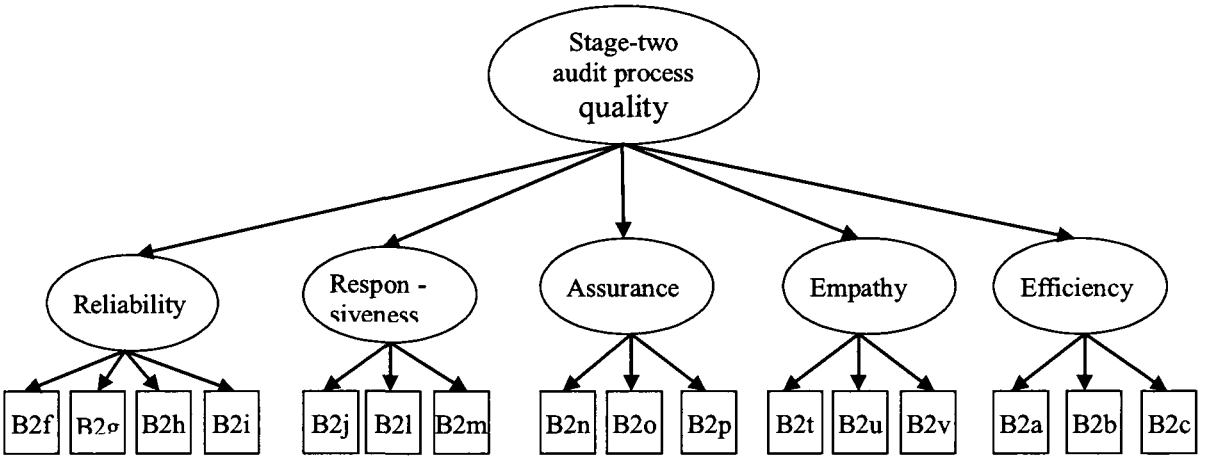


Table 5-14: CFA Results for Stage-two Audit Process Quality

Constructs	Items	Estimates	t-Value
stage-two audit process quality	reliability	0.402	3.044
	responsiveness	0.798	-*
	assurance	0.532	3.446
	empathy	0.367	3.015
	efficiency	0.413	3.289
efficiency	B2a	0.834	10.984
	B2b	0.796	-*
	B2c	0.765	10.548
reliability	B2f	0.580	6.781
	B2g	0.795	-*
	B2h	0.561	6.053
	B2i	0.732	7.098
responsiveness	B2j	0.701	-*
	B2l	0.639	6.305
	B2m	0.608	6.176
assurance	B2n	0.775	11.607
	B2o	0.763	11.445
	B2p	0.890	-*
empathy	B2t	0.632	-*
	B2u	0.609	5.009
	B2v	0.616	5.025

*Not estimated because loading was fixed to 1.0.

The results for model fit assessment are shown in Table 5-15. The Normed chi-square of the initial CFA for audit process quality is less than 3.0, the cutoff value, which indicates acceptable model fit. The RMSEA ranged from 0.042 to 0.072 with 95% of confidence, which meets the model fit criteria 0.08.

Normed fit index (NFI), Tucker Lewis Index (TLI), Comparative fit index (CFI) and Incremental fit index (IFI or BL89) were examined as incremental fit measures. As shown in Table 5-14, all the incremental fit indices met the 0.90 cutoff value for model fit. In summary, a majority of the fit indices indicated fair fit the stage-two audit process quality CFA model.

Table 5-15: Final CFA Model Fit for Stage-two Audit Process Quality Construct

Fit Indices	Values	Cutoff Values
χ^2	232	
p value	0.000	≥0.05
χ^2/d.f.	2.348	≤ 3.0
NFI	0.904	≥0.90
TLI	0.910	≥0.90
CFI	0.911	≥0.90
IFI (BL89)	0.907	≥0.90
GFI	0.913	≥0.90
RMSEA (confidence interval)	0.057(0.042, 0.072)	≤0.08

After refining the measurement model for stage-two audit process quality, I conducted CFA on stage-one audit process quality and stage-two audit process quality. For this CFA, composite score was used for each dimension of stage-two audit process quality by taking the average of each item score. For instance, for one respondent, the score of "reliability" is calculated by taking the average score of items B2f, B2g, B2h, and B2i. The specification of the refined CFA model for stage-one audit process quality and stage-two audit process quality is shown in Figure 5-3. The factor loading associated with t-value for each item is presented in Table 5-16.

Figure 5-3: CFA on Stage-one Audit Process Quality and Stage-two Audit Process Quality

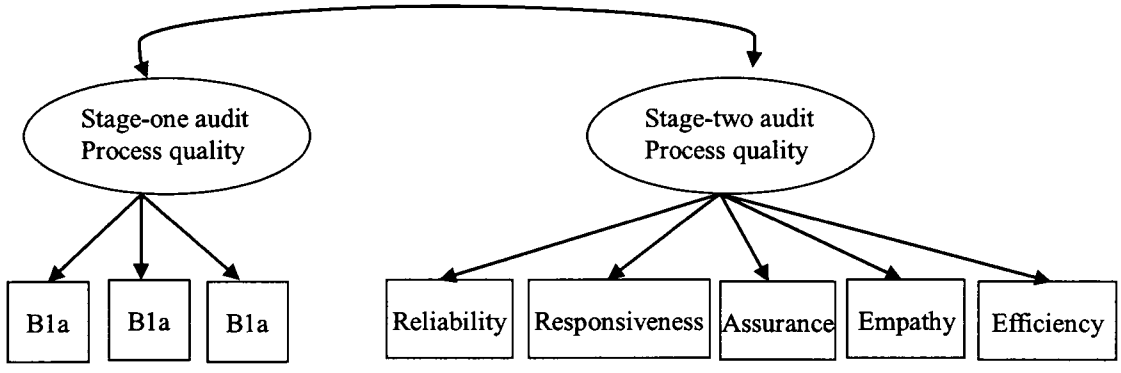


Table 5-16: CFA Results for Stage-one Audit Process Quality and Stage-two Audit Process Quality

Constructs	Items	Estimates	t-Value
stage-one audit process quality	B1a	0.802	12.767
	B1b	0.870	-*
	B1c	0.847	13.636
stage-two audit process quality	reliability	0.462	5.047
	responsiveness	0.808	-*
	assurance	0.562	6.642
	empathy	0.397	5.116
	efficiency	0.442	5.036

*Not estimated because loading was fixed to 1.0.

The results for model fit assessment are shown in Table 5-17. The Normed chi-square of the initial CFA for audit process quality is less than 3.0, the cutoff value, which indicates acceptable model fit. The RMSEA ranged from 0.027 to 0.067 with 95% of confidence, which meets the model fit criteria 0.08. All the incremental fit indices (NFI, TLI, CFI and IFI) are greater than the 0.90 cutoff value, indicating acceptable model fit.

Table 5-17: Final CFA Model Fit for Stage-one Audit Process Quality and Stage-two Audit Process Quality Construct

Fit Indices	Values	Cutoff Values
χ^2	46	
p value	0.000	≥0.05
χ^2/d.f.	2.421	≤ 3.0
NFI	0.912	≥0.90
TLI	0.915	≥0.90
CFI	0.910	≥0.90
IFI (BL89)	0.908	≥0.90
GFI	0.921	≥0.90
RMSEA (confidence interval)	0.048(0.027, 0.067)	≤0.08

The Auditor's Knowledge-Based Resources

The CFA was conducted on the knowledge-based resource constructs, which included human capital, structural capital, communication and cooperation. The initial

measurement model for the knowledge-based resource construct contained four latent constructs measured by 21 items. Six items are highlighted as problematic because they have low and non-significant loadings on their intended constructs. These items were to be subject to the subsequent scale purification based on theoretical considerations and statistical analysis. The modified measurement model for the auditor's knowledge-based resources contains 15 items that load significantly on their intended constructs. The loading and its corresponding t-value of each retained item are reported in Table 5-18.

Table 5-18: CFA Results for Knowledge-Based Resource Construct

Constructs	Items	Estimates	t-Value
human capital	A1f	0.672	10.115
	A1h	0.869	-*
	A1i	0.712	11.661
structural capital	A2b	0.712	11.437
	A2c	0.863	-*
	A2d	0.624	9.127
	A2e	0.823	14.108
communication	A3b	0.715	9.164
	A3c	0.680	8.712
	A3d	0.755	-*
	A3g	0.636	8.246
	A3h	0.662	8.631
cooperation	A3i	0.798	-*
	A3j	0.401	4.759
	A3k	0.598	5.898

*Not estimated because loading was fixed to 1.0.

The results for model fit assessment are shown in Table 5-19. The Normed chi-square of the initial CFA for audit process quality is less than 3.0, the cutoff value, which indicates acceptable model fit. The RMSEA ranged from 0.041 to 0.072 with 95% of confidence, which meets the model fit criteria 0.08. All the incremental fit indices (NFI, TLI, CFI and IFI) are greater than the 0.90 cutoff value, indicating acceptable model fit.

Table 5-19: Final CFA Model Fit for Knowledge-Based Resources

Fit Indices	Values	Cutoff Values
χ^2	158	
p value	0.000	≥0.05
χ^2/d.f.	1.879	≤ 3.0
NFI	0.890	≥0.90
TLI	0.923	≥0.90
CFI	0.939	≥0.90
IFI (BL89)	0.940	≥0.90
GFI	0.914	≥0.90
RMSEA (confidence interval)	0.057(0.041, 0.072)	≤0.08

Outcomes and Client Satisfaction

The measurement model for the client's competitive outcomes and client satisfaction was assessed. Initial measurement model contain 12 items for the two construct. Although the model fit indices indicate good fit, the initial CFA solution revealed items C1a, C1f, E1d and E1e had insignificant low loadings. Further modification was made to improve the measurement model. Table 5-20 reports that final CFA results. Each item has significant loadings on its intended item.

Table 5-20: CFA Results for Outcomes and Client Satisfaction

Constructs	Items	Estimates	t-Value
the client's competitive outcomes	C1b	0.708	9.870
	C1c	0.816	-*
	C1d	0.731	10.208
	C1e	0.745	10.389
client satisfaction	E1a	0.804	10.409
	E1b	0.840	-*
	E1c	0.723	10.110
	E1f	0.706	9.257

*Not estimated because loading was fixed to 1.0.

The results for model fit assessment are shown in Table 5-21. The Normed chi-square of the initial CFA for audit process quality is less than 3.0, the cutoff value, which

indicates acceptable model fit. The RMSEA ranged from 0.021 to 0.066 with 95% of confidence, which meets the model fit criteria 0.08. All the incremental fit indices (NFI, TLI, CFI and IFI) are greater than the 0.90 cutoff value, indicating good model fit.

Table 5-21: Final CFA Model Fit for Outcomes and Client Satisfaction

Fit Indices	Values	Cutoff Values
χ^2	35	
p value	0.016	≥0.05
χ^2 /d.f.	1.817	≤ 3.0
NFI	0.951	≥0.90
TLI	0.966	≥0.90
CFI	0.977	≥0.90
IFI (BL89)	0.976	≥0.90
GFI	0.962	≥0.90
RMSEA (confidence interval)	0.043(0.021, 0.066)	≤0.08

Up to date, the measurement models for the key constructs have been refined to ensure high loadings of each item on its intended construct. In the next section, the reliability and validity of the constructs will be assessed based on the revised measurement models.

5.5 Construct Validity Assessment

Constructs involved in this research were validated using the three-step approach recommended by O'Leary-Kelly and Vokurka (1998). The first step requires establishing content validity: the extent to which the measurement items reflect the domain of the construct. Content validity is qualitative and subject to the judgment of the researcher(s) (Bollen, 1989).

The second step involves assessing construct validity, which is central to the measurement of theoretical constructs. Construct validity concerns the extent to which the empirical indicators measure the construct that they are intended to measure, and do

not measure what it is not supposed to be measured (Churchill, 1987). It can be supported if the relationship among multiple indicators designed to represent the construct and other relevant constructs are similar in terms of direction, strength and consistency. Establishment of construct validity requires a series of empirical tests for unidimensionality, reliability, convergent validity and discriminant validity (O'Leary-Kelly and Vokurka, 1998).

Unidimensionality refers to the extent to which measures are associated with only one underlying construct (Anderson and Gerbing, 1982). CFA is commonly used to assess the unidimensionality of a measure. A set of measurement items are considered unidimensional with regard to a theoretical construct if they significantly load on this construct, and only on this construct, in CFA. A factor loading greater than 0.40 is recommended as a rule of thumb for significance (Hair et al., 2009).

Both Cronbach's alpha and composite reliability were used to assess construct reliability. As an alternative to Cronbach's alpha, Werts, Linn, and Jöreskog's composite reliability measure (the WLJ composite) does not give each item equal weight in the assessment of reliability (Werts et al., 1974). In mathematical form, the composite reliability is derived using the following formula:

$$\text{Composite reliability} = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum (1 - \lambda_i^2)}$$

where λi is the factor loading resulted from CFA. The WLJ composite reliability index ranges from zero to one, with a higher value indicating greater reliability. A value above 0.70 is desirable as it implies more systematic variance than error variance.

Convergent validity relates to the extent to which multiple measures of a construct are in agreement. Factor loading resulting from CFA can be examined to assess whether

the multiple measures share a high proportion of common variance (Hair et al., 2009). The recommended rule of thumb for significant factor loading is 0.50, while loading greater than 0.70 is considered a strong indicator for convergent validity (Hair et al., 2009). In addition, average variance extracted (AVE) can be used to assess convergent validity. AVE is the mean variance extracted for the items loading on one construct: it is computed using the following formula:

$$AVE = \frac{\sum_{i=1}^{n} L_i^2}{n}$$

where L_i is the standardized factor loading and n is the number of items. An AVE value greater than 0.50 indicates adequate convergence of the measurement items.

Discriminant validity concerns the extent to which one construct can be differentiated from another construct. Testing nested models in CFA and comparing the square root of AVE with correlation between constructs are two common methods to assess discriminant validity. The nested model method requires a comparison between the constrained model (correlations between two constructs fixed to one) to the unconstrained model. If the fit of the unconstrained model is significantly better than the fit of the constrained model based on the $\chi 2$ difference test, discriminant validity is supported (Hair et al., 2009). For the second method, the square root of AVE must be greater than the correlation between constructs: this result indicates that the latent construct explains more of its variance in its measurement items than it shares with another construct, which provides strong evidence for discriminant validity. In sections 5.5.1, 5.5.2 and 5.5.3, the validity of the audit process quality constructs and knowledge-

based resource constructs, as well as the audit outcome and client satisfaction constructs, were assessed, respectively.

According to O'Leary-Kelly and Vokurka's guidelines (1998), the third step of construct validation is to assess nomological validity, testing the nomological relationship among latent constructs (Bagozzi, 1980). In Section 5.6, the SEM approach is used to test the hypothesized structural model, seeking evidence for nomological validity.

5.5.1 Content Validity

Content validity requires that the manifest indicators developed are adequate for reflecting the theoretical latent constructs. In this study, content validity was established based on literature review and opinions collected from industry and academic experts.

5.5.2 Unidimensionality

As reported in Section 5.4.2, all measurement items in the audit process quality measurement model significantly loaded on their intended factors (loading greater than 0.40), without notable cross-loadings on other factors: the t-value associated with each item reflects the significance of factor loading. If a loading has a critical ratio greater than two, the loading is significantly different from zero at the 0.05 level: all of the t-values were greater than two. The instruments for stage-one audit process quality, as well as stage-two quality reflected by efficiency, reliability, responsiveness, assurance and empathy are therefore considered unidimensional.

All measurement items for knowledge-based resource constructs significantly loaded on their intended factors only (loading greater than 0.40), without notable cross-loadings on other factors. The corresponding t-value of each item was greater than 2.0,

which indicated the significance of the loadings; therefore, the instruments for human capital, structural capital, communication and cooperation are considered unidimensional.

Measurement items for outcome and client satisfaction constructs also significantly loaded on their intended factors only (loading greater than 0.40), without notable cross-loadings on other factors. The t-value associated with each item was greater than 2.0, which indicated the significance of the loadings; therefore, the instruments for outcome and client satisfaction are considered unidimensional.

5.5.3 Reliability

Cronbach's alpha coefficient and the WLJ composite reliability index were utilized to assess reliability: the retained items for each construct, t-value associated with each item, Cronbach's alpha coefficient and the WLJ composite of each construct are all shown in Table 5-31. The alpha coefficients range from 0.703 to 0.867, and the WLJ composite index ranges from 0.706 to 0.878. Both results were above the cut-off value 0.70, providing evidence for reliability of the audit process quality constructs.

As for the four constructs reflecting knowledge-based resources, the alpha coefficients range from 0.734 to 0.842. The WLJ composite index ranges from 0.722 to 0.851. Both results were above the cut-off value of 0.70, providing evidence for reliability of the knowledge-based resource constructs.

Also reported in Table 5-22, the alpha coefficients were 0.841 and 0.825 for the client's competitive outcomes and client satisfaction, respectively. For both constructs, the WLJ composite index is above the cut-off value of 0.70, providing adequate evidence for reliability.

Table 5-22: Retained Items, t-Values and Reliabilities

construct and retained items		t-value	Cronbach's α	WLJ composite
stage-one audit process quality	B1a	12.767	0.863	0.865
	B1b	13.636		
	B1c	11.108		
stage-two audit process quality efficiency	B2a	11.119	0.832	0.846
	B2b	10.896		
	B2c	10.503		
stage-two audit process quality reliability	B2f	5.194	0.732	0.792
	B2g	7.374		
	B2h	6.124		
	B2i	7.153		
stage-two audit process quality responsiveness	B2j	10.492	0.716	0.718
	B2l	5.767		
	B2	5.582		
stage-two audit process quality assurance	B2n	11.684	0.867	0.878
	B2o	11.522		
	B2p	13.992		
stage-two audit process quality empathy	B2t	5.092	0.703	0.706
	B2u	5.095		
	B2v	5.098		
human capital	A1f	10.196	0.817	0.838
	A1h	12.764		
	A1i	11.732		
structural capital	A2b	11.518	0.842	0.851
	A2c	10.963		
	A2d	9.111		
	A2e	14.280		
communication	A3b	9.106	0.821	0.826
	A3c	8.930		
	A3d	9.113		
	A3g	8.331		
	A3h	8.732		
cooperation	A3i	14.368	0.734	0.722
	A3j	4.607		
	A3k	5.789		
the client's competitive outcomes	E1a	10.409	0.841	0.853
	E1b	10.710		
	E1c	9.963		
	E1f	9.257		
client satisfaction	C1b	9.872	0.825	0.838
	C1c	11.117		
	C1d	10.208		
	C1e	10.389		

5.5.4 Convergent Validity

Loading results from CFA and AVE values were examined to assess the convergent validity. AVE values calculated for each construct are reported in Table 5-23. For the six latent constructs that reflect audit process quality, all of the item loadings were greater than the 0.50 cut-off value. The AVE values ranged from 0.512 to 0.688, greater than the 0.50 cut-off. Fourteen out of 19 items had loadings greater than 0.70. Both the factor loading and AVE assessment suggest adequate convergence of the measurement items for audit process quality constructs.

For the four latent constructs that reflect knowledge-based resources, all the item loadings were greater than the 0.50 cut-off value. The AVE values ranged from 0.510 to 0.635, also greater than 0.50. Eleven out of 15 items had factor loadings greater than 0.70. Both the factor loading and AVE assessment suggest adequate convergence of the measurement items for the four knowledge-based resource constructs.

Table 5-23: AVE Values of the Key Constructs

Construct	AVE value
stage-one audit process quality (B1a, B1b, B1c)	0.681
stage-two audit process quality efficiency (B2a, B2b, B2c)	0.647
stage-two audit process quality reliability (B2f, B2g, B2h, B2i)	0.592
stage-two audit process quality responsiveness (B2j, B2l, B2m)	0.588
stage-two audit process quality assurance (B2n, B2o, B2p)	0.688
stage-two audit process quality empathy (B2t, B2u, B2v)	0.512
human capital (A1f, A1h, A1i)	0.635
structural capital (A2b, A2c, A2d, A2e)	0.592
communication (A3b, A3c, A3d, A3g, A3h)	0.587
cooperation (A3i, A3j, A3k)	0.510
the client's competitive outcomes (E1a, E1b, E1c, E1f)	0.593
client satisfaction (C1b, C1c, C1d, C1e)	0.564

For the two latent constructs that reflect the client's competitive outcomes and client satisfaction, all of the factor loadings were greater than 0.70. The AVE values for

the outcome and client satisfaction were both greater than 0.50. Both the factor loading and AVE assessment suggest adequate convergence of the measurement items for the audit outcome and client satisfaction constructs.

5.5.5 Discriminant Validity

Discriminant validity for the audit process quality constructs was first examined by comparing nested models, and then by comparing the square root of AVE with the correction between latent variables. When implementing the nested model approach, if there are more than two constructs in the measurement model, each pair of constructs should be subjected to a similar analysis, constraining the constructs to be perfectly correlated and then freeing the constraints (Bagozzi et al., 1991). For the six audit process quality constructs, there were 15 pairs of latent variables ($C_6^2 = 15$) that were examined in the CFA. In Figure 5-4, one pair of the nested models is provided as an example. Fifteen chi-square tests were conducted to compare the constrained model (correlation between two LVs were fixed to 1.0) and the unconstrained model. The results indicate that the fit for the unconstrained model is significantly better than for the constrained model; therefore, the results provide support for discriminant validity.

In addition, the square root of AVE was calculated and compared to the correlation between LVs. The correlation matrix of the six audit process quality constructs with the square root of AVE values highlighted on the diagonal are presented in Table 5-24. For each latent variable, the square root of AVE was greater than its correlation with other latent variables, affirming the discriminant validity of the constructs.

Figure 5-4: Example of Comparing Constrained CFA on the Top with Unconstrained CFA on the Bottom

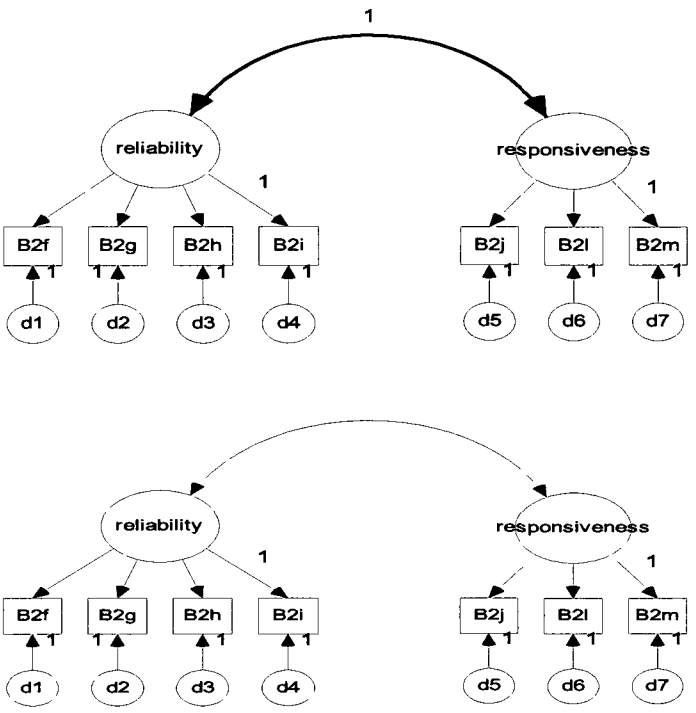


Table 5-24: Compare Square Root of AVE with Correlation between LVs - Audit Process Quality

	stage-one audit process quality	efficiency	reliability	responsiveness	assurance	empathy
Stage-one audit process quality	0.825					
Efficiency	0.041	0.804				
Reliability	0.304	0.255	0.769			
Responsiveness	0.036	0.449	0.263	0.767		
Assurance	-0.048	0.153	0.177	0.473	0.829	
Empathy	-0.096	0.211	0.243	0.117	0.178	0.716

Using the same approach, discriminant validity for the four knowledge-based resource constructs was examined. For these constructs, six pairs of latent variables ($C_4^2 = 6$) were examined in CFA. Six chi-square tests were conducted to compare the

constrained model (correlation between two LVs were fixed to 1.0) and the unconstrained model. The results indicate that the fit for the unconstrained model is significantly better than for the constrained model; therefore, the results provide support for discriminant validity.

The square root of AVE was calculated and compared to the correlation between LVs. In Table 5-25, the correlation matrix of the four knowledge-based resource constructs with the square root of AVE values highlighted on the diagonal are presented. For each latent variable, the square root of AVE was greater than its correlation with other latent variables, affirming the discriminant validity of the constructs.

For the two latent constructs, the client's competitive outcomes and client satisfaction, the chi-square test was conducted to compare the constrained model (correlation between two LVs were fixed to 1.0) and the unconstrained model. The

Table 5-25: Compare Square Root of AVE with Correlation between LVs – Knowledge-Based Resource

	human capital	structural capital	communication	cooperation
human capital	0.797			
structural capital	0.514	0.769		
communication	0.275	0.276	0.766	
cooperation	0.197	0.407	0.024	0.714

results indicate that the fit for the unconstrained model is significantly better than the constrained model, therefore providing support for discriminant validity.

The square root of AVE was calculated and compared to the correlation between outcome and client satisfaction. The correlation between the two constructs and the square root of AVE values highlighted on the diagonal are presented in Table 5-26. For

each latent variable, the square root of AVE is greater than its correlation with other latent variables, affirming the discriminant validity of the constructs.

Table 5-26: Compare Square Root of AVE and Correlation between Outcomes and Client Satisfaction

	the client's competitive outcomes	client satisfaction
the client's competitive outcomes	0.770	
client satisfaction	0.278	0.751

Because the tests for unidimensionality, reliability, convergent validity and discriminant validity provide strong support for construct validity, it is concluded that the modified measurement model is valid. No further modification was made. The validity of the measurement models provides solid ground for the structural model analysis in the next section, which assesses the nomological relationships between the latent constructs.

CHAPTER SIX: STRUCTURAL MODEL RESULTS AND DISCUSSION

6.1 Chapter Preview

In this chapter, hypotheses developed in Chapter Three will be tested using structural equation modeling. The statistical results will be related to managerial implications. Specifically, the structural model which links knowledge-based resources, audit process quality, the client's competitive outcome and client satisfaction will be assessed. The statistical results will then be related to the research questions raised in Chapter One. More importantly, the managerial implications and insights for improving audit process quality in voluntary industry standard audits will be discussed based on the research findings.

6.2 Structural Model Testing for Nomological Validity

In this section, the nomological relationships between the constructs proposed in Chapter three are tested using the SEM approach. Structural model fit was assessed to evaluate whether the proposed conceptual framework fits the data. Path estimates were assessed to determine the direction and strength of the nomological relationship between the key constructs. The possible effect of control variables including country, standard, type of the auditor and industry were also assessed. The power of the statistical analysis was examined by conducting a post-hoc power analysis.

The theoretical model proposed in this research involves a series of dependence relationships between knowledge-based resources, audit process quality, the client's competitive outcomes and client satisfaction. SEM was appropriate for testing the

hypothesized model due to its capability of assessing a series of dependence relationships simultaneously (Hair et al., 2009).

In a structural equation model, the relationships among a set of manifest variables (MVs) and latent variables (LVs) are estimated and specified. Although it cannot be observed directly, the LV (a construct) can be measured or represented by MVs, the empirical indicators that can be observed by the researcher or measured by the responses collected from field interviews or surveys. Based on the support of construct validity, SEM is used to assess the dependence relationships between LVs. Similar to the concept of independent and dependent variables in regression analysis, there are exogenous and endogenous LVs in SEM. Illustrated in a path diagram, exogenous LVs have causal arrows leading only from them, acting as predictors or influencing factors for other LVs: they do not depend on any other LVs in the SEM. An LV is considered endogenous if it acts as an outcome or dependent variable, with at least one arrow leading to it in the path diagram (Hair et al., 2009). It is possible that an endogenous LV plays a mediating role in SEM, with arrows leading to and from it. Mathematically, SEM is based on the following three equations:

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

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

3) $\eta = B\eta + \Gamma\xi + \varsigma$

Where x: the measures of exogenous MVs;

Λ_x: the effect of exogenous LVs on their MVs;

δ: the residual errors in exogenous MV measures;

y: the measures of endogenous LVs;

Λ_y : the effect of endogenous LVs on their MVs;

ε : the residual errors in endogenous MV measures;

ξ : the exogenous LVs;

η : the endogenous LVs;

Γ : the effect of exogenous LVs on endogenous LVs;

B: the effect of endogenous LVs on other endogenous LVs;

ς : the residual errors in structural equation;

Equation (1) represents the directional influences of the exogenous LVs (ξ) on their indicators (x). Equation (2) represents the directional influences of the endogenous LVs (η) on their indicators (y). The two equations link the observed variables (MVs) to unobserved variables (LVs) through a factor analytic model for measurement. Equation (3) represents the endogenous LVs (η) as linear combinations of other exogenous LVs (ξ) and LVs plus residual terms (ς). It specifies relationships between LVs through a structural equation model (Jöreskog, 1974).

To identify the distinct effect of each component of the knowledge-based resources, the effect of human capital, structural capital, communication and cooperation were assessed in four separate structural models as exogenous LVs. In the structural model, the audit process quality construct was tested as multi-stage and multi-dimensional. Based on the conceptual model developed in Chapter Three, stage-two audit process quality was tested as a second-order LV that influences the first-order LVs of efficiency, reliability, responsiveness, assurance and empathy.

6.2.1 Model Fit

Model fit was assessed using both absolute and incremental measures. The absolute fit indices that were examined included chi-square, normed chi-square, goodness-of-fit index (GFI) and root mean square error of approximation (RMSEA) with a 95 per cent confidence interval. Incremental fit measures examined for each structural equation model included normed fit index (NFI), Tucker Lewis Index (TLI), Comparative Fit Index (CFI) and Incremental Fit Index (IFI or BL89). The structural model fit measures for each SEM are presented in Table 6-1.

Table 6-1: Fit Indices of the Structural Models

	Values				
Fit Indices	Human Capital SEM	Structural Capital SEM	Communication SEM	Cooperation SEM	Cut-off Values
$\chi 2$	379	769	837	825	
p value	0.000	0.000	0.000	0.000	≥0.05
$\chi 2$ /d.f.	1.312	1.811	1.834	1.832	≤ 3.0
NFI	0.913	0.901	0.858	0.892	≥0.90
TLI	0.886	0.896	0.901	0.902	≥0.90
CFI	0.907	0.903	0.896	0.898	≥0.90
IFI (BL89)	0.903	0.901	0.892	0.901	≥0.90
GFI	0.906	0.905	0.897	0.902	≥0.90
RMSEA	0.065	0.066	0.064	0.075	≤0.08
(confidence interval)	(0.057, 0.073)	(0.058, 0.074)	(0.056, 0.071)	(0.068, 0.082)	
R^2(Variance Explained)					
the client's competitive outcome	0.637	0.632	0.651	0.645	
client satisfaction	0.706	0.691	0.722	0.713	

As reported in Table 6-1, the fit indices for the four structural models are similar. For the absolute measures, all of the values of normed chi-square are below 3.0, indicating good model fit. GFI is at or greater than 0.90, indicating good model fit. RMSEA values and confidence intervals for all the SEM models indicate good fit.

When compared to the cut-off values, NFI and CFI for the human capital model and structural capital model reflect good fit. For the communication and cooperation models,

NFI and CFI indicate acceptable fit. TLI results for the four tested structural models are at or greater than 0.90, indicating acceptable fit. IFI results reflect good fit of the human capital, structural and cooperation models, while the communication model shows acceptable fit based on its IFI. Because a majority of the fit indices examined are greater than the suggested cut-off values, it is concluded that there is adequate evidence for the structural model fit.

In addition to model fit indices, Table 6-1 also reports the explained variance in the outcome variables, specifically, the R square values for the client's competitive outcomes and client satisfaction. The variance explained are all greater than 60%, which can be considered acceptable in social science research (Hair et al., 2009).

Due to limited sample size and the complexity of the structural model, four dimensions of knowledge-based resources were tested in four separated SEMs. To verify the stability and robustness of the SEM model, the thirteen LVs were tested simultaneously in one SEM. The scores for the LVs are computed by equally weighing and averaging the MV scores: using the average score is preferred to using the estimated factor score because the factor score is data dependent, and therefore cannot be replicated or validated by future research (McDonald, 1997). The SEM results were reviewed: the significance of each path coefficient remained consistent with the path estimated in the four separate structural equation models for human capital, structural capital, communication and cooperation, which indicates the robustness of the structural model.

6.2.2 Path Estimates

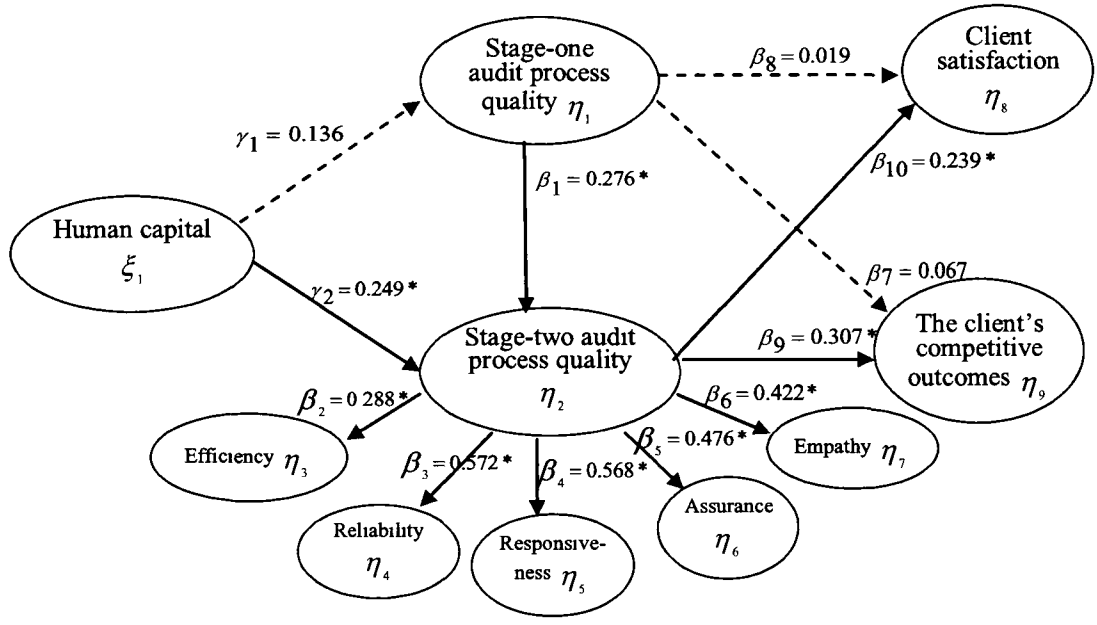
The conceptual model developed in Chapter Three suggests hypotheses between audit process quality, knowledge-based resources, the client's competitive outcomes and

client satisfaction. To test the hypothesized relationships, the path estimates in SEM were examined to assess the direction and strength of the linkages: a positive significant path estimate ($p < 0.05$) provides support for the hypothesis. The path estimates, along with their corresponding hypotheses are presented in Table 6-2. The results of the four structural equation models assessing the effect of human capital, structural capital, communication and cooperation are displayed in Figures 6-1 through 6-4.

Table 6-2: Hypothesis Testing Results

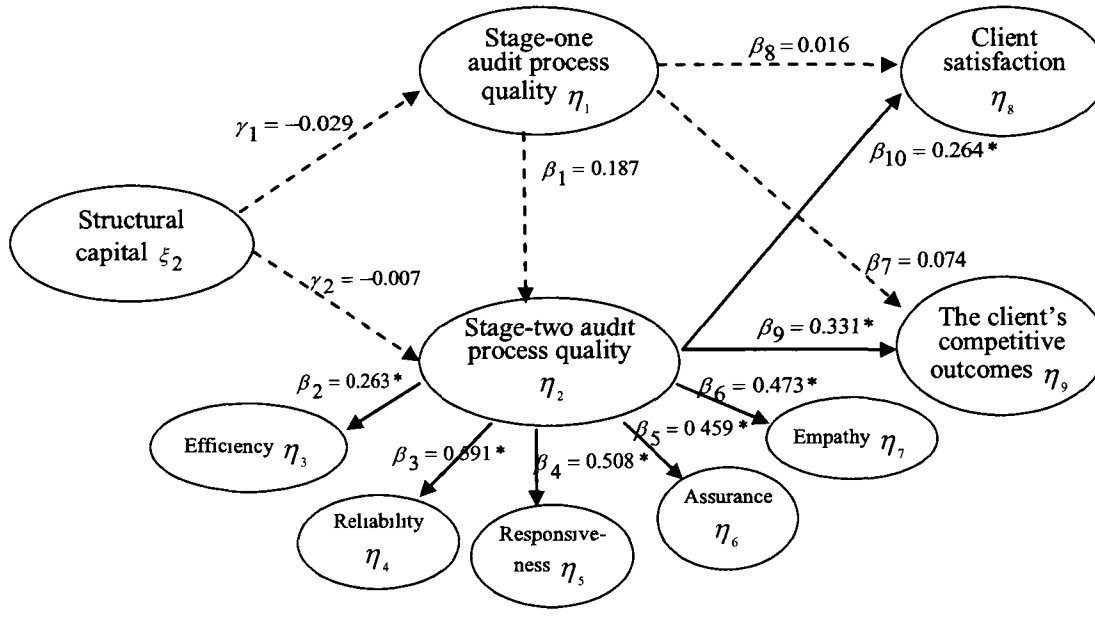
	Hypothesis Description	Structural path	Hypothesis supported?
H1	The audit process quality is a multistage construct, consisting of stage-one audit process quality and stage-two audit process quality.	Tested in CFA measurement model	Yes
H2	Stage-two audit process quality is a multidimensional construct, reflecting		
	a) reliability	stage-two audit process quality → reliability	Yes
	b) responsiveness	stage-two audit process quality → responsiveness	Yes
	c) assurance	stage-two audit process quality → assurance	Yes
	d) empathy	stage-two audit process quality → empathy	Yes
	e) efficiency	stage-two audit process quality → efficiency	Yes
H3	Stage-one audit process quality will positively influence stage-two audit process quality.	stage-one audit process quality → stage-two audit process quality	Yes
H4a	Human capital is positively related to stage-one audit process quality.	human capital → stage-one audit process quality	No
H4b	Human capital is positively related to stage-two audit process quality.	human capital → stage-two audit process quality	Yes
H5a	Structural capital is positively related to stage-one audit process quality.	structural capital → stage-one audit process quality	No
H5b	Structural capital is positively related to stage-two audit process quality	structural capital → stage-two audit process quality	No
H6a	Communication is positively related to stage-one audit process quality.	communication → stage-one audit process quality	Yes
H6b	Communication is positively related to stage-two audit process quality.	communication → stage-two audit process quality	Yes
H7a	Cooperation is positively related to stage-one audit process quality.	cooperation → stage-one audit process quality	No
H7b	Cooperation is positively related to stage-two audit process quality.	cooperation → stage-two audit process quality	Yes
H8a	Stage-one audit process quality is positively related to the client's competitive outcomes.	stage-one audit process quality → outcome	No
H8b	Stage-two audit process quality is positively related to the client's competitive outcomes.	stage-two audit process quality → outcome	Yes
H9a	Stage-one audit process quality is positively related to client satisfaction.	stage-one audit process quality → client satisfaction	No
H9b	Stage-two audit process quality is positively related to client satisfaction.	stage-two audit process quality → client satisfaction	Yes

Figure 6-1: Structural Model with Human Capital



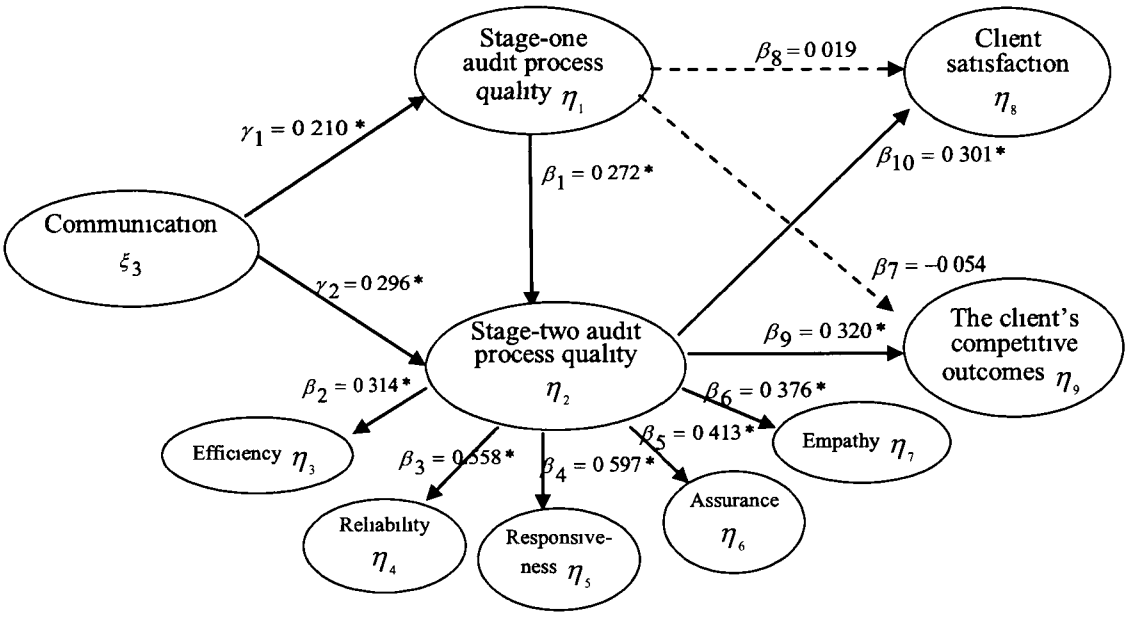
* indicates path coefficient is significant at 0.05 level
The dashed line indicates the non-significant path.

Figure 6-2: Structural Model with Structural Capital



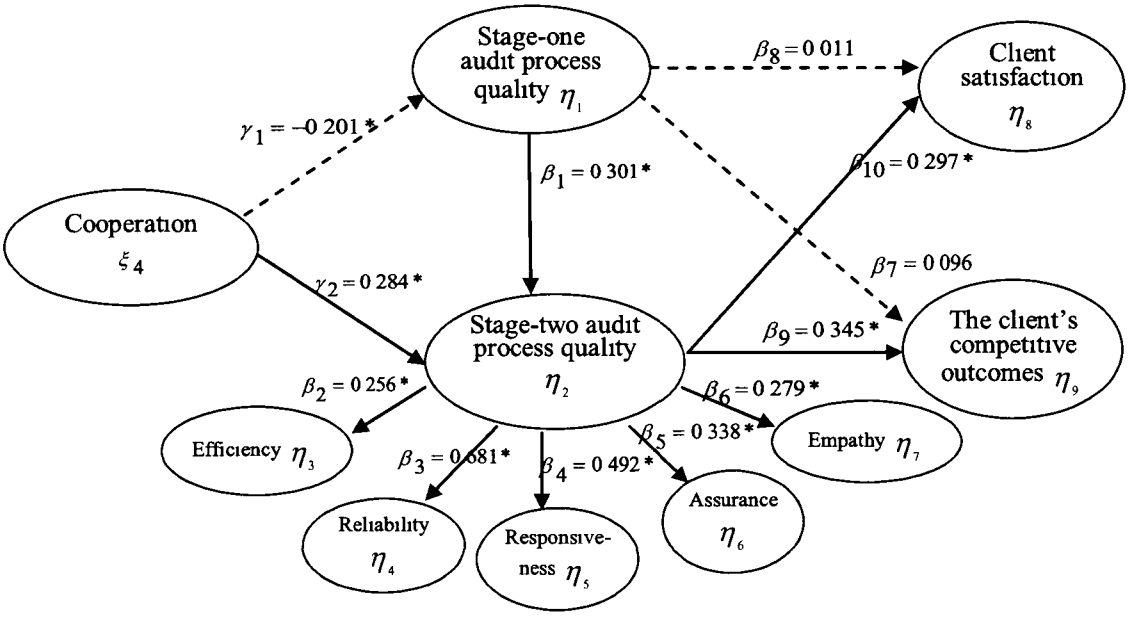
* indicates path coefficient is significant at 0.05 level
The dashed line indicates the non-significant path.

Figure 6-3: Structural Model with Communication



* indicates path coefficient is significant at 0 05 level
The dashed line indicates the non-significant path

Figure 6-4: Structural Model with Cooperation



* indicates path coefficient is significant at 0 05 level
The dashed line indicates the non-significant path

6.3 Research Findings and Discussion

6.3.1 The Audit Process Quality

Research Findings

The first research question was addressed by hypotheses one, two and three.

H1: The audit process quality is a multistage construct, consisting of stage-one audit process quality and stage-two audit process quality.

H2: Stage-two audit process quality is a multidimensional construct, reflecting reliability, responsiveness, assurance, empathy and efficiency.

H3: Stage-one audit process quality is positively related to stage-two audit process quality.

In Chapter Five, the final CFA results on audit process quality supported that stage-one audit process quality, efficiency, reliability, responsiveness, assurance and empathy related to stage-two audit process quality were valid measures for audit process quality. Hypothesis one was supported. CFA results revealed that six factors were extracted based on 19 empirical indicators (items). Each item had clean significant loadings on the factor it was supposed to measure. For all the constructs measuring audit process quality, the reliability was strongly supported with a minimum Cronbach's alpha greater than 0.70 and WLI composite index greater than 0.70. The convergent and discriminant validity were also supported based on AVE values.

Second-order factor SEM was used to test the multi-dimensionality of stage-two audit process quality. The second-order factor can be considered as the causal construct that influences the first-order factors (Hair et al., 2009). It is appropriate to apply a second-order factor in SEM when the first-order factors are considered as sub-dimensions of a complex and broader construct (Prahinski, 2001). In this case, stage-two audit

process quality is considered to influence efficiency, reliability, responsiveness, assurance and empathy perceived by the client during the on-site certification audit.

Meanwhile, efficiency, reliability, responsiveness, assurance and empathy can be viewed as indicators for stage-two audit process quality. The fit of the second-order factor model depends on the statistical significance of the structural path from the second-order factor to its first-order factors. A significant path coefficient ($p < 0.05$) with t-value higher than 1.96 supports the second-order model fit (Venkatraman, 1989). In this research, the path coefficients for the four SEM models are reported in Tables 6-3 through 6-6. The SEM results related to H1, H2 and H3 are highlighted as they concern only the audit process quality construct.

Table 6-3: Path Coefficients of the Human Capital Model

Structural relationship	Path	path coefficient	t-value
stage-two audit process quality → efficiency	β_2	0.288	2.439
stage-two audit process quality → reliability	β_3	0.572	3.434
stage-two audit process quality → responsiveness	β_4	0.568	3.429
stage-two audit process quality → assurance	β_5	0.476	3.336
stage-two audit process quality → empathy	β_6	0.422	2.893
stage-one audit process quality → stage-two audit process quality	β_1	0.276	2.576
human capital → stage-one audit process quality	γ_1	0.136	1.277
human capital → stage-two audit process quality	γ_2	0.249	3.053
stage-one audit process quality → outcome	β_7	0.067	0.795
stage-one audit process quality → client satisfaction	β_8	0.019	0.217
stage-two audit process quality → outcome	β_9	0.307	2.488
stage-two audit process quality → client satisfaction	β_{10}	0.239	2.209

Table 6-4: Path Coefficients of the Structural Capital Model

Structural relationship	Path	path coefficient	t-value
stage-two audit process quality → efficiency	β_2	0.263	2.205
stage-two audit process quality → reliability	β_3	0.591	3.060
stage-two audit process quality → responsiveness	β_4	0.508	2.880
stage-two audit process quality → assurance	β_5	0.459	2.911
stage-two audit process quality → empathy	β_6	0.473	3.055
stage-one audit process quality → stage-two audit process quality	β_1	0.187	1.823
structural capital → stage-one audit process quality	γ_1	-0.029	-0.503
structural capital → stage-two audit process quality	γ_2	-0.007	-0.281
stage-one audit process quality → outcome	β_7	0.074	0.610
stage-one audit process quality → client satisfaction	β_8	0.016	0.014
stage-two audit process quality → outcome	β_9	0.331	2.415
stage-two audit process quality → client satisfaction	β_{10}	0.264	2.139

Table 6-5: Path Coefficients of the Communication Model

Structural relationship	Path	path coefficient	t-value
stage-two audit process quality → efficiency	β_2	0.314	2.170
stage-two audit process quality → reliability	β_3	0.558	2.521
stage-two audit process quality → responsiveness	β_4	0.597	2.559
stage-two audit process quality → assurance	β_5	0.413	2.454
stage-two audit process quality → empathy	β_6	0.376	2.095
stage-one audit process quality → stage-two audit process quality	β_1	0.272	2.224
communication → stage-one audit process quality	γ_1	0.210	2.539
communication → stage-two audit process quality	γ_2	0.296	2.086
stage-one audit process quality → outcome	β_7	-0.054	-0.656
stage-one audit process quality → client satisfaction	β_8	0.019	0.233
stage-two audit process quality → outcome	β_9	0.320	2.164
stage-two audit process quality → client satisfaction	β_{10}	0.301	2.189

Table 6-6: Path Coefficients of the Cooperation Model

Structural relationship	Path	path coefficient	t-value
stage-two audit process quality → efficiency	β_2	0.256	2.551
stage-two audit process quality → reliability	β_3	0.681	4.355
stage-two audit process quality → responsiveness	β_4	0.492	3.652
stage-two audit process quality → assurance	β_5	0.338	3.982
stage-two audit process quality → empathy	β_6	0.279	3.861
stage-one audit process quality → stage-two audit process quality	β_1	0.301	2.913
cooperation → stage-one audit process quality	γ_1	-0.201	-1.988
cooperation → stage-two audit process quality	γ_2	0.284	2.618
stage-one audit process quality → outcome	β_7	0.096	0.765
stage-one audit process quality → client satisfaction	β_8	0.011	0.227
stage-two audit process quality → outcome	β_9	0.345	3.986
stage-two audit process quality → client satisfaction	β_{10}	0.297	2.692

In all four models, the paths from stage-two audit process quality to its five dimensions are significant and positive. As reported in Tables 6-2 through 6-5, the path coefficients from stage-two audit process quality to efficiency, reliability, responsiveness, assurance and empathy all have p-value less than 0.05. The significance of the path coefficients provides strong support for H2 — that stage-two audit process quality is multi-dimensional. A summary of path coefficients from stage-two audit process quality to its first-order factors are displayed in Table 6-7.

Table 6-7: Paths from Stage-two Audit Process Quality to its First-Order Factors

structural relationship	path	path coefficient			
		Human capital SEM	Structural capital SEM	Communication SEM	Cooperation SEM
stage-two audit process quality → efficiency	β_2	0.288*	0.263*	0.314*	0.256*
stage-two audit process quality → reliability	β_3	0.572*	0.591*	0.558*	0.681*
stage-two audit process quality → responsiveness	β_4	0.568*	0.508*	0.597*	0.492*
stage-two audit process quality → assurance	β_5	0.476*	0.459*	0.413*	0.338*
stage-two audit process quality → empathy	β_6	0.422*	0.473*	0.376*	0.279*

* p-value < 0.05

It is hypothesized that the stage-one audit process quality is positively related to stage-two audit process quality (H3). As summarized in Table 6-8, the path coefficients from stage-one audit process quality to stage-two audit process quality across the four SEMs were 0.276, 0.187, 0.272 and 0.301. Three of the path estimates was significant as their t-values were above 2.0. In the structural capital SEM, the t-value of the path estimate from stage-one audit process quality to stage-two audit process quality was 1.823 ($p > 0.05$). With three out of four significant path estimates and one close to the borderline, the hypothesis that stage-one audit process quality is positively related to stage-two audit process quality was partially supported.

Table 6-8: Paths from Stage-one Audit Process Quality to Stage-two Audit Process Quality

structural relationship	path	path coefficient			
		Human capital SEM	Structural capital SEM	Communi-cation SEM	Cooperation SEM
stage-one audit process quality → stage-two audit process quality	β_1	0.276*	0.187	0.272*	0.301*

* p-value < 0.05

Implications

There has been extensive research on service quality. The multidimensionality of this construct has been well established based on previous research (Cronin and Taylor, 1992; Grönroos, 1982; Parasuraman et al., 1985, 1988). Commonly used dimensions for measuring the customer perceptions of service quality include tangibles, reliability, responsiveness, assurance, and empathy. The five multiple dimensions have been adapted to assess service quality in a variety of industries (Parasuraman et al., 2005). Furthermore, to adequately capture the complexity of customer perception of service quality, researchers contend that service quality may be assessed as a multilevel,

multidimensional and dynamic construct. Dabholkar, Thorpe, and Rentz (1996) identified and tested a hierarchical conceptualization of retail service quality that proposes three levels: (1) customers' overall perceptions of service quality, (2) primary dimensions, and (3) subdimensions. In their multilevel model, retail service quality is viewed as a higher-order factor that is defined by two additional levels of attributes. The dynamic perspective of service quality is critical because customers are likely to update their perceptions as they go through different stages of the service process (Rust and Oliver, 1994). However, empirical research on dynamic service quality model is limited (Dagger and Sweeney, 2007).

Building on the previous research of service quality, the present study adapts the commonly used quality dimensions to assess the audit service for voluntary industry standard. Meanwhile, both the dynamic and multilevel, multidimensional nature were captured while assessing the audit process quality construct.

To capture the dynamic nature of the construct, audit process quality was considered multi-stage: stage-one audit process quality associated with the first readiness review stage and stage-two audit process quality associated with the second on-site certification audit stage. As service encounters accumulate between the two parties, it is particularly important for the auditors to understand the service quality attributes that drive positive service outcomes throughout the different stages of the service process. Audit service for voluntary industry standard is typically carried out by the two-stage approach. Therefore, a process-based perspective is instrumental in identifying the essential quality dimensions for each stage.

To capture the many facets and dimensions of service quality perceptions, stage-two audit process quality was proposed to be a second-order factor that reflected five subdimensions as first-order factors, while stage-one audit process quality was evaluated as a project. In a stage-one audit, the auditor mainly focused on reviewing the client's management system documentation, as well as evaluating the client's location and site-specific conditions. At this stage, the interaction between the auditor and client is limited. Client perceptions during this first stage rely heavily on whether the first-stage service is carried on in a timely manner. Therefore, the measurement for project efficiency was considered appropriate to assess stage-one quality.

During the second-stage of the audit, the auditor spends a significant amount of time on-site to conduct opening meetings, to collect audit evidence and to communicate the audit progress along with any concerns to the client. The intensive service encounter between the auditor and the client added a great deal of complexity in assessing the audit process quality for the second stage. As identified in the present study, stage-two audit process quality can be represented by five subdimensions: efficiency, reliability, responsiveness, assurance and empathy. The efficiency dimension was added because the on-site certification stage resembles every characteristics of a project, with a time frame, limited resources and an objective. In addition, on-site certification is sometimes viewed as a disturbance to the daily operation of the client because the auditor needs to conduct interviews with management and shop floor personnel to collect audit evidence. High efficiency translated to conducting and completing the on-site certification audit in a timely manner. This subdimension is critical to the client who appreciates a minimal disturbance to its daily operations. Consistent with previous research, reliability,

responsiveness, assurance and empathy were found to be significant subdimensions when evaluating the audit process quality for stage-two on-site certification audit.

Tangible service quality, a commonly considered attribute of service quality, was not incorporated in the first-order indicators for stage-two service quality. Since the stage-two audit is typically conducted at the client's site, the tangibles of the audit firm such as the physical appearance of the office facility would not contribute to the client's perception of the audit process quality.

In addition to the multistage and multidimensional nature of the audit process quality, the results of the SEM analysis in this study implies that stage-one audit process quality is positively related to stage-two audit process quality. The implication is that, while accounting for different levels of abstraction for defining service quality, the linkages between the multiple aspects and subdimensions of quality are worthy of acknowledgement. The positive relationship between stage-one and stage-two audit process quality found in this study suggests that a high quality stage-one readiness review is one of the determining factors for delivering high quality service in the second stage of the certification audit. If, by the end of stage one, the client perceives that the document review is done efficiently and they are ready for the on-site audit, stage one provides a solid foundation for the auditor to carry out activities needed in stage two, such as conducting meetings, collecting and verifying information. Consequently, the client may perceive the stage-two audit service as reliable, responsive, trustworthy and empathetic due to the momentum established during the high quality stage-one audit.

A high quality stage-one audit is also reflected by the readiness of the client for the stage-two on-site certification audit. For example, if the auditor found in the stage-one

audit that the client's QMS documentation is inadequate to meet the criteria specified in the ISO 9001 standard, the auditor needs to inform the client of the concerns that need to be addressed. In this process, the client has the opportunity to rectify the gaps, add the missing documents on quality procedures, and be aware of what might be missing in its quality management practice. As a result, the client is well prepared for the next step, the on-site certification audit. The implication for the auditor is that before proceeding to the on-site certification audit, one has to make sure that the client's documentation conforms to the specification in the ISO standards, which helps to reduce possible surprises or disagreement that may rise during on-site certification audit. A well prepared client is more likely to perceive the stage-two on site certification audit as high quality.

6.3.2 Knowledge-based Resources and Audit Process Quality

Theoretically, human capital, structural capital and client relationship were proposed as the knowledge-based resources for a high quality audit. Human capital reflects the skills, knowledge and expertise of the auditor. Structural capital is characterized by the codified knowledge embedded in the audit process, such as the design of the process, planning and execution procedure. Client relationship involves the communication and cooperation between the auditor and the client through the audit service encounter.

Hypotheses H4, H5, H6 and H7 address the second research question: "Does the client's perception of the knowledge-based resources of the auditor affect the audit process quality?" In the generic model, it was hypothesized that knowledge-based resources are positively related to audit process quality.

6.3.2.1 Human Capital and Audit Process Quality

Research Findings

H4a: Human capital is positively related to stage-one audit process quality.

H4b: Human capital is positively related to stage-two audit process quality.

The significant linkage between two LVs depends on the statistical significance of the path coefficient and the structural model fit. Now that the structural model fit had been established in Section 6.2.1, the assessment was focused on the path coefficient. If the path coefficient is positive and significantly different from zero, the relationship between the two LVs can be considered significant. As reported in Table 6-2, the path coefficient from human capital to stage-one audit process quality was 0.136 ($p>0.05$). H4a was not supported because the path coefficient was not significant. The path coefficient from human capital to stage-two audit process quality was 0.249 ($p<0.050$), providing support for H4b. Based on the SEM test, human capital is positively related to stage-two audit process quality, but had no significant impact on stage-one audit process quality.

Implications

As indicated by the factor analysis results, auditing experience, professional training and auditor competence are important indicators for infrastructural capital perceived by the client. Closely related to these significant indicators, the client considers the auditor's generic knowledge of quality or the environmental management system essential, compared to their sector specific knowledge built from working experience. To establish and increase its human capital, an audit firm may put more efforts towards helping its auditors gain substantial auditing experience in multiple industries, providing more resources for professional training and ultimately building auditor competence.

Surprisingly, human capital is found not to be a significant factor in delivering high quality service at the stage one readiness review. The insignificance relationship may be due to the activities heavily involved with document review in the stage-one audit. During the first stage, the auditor reviews the client's documentation on its quality management system and determines whether it conforms to the criteria stated in the ISO 9001 standard. To be in conformance with the standard, the client's documentation should include documented statements of a quality policy and quality objectives, a quality manual, documented quality management procedures, documents needed by the organization to ensure the effective planning, operation and control of its processes, as well as the quality control (QC) records required by the standard. Since the documentation requirement is specific to the standard, the major tasks are to verify whether the QMS documentation prepared by the client meets the specified criteria. For instance, ISO 9001 specifically requires the organization to have documentation for the following six procedures: control of documents; control of records; internal audit; control of the nonconforming product; corrective action and preventive action. It can be easily identified if one or more required document is missing. This type of task does not require the same level of expertise, training and skills that are instrumental to the on-site certification audit.

6.3.2.2. Structural Capital and Audit Process Quality

Research Findings

H5a: Structural capital is not positively related to stage-one audit process quality.

H5b: Structural capital is not positively related to stage-two audit process quality.

The path estimates in Table 6-3 were examined: none of the path coefficients linking structural capital and audit process quality are significant. The path coefficient from structural capital to stage-one audit process quality is -0.029 ($p > 0.05$), lending no support to H5a. H5b is also not supported because the path coefficient from structural capital to stage-two audit process quality is -0.007 ($p > 0.05$). Based on the SEM results, structural capital is not positively related to either stage-one or stage-two audit process quality.

Implications

Structural capital has been viewed as an invaluable knowledge-based resource for a firm's competitive advantage (Hill, 2000; Hayes and Wheelwright, 1984). However, for the audit firm that is involved with voluntary standard auditing, structural capital may not be a significant contributor to a high quality audit. For the ISO standard audit, the audit firm's structural capital, such as the audit plan, audit protocol, and the style and format of the audit report, was developed primarily based on the ISO audit guideline. The guideline intends to ensure that the audit firm uses a standardized process to conduct the audit for the client.

The nonsignificant relationship between structural capital and the audit process quality found in this study implies that a high quality audit service cannot be achieved by relying on implementing a standardized audit process prescribed by the ISO audit guideline. In the readiness review stage, the standardized process does not help to enhance the efficiency of the stage-one audit. The standardized process also does not help to improve the efficiency of the stage-two on-site certification audit or to enhance the auditor's reliability, responsiveness, assurance, and empathy as perceived by the client.

For the audit firms who want to improve the audit process quality with both stages of the audit, efforts on improving the development and design of the audit plan, audit protocol, as well as the style and format of the audit report should be appropriately managed but not emphasized.

6.3.2.3 Communication and Audit Process Quality

Research Findings

H6a: Communication is positively related to stage-one audit process quality.

H6b: Communication is positively related to stage-two audit process quality.

In Table 6-4, the path estimate for communication to stage-one audit process quality is 0.210 ($p < 0.05$), which provides support for H6a. The path coefficient for communication to stage-two audit process quality is 0.296 ($p < 0.05$), which provides support for H6b. The significant paths indicate that communication between the auditor and the client positively influences stage-one as well as stage-two audit process quality.

Implications

The significant positive effect of communication in both stages of audit process quality highlights the important role of communication in improving the quality of the ISO standard audit. To improve the audit process quality for both the readiness review and on-site certification audit, the auditor needs to keep the client informed of the audit progress, help the client clearly understand its role in the audit, keep the client thoroughly informed about what to expect in the audit process, and provide useful information for the client to take corrective actions if problems are detected.

6.3.2.4 Cooperation and Audit Process Quality

Research Findings

H7a: Cooperation is positively related to stage-one audit process quality.

H7b: Cooperation is positively related to stage-two audit process quality.

The path estimates shown in Table 6-5 were reviewed. The standardized regression weight for the path from cooperation to stage-one audit process quality is -0.201 ($p < 0.05$). Although the strength of linkage is significant, it indicates a negative relationship between cooperation and stage-one audit process quality, which is opposite to the hypothesized positive relationship (H7a). The path coefficient from cooperation to stage-two audit process quality is 0.284 ($p < 0.05$), providing support for H7b. In summary, the SEM results suggest that cooperation between the auditor and the client is negatively related to stage-one audit process quality, while it has positive linkage to stage-two audit process quality.

Implications

Although research has generally supported the positive association between cooperation and the trading partner relationship (Heide and Miner, 1992; Cannon and Perreault, 1999), the present study provides a closer assessment on the effect of cooperation at two different stages of the ISO standard audit. Results show that cooperation contributes to a deterioration of the stage-one audit process quality. Yet, cooperation enhances the audit process quality of the second on-site certification stage.

To improve the quality of the on-site certification audit, the auditor needs to make more of an effort to cooperate with the client. However, the auditor should be cautious when trying to enhance the audit process quality through improving the cooperation during the first with the client. To accommodate the client's requests, the auditor may need to adjust the audit plan in terms of audit hours or interview schedules. Under the

client's pressure, the auditor may compromise the total audit hours needed for the audit or adjust the schedule frequently. Such compromise will impair the stage-one audit process quality. On one hand, it will decrease the efficiency of the document review process. On the other hand, missing documentation and procedures for the ISO standard may be left undetected due to reduced audit hours. Consequently, the client would not be fully prepared for the second stage on-site certification audit. The implication is that the auditor should maintain its professional integrity when cooperating with the client. To speed up the stage-one audit as requested by the client, more auditors can be assigned without reducing the total audit hours needed.

6.3.3 Audit Process Quality and the Client's Competitive Outcomes

Hypothesis eight addresses the third research question: "Does the audit process quality affect the client's competitive outcomes?"

H8a: Stage-one audit process quality is positively related to the client's competitive outcomes.

H8b: Stage-two audit process quality is positively related to the client's competitive outcomes.

The path coefficients from audit process quality to outcome for the four structural equation models are summarized in Table 6-9. When linking the audit process quality to the outcome, the four models showed similar results. The path coefficient from stage-one audit process quality to the outcome is not significant when assessed in each of the four models; therefore, H8a is not supported. The path coefficients from stage-two audit process quality to the outcome are 0.307, 0.331, 0.320, and 0.345, respectively, for the four models with p-values less than 0.05, providing support for H8b. Overall, the SEM

results reveal that stage-one audit process quality does not relate to outcome, while stage-two audit process quality is positively related to the client's competitive outcomes.

Table 6-9: The Paths from Audit Process Quality to the Client's Competitive Outcome

structural relationship	path	Path coefficient: Human capital SEM	Structural capital SEM	Communication SEM	Cooperation SEM
stage-one audit process quality → the client's competitive outcomes	β_7	0.067	0.074	-0.054	0.096
stage-two audit process quality → the client's competitive outcomes	β_9	0.307*	0.331*	0.320*	0.345*

* p-value < 0.05

Implications

Consistent with previous research, the expected outcome of ISO certification include increased business opportunity, less quality monitoring from customers, lower operating costs and improved systems and processes. These beneficial outcomes can be achieved by improving the second-stage audit process quality. Although the audit process quality in the readiness review stage does not directly influence the outcome, the high degree of reliability, responsiveness, assurance and empathy associated with audit service in the on-site certification audit stage significantly contribute to the beneficial outcome expected from the ISO certified client.

6.3.4 Audit Process Quality and Client Satisfaction

Hypothesis nine addresses the fourth research question:" Does the audit process quality affect client satisfaction?"

H9a: Stage-one audit process quality is positively related to client satisfaction.

H9b: Stage-two audit process quality is positively related to client satisfaction.

The path coefficients from audit process quality to client satisfaction for the four SEMs are presented in Table 6-10. Stage-one audit process quality was not related to

client satisfaction since its path to client satisfaction was not significant in each of the four SEMs. The path coefficients from stage-two audit process quality to client satisfaction were 0.239, 0.264, 0.301 and 0.297, respectively, in the four SEMs with p-value below 0.05, lending support to H7b. Therefore, stage-two audit process quality was found to be positively related to client satisfaction.

Table 6-10: The Paths from Audit Process Quality on Client Satisfaction

		Path coefficient			
	Path	human capital SEM	structural capital SEM	communi-cation SEM	cooperation SEM
stage-one audit process quality → client satisfaction	β_8	0.019	0.016	0.019	0.011
stage-two audit process quality → client satisfaction	β_{10}	0.239*	0.264*	0.301*	0.297*

* p-value < 0.05

Implications

The stage-one audit process quality is not directly related to client satisfaction, while the stage-two audit process quality has a significant impact on the level of client satisfaction. Compared to the first document review stage, the second on-site certification audit stage involves intensive interaction between the auditor and client. It is during the on-site certification audit when the client forms its perceptions of the reliability, responsiveness, assurance and empathy related to the audit service. The auditor should strive to improve the stage-two audit process quality in order to achieve high level of client satisfaction.

6.3.5 Post-hoc Power Analysis

It is critical to have adequate power for the tests of model fit in SEM. Power refers to the probability of rejecting the null hypothesis, given that the null hypothesis is false (Hair et al., 2009). In the current research, power analysis was conducted for each of the

four structural models assessing the effects of human capital, structural capital, communication and cooperation, based on the approach recommended by MacCallum et al. (1996). Power was calculated for each structural model to test the null hypotheses of not-close fit. The following question was addressed: If the model fit is good, we test the hypothesis that the fit is not close — what is the probability of rejecting the null hypothesis?

The SAS program provided by MacCallum et al. (1996) was used to compute the power for each structural model on the basis of RMSEA. The null value for RMSEA was set to 0.05, while the alternative RMSEA was 0.08, following the guidelines suggested by MacCallum et al. (1996). Other inputs for the SAS program included the alpha significance level (0.05), degree of freedom and sample size of each model. A power value greater than 0.80 indicates that the structural model has sufficient power (MacCallum et al., 1996).

Table 6-11 reports the results for power analysis. The upper bound of RMSEA for all of the models was below 0.10, indicating acceptable fit (Browne and Cudeck, 1993). All of the power values for the not-close fit were above 0.80 — close to 1.0 — indicating the hypothesis of not-close fit could be rejected; thus, the results provide support for adequate power.

6.4. Control Variables

6.4.1 ANOVA Analysis

Country, standard, type of audit firm and industry are considered control variables for this study. Anecdotal evidence has suggested the type of the audit firm may be related to different level of audit process quality. The preliminary study revealed concerns with

Table 6-11: Post-hoc Power Analysis

	Values			
	human capital SEM	structural capital SEM	communication SEM	cooperation SEM
d.f.	288	422	452	393
Sample size	204	204	204	204
RMSEA	(0.057,0.073)	(0.058, 0.074)	(0.056, 0.071)	(0.068, 0.082)
Null RMSEA	0.05	0.05	0.05	0.05
Alternative RMSEA	0.08	0.08	0.08	0.08
α significance level	0.05	0.05	0.05	0.05
Power	0.99	0.99	1.00	0.99

the non-accredited audit firm. Moreover, accounting literature suggests large audit firm size ("the big five") is associated with high quality audit. Therefore, it is important to control for the type of audit firm. An One-Way ANOVA was conducted to compare the means of each audit process quality item between the clients who were certified by big-ten accredited firms, boutique accredited firms and non-accredited firms. The ANOVA results are reported in Table 6-12. Based on the F-statistics, no significant difference was found among the clients who were certified by different type of audit firms.

6.4.2 Multiple Group Analysis

After testing the hypothesized relationships between the constructs of interest, the next step is to assess whether the SEM results stand considering the relevant control variables in this research.

Multiple group analysis was used to test if the structural relationship between LVs remained invariant across different groups (Hair et al., 2009). When conducting multiple group analysis, one may add constraints manually by specifying that the model parameters of interest be equal across groups. Then, the model is fitted, yielding a chi-square value for the constrained model for each group. A chi-square difference test is applied to assess if the constrained model is significantly different from the unconstrained

Table 6-12: One-Way ANOVA to Compare Clients Certified by Three Types of Audit Firms

construct	item	F value	significance level
stage-one audit process quality			
	B1a	1.632	0.198
	B1b	0.612	0.543
	B1c	0.768	0.465
stage-two audit process quality			
efficiency	B2a	1.787	0.170
	B2b	1.271	0.283
	B2c	1.697	0.186
reliability	B2f	0.951	0.388
	B2g	1.669	0.191
	B2h	0.202	0.817
	B2i	0.800	0.451
responsiveness	B2j	1.320	0.276
	B2l	0.984	0.376
	B2m	0.702	0.497
assurance	B2n	0.217	0.805
	B2o	0.383	0.682
	B2p	1.720	0.182
empathy	B2t	0.588	0.556
	B2u	1.384	0.253
	B2v	1.304	0.274

multigroup model. If it is not significant (p value > 0.05), one can conclude that the constrained model is the same as the unconstrained multigroup model, leading to the conclusion that the model does apply across groups, and the control variable poses no effect on the structural relationship (Byrne, 2001; Kline, 2005).

The control variables involved in this research were country (US, Canada), Standard (ISO 9001, ISO 14001), type of auditor (accredited big-ten, accredited boutique, unaccredited) and industry (transportation equipment manufacturing, electrical and optical equipment, machinery manufacturing, plastics and rubber products manufacturing, chemicals, chemical products and fiber). The invariance across different

subgroups can be established based on examining series of parameters such as factor loadings, measurement intercepts, structural path coefficients, structural intercepts, structural means, structural covariance, structural residuals, and measurement residuals (Hair et al., 2009). However, the invariance of path coefficients can provide adequate evidence to assess the theoretical equivalence, that is, whether the relationship between constructs are the same across subgroups (Sila, 2007).

After testing the structural relationships between knowledge-based resources, audit process quality and outcome based on the entire data file, the interest centers on whether the structural relationships hold across different groups resulted from stratified sampling (divided by country, standard, type of auditor and industry). In the current analysis, the subgroups of each control variable were subject to SEM by setting the parameters for structural paths equal across subgroups in AMOS 17.

To assess whether structural relationship between human capital, audit process quality, the client's competitive outcomes and client satisfaction tested with the entire sample holds across different groups divided by standard, the data file was first sorted into two subgroups: the ISO 9001 group and the 14001 group. The identical structural model was analyzed with the two group data, allowing the path coefficients to be estimated freely (unconstrained model). Then, the path coefficients in the human capital SEM were set equal across the ISO 9001 certified plant group and the ISO 14001 certified plant group (constrained model). This was done by the multiple-group analysis in AMOS 17 program.

Table 6-13 shows the chi-square difference test showed that there was no significant difference between the unconstrained model and the constrained model. All models yielded acceptable model fit.

Table 6-13: Testing for Standard as a Control Variable

	N	df	$\chi 2$	CFI	$\Delta\chi 2$	p
Baseline model (human capital, Figure 6-1)	204	289	379	0.907		
Constrained model	204	296	388	0.905	9	0.513
Unconstrained model - ISO 9001 Group	115	289	368	0.906	11	0.430
Unconstrained model - ISO 14001 Group	89	289	366	0.906	13	0.242
Baseline model (structural capital, Figure 6-2)	204	425	769	0.903		
Constrained model	204	432	775	0.900	6	0.662
Unconstrained model - ISO 9001 Group	115	425	758	0.902	11	0.430
Unconstrained model - ISO 14001 Group	89	425	753	0.902	16	0.211
Baseline model (communication, Figure 6-3)	204	456	837	0.896		
Constrained model	204	463	844	0.895	7	0.527
Unconstrained model - ISO 9001 Group	115	456	827	0.895	10	0.462
Unconstrained model - ISO 14001 Group	89	456	826	0.895	11	0.430
Baseline model (cooperation, Figure 6-4)	204	450	825	0.898		
Constrained model	204	457	836	0.896	11	0.430
Unconstrained model - ISO 9001 Group	115	450	813	0.897	12	0.466
Unconstrained model - ISO 14001 Group	89	450	810	0.897	15	0.282

To assess whether there was significant difference between the path coefficients estimated in the constrained model with those estimated in the unconstrained model, the chi-square difference test in AMOS was used. P value associated with the chi-square difference was examined, where p-value less than 0.05 indicates significant difference. As reported in Table 6-13, none of the chi-square difference is significant. Therefore, there was no significant difference between the groups in terms of the estimated structural relationships.

Similar procedures were implemented to test whether the structural relationships tested on the entire sample differ across subgroups divided by country, standard, type of auditor and industry. No significant difference was found in terms of model fit and path coefficients across different group models.

In this chapter, the research questions were examined. The statistical results have been related to each research question. For each research question, research findings have been discussed based on the statistical testing for the related hypotheses. Managerial implications drawn from the research findings were also discussed.

In the following Chapter Seven, a summary of this research will be presented, followed by the discussion on the contributions and limitations of this study, and future research opportunities.

CHAPTER SEVEN: CONCLUSION

7.1 Chapter Preview

This chapter provides concluding remarks on the dissertation study. The purpose of the research, the conceptual framework developed, the research methodology applied and principal findings and implications will be summarized in a research overview. In addition, I will discuss the contributions and limitations of the study along with further identifying research opportunities.

7.2 Research Overview

Popular voluntary industry standards, such as ISO 9001 and ISO 14001, have been increasingly adopted by business organizations worldwide to improve their processes and quality performance. The primary approach to get ISO certified is through the readiness review and on-site certification audit conducted by an independent auditor. As the two critical players in the ISO certification process, both the auditor and the client contribute to the success of the project.

There have been applauses and critics towards the credibility of the ISO certification due to the anecdotal evidence and mixed results revealed from previous studies that focus on the factors related to the client (Anderson et al., 1999; Corbett et al., 2005; Morris, 2006). These mixed results could be attributed to the lack of focus on the role of the auditor, the knowledgeable professionals in the certification process. What remains unclear is the role of the auditor in ensuring the credibility of the ISO certification.

The purpose of this study is to investigate the effect of the knowledge-based resources of the auditor on the audit process quality, and the effect of the audit process quality on the client's competitive outcomes and client satisfaction. Previous research has studied the motivations and resource commitment of the clients for ISO certification, and the performance outcomes of ISO certification. This research attempts to address the literature gap on the auditor's impact in the process. Specifically, this study investigates what the auditor can do to improve audit process quality, and ultimately the client's competitive outcomes and client satisfaction. The research questions center on: How is the audit process quality defined for a voluntary standard audit? Does the client's perception of the knowledge-based resources of the auditor affect the audit process quality? Does the audit process quality affect the client's competitive outcomes? Does the audit process quality affect client satisfaction?

These research questions were developed based on the preliminary studies conducted with eight audit industry experts and four ISO certified clients. Based on the preliminary study and the literature review of the previous research, a conceptual model was developed, specifying the hypothesized relationships between knowledge-based resources of the auditor, audit process quality, the client's competitive outcomes and client satisfaction. Hypotheses were developed to address the proposed four research questions. Shown in Figure 6-2 through 6-5, four types of knowledge-based resources of the auditor were assessed: human capital, structural capital, communication and cooperation.

7.3 Research Methodology

Since the objective of the present study is to understand the auditor's behavior that contributes to the audit process quality perceived by the client and the client's competitive outcomes rather than optimization, a cross sectional survey was used to collect perceptual measures from the client. 209 out of 800 certified organizations responded to the survey, which yielded 26.1 percent response rate. Stratified sampling was utilized. The strata criteria were country, standard, type of the audit firm to avoid over or underrepresentation of the subgroup population. Five industries (transportation equipment manufacturing (336), electrical and optical equipment (334), machinery manufacturing (333), plastics and rubber products manufacturing (326), and chemicals, chemical products and fiber (325)) were selected due to the high rate of ISO certification and their capabilities of providing insights due to rich experience with the certification.

Data were examined to prepare for the further statistical analysis. The data examination included the verification of data entry, treatment of missing data, detection of outliers and the assessment of normality assumption. Before assessing the structural model, measurement model was developed and refined. The measurement model was refined through a systematic procedure using CFA assessing the initial measurement model, deleting or retaining problematic items based on the loadings, communalities, error residuals based on from CFA and theoretical considerations. The final measurement model contains 43 items out of the 60 items originally included in the survey for the 12 constructs. The constructs were validated by assessing the content validity, reliability, unidimentionality, convergent validity and discriminant validity.

Once the measurement model was validated, the proposed hypotheses were tested by assessing the structural model. As reported in Table 6-1, the fit indices provide strong

support for structural model fit. A summary of the hypothesis, the research question it intends to address and the results based on the SEM analysis is presented in Table 7-1. The post-hoc power analysis reflects that the statistical power of the structural model is close to 1.0, indicating a high probability that the SEM results are valid.

7.4 Findings and Implications

The research findings of the present study provide insightful implications for the auditor who is dedicated to enhance the credibility of the ISO certification. Specifically, the implications concern how the audit process quality is evaluated from the client's perspective, the effect of different type of knowledge-based resources on the audit process quality, and ultimately the effect of audit process quality on the client's competitive outcomes and client satisfaction.

1. Understand the Audit process quality

The audit process quality is a multistage, multidimensional construct. It incorporates stage-one audit process quality and stage-two audit process quality, corresponding with the first readiness review stage and the second on-site certification audit stage of the audit process. While the stage-one audit process quality is reflected by the efficiency of the document review and the degree to which the client is well prepared and ready for proceeding to the on-site certification stage, stage-two audit is reflected by reliability, responsiveness, assurance, empathy and efficiency perceived by the client.

Stage-one audit process quality positively influences stage-two audit process quality. When the first stage of document review is conducted efficiently, and the client feels well prepared for the second stage on-site certification, it is most likely that during

Table 7-1: Hypothesis, Related Research Questions and Results

Research Question		Hypothesis	Findings
1 How is the audit process quality defined for a voluntary standard audit?	H1	The audit process quality is a multistage construct, consisting of stage-one audit process quality and stage-two audit process quality	The audit process quality is a multistage, multidimensional construct It is reflected by stage-one audit process quality and stage-two audit process quality Stage-two audit is reflected by reliability, responsiveness, assurance, empathy and efficiency Stage-one audit process quality is positively related to stage-two audit process quality
	H2	Stage-two audit process quality is a multidimensional construct, reflecting a) reliability b) responsiveness c) assurance d) empathy e) efficiency	
	H3	Stage-one audit process quality is positively related to stage-two audit process quality	
2 Does the client's perception of the knowledge-based resources of the auditor affect the audit process quality?	H4a	Human capital is positively related to stage-one audit process quality	Human capital is not positively related to stage-one audit process quality
	H4b	Human capital is positively related to stage-two audit process quality	Human capital is positively related to stage-two audit process quality
	H5a	Structural capital is positively related to stage-one audit process quality	Structural capital is not positively related to stage-one audit process quality
	H5b	Structural capital is positively related to stage-two audit process quality	Structural capital is not positively related to stage-two audit process quality
	H6a	Communication is positively related to stage-one audit process quality	Communication is positively related to stage-one audit process quality
	H6b	Communication is positively related to stage-two audit process quality	Communication is positively related to stage-two audit process quality
	H7a	Cooperation is positively related to stage-one audit process quality	Cooperation is negatively related to stage-one audit process quality
	H7b	Cooperation is positively related to stage-two audit process quality	Cooperation is positively related to stage-two audit process quality
3 Does the audit process quality influence the client's competitive outcomes?	H8a	Stage-one audit process quality is positively related to the client's competitive outcomes	Stage-one audit process quality is not positively related to the client's competitive outcomes
	H8b	Stage-two audit process quality is positively related to the client's competitive outcomes	Stage-two audit process quality is positively related to the client's competitive outcomes
4 Does the audit process quality influence client satisfaction?	H9a	Stage-one audit process quality is positively related to client satisfaction	Stage-one audit process quality is not positively related to client satisfaction
	H9b	Stage-two audit process quality is positively related to client satisfaction	Stage-two audit process quality is positively related to the client satisfaction

the second stage the client perceives high degree of reliability, responsiveness, assurance, empathy and efficiency of the audit service.

2. Knowledge-based Resources as antecedents to the Audit Process Quality

From the clients' perspective, the four types of knowledge-based resources, human capital, structural capital, communication and cooperation have mixed effects on stage-one audit process quality and stage-two audit process quality.

Surprisingly, only communication helps to enhance stage-one audit process quality. When clients perceive that the auditor's communication is timely, clear, useful and effective, the audit process quality of the first readiness review stage is enhanced. Human capital and structural capital do not have an impact on the stage-one audit process quality. Interestingly, cooperation will negatively influence stage-one audit process quality. When cooperation efforts are made at the cost of professional integrity of the auditor, stage-one audit process quality reflected by the efficiency and the readiness of the client will be negatively affected.

Human capital, communication and cooperation are significant resources for improving the audit process quality of the second on-site certification stage. The clients perceive the knowledge, experience and skills of the auditor, their effective communication, as well as the auditors' cooperation efforts as positive indicators for high quality audit service in stage two on-site certification audit. Stage-two audit process quality is not influenced by the structural capital of the auditor which includes the audit plan, audit protocol, format and style of audit report.

3. The Linkage from Audit Process Quality to the Client's Competitive Outcomes

Stage-one audit process quality does not directly influence the client's competitive outcomes, while high quality audit in the second on-site certification audit stage contributes to beneficial outcomes for the client. These outcomes are reflected by the increased business opportunity, improved quality performance, reduced operating costs and timely corrective actions towards identified problems.

4. The Linkage from Audit Process Quality to Client Satisfaction

Stage-one audit process quality is not directly related to client satisfaction, while stage-two audit process quality has a positive impact on client satisfaction. The clients are more likely to be satisfied if they consider the audit service in stage-two on-site certification audit as high quality.

The mixed research findings imply the complex interconnections between knowledge-based resources, audit process quality, the outcomes of the audit and client satisfaction. To help clients achieve beneficial outcomes through ISO certification and achieve client satisfaction, the auditor should focus on improving the audit process quality, specially, the quality of the second stage on-site certification audit. To increase stage-two audit process quality, efforts need to be made to improve human capital, communication and cooperation with the client.

7.5 Limitations

This study assesses the linkages between knowledge-based resources, audit process quality, the client's competitive outcomes and client satisfaction using a cross-sectional survey conducted in Canada and U.S. This study has several limitations.

First, using cross-sectional data in this study does not establish causality between the constructs in the conceptual model. Establishing causality requires using longitudinal data (Bullock et al., 1994) to verify that a cause unambiguously precedes an effect.

Second, this study relies on the perceptions of the single respondent of the clients. Due to limited resources, only one informant was contacted for each client. Consequently, potential common method bias may be introduced to the data, posing threats to the reliability and validity of the measurement model and ultimately the validity of the structural relationships between the key constructs. Although the analysis conducted in Chapter five provides strong support for construct validity, the potential bias may not be completely rule out. Future research can survey multiple informants in the client and cross validate their opinions before using the data to assess the conceptual model. Reverse coding technique and seeking archival data can also used to reduce common method bias (Lindell and Whitney, 2001).

Third, the client's competitive outcomes were measured based on the respondents' perceptions. Using archival data such as financial performance may provide richer insights to the auditor as well as the client. Objective measures such as financial performance were not attained in this study because not all clients are public companies and because ISO certification is generally issued on the plant level where the financial data are not publically available.

Fourth, data for this research were collected only from the ISO certified organizations in US and Canada. The survey was limited to five manufacturing industries that had the highest rate of adopting ISO standards. According to ISO, the standards are generic and independent of any specific industries or economic sector. Although in

practice, the manufacturing industries have gotten an earlier start on ISO certification than the services industries, the standards have gained increasing popularity in the service industry. To increase the generalizability of this research, further investigations can extend to investigate the validity of the present proposed conceptual model by surveying service organizations, other industries in manufacturing sector or the certified organizations in developing countries.

7.6 Contributions

Research on the effectiveness and credibility of ISO certification has been primarily focused on the factors related to the clients. The role of the auditor, the knowledgeable professionals, receives sparse attention. This study is among the first attempts to explore the role of the auditor in improving the effectiveness and credibility of ISO certification. Specifically, this study assessed the impact of knowledge-based resources of the auditor on audit process quality and the impact of audit process quality on the client's competitive outcomes and client satisfaction.

Theoretical Contributions

This study extends the conceptualization of service quality from the previous research. In addition to the multidimensionality of service quality, this study proposed and empirically tested that service quality is associated with different stages of the service delivery. The quality dimensions can differ with different stages of the service. Another further understanding on service quality is the interrelations between the service quality of different stages. Specifically, in this research, empirical supports were found that the audit process quality is assessed based on the two-stage approach used for ISO certification audit. Stage-one audit process quality concerns the efficiency and

preparedness perceived by the client after the first readiness review stage. Stage-two audit process quality concerns the reliability, responsiveness, assurance, empathy and efficiency of the audit service delivered in the second on-site certification audit stage. It is found that stage-one audit process quality has a positive impact on stage-two audit process quality.

Complementary to previous research, this study addresses the missing link from the factors related to the auditor to the effectiveness of ISO certification. Previous research has focused on the motivations and implementations of ISO management system in the client and how these factors relate to the outcome of the certification. This research centers on the impact of knowledge-resources of the auditor on the audit process quality and how the audit process quality affects the client's competitive outcomes and client satisfaction.

Empirical Contribution

This research provides substantial empirical evidence that the auditors play a pivotal role in improving the effectiveness of ISO certification.

1) To the auditors, investments on human capital are critical to the delivery of high quality audit service during the on-site certification stage. Regular professional training is needed to enhance the competence, knowledge and skills of the auditors.

2) Effective communication is crucial to a high quality certification audit, especially when the on-site certification audit can be viewed as an interruption of the business of the client. If the client gets a timely update of the audit progress, problems identified in the audit, and useful information for taking corrective actions, they are more

likely to rates highly in terms of the reliability, responsiveness, assurance, empathy and efficiency of the audit service.

3) For the auditor, cooperation with the client is beneficial to delivering high quality service in the second stage on-site certification audit. When the auditor is flexible to accommodate to the client's needs and makes efforts on joint problem solving, high audit process quality perceived by the client can be expected. However, the auditor should exercise caution when cooperating with the client. Professional integrity should not be sacrificed under the pressure of the client.

4) High audit process quality is instrumental in achieving beneficial client's competitive outcomes. Although stage-one audit process quality does not directly influence, it is found that stage-two audit process quality has a positive impact on the client's competitive outcomes. For the client, high quality audit service results in more business opportunities, better quality performance, lower operating costs and continuous improvement.

5) Client satisfaction is directly influenced by stage-two audit process quality. To the auditors, client satisfaction is crucial to their future business as satisfied clients may bring in more business opportunities. The on-site certification audit stage involves intensive interactions between the auditor and the client. It is the audit process quality in this stage that defines the satisfaction level of the client. To achieve client satisfaction, the auditors must enhance their reliability, responsiveness, assurance, empathy and efficiency when conducting the on-site certification audit.

In this research, the development and refinement of the measurement model provides empirically validated scales for constructs such as human capital, structural

capital, communication, cooperation, audit process quality, the client's competitive outcomes and client satisfaction. Based on previous research literature and preliminary field studies, the measurement items were adapted to fit in the context of an ISO certification audit. The refined measurement model establishes the bases for future research on ISO certification audit service.

7. 7 Future Research

This study focuses on the role of the auditor in conducting high quality audit service, which is related to the client's competitive outcomes. Further research may investigate how the auditor and client work together to achieve positive outcomes from certification audit. Powell (1995) found that Total Quality Management (TQM) success is related to the tacit, behavioral feature of an organization, such as open culture, employee empowerment and management commitment. Moreover, Westphal et al. (1997) found that TQM outcomes may be related to the motivation of adopting the quality management practices – to improve internal efficiency or to achieve external legitimacy. An extension of this study is to assess if the relationship between audit process quality and the client's competitive outcomes is moderated by the client's organizational culture, management commitment or motivation of adopting the industry standard.

This study reveals that the auditor's knowledge-based resources are close related to the audit process quality, which is related to the client's competitive advantage. Further study may investigate how the strategic knowledge-based resources of the auditor are transferred to the client organization through organization learning process. The service profit chain framework may also provide insightful theoretical perspective.

This study revealed interesting results associated with the auditor's cooperation efforts for the client. Cooperation is negatively linked to the stage-one audit process quality, but is positively related to stage-two process quality. It seems in the certification audit process, a balance is needed to maintain the auditor's professional integrity as well as to satisfy the customer's needs. Future research can investigate how to achieve this balance and what factors are related to the balance (for instance, the auditor's conflict resolution capabilities).

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Appendix 4-1: First Contact Letter to the Auditors

Dear Mr. /Ms. ____,

The purpose of this letter is to formally invite you, on behalf of an Ivey research team, to be the key industry advisor to our research project on high quality auditing service and the effectiveness of ISO certification process. As a premier ISO 14001 registrar, Quality Management Institute has helped numerous clients develop and improve their quality/environmental management systems through the process of auditing and certification. Your successful experience is an invaluable asset to help establish the industry benchmark of high quality auditing service delivery.

To satisfy the needs of the clients, auditors must ensure that the auditing service and certification processes facilitate continuous improvement and add value to the client. By investigating the essential elements of audit service quality, this research would establish an effective system of competitive advantage through audit service quality. As an industry expert, your opinions on ISO certification topics, such as how to assess the service quality of the auditing process; how to cooperate with the client in the process of developing, implementing and maintaining the certified system; and the approaches you have used in the auditing process to help the client improve their environmental management system, would provide rich insights to our research project.

At this stage in my research, I am developing case studies of the ISO 9001/14001 certification process and would consider your firm as one of the premier organizations for this study. In exchange for your time, I would be happy to share the valuable results of this study.

Would I be able to further discuss this research with you on _____? If you have any questions, please feel free to reach me at [redacted] or [redacted]

Sincerely,

Ying Fan

PhD Candidate, Operations Management
Richard Ivey School of Business
University of Western Ontario
1151 Richmond Rd.
London, Ontario N6A 3K7

Appendix 4-2: Interview Protocols Used in the Preliminary Study

Interview Protocol (For the Auditors)

Service Provided:

1. What type of ISO management system auditing and certification services do you provide?
2. Describe your clients? (Industry; Size ;)
3. How do you approach new clients?

Audit team organization:

1. How many auditors do you have currently?
2. How do you evaluate auditor competence (training, certification e.g. Canadian Environmental Certification Approvals Board CECAB certified)
3. Do the environmental auditors need to be certified before undertaking audit activities? Audit certificate issued by which organization is considered legible for conducting environmental audit in Canada?
4. Team organization for a typical ISO 14001 audit process? (Lead auditor, auditor, provisional auditor.... Subcontract, e.g. hire independent auditor outside?)
5. Does the client have internal auditor? What's the role of the internal auditor in the auditing process?

Management System Audit Process:

1. Describe a typical ISO 14001 audit process?
   - Who is involved and when? How is the process conducted?
   - When do certain activities get conducted?
   - Are some activities "optional" and when is the option utilized?
2. What's the average length of ISO 14001/9001 certification process?
3. Important timelines of the process
4. Describe the activities conducted during the ISO certification process: pre-certification audit, certification audit and certified system maintenance auditing?
5. How do you cooperate with the client during the auditing process? (Communication mode, frequency, resource commitment of the client...)
6. What approaches do you apply to help the client achieve continuous improvement of their management system?
7. Does the firm have competition? Who are the competitors?
8. How does ISO ensure consistency between various auditors?
9. How does your firm ensure that its auditors provide consistent standards of auditing amongst its employees? What are the responsibilities of the auditors involved in the certification process?

Audit process quality:

1. Do you monitor audit process quality?
2. How do you assess the auditing service quality associated with each auditing and certification process? Client's feedback? Evaluation criteria used?

3. From your point of view, what are the critical elements that constitute an effective certification?
4. What are the important factors that contribute to high quality audit? (auditor, client)
5. How does the manager conclude that the auditing performance is "exceptional" average, etc.?
6. What metrics are used to assess performance? Of his/her firm's audit? Of the client's ISO standard implementation effectiveness?
7. Do you subcontract audit service to other consulting firms?
8. If you subcontract the audit service, how do you monitor and control the audit process quality? What evaluation criteria are used to measure the performance of the contractor auditor?

Challenges:

1. Based on your ISO audit experience, what do you think is the biggest barrier that hinders high quality audit service delivery? (Auditor, client, competitors, other auditors?)
2. How to improve the process to foster the credibility and confidence in the effectiveness of ISO registration?
3. From your point of view, what can be done to improve audit process quality? (Auditor, client, ISO, accreditation bodies, government agencies?)

Additional Comments:

Appendix 4-3:

First Contact Letter to the Client

Dear Mr. /Ms. ____,

The purpose of this letter is to formally invite you, on behalf of an Ivey research team, to be the key industry advisor to our research project on high quality auditing service and the effectiveness of ISO certification process. As an industry leader in environmental management, your company has developed an effective quality/environmental management systems through the process of ISO 901/14001 auditing and certification. Your successful experience is an invaluable asset to help establish the industry benchmark of superior quality/environmental performance.

Our research aims to identify essential elements of high quality 9001/14001 audit. In order to provide managerial implications, we are particularly interested in the key drivers for high quality 9001/14001 audit and the outcomes of the audit. By investigating the antecedents and outcomes of high quality audit service, this research would establish an effective system of competitive advantage for the client firm through audit service quality. As an industry expert, your opinions on ISO certification topics, such as how to assess the service quality of the auditing process; how to interact with the auditor in the process of developing, implementing and maintaining the certified system; and the most critical outcomes associated with the ISO management system audit would provide rich insights to our research project.

At this stage in my research, I am developing case studies of the ISO 9001/14001 certification process and would consider your firm as one of the premier organizations for this study. In exchange for your time, I would be happy to share the valuable results of this study.
Would I be able to further discuss this research with you on _____? If you have any questions, please feel free to reach me at [redacted] or [redacted].

Sincerely,

Ying Fan
PhD Candidate, Operations Management
Richard Ivey School of Business
University of Western Ontario
1151 Richmond Rd.
London, Ontario N6A 3K7

Appendix 4-4: Interview Protocols Used in the Preliminary Study
Interview Protocol (For the Client Firm)

Management System Audit Process:

1. Based on your ISO certification experience, describe a typical ISO 9001/14001 audit process?
   - Who is involved and when? How is the process conducted?
   - When do certain activities get conducted?
   - Are some activities "optional" and when is the option utilized?
2. What's the average length of ISO 14001/9001 certification process?
3. Important timelines of the process
4. Describe the activities conducted during the ISO certification process: pre-certification audit, certification audit and certified system maintenance auditing?
5. How do you interact with the auditor during the auditing process? (Communication mode, frequency, cooperation with the auditor.....)
6. Have you assigned certain staff to take charge of the ISO certification project? What are the person's responsibilities when involved in the certification process?

Audit Process Quality:

1. How do you assess the audit service quality associated with each auditing and certification process? Does the auditor ask for your feedback during the document review stage and the on-site certification audit stage? If so, what are the measurements they use to assess audit process quality?
2. From your point of view, what are the critical elements that constitute an effective certification audit?
3. What are the important factors that contribute to high quality audit? (auditor, client)

Audit Outcomes and Client Satisfaction:

1. What metrics are used to assess audit outcomes in your company?
2. What are the indicators that you would consider as important indicators for the success of the first stage document review audit?
3. What are the indicators that you would consider as important indicators for the success of the second stage on-site certification audit?
4. Are you satisfied with the auditor who has provided you the ISO audit service? Will you repurchase audit service from the same firm in the future?

Appendix 4-5: Survey Instrument for ISO 9001 Certified Organization

May XX, 2009

<<COMPANY>>
<<ADDRESS1>>
<<ADDRESS2>>

Dear <<NAME>>,

As you are well aware, the global marketplace for manufacturers is extremely competitive. In response, one approach that many firms are pursuing is external audit and registration of their internal management systems using widely recognized international standards. One such standard in that area of quality is ISO 9001. Here at the Ivey Business School, we are conducting a research study to understand the rationale behind, the process used for, and the performance outcomes linked to an ISO certification audit. In addition, we also assess how audited firms measure the quality of their audit, as well as the key drivers for a high-quality audit.

This research is designed, in part, to help you benchmark your ISO audit experience against other firms in Canada and the U.S. Senior managers from a small number of US and Canadian firms that have been ISO 9001 registrants are being approached to provide details of their most recent audit experience. Enclosed is a questionnaire consisting of a series of questions which ask your opinions about issues related to the audit process, audit process quality and business outcomes of your ISO 9001 certification process. It should take approximately 30 minutes to complete. Participation is voluntary. Completing and returning the survey questionnaire will indicate your consent to participate in this study. The questionnaire can be completed in paper or online. The completed paper survey can be returned using the enclosed business reply envelope or faxed to 1-888-662-7693 (toll free). Online survey can be accessed and completed at http://www.ivey.ca/checkbox/survey.aspx?surveyid=3783.

All participants will receive a copy of the summary results, which you can compare against your own firm's experience. Also, in recognition of your participation, you will be entered in a drawing; five winners will receive the business bestseller: *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer* by Jeffrey Liker. There will be no risks associated with the participation of the study.

The data collected in this study will be used in my doctoral dissertation. All information will be kept confidential and only anonymous opinions and aggregate results will be reported. If you have any questions or comments, please contact me [redacted] or by email at [redacted] If you have any concerns about the study, you may also contact the UWO Office of Research Ethics at [redacted]

Thank you in advance for your participation and generous support for this doctoral dissertation research. I look forward to hearing from you.

Sincerely yours,

Ying Fan, M. of Mgmt. B.Eng.
Doctoral Candidate
Operations Management

Robert Klassen, Ph.D., P. Eng.
Professor
Operations Management

Richard Ivey School of Business
The University of Western Ontario

Audit Process Quality, Its Key Drivers, and Outcomes

In ISO 9001 Certification Auditing

Questionnaire Instructions

1. Please respond to each question or statement carefully and candidly. It is your opinion and perception as a manager knowledgeable about your organization that is important.
2. The specific information of your organization will be kept strictly confidential. Only aggregated summaries will be reported.
3. Please provide an approximate answer in the event that you do not have the precise data required to answer a question. Earlier research has shown that approximate answer is better than no answer at all.
4. We will provide all participating companies with a summary of the results of the study to reflect our appreciation.
5. Please return the completed questionnaire using the enclosed business reply envelope or fax it to **1-888-662-7693** (toll free).
6. You can also fill out the survey online. Simply follow the link: http://www.ivey.ca/checkbox/survey.aspx?surveyid=3783 and input password **20099001**.

If you have any questions or concerns, please contact Ying Fan at [redacted] or at [redacted] Please return the completed survey to:

Ying Fan
PhD Candidate
Operations Management
Richard Ivey School of Business
University of Western Ontario
London, Ontario N6A 3K7

In this questionnaire:
Certification audit refers to the audit that is conducted by external, independent auditing organizations, such as those providing certification of conformity to the requirements of ISO 9001 standard.
Auditor refers to the person who conducts the certification audit for ISO 9001 standard or the team leader of the audit team.

When was the most recent ISO 9001 certification audit completed in your plant? Please check the time below.

Year ☐ 2007 ☐ 2008 ☐ 2009

Month
☐ January ☐ July
☐ February ☐ August
☐ March ☐ September
☐ April ☐ October
☐ May ☐ November
☐ June ☐ December

Part A: The Auditing Practice

This section examines auditing practices used by the auditor that conducted your most recent certification audit. Please circle the number based on your assessment of the auditor's qualifications and the audit services provided to your firm.

A1. The following statements relate to the auditing firm's resources. Please assess these statements based on your familiarity with the quality control practices employed in the auditing firm.

	strongly disagree			neutral			strongly agree
a. The auditor's activities were extensively monitored by the designated quality management personnel in the auditor.....	1	2	3	4	5	6	7
b. We were frequently asked to provide feedback on the audit activities conducted by the auditors.....	1	2	3	4	5	6	7
c. The audit was conducted according to formal auditing procedures established by the auditor.....	1	2	3	4	5	6	7
d. Occasionally, the auditors' activities were observed and witnessed by a senior auditor to ensure they are following the rules that govern their auditing practices.	1	2	3	4	5	6	7
e. The working paper and audit report issued by the auditor went under extensive review in the auditor.....	1	2	3	4	5	6	7

Please assess the following statements based on your familiarity with the skills, knowledge, and expertise of the auditor through the ISO certification process.

	strongly disagree			neutral			strongly agree
f. The auditor has substantial auditing experience.....	1	2	3	4	5	6	7
g. The auditor has extensive working experience related to our industry	1	2	3	4	5	6	7
h. The auditor has been professionally trained.....	1	2	3	4	5	6	7
i. The auditor was competent in carrying out the audit project.....	1	2	3	4	5	6	7

A2. The following statements relate to the way the audit service was conducted. Please assess these statements based on your experience with the auditor in the audit process.

	strongly disagree			neutral			strongly agree
a. The audit process was well-designed by the auditor.....	1	2	3	4	5	6	7
b. The well-developed audit plan made it easy to understand the objective of the audit and audit activities that could be expected at each step.....	1	2	3	4	5	6	7
c. The well-developed audit protocol provided helpful guidance on the questions to be answered	1	2	3	4	5	6	7
d. The *style* used in the audit report made it easy to understand the findings and the conclusions of the audit	1	2	3	4	5	6	7
e. The *format* used in the audit report made it easy to understand the findings and the conclusions of the audit	1	2	3	4	5	6	7
f. Advanced information technology was used in the audit process.	1	2	3	4	5	6	7

A3. The following statements pertain to the organizational relationship between you and your auditor. Please report on your experience with the auditor during the audit process.

	strongly disagree			neutral			strongly agree
a. We were informed about the activities to be undertaken in the audit plan in a timely manner.....	1	2	3	4	5	6	7
b. We were informed about the progress of the audit in a timely manner.	1	2	3	4	5	6	7
c. We were informed by the auditor if there is evidence collected during the audit indicates an immediate and significant risk related to the quality issues in a timely manner.....	1	2	3	4	5	6	7
d. We clearly understood our roles in the audit process	1	2	3	4	5	6	7
e. We clearly understood our responsibilities in the audit process...	1	2	3	4	5	6	7
f. We were thoroughly informed about what to expect from the audit.....	1	2	3	4	5	6	7
g. Information exchange during the audit was useful for us to take corrective action.....	1	2	3	4	5	6	7
h. The communication between our firm and the auditor was effective.....	1	2	3	4	5	6	7

	strongly disagree			neutral			strongly agree
i. The auditor was flexible in responding to our requests to modify the audit plan (e.g., dates, time, duration of the meeting, interviews or on-site observation)	1	2	3	4	5	6	7
j. When an unexpected situation arose, the auditor would rather work out new arrangements than hold us to the original plan.....	1	2	3	4	5	6	7
k. The auditor worked with us to resolve any diverging opinions concerning the audit evidence and / or findings.....	1	2	3	4	5	6	7

A4. The following statements relate to the auditor's ability of resolving the conflicts and disagreements with your organization during the audit process. Please assess these statements based on your experience with the auditor.

	strongly disagree			neutral			strongly agree
a. The auditor had systems and procedures in place to resolve disputes with us during the audit.....	1	2	3	4	5	6	7
b. The auditor viewed difference in opinions with us as an opportunity to improve our business relationship.....	1	2	3	4	5	6	7
c. Settling disagreements during the audit process was a joint responsibility of us and the auditor.....	1	2	3	4	5	6	7
d. We regularly discussed with the auditor any differences in opinions that we had with them.....	1	2	3	4	5	6	7

Part B: The Audit process quality

This section examines audit service quality associated with the audit process. Please rate the audit service quality based on your experience in the ISO certification process.

B1. Recall your experience with auditor **before** the actual on-site audit took place. Please assess the following statements.

	strongly disagree			neutral			strongly agree
a. The readiness review stage of the audit was conducted in a timely manner.....	1	2	3	4	5	6	7
b. Audit activities in the readiness review stage were conducted and completed according to the timeline as we agreed with the auditor.....	1	2	3	4	5	6	7
c. We were ready for the on-site visit by the time the document review was completed.....	1	2	3	4	5	6	7
d. The cost associated with the readiness review stage met our budget.....	1	2	3	4	5	6	7

B2. Recall your experience with the auditor **during** the actual on-site audit took place. Please assess the following statements.

	strongly disagree			neutral			strongly agree
a. The on-site stage of the audit was conducted in a timely manner	1	2	3	4	5	6	7
b. Audit activities during the on-site stage were *conducted* according to the audit plan	1	2	3	4	5	6	7
c. Audit activities during the on-site stage were *completed* according to the audit plan	1	2	3	4	5	6	7
d. The audit report was issued soon after the on-site visit	1	2	3	4	5	6	7
e. The cost associated with the on-site certification audit stage met our budget	1	2	3	4	5	6	7
f. The auditor delivered services within a certain time frame as promised	1	2	3	4	5	6	7
g. The auditor was technically competent to perform the audit service	1	2	3	4	5	6	7
h. The auditor's activities were consistent with the agreed upon audit plan	1	2	3	4	5	6	7
i. We could count on the auditor to achieve the overall objective of the audit project	1	2	3	4	5	6	7
j. The auditor responded to our questions and concerns very quickly	1	2	3	4	5	6	7
k. When arranging the interviews with the facility personnel, the auditor would adjust their schedule if we indicate there was time conflicts	1	2	3	4	5	6	7
l. The auditor informed us immediately if there was evidence of any non-conformity	1	2	3	4	5	6	7
m. The audit report was produced quickly after the audit	1	2	3	4	5	6	7
n. At my organization, we have been able to trust the auditor	1	2	3	4	5	6	7
o. The auditor assured confidence during the auditing process	1	2	3	4	5	6	7
p. The auditor had my organization's best interest at heart	1	2	3	4	5	6	7
q. I believe that the audit added value to our organization's business	1	2	3	4	5	6	7
r. The on-site audit activities were arranged at times convenient to our organization	1	2	3	4	5	6	7
s. The auditor proposed opportunities that contributed to the improvement of management system	1	2	3	4	5	6	7
t. The auditor's attitude during the audit process was friendly	1	2	3	4	5	6	7
u. The auditor's attitude during the audit process was professional.	1	2	3	4	5	6	7
v. The auditor put us at ease when he talked with us	1	2	3	4	5	6	7

Part C: Client Satisfaction

C1. The following statement is related to the degree of your satisfaction with the audit service provided. Please circle the number to rate your level of satisfaction.

	strongly disagree			neutral			strongly agree
a. If we have future needs, we are likely to hire the same auditor	1	2	3	4	5	6	7
b. We would recommend the auditor's service to a peer organization.	1	2	3	4	5	6	7
c. Our choice to hire this auditor was a wise one.	1	2	3	4	5	6	7
d. The audit service was exactly what we needed for a successful ISO 9001 certification.	1	2	3	4	5	6	7
e. Overall, we were satisfied with the audit service.	1	2	3	4	5	6	7
f. I would recommend ISO 9001 certification to other businesses...	1	2	3	4	5	6	7

C2. The following items ask your opinion on how the ISO certification audit **should** be performed and your assessment on how the audit was **actually** performed in your plant. To what extent do the following statements represent your view of the performance of the auditor?

	not at all			to some extent			to a great extent
a1. The auditor *should* help us improve our internal process.	1	2	3	4	5	6	7
a2. The auditor *actually* helped us improve our internal process.	1	2	3	4	5	6	7
b1. The auditor *should* help us improve our products and services.	1	2	3	4	5	6	7
b2. The auditor *actually* helped us improve our products and services.	1	2	3	4	5	6	7
c1. The auditor *should* be flexible and able to adjust his/her style to meet our requirements.	1	2	3	4	5	6	7
c2. The auditor was *actually* flexible and able to adjust his/her style to meet our requirements.	1	2	3	4	5	6	7
d1. The auditor *should* work with us by being a good communicator.	1	2	3	4	5	6	7
d2. The auditor *actually* worked with us by being a good communicator.	1	2	3	4	5	6	7
e1. The auditor *should* be able to facilitate continuous improvement of our quality management system.	1	2	3	4	5	6	7
e2. The auditor was *actually* able to facilitate continuous improvement of our quality management system.	1	2	3	4	5	6	7
f1. The auditor *should* be able to adapt to the needs of our plant .	1	2	3	4	5	6	7
f2. The auditor was *actually* able to adapt to the needs of our plant.	1	2	3	4	5	6	7

Part D: The ISO Certification Project

This section examines the motivation for ISO certification and the implementation of the ISO certification project in your organization. Please indicate what best describes your organization's situation.

D1. Please indicate the degree of importance of the following reasons for ISO 9001 certification.

	not important			moderately important			extremely important
a. Certification was required by one or more of our customers.....	1	2	3	4	5	6	7
b. Certification as a strategic goal was set by our parent company..	1	2	3	4	5	6	7
c. We intended to improve product quality through internal process improvement.....	1	2	3	4	5	6	7
d. We intended to reduce cost by implementing ISO 9001 quality management system.....	1	2	3	4	5	6	7
e. We intended to gain a marketing advantage through ISO 9001 certification.....	1	2	3	4	5	6	7

D2. Over the fiscal year when the ISO certification project took place, what percentage of the annual operating costs on average was allocated to the project?

<1% 2% 4% 6% 8% 10% 12% Other: ____%

D3. Over the fiscal year when the ISO certification project took place, what percentage of the organization's total capital budget on average was allocated to invest in the project?

<1% 2% 4% 6% 8% 10% 12% Other: ____%

D4. Please identify the level of financial, managerial and technological resources committed to the ISO certification project in your organization.

	extremely low			moderate			extremely high
a. The level of financial investments committed to the ISO certification.....	1	2	3	4	5	6	7
b. The level of top management support to the ISO certification....	1	2	3	4	5	6	7
c. The level of the cooperation of related personnel during the audit process.....	1	2	3	4	5	6	7
d. The degree that our top management explicitly reinforced their support for ISO certification in related management decisions....	1	2	3	4	5	6	7
e. The degree that our top management showed interest in specific quality issues.....	1	2	3	4	5	6	7
f. The degree that our top management included the ISO certification status review in each operations review meeting.....	1	2	3	4	5	6	7
g. The level of technological support committed to the ISO certification project (e.g., information system used for communication, reporting and data analysis).....	1	2	3	4	5	6	7

Part E: Outcomes of the Audit

This section examines outcomes that resulted from the audit process. Please assess the impact of the certification audit on your organization's business.

E1: Please assess the following statements as it relates to the impact of ISO 9001 quality management system certification on your organization's business.

	strongly disagree			neutral			strongly agree
a. Our business opportunities increased after we were ISO 9001 certified	1	2	3	4	5	6	7
b. Our most important customer has reduced the frequency of quality evaluation and monitoring after we were ISO 9001 certified	1	2	3	4	5	6	7
c. Our operations costs were reduced after we were ISO 9001 certified	1	2	3	4	5	6	7
d. Our quality assurance procedure was tracked and monitored regularly after we implemented ISO 9001 standard	1	2	3	4	5	6	7
e. Causes of quality problems were quickly identified after we adopted ISO 9001 standard	1	2	3	4	5	6	7
f. Causes of quality problems were quickly rectified after we adopted ISO 9001 standard	1	2	3	4	5	6	7

Part F: Performance

This section is related to the strategic advantage, operational performance and business performance of your organization after your organization was ISO certified.

F1: Please assess the following statements as it relates to the strategic influence of the ISO 9001 certification.

	strongly disagree			neutral			strongly agree
a. The opportunity for new business has been increased after the ISO certification	1	2	3	4	5	6	7
b. There has been significant, ongoing improvement of our manufacturing process	1	2	3	4	5	6	7
c. ISO 9001 certification facilitated our expansion into new international markets	1	2	3	4	5	6	7
d. ISO 9001 certification differentiated our organization from the competitors	1	2	3	4	5	6	7
e. After ISO certification, we could fend off the competition from companies without ISO 9001 certification	1	2	3	4	5	6	7
f. ISO 9001 certification helped to enhance the corporate image	1	2	3	4	5	6	7

F2. For each of the item listed below, how does your organization perform when compared to your primary competitors?

	much worse			neutral			much better
a. Production cost	1	2	3	4	5	6	7
b. Total product cost	1	2	3	4	5	6	7
c. Productivity	1	2	3	4	5	6	7
d. Reliability of the product (probability of failure in a specified time)	1	2	3	4	5	6	7
e. Conformance to established specifications and standards	1	2	3	4	5	6	7
f. Durability (the amount of use before the product deteriorates or needs to be replaced)	1	2	3	4	5	6	7
g. Serviceability (ease of repair)	1	2	3	4	5	6	7
h. Aesthetics (how the product looks, feels, sounds, tastes or smells)	1	2	3	4	5	6	7
i. Overall product quality	1	2	3	4	5	6	7
j. Promptness in solving customer complaints	1	2	3	4	5	6	7
k. Order fulfillment speed	1	2	3	4	5	6	7
l. New product development speed	1	2	3	4	5	6	7
m. Manufacturing throughput time	1	2	3	4	5	6	7
n. Delivery due date	1	2	3	4	5	6	7
o. Ability to adjust delivery date	1	2	3	4	5	6	7
p. Ability to adjust output volume	1	2	3	4	5	6	7
q. Ability to adjust product mix	1	2	3	4	5	6	7

F3. Please think back to your organization's performance two years ago (2007). How has your organization's performance changed during this two-year period, from 2007 to 2009?

	much worse			neutral			much better
a. Market share	1	2	3	4	5	6	7
b. Sales growth	1	2	3	4	5	6	7
c. Profitability	1	2	3	4	5	6	7

Part G: Facility Demographic Information

Please describe the characteristics of your organization in this section.

G1: By April 1, 2009, how many full time employees worked at your plant? _____ employees

G2. In the last 12 month, your organization represented approximately _____% of your parent company's total annual sales.

G3. During the last 12 months, approximately what portion of sales from your plant has been made in each of the following geographic regions? (Total should equal 100%).

☐ Canada	_____%
☐ US	_____%
☐ Europe	_____%
☐ Japan	_____%
☐ Asia (excluding Japan)	_____%
☐ South America	_____%
☐ Other	_____%
Total	100%

G4. Please indicate the approximate level of your plant's total sales during 2008.

- ☐ Less than $20 million
- ☐ $20 million to $50 million
- ☐ $50 million to $100 million
- ☐ $100 million to $500 million
- ☐ Over $500 million

G5. Your position with your organization is best described as (please check one):

- ☐ CEO
- ☐ Vice President of _____
- ☐ Director of _____
- ☐ Manager of _____
- ☐ Other (Please specify): _____

How many years have you held this position? ____

G6. Has your organization implemented voluntary industry standards other than ISO9001?

- ☐ no
- ☐ yes...if yes, please specify the standards _____

G7. Does your organization plan to adopt voluntary industry standards other than ISO 9001?

- ☐ no
- ☐ yes...if yes, please specify the standards _____

Thank you very much for your participation.

Participant Form

Audit Process Quality, Its Key Drivers, and Outcomes

In ISO 9001 Certification Auditing

A summary of the research results will be sent to you upon completion of the project. In recognition of your participation, you will be entered in a drawing. Five winners will receive the business bestseller: *The Toyota Way, 14 Management Principles from the World's Greatest Manufacturer* by Jeffrey Liker.

This page enables us to mail the results to you and to enter your name in the drawing. It will be separated from the data.

Name of the Plant _____

Name of the Parent Company _____

Would you like to receive the results of this study? ☐ Yes; ☐ No

If yes, please indicate, below, the name and address of the person responsible for coordinating the completion of the survey in your plant (or attach a name card).

Survey Coordinator

Name _____

Title/Function _____

Mailing Address _____

_____

_____

Phone Number _____

Fax Number _____

E-mail Address _____

Appendix 4-6: Survey Instrument for ISO 14001 Certified Organizations*

May XX, 2009

<<COMPANY>>
<<ADDRESS1>>
<<ADDRESS2>>

Dear <<NAME>>,

Stakeholders such as the customers, government regulators, local communities and environmental non-government organizations are increasingly concerned about the environmental impact of business organizations. In response, companies are developing and implementing advanced environmental management systems such as ISO 14001 to adapt to the mounting pressure from different stakeholders. Here at the Ivey Business School, we are conducting a research study to understand the rationale behind, and most importantly, performance outcomes associated with the ISO certification audit. In addition, we also assess how audited firms measure the quality of their audits, as well as the key drivers for high quality audit.

This research is designed, in part, to help you benchmark your ISO audit experience against other firms in Canada and the U.S. Senior managers from a small number of US and Canadian firms that have been ISO 14001 registrants are being approached to provide details of their most recent audit experience. Enclosed is a questionnaire consisting of a series of questions which ask your opinions about issues related to the audit process, audit process quality and business outcomes of your ISO 14001 certification process. It should take approximately 30 minutes to complete. Participation is voluntary. Completing and returning the survey questionnaire will indicate your consent to participate in this study. The questionnaire can be completed in paper or online. The completed paper survey can be returned using the enclosed business reply envelope or faxed to 1-888-662-7693 (toll free). Online survey can be accessed and completed at http://www.ivey.ca/checkbox/survey.aspx?surveyid=3786.

All participants will receive a copy of the summary results, which you can compare against your own firm's experience. Also, in recognition of your participation, you will be entered in a drawing; five winners will receive the business bestseller: *The Toyota Way, 14 Management Principles from the World's Greatest Manufacturer* by Jeffrey Liker. There will be no risks associated with the participation of the study.

The data collected in this study will be used in my doctoral dissertation. All information will be kept confidential and only anonymous opinions and aggregate results will be reported. If you have any questions or comments, please contact me [redacted] or by email at [redacted]
If you have any concerns about the study, you may also contact the UWO Office of Research Ethics at [redacted]
Thank you in advance for your participation and generous support for this doctoral dissertation research. I look forward to hearing from you.

Sincerely yours,

Ying Fan, M. of Mgmt. B.Eng.
Doctoral Candidate
Operations Management

Robert Klassen, Ph.D., P. Eng.
Professor
Operations Management

IVEY

Richard Ivey School of Business
The University of Western Ontario

Audit Process Quality, Its Key Drivers, and Outcomes

In ISO 14001 Certification Auditing

Questionnaire Instructions

1. Please respond to each question or statement carefully and candidly. It is your opinion and perception as a manager knowledgeable about your organization that is important.
2. The specific information of your organization will be kept strictly confidential. Only aggregated summaries will be reported.
3. Please provide an approximate answer in the case that you do not have the precise data required to answer a question. Earlier research has shown that approximate answer is better than no answer at all.
4. We will provide all participating companies with a summary of the results of the study to reflect our appreciation.
5. Please return the completed questionnaire using the enclosed business reply envelope or fax it to **1-888-662-7693** (toll free).
6. You can also fill out the survey online. Simply follow the link: http://www.ivey.ca/checkbox/survey.aspx?surveyid=3793 and input password **200914001**.

If you have any questions or concerns, please contact Ying Fan at [redacted] or at [redacted] Please return the completed survey to:

Ying Fan
PhD Candidate
Operations Management
Richard Ivey School of Business
University of Western Ontario
London, Ontario N6A 3K7

In this questionnaire:
Certification audit refers to the audit that is conducted by external, independent auditing organizations, such as those providing certification of conformity to the requirements of ISO 14001 standard.
Auditor refers to the person who conducts the certification audit for the ISO 14001 standard or the team leader of the audit team.

F1: Please assess the following statements as it relates to the strategic influence of the ISO 14001 certification.

	Strongly disagree			neutral			strongly agree
a. The possibility of new business has been increased after the ISO certification	1	2	3	4	5	6	7
b. There has been significant ongoing improvement of our manufacturing process	1	2	3	4	5	6	7
c. ISO 14001 certification facilitated our expansion into new international markets	1	2	3	4	5	6	7
d. ISO 14001 certification differentiated our organization from the competitors	1	2	3	4	5	6	7
e. We can fend off the competition from companies without ISO 14001 certification	1	2	3	4	5	6	7
f. ISO 14001 certification helped to enhance the corporate image	1	2	3	4	5	6	7

F2. For each of the item listed below, how does your organization perform when compared to your primary competitors?

	Much worse			neutral			much better
a. Production cost	1	2	3	4	5	6	7
b. Total product cost	1	2	3	4	5	6	7
	much worse			**neutral**			**much better**
c. Productivity	1	2	3	4	5	6	7
d. Reliability of the product (probability of failure in a specified time)	1	2	3	4	5	6	7
e. Conformance to established specifications and standards	1	2	3	4	5	6	7
f. Durability (the amount of use before the product deteriorates or needs to be replaced)	1	2	3	4	5	6	7
g. Serviceability (ease of repair)	1	2	3	4	5	6	7
h. Aesthetics (how the product looks, feels, sounds, tastes or smells)	1	2	3	4	5	6	7
i. Overall product uality	1	2	3	4	5	6	7
j. Promptness in solving customer complaints	1	2	3	4	5	6	7
k. Order fulfillment peed	1	2	3	4	5	6	7

l. New product development speed.....	1	2	3	4	5	6	7
l. Manufacturing throughput time.....	1	2	3	4	5	6	7
m. Delivery due date.....	1	2	3	4	5	6	7
n. Ability to adjust delivery ate.....	1	2	3	4	5	6	7
o. Ability to adjust output volume.....	1	2	3	4	5	6	7
p. Ability to adjust product mix.....	1	2	3	4	5	6	7

F3. For each of the environmental performance listed below, how does your organization do when compared to your primary competitors?

	Much worse			neutral			much better
a. Air emission reduction (greenhouse gas).....	1	2	3	4	5	6	7
b. Hazardous waste reduction.....	1	2	3	4	5	6	7
c. Chemical use, toxic substance reduction.....	1	2	3	4	5	6	7
d. Effective energy management	1	2	3	4	5	6	7
e. Solid waste recycling ate.....	1	2	3	4	5	6	7
f. Reduction of environmental incidents.....	1	2	3	4	5	6	7

*Note: Most of the items used in ISO 14001 Certification Audit survey are the same as those used in the ISO 9001 Certification Audit survey. To avoid replication, only the items that are different from those used in the ISO 9001 Certification Audit survey are presented.

Participant Form

Audit Process Quality, Its Key Drivers, and Outcomes

In ISO 14001 Certification Auditing

A summary of the research results will be sent to you upon completion of the project. In recognition of your participation, you will be entered in a drawing. Five winners will receive the business bestseller: *The Toyota Way, 14 Management Principles from the World's Greatest Manufacturer* by Jeffrey Liker.

This page enables us to mail the results to you and to enter your name in the drawing. It will be separated from the data.

Name of the Plant _____

Name of the Parent Company _____

Would you like to receive the results of this study? ☐ Yes; ☐ No

If yes, please indicate, below, the name and address of the person responsible for coordinating the completion of the survey in your plant (or attach a name card).

Survey Coordinator

Name _____

Title/Function _____

Mailing Address _____

_____

_____

Phone Number _____

Fax Number _____

E-mail Address _____

Appendix 4-7: French Version of the Survey Instrument

La qualité da la verification, ses facteurs principaux et les résultats sur la vérification de la certification OIN 9001

Instructions du questionnaire

1. S'il vous plait, répondez à chaque question attentivement et franchement. Votre avis et connaissances dans le rôle du gestionnaire de votre entreprise sont importants.
2. Les informations qui sont spécifiques à votre entreprise seront conservées dans la plus stricte confidentialité. Le rapport ne contiendra que des sommaires agrégés.
3. Dans le cas où vous ne disposeriez pas des données appropriées pour répondre à la question, s'il vous plaisait, donnez une réponse approximative. La recherche a démontré qu'une réponse approximative soit mieux qu'aucune réponse.
4. Pour montrer notre gratitude, nous fournirons un résumé des résultats à toutes les entreprises participantes.
5. S'il vous plaît, retourner le questionnaire rempli dans l'enveloppe jointe par courrier-réponse, ou par télécopieur à : **1-888-379-7787** (sans frais).
6. Vous pouvez également remplir le questionnaire sur l'internet. Suivez le lien : **http://www.ivey.ca/checkbox/survey.aspx?surveyid=3783** et entrez le mot de passe **20099001**.

Si vous avez des questions ou des appréhensions, s'il vous plait contactez Ying Fan à [redacted] ou à [redacted]. Retournez votre questionnaire rempli à

Ying Fan
PhD Candidate
Operations Management
Richard Ivey School of Business
University of Western Ontario
London, Ontario, Canada N6A 3K7

Dans ce questionnaire:
La vérification de certification renvoie au contrôle qui est mené par la vérification des organisations indépendantes, telles que celles qui sont prévoyantes la certification de conformité aux exigences de l'OIN 9001.
Commissaire aux comptes désigne la personne qui effectue l'audit de standard certification OIN 9001, ou la Chef d'équipe de vérification.

Quand est-ce que le dernier audit de certification OIN 9001 s'était achevé dans votre usine? S'il vous plaît sélectionnez la date ci-dessous.

Année ☐ 2007 ☐ 2008 ☐ 2009

Mois
☐ Janvier ☐ Juillet
☐ Février ☐ Août
☐ Mars ☐ Septembre
☐ Avril ☐ Octobre
☐ Mai ☐ Novembre
☐ Juin ☐ Décembre

Parti A : La pratique de la vérification

La présente section examine les pratiques de contrôle utilisées par le cabinet de la vérification qui a effectué votre certification de l'audit le plus récent. S'il vous plaît, encercler le chiffre qui reflète votre évaluation des qualifications de votre société de la vérification et les services du contrôle qu'ils rendent a votre entreprise.

A1. Les phrases suivantes se rapportent aux ressources de la société de la vérification. S'il vous plaît, évaluer ces paramètres en fonction de votre familiarité avec les pratiques et la qualité de contrôle employé dans la société de la vérification.

	fortement contre			neutre			Fortement d'accord
a. Les activités des commissaires aux comptes ont été largement suivies par le gestionnaire de qualité désignée par la société de la vérification.....	1	2	3	4	5	6	7
b. Nous étions souvent invités à fournir des informations sur les activités de contrôle menées par les commissaires aux comptes.	1	2	3	4	5	6	7
c. La vérification a été effectuée conformément aux procédures de vérification formelle établie par la société de la vérification.....	1	2	3	4	5	6	7
d. À l'occasion, les activités des commissaires aux comptes ont été observées et attestées par un vérificateur principal à ce qu'ils suivent les règles qui régissent leurs pratiques de la vérification.	1	2	3	4	5	6	7
e. Le document de travail et le rapport du contrôle émis par la vérificateur(s) ont été examinés attentivement par la société de la vérification.....	1	2	3	4	5	6	7

S'il vous plaît, évaluer les phrases suivantes en fonction de votre familiarité avec les compétences, les connaissances et l'expertise du commissaire aux comptes à travers le processus de certification OIN.

	fortement contre			neutre			Fortement d'accord
f. Le commissaire aux comptes a une expérience de la vérification substantielle.....	1	2	3	4	5	6	7
g. Le commissaire aux comptes a de l'expérience professionnelle substantielle qui est liée à notre industrie.....	1	2	3	4	5	6	7
h. Le commissaire aux comptes a été professionnellement formé...	1	2	3	4	5	6	7
i. Le commissaire aux comptes a été compétent dans la réalisation du projet de la vérification.....	1	2	3	4	5	6	7

A2. Les phrases suivantes ont trait à la façon dont le service de la vérification a été effectué. S'il vous plaît, évaluez ces phrases basées sur votre expérience avec le commissaire aux comptes dans le processus de la vérification.

	fortement contre			neutre			Fortement d'accord
a. Le processus de la vérification était bien désigné par le commissaire aux comptes.....	1	2	3	4	5	6	7
b. Avec ce plan du contrôle bien développé, il était facile de comprendre l'objectif de l'audit et les activités de la vérification qui s'étaient produits à chaque étape..	1	2	3	4	5	6	7
c. Le protocole de vérification fournit des orientations utiles sur les questions à résoudre.....	1	2	3	4	5	6	7
d. *Le style* utilisé dans le rapport de la vérification nous a permis de comprendre les constatations et les conclusions de la vérification.....	1	2	3	4	5	6	7
e. *Le format* utilisé dans le rapport de vérification nous a permis de comprendre les constatations et les conclusions de la vérification.....	1	2	3	4	5	6	7
f. La technologie informatique avancée était utilisée dans le processus de vérification.....	1	2	3	4	5	6	7

A3. Les phrases suivantes ont trait à la relation organisationnelle entre vous et votre commissaire aux comptes. S'il vous plaît, formulez vos réponses sur votre expérience avec le commissaire aux comptes au cours du processus de vérification.

	fortement contre			neutre			Fortement d'accord
a. Nous avons été informés sur les activités à entreprendre dans le plan de vérification en temps pportun.....	1	2	3	4	5	6	7
b. Nous étions informés de l'avancement de la vérification en temps opportun	1	2	3	4	5	6	7
c. Nous avons été informés par le commissaire aux comptes s'il existait des preuves recueillies lors de la vérification qui révèlent un risque immédiat et significatif lié aux questions de qualité en temps opportun.....	1	2	3	4	5	6	7
d. Nous avons clairement compris notre rôle dans le processus de vérification	1	2	3	4	5	6	7

e. Nous avons clairement compris nos responsabilités dans le processus de vérification..... 1 2 3 4 5 6 7
f. Nous avons été informés en détail à quoi s'attendre de la vérification 1 2 3 4 5 6 7
g. L'échange d'informations lors de la vérification a été utile pour nous afin que nous puissions prendre des mesures correctives ... 1 2 3 4 5 6 7
h. La communication entre notre entreprise et le commissaire aux comptes a été efficace 1 2 3 4 5 6 7

	fortement contre			neutre			Fortement d'accord
i. Le commissaire aux comptes était flexible en répondant à nos demandes de modification sur le plan de vérification (par exemple, les dates, l'heure, la durée de la réunion, les entretiens ou d'observations sur place).....	1	2	3	4	5	6	7
j. Face à une situation imprévue, le commissaire aux comptes préféré négocier des nouveaux arrangements plutôt que nous tenir au plan initial	1	2	3	4	5	6	7
k. Le commissaire aux comptes a travaillé avec nous pour résoudre les divergences d'opinion quant à la preuve d'audit et/ou conclusions	1	2	3	4	5	6	7

A4. Les phrases suivantes ont trait à la capacité de la société de la vérification pour régler les conflits et les désaccords avec votre organisation au cours du processus de vérification. S'il vous plaît, évaluez ces expressions en fonction de votre expérience avec le vérificateur.

	fortement contre			neutre			Fortement d'accord
a. La société de la vérification avait des systèmes et des procédures en place pour régler les disputes avec nous pendant la vérification	1	2	3	4	5	6	7
b. La société de la vérification a vu nos divergences d'opinion comme une occasion d'améliorer notre relation d'affaires	1	2	3	4	5	6	7
c. Le règlement des désaccords lors du processus de vérification était une responsabilité partagée entre notre entreprise et la société de la vérification	1	2	3	4	5	6	7
d. Nous avons régulièrement parlé avec les commissaires aux comptes concernant les différences d'opinions que nous avons eues avec la société de la vérification	1	2	3	4	5	6	7

Partie B : La qualité de l'audit

Cette section examine la qualité du service de la vérification associée au processus de vérification. S'il vous plaît, évaluez la qualité du service au cours de la vérification en fonction de votre expérience dans le processus de certification OIN.

B1. Rappelez-vous votre expérience avec le commissaire aux comptes avant que la réelle vérification sur place a transpiré. S'il vous plaît évaluez les phrases suivantes.

	fortement contre			neutre			Fortement d'accord

a. La phase d'examen préparatoire de la vérification a été effectuée en temps opportun	1	2	3	4	5	6	7
b. Les activités de vérification pendant la phase de revue d'aptitude ont été menées et achevées selon le calendrier que nous avons convenu avec le vérificateur	1	2	3	4	5	6	7
c. Nous étions prêts pour la visite sur place avant que l'examen des documents fût achevé	1	2	3	4	5	6	7
d. Le coût associé à la phase d'examen préparatoire respecté notre budget	1	2	3	4	5	6	7

B2. Rappelez votre expérience avec le commissaire aux comptes **durant** la phase de la vérification sur site. S'il vous plaît, évaluez les phrases suivantes.

	fortement contre			neutre			Fortement d'accord
a. Le site sur scène de la vérification a été effectué en temps opportun	1	2	3	4	5	6	7
b. Les activités d'audit au cours de la phase sur place ont été effectuées conformément au plan de vérification	1	2	3	4	5	6	7
c. Les activités de la vérification au cours de la phase sur place ont été menées conformément au plan de vérification	1	2	3	4	5	6	7
d. Le rapport de la vérification a été publié à bref délai après la visite sur site	1	2	3	4	5	6	7
e. Le coût associé à la phase de certification sur site de vérification a respecté notre budget	1	2	3	4	5	6	7
f. Le commissaire aux comptes est rendu des services dans le délai convenu, car la société avait promis	1	2	3	4	5	6	7
g. Le commissaire aux comptes était techniquement compétent pour assurer le service de la vérification	1	2	3	4	5	6	7
h. Les activités du commissaire aux comptes ont été compatibles avec les arrangements préalables sur le plan de verification.....	1	2	3	4	5	6	7
i. Nous pourrions compter sur le commissaire aux comptes pour atteindre l'objectif global du projet de la vérification	1	2	3	4	5	6	7
j. Le commissaire aux comptes a répondu à nos questions et préoccupations très rapidement	1	2	3	4	5	6	7
k. Lorsqu'ils organisaient des entretiens avec le personnel de l'installation, le commissaire aux comptes ajusterait son programme prévu si nous avons indiqué qu'il y avait des conflits d'horaire	1	2	3	4	5	6	7
l. Le commissaire aux comptes nous a informés immédiatement s'il y avait des preuves de non-conformité.....	1	2	3	4	5	6	7
m. Le rapport de la vérification a été réalisé rapidement après la vérification	1	2	3	4	5	6	7
n. Au sein de mon organisation, nous pourrions faire confiance au vérificateur	1	2	3	4	5	6	7
o. Le vérificateur a assuré la confiance au cours du processus de la	1	2	3	4	5	6	7

vérification .....

p. Le vérificateur mettait l'intérêt de mon organisation au fond	1	2	3	4	5	6	7
q. Je crois que la vérification a ajoutée de la valeur en ce qui concerne les entreprises de notre organisation	1	2	3	4	5	6	7
r. Les activités de la vérification sur site ont été organisées pendant des heures convenables pour notre organisation	1	2	3	4	5	6	7
s. Le vérificateur a proposé des possibilités qui ont contribué à l'amélioration du système de gestion	1	2	3	4	5	6	7
t. L'attitude du commissaire aux comptes au cours du processus de vérification était amicale	1	2	3	4	5	6	7
u. L'attitude du commissaire aux comptes au cours du processus de vérification était professionnelle.....	1	2	3	4	5	6	7
v. Parler avec le vérificateur mettait nos esprits à l'aise	1	2	3	4	5	6	7

Partie C : La satisfaction du client

C1. Les phrases suivantes sont liées au degré de votre satisfaction avec le service de vérification fournie. S'il vous plait, encerclez le représentant numéro de votre niveau de satisfaction.

.

	fortement contre			neutre			Fortement d'accord
a. Si nous avons des besoins dans l'avenir, nous serons susceptibles d'embaucher la même société de verification.....	1	2	3	4	5	6	7
e. Nous sommes susceptibles de recommander des services du vérificateur à nos pairs.	1	2	3	4	5	6	7
f. Notre choix de solliciter cette société de vérification était sage ..	1	2	3	4	5	6	7
g. Le service de vérification était exactement cela que nous avions besoin pour la réussite de la certification OIN 9001.....	1	2	3	4	5	6	7
e. Dans l'ensemble, nous avons été satisfaits du service de vérification.....	1	2	3	4	5	6	7
f. Je recommanderais certification OIN 9001 aux autres entreprises.....	1	2	3	4	5	6	7

C2. Les éléments suivants vous demandent votre avis sur la façon dont la vérification de certification OIN serait pratiquée et votre appréciation sur la manière dont la vérification a été effectivement réalisée dans votre usine. Dans quelle mesure est-ce que les phrases suivantes représentent votre vision de la performance du vérificateur?

	fortement contre			neutre			Fortement d'accord
a1. Le vérificateur doit nous aider à améliorer nos processus internes.....	1	2	3	4	5	6	7
a2. Le vérificateur a effectivement nous aidés à améliorer nos processus internes	1	2	3	4	5	6	7
b1. Le vérificateur doit nous aider à améliorer nos produits et services	1	2	3	4	5	6	7

b2. Le vérificateur a effectivement nous aidés à améliorer nos produits et services 1 2 3 4 5 6 7
c1. Le vérificateur doit être agréable et capable d'adapter son style pour répondre à nos exigences 1 2 3 4 5 6 7
c2. Le vérificateur a été effectivement agréable et capable d'ajuster son style en répondant à nos exigences 1 2 3 4 5 6 7
d1. Le vérificateur doit travailler avec nous par être un bon communicateur..... 1 2 3 4 5 6 7
d2. Le vérificateur a travaillé effectivement avec nous et était un bon communicateur 1 2 3 4 5 6 7
e1. Le vérificateur doit être capable de faciliter l'amélioration continue de notre système de gestion de la qualité 1 2 3 4 5 6 7
e2. Le vérificateur a effectivement facilité l'amélioration continuée de notre système de gestion de la qualité 1 2 3 4 5 6 7
f1. Le vérificateur doit être capable de s'adapter aux besoins de notre usine 1 2 3 4 5 6 7
f2. Le vérificateur a été effectivement capable de s'adapter aux besoins de notre usine..... 1 2 3 4 5 6 7

Partie D : Le projet de certification OIN

Cette section examine la motivation pour la certification OIN et le lancement du projet de certification OIN dans votre organisation. S'il vous plaît, indiquez ce qui décrit le mieux la situation de votre organization.

D1. S'il vous plaît indiquez le degré d'importance des raisons suivantes pour la certification OIN 9001

	sans importance			assez important			très important
a. Cette certification a été requise par un ou plusieurs de nos clients.....	1	2	3	4	5	6	7
b. Certification a été établie comme un objectif stratégique par notre entreprise.....	1	2	3	4	5	6	7
c. Nous avions l'intention d'améliorer la qualité des produits grâce à l'amélioration des processus internes.....	1	2	3	4	5	6	7
d. Nous avons l'intention de réduire les coûts en mettant en œuvre le système de gestion de la qualité OIN 9001.....	1	2	3	4	5	6	7
e. Nous avons l'intention d'acquérir un avantage commercial grâce à la certification OIN 9001.....	1	2	3	4	5	6	7

D2. Pendant l'année financière au cours du projet de certification OIN, quel était le pourcentage moyen des frais de fonctionnement annuel qui a été allouée au projet?

<1% 2% 4% 6% 8% 10% 12% Autre valeur: ____%

D3. Pendant de l'année financière, au cours du projet de certification OIN, quel était le pourcentage moyen du budget d'investissement total de l'organisation qui a été attribuée du projet?

<1% 2% 4% 6% 8% 10% 12% Autre valeur: ____%

D4. S'il vous plaît identifiez le niveau de ressources financières, managériales et technologiques engagés pour le projet de certification OIN par votre organisation.

	extrêmement bas			modérée			extrêmement haut
a. Le niveau des investissements financiers engagés au service de la certification OIN	1	2	3	4	5	6	7
b. Le niveau du soutien accordé par des cadres dirigeant à la certification OIN	1	2	3	4	5	6	7
c. Le niveau de la coopération entre le personnel lié au cours du processus de vérification	1	2	3	4	5	6	7
d. La mesure du soutien a la certification OIN expressément renforcé par notre direction dans les décisions de gestion pertinentes.....	1	2	3	4	5	6	7
e. Le degré d'intérêt manifesté par notre gestion supérieure en ce qui concerne les problèmes de qualité spécifiques	1	2	3	4	5	6	7
f. La mesure dans laquelle notre gestion supérieure a incorporé le rapport du contrôle au cours de chaque réunion examinant les opérations.....	1	2	3	4	5	6	7
g. Le niveau du soutien technologique engagé dans le projet de certification OIN (par exemple, le système d'information utilisé pour la communication, l'établissement de rapports et l'analyse des données).....	1	2	3	4	5	6	7

Partie E : Résultats de la vérification

Cette section examine les résultats issus du processus de vérification. S'il vous plaît évaluez l'impact de la vérification de certification sur les entreprises de votre organisation.

E1: S'il vous plaît, évaluez les phrases suivantes en ce qui concerne l'impact que la certification du système OIN 9001 contrôlant de la qualité a eu sur l'entreprise de votre organisation.

	fortement contre			neutre			Fortement d'accord
a. Nos opportunités d'affaires ont augmenté après que nous avons eu de la certification OIN 9001.....	1	2	3	4	5	6	7
c. Notre client le plus important a réduit la fréquence de l'évaluation de la qualité après que nous avons reçu la certification OIN 9001.....	1	2	3	4	5	6	7
c. Nos frais de fonctionnement ont été réduits après que nous avons reçu la certification OIN 9001.....	1	2	3	4	5	6	7
d. Notre procédure de l'assurance de la qualité a été suivie et surveillée régulièrement après que nous avons adopté le standard d'OIN 9001.....	1	2	3	4	5	6	7

e. Les causes des problèmes de qualité ont été rapidement identifiées après que nous avons adopté le standard d'OIN 9001	1	2	3	4	5	6	7
f. Les causes des problèmes de qualité ont été rapidement rectifiées après que nous avons adopté le standard d'OIN 9001..	1	2	3	4	5	6	7

Partie F : La performance

Cette section est liée à l'avantage stratégique, la performance opérationnelle et la performance commerciale de votre entreprise après que votre organisation avait reçu la certification OIN.

F1: S'il vous plaît évaluer les relevés suivants, car ils portent sur l'influence stratégique de la certification OIN 9001.

	fortement contre			neutre			Fortement d'accord
a. L'occasion pour les affaires nouvelles est devenue plus fréquent après que vous avez reçu la certification OIN	1	2	3	4	5	6	7
b. Il y a eu une amélioration significative en cours de notre processus de fabrication	1	2	3	4	5	6	7
c. La certification OIN 9001 a facilité notre expansion dans de nouveaux marchés internationaux	1	2	3	4	5	6	7
d. La certification OIN 9001 a différencié notre organisation de celles de nos concurrents.....	1	2	3	4	5	6	7
e. Après la certification OIN, nous pourrions repousser la concurrence des entreprises sans certification OIN 9001.....	1	2	3	4	5	6	7
f. La certification OIN 9001 a contribué à rehausser l'image de notre entreprise	1	2	3	4	5	6	7

F2. Pour chacune des rubriques énumérées ci-dessous, comment est-ce que on peut comparer la performance de votre organisation par rapport à celle de vos principaux concurrents?

	fortement pire			neutre			fortement mieux
a. Coût de production.....	1	2	3	4	5	6	7
b. Coût totale du produit	1	2	3	4	5	6	7
c. La productivité	1	2	3	4	5	6	7
d. La fiabilité du produit (probabilité de défaillance pendant une période spécifiée).....	1	2	3	4	5	6	7
e. La conformité aux spécifications et normes établies	1	2	3	4	5	6	7
f. Durabilité (le volume d'utilisation avant que le produit se dégrade ou doit être remplacé).....	1	2	3	4	5	6	7
g. Entretien (facilité de réparation).....	1	2	3	4	5	6	7
h. L'esthétique (comment le produit semble, sent, son, ou goût).....	1	2	3	4	5	6	7
i. Qualité global du produit.....	1	2	3	4	5	6	7
j. Promptitude dans la résolution de plaintes des clients.....	1	2	3	4	5	6	7
k. La vitesse du traitement des commandes.....	1	2	3	4	5	6	7
l. La vitesse du développement de nouveaux produits.....	1	2	3	4	5	6	7

m. Temps nécessaire à la fabrication.....	1	2	3	4	5	6	7
n. Date de livraison.....	1	2	3	4	5	6	7
o. Possibilité d'ajuster la date d'échéance.....	1	2	3	4	5	6	7
p. Possibilité d'ajuster la production en volume.....	1	2	3	4	5	6	7
q. Possibilité d'ajuster la combinaison de produits.....	1	2	3	4	5	6	7

F3. S'il vous plaît repense à la performance de votre organisation depuis deux ans (2007). Comment la performance de votre organisation a changé pendant cette période de deux ans, de 2007 à 2009?

	fortement pire			neutre			fortement mieux
a. Part de marché.....	1	2	3	4	5	6	7
b. La fréquence des ventes.....	1	2	3	4	5	6	7
c. Profitabilité.....	1	2	3	4	5	6	7

Partie G : L'information démographique de l'installation

S'il vous plaît décrire les caractéristiques de votre organisation dans cette section.

G1. Au 1er avril 2009, combien d'employés ont travaillé à temps plein dans votre usine?
_____ Employés

G2. Au cours des 12 derniers mois, votre organisation représente environ _____% des chiffres d'affaires total annuel de votre société globale.

G3. Au cours des 12 derniers mois, environ quel pourcentage des ventes provenant de votre usine ont été réalisés dans chacune des régions géographiques suivantes? (Le total doit être égal à 100%).

☐ le Canada	_____%
☐ les Etats-Unis	_____%
☐ l'Europe	_____%
☐ le Japon	_____%
☐ l'Asie (sauf au Japon)	_____%
☐ l'Amérique du sud	_____%
☐ Ailleurs	_____%
Total	100%

G4. S'il vous plaît indiquer le niveau approximatif du total des ventes de votre usine en 2008.

☐ Moins de $20 millions
☐ $20 millions à $50 millions
☐ $50 millions à $100 millions
☐ $100 millions à $500 millions
☐ Plus de $500 millions

G5. Votre position dans votre organisation est mieux décrite comme (s'il vous plaît cocher une):

☐ PDG

- ☐ VP de _____
- ☐ Directeur de _____
- ☐ Gestionnaire de _____
- ☐ Autre (préciser s'il vous plaît)_____

Combien d'années avez-vous occupé ce poste? ____

G6. Votre organisation mise en œuvre des standards volontaires de l'industrie autres que ceux d'OIN 9001?

- ☐ Non
- ☐ Oui (Si oui, s'il vous plaît préciser ces standards)_____

G7. Est-ce que votre organisation a l'intention d'adopter des standards volontaires de l'industrie autres que l'OIN 9001?

- ☐ Non
- ☐ Oui (Si oui, s'il vous plaît préciser ces standards)

Merci beaucoup pour votre participation.

Appendix 4-8: Survey Reminder Postcard ISO 9001 Survey

Richard Ivey School of Business
The University of Western Ontario

IVEY

June 20, 2009

Recently, a questionnaire was mailed to you asking you to assist us in assessing the ISO 9001 certification audit conducted with your organization.

If you have completed and returned the questionnaire to us, please accept our sincere thanks. If you have not had a chance to take the survey yet, please do so today. We are especially grateful for your help because your opinions are critical to the success of this study.

If you did not receive a questionnaire, or if it was misplaced, please call us at [redacted] or e-mail to [redacted] and we will get another one in the mail to you today.

The completed paper survey can be returned using the enclosed business reply envelope or faxed to 1-888-662-7693 (toll free). You can also fill out the survey online. Simply follow the link: **http://www.ivey.ca/checkbox/survey.aspx?surveyid=3783** and input password **20099001**.

Ying Fan
PhD Candidate
Ivey School of Business
University of Western Ontario

Appendix 4-9: Reminder Postcard ISO 14001 Survey

Richard Ivey School of Business
The University of Western Ontario

IVEY

June 20, 2009

Recently, a questionnaire was mailed to you asking you to assist us in assessing the ISO 14001 certification audit conducted with your organization.

If you have completed and returned the questionnaire to us, please accept our sincere thanks. If you have not had a chance to take the survey yet, please do so today. We are especially grateful for your help because your opinions are critical to the success of this study.

If you did not receive a questionnaire, or if it was misplaced, please call us at [redacted] or e-mail to [redacted] and we will get another one in the mail to you today.

The completed paper survey can be returned using the enclosed business reply envelope or faxed to 1-888-662-7693 (toll free). You can also fill out the survey online. Simply follow the link: **http://www.ivey.ca/checkbox/survey.aspx?surveyid=3793** and input password **200914001**.

Ying Fan
PhD Candidate
Ivey School of Business
University of Western Ontario

Appendix 4-10: One-page Follow-up Survey for Non-respondents

A3. The following statements pertain to the organizational relationship between you and your auditor. Please report on your experience with the auditor during the audit process.

	strongly disagree			neutral			strongly agree
a. We were informed about the activities to be undertaken in the audit plan in a timely manner.....	1	2	3	4	5	6	7
b. We were informed about the progress of the audit in a timely manner.	1	2	3	4	5	6	7
c. We were informed by the auditor if there is evidence collected during the audit indicates an immediate and significant risk related to the quality issues in a timely manner.....	1	2	3	4	5	6	7
d. We clearly understood our roles in the audit process	1	2	3	4	5	6	7
e. We clearly understood our responsibilities in the audit process...	1	2	3	4	5	6	7
f. We were thoroughly informed about what to expect from the audit.....	1	2	3	4	5	6	7
g. Information exchange during the audit was useful for us to take corrective action.....	1	2	3	4	5	6	7
h. The communication between our firm and the auditor was effective.....	1	2	3	4	5	6	7
i. The auditor was flexible in responding to our requests to modify the audit plan (e.g., dates, time, duration of the meeting, interviews or on-site observation)	1	2	3	4	5	6	7
j. When an unexpected situation arose, the auditor would rather work out new arrangements than hold us to the original plan.....	1	2	3	4	5	6	7
k. The auditor worked with us to resolve any diverging opinions concerning the audit evidence and / or findings.....	1	2	3	4	5	6	7

B2. Recall your experience with the auditor **during** the actual on-site audit took place. Please assess the following statements.

	strongly disagree			neutral			strongly agree
a. The on-site stage of the audit was conducted in a timely manner.....	1	2	3	4	5	6	7
b. Audit activities during the on-site stage were *conducted* according to the audit plan.....	1	2	3	4	5	6	7
c. Audit activities during the on-site stage were *completed* according to the audit plan.....	1	2	3	4	5	6	7
d. The audit report was issued soon after the on-site visit.....	1	2	3	4	5	6	7
e. The cost associated with the on-site certification audit stage met our budget.....	1	2	3	4	5	6	7
f. The auditor delivered services within a certain time frame as promised.....	1	2	3	4	5	6	7
g. The auditor was technically competent to perform the audit service.....	1	2	3	4	5	6	7
h. The auditor's activities were consistent with the agreed upon audit plan	1	2	3	4	5	6	7
i. We could count on the auditor to achieve the overall objective of the audit project.....	1	2	3	4	5	6	7

IVEY

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The University of Western Ontario

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Use of Human Subjects – Ethics Approval Notice

Principal Investigator: Rob Klassen		Review Number: 008/09(BREB)
Re: PhD Student	Ying Fan	
Protocol Title:	Audit quality, its key drivers, and outcomes in voluntary industry standards auditing	
Approval Date:	May 4, 2009	End Date: April 4, 2010

This is to notify you that the Ivey School of Business Expedited Research Ethics Board (BREB) has granted expedited approval to the above named research study on the date noted above.

The BREB is a sub-REB of the University of Western Ontario's Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB), which is organized and operates according to the Tri-Council Policy Statement and the applicable laws and regulations of Ontario.

This approval shall remain valid until the end date noted above assuming timely and acceptable responses to the BREB's periodic requests for surveillance and monitoring information.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the BREB except when the change(s) involve only logistical or administrative aspects of the study. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the BREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely effect the safety of the subjects or the conduct of the study.

If these changes require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information must be submitted to this office for approval.

Members of the BREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to such studies when they are presented to the BREB.

Signature: [redacted]
Rod White, Associate Dean, Faculty Relations & Research
Chair, Business Expedited Research Ethics Board (BREB)

This is an official document. Please retain the original in your files.

VITA

Name: Ying Fan

Post-Secondary Education and Degree:

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Selected Conference Presentation:

Fan, Y., Prahinski, C. And Klassen, R. "Audit Quality, Its Key Drivers, and Outcomes in Voluntary Industry Standards Auditing" presented at the 40th Annual Meeting of the Decision Sciences Institute (DSI), New Orleans, USA, November, 2009

Prahinski, C., Benton, W.C. and Fan, Y. " The Influence of Supplier Development Program on Buyer-Supplier Relationship", presented at the 39th Annual Meeting of the Decision Sciences Institute (DSI), Baltimore, USA, November, 2008

Prahinski, C., Benton, W.C. and Fan, Y. "Supplier Development: the Role of the Buyer-Supplier Relationship," presented at The 38th Annual Meeting of the Decision Sciences Institute (DSI), Phoenix, USA, November, 2007

Selected Publications:	Prahinski, C., and Fan, Y. (2007) Supplier Evaluation: The Role of Communication Quality, Journal of Supply Chain Management 43(3), page 16-28
Selected Teaching Cases:	Teaching Case: Halton Recycling Inc. (2007) Ivey Publishing # 9B07D009 Case Teaching Note: Halton Recycling Inc. (2009) Ivey Publishing # 8B07D09
Teaching Experience:	Instructor, Winter 2007, BMOS Program, Operations Management, Huron University College Assistant Professor, Fall 2009 to Present, Foundations of Operations Management, University of Colorado at Colorado Springs
Industry Work Experience:	Assistant Manager, Project Development Department, China National Investment & Reinsurance Co. Ltd, Beijing, China 2000 - 2001 Accountant, Road Transportation Division, He Bei Ministry of Transportation, Shi Jiazhuang, China, 1996 – 1998